1948-51 HUDSON DRIVE-MASTER (Continued)

Transmission Switch—Mounted on power unit mounting bracket on left side of engine.
Transfer Mechanism—Mounted on bracket on rear of power unit mounting. Unit is new design three-lever type with power lever (inner) linked to power cylinder by non-adjustable strap, manual lever (outer) linked to gearshift lever on steering column, and center gear engagement lever linked to shift lever on transmission case by new adjustable rod. This center lever has transfer key (operated by Transfer Diaphragm Cylinder) by which lever is locked to inner lever (for automatic shifting), or outer lever (for manual shifting). Detent ball and spring is provided for both inner and outer levers to positively locate them in each gear position.

Instrument Panel Control Switch (1948-49): Rotary type on instrument panel (center "off" with right and left "on" positions).
Center "Off" Position—Manual gear shifting and clutch operation.
Left "On" Position—Manual gear shifting with automatic clutch operation (Vacumotive Drive on).
Right "On" Position—Automatic gear shifting and clutch operation (Drive-Master & Vacumotive Drive on).

Instrument Panel Control Switch (1950 & Later): Two button type on instrument panel with separate "on" and "off" buttons.
Left "OFF" Button—Pressing button in provides manual gearshifting and clutch operation.
Right "HDM" Button—Pressing button in provides automatic gearshifting and clutch operation.

Drive-Master Fuse: Located on back of switch (1948-49), in cartridge type holder in control switch lead (beginning 1950).
Fuse Capacity—15 amperes.
►***CAUTION—15 ampere fuse replaces 10 ampere fuse used originally on 1948-49 cars.***

OPERATION: All units operate in exactly same manner as on previous models. Shifting limits are as follows:
Automatic Second-to-High Shift—9.5 to 14 MPH.
Automatic High-to-Second Shift—9 to 12 MPH.
Vacumotive Drive Cutout (In High Gear)—16 MPH. (minimum), 21 MPH. (maximum) and must be inoperative at all higher speeds.

CHECKING & ADJUSTMENT: Check all of the following points before making any Drive-Master adjustments:
1. **Engine Performance**—Must be properly tuned up with idle speed set at 580-600 RPM. with Drive-Master "on" button pressed in. Engine vacuum reading must be at least 17-18" to insure proper engine performance and Drive-Master operation.
2. **Vacuum Connections**—Check lines for leaks.
3. **Battery**—In good condition and not discharged (gravity reading of not less than 1225).
4. **All Electrical Connections Clean & Tight**—Check following plug connectors particularly: Clutch Power Unit Solenoids, Accelerator Switch, Transmission Power Unit, Transmission Switch, Governor, and Shift Rail Terminal.
5. **Accelerator Linkage**—Must work freely and return solidly against stop on accelerator switch when accelerator pedal is released. This is important to insure clutch release for Drive-Master operation. Adjust accelerator pedal rod so that carburetor throttle valve is wide open just before accelerator pedal touches stop (cars without overdrive), stem of kick-down switch (cars with overdrive), or tip of pedal strikes floor mat (Pacemaker without overdrive).
6. **Clutch Pedal Free Travel**—Must be 1½". Starter switch should become operative (starter will crank with starting button depressed) before pedal is within 2" of floor.
7. **Vacumotive Drive & Drive-Master Linkage**—Must work freely without binding at joints. Check with control switch "off" by opening throttle slightly and releasing pedal slowly. Accelerator bellcrank arm must return solidly against stop on bracket.
8. **Vacumotive Drive Adjustments**—Check operation and make all necessary adjustments.
See Hudson Vacumotive Drive in Clutch Section.
9. **Drive-Master Adjustment**—After all above points checked, adjust Drive-Master units as follows:

(A) Transfer Key Ball Joint: Joint at transfer key end of diaphragm cylinder rod must operate freely without any perceptible endplay. To adjust, loosen locknut on rod, turn adjusting sleeve inward to take up all play. Ball joint must work freely.
Lubrication Note—Lubricate with viscous chassis lubricant through grease fitting on transfer key (pull diaphragm rod forward for clearance).

(B) Transfer Diaphragm Rod (1948-49): With steering column shift lever and outer lever of transfer mechanism in neutral, check distance from rear face of diaphragm cylinder to front face of rod end (round portion of rod), which should be 1 3/16". To adjust, hold diaphragm rod from turning with wrench on hexagonal end, loosen locknut, turn outer rod in or out (knurled section provided for gripping with pliers).
(1950 & Later)—With engine not running, place steering column shift lever in High Gear, adjust length of selector diaphragm rod by loosening locknut and turning rod (knurled section provided for gripping rod with pliers) until selector key bottoms solidly in slot in hand shift lever. Check this adjustment by starting engine and shifting transmission to Neutral—selector key should bottom solidly in slot in power shift lever.
►***CAUTION—Do not allow diaphragm rod to turn when adjusting (will damage diaphragm).***

(C) Transmission Shift Rod (All Car Models except Pacemaker): See that the transmission gears are in neutral, disconnect shift rod front end (center lever connection at transfer mechanism). Push or pull slightly on rod until neutral cross-over action is free, see that gear engagement lever is in neutral position (jiggle lever to engage neutral detent), adjust rod length by loosening locknut and turning end fitting so rod can be connected without disturbing position of transmission shift lever or transfer gear engagement lever. Connect rod and recheck cross-over action. Re-adjust by shortening or lengthening rod ½-turn at a time until action is free.
Pacemaker Models—Check in same manner as the others (above), adjust by backing off one nut tightening opposite nut at end fitting on forward end of rod.

(D) Manual Lever (Gearshift Lever Position): Adjust rod linking shifter shaft on steering column to idler lever at lower end of column (loosen locknut and turn rod in end fitting) until gearshift lever under steering wheel is approximately 1" above a horizontal position in neutral.

(E) Power Lever Stop: Run the engine for vacuum, place control switch in HDM position (right hand "on" position), shift to second gear. Turn stopscrew on transfer mechanism down until it just contacts power lever (inner lever), then turn stopscrew down additional ½-turn, tighten Allen head setscrew to lock stopscrew in this position.

(F) Throttle Lock: Run engine and connect jumper wire from battery negative post or other hot terminal to either of the two upper throttle lock solenoid terminal pins (lower pin not used) to cause throttle lock to operate. Loosen locknut and turn adjusting nut on threaded fitting at lower end of throttle lock cable until accelerator pedal bellcrank lever is held solidly against stop on bellcrank bracket when accelerator pedal is depressed, tighten locknut.
►***CAUTION—Cable must not be adjusted so short that accelerator cross-shaft is deflected when throttle lock operates.***

(G) Neutral Switch: Run engine with control switch HDM position, shift transmission to neutral. Disconnect transmission shift rod at forward end (center lever of transfer mechanism), move gear shift lever on steering column to Second Gear position, then back to Neutral position. Jiggle shift rod until cross-over action in transmission is free. Check length of shift lever rod in relation to position of transfer mechanism lever from which it was disconnected but do not change adjustment of this rod. Adjust neutral switch rod length (see below), then repeat test procedure (move gearshift lever to Second, back to Neutral, check rod length), until gear shift rod can be connected without disturbing position of levers.
►***CAUTION—Do not change transmission shift rod length when making this adjustment.***
Neutral Switch Rod Adjustment—Adjust by backing off one nut, and tightening opposite nut, on threaded end of neutral switch rod at transfer mechanism center lever. If transmission shift rod appeared to be too short when making above test, shorten neutral switch rod by turning up rear nut, if shift rod appeared to be too long, lengthen neutral switch rod by turning up front nut. Tighten opposite nut to lock adjustment in each case.

Final Performance Check: After all adjustments completed, check for free cross-over action (gear shift lever must return to second-high side from any position in neutral) and transfer key should move from engagement with power lever to engagement with manual lever as steering column gear shift lever is moved upward in neutral.
►*NOTE*—If cross-over action not free, recheck Transmission Shift Rod Adjustment (C) and Power Lever Stop Adjustment (E) above. See that cross-over switch rod is centered in clip at clutch housing.

DRIVE-MASTER SERVICING: All units which do not operate satisfactorily after adjustment should be replaced.

TRANSMISSION SERVICING: *See Hudson Transmission.*

REMOVAL & INSTALLATION OF DRIVE-MASTER: Units can be removed separately as follows:

Power Cylinder & Transfer Diaphragm: Disconnect diaphragm engaging rod from rod end, disconnect shift strap by removing bolt attaching strap to power cylinder. Disconnect battery cables, remove battery and battery tray and support. Disconnect vacuum lines at transfer diaphragm solenoids. Remove cotter pins, nuts, ferrules, washers, and rubber

CONTINUED ON NEXT PAGE

1948-51 HUDSON DRIVE-MASTER (Cont.)

bushings from power cylinder mounting studs, remove power cylinder and diaphragm assembly.

►*INSTALLATION CAUTION*—Adjust Transfer Key Ball Joint (Adjustment A), and Transfer Diaphragm Rod (Adjustment B) after unit re-installed.

Power Unit Mounting Bracket: To remove this bracket from the engine, first remove power unit and transmission control switch (see above), disconnect shift rod and cross-over rod at power shift and at manual shift bell-crank, disconnect clutch rod at transmission control switch. Remove two bolts at lower bracket support, one bolt at oil pan at forward end, two nuts and lockwashers at side of cylinder block. Lift off bracket with power shift shaft and shift levers as an assembly.

Transmission Control Switch: Remove distributor (6 Cyl. models only). Disconnect clutch operating rod, transfer switch rod, neutral and limit switch rod, and selector switch rod. Disconnect wiring harness plug. Remove bolt, lockwasher, and nut at top and bottom of switch, remove switch from mounting bracket.

Drive-Master Shift Shaft & Shift Shaft Levers: Remove shift shaft nut at rear of support bracket (disconnect transfer switch rod at switch for wrench clearance). Disconnect power shift rod by taking out cotter pin and clevis pin. Slide shift shaft out toward fender (CAUTION—use care not to lose detent balls and springs which may fall out of retainers).

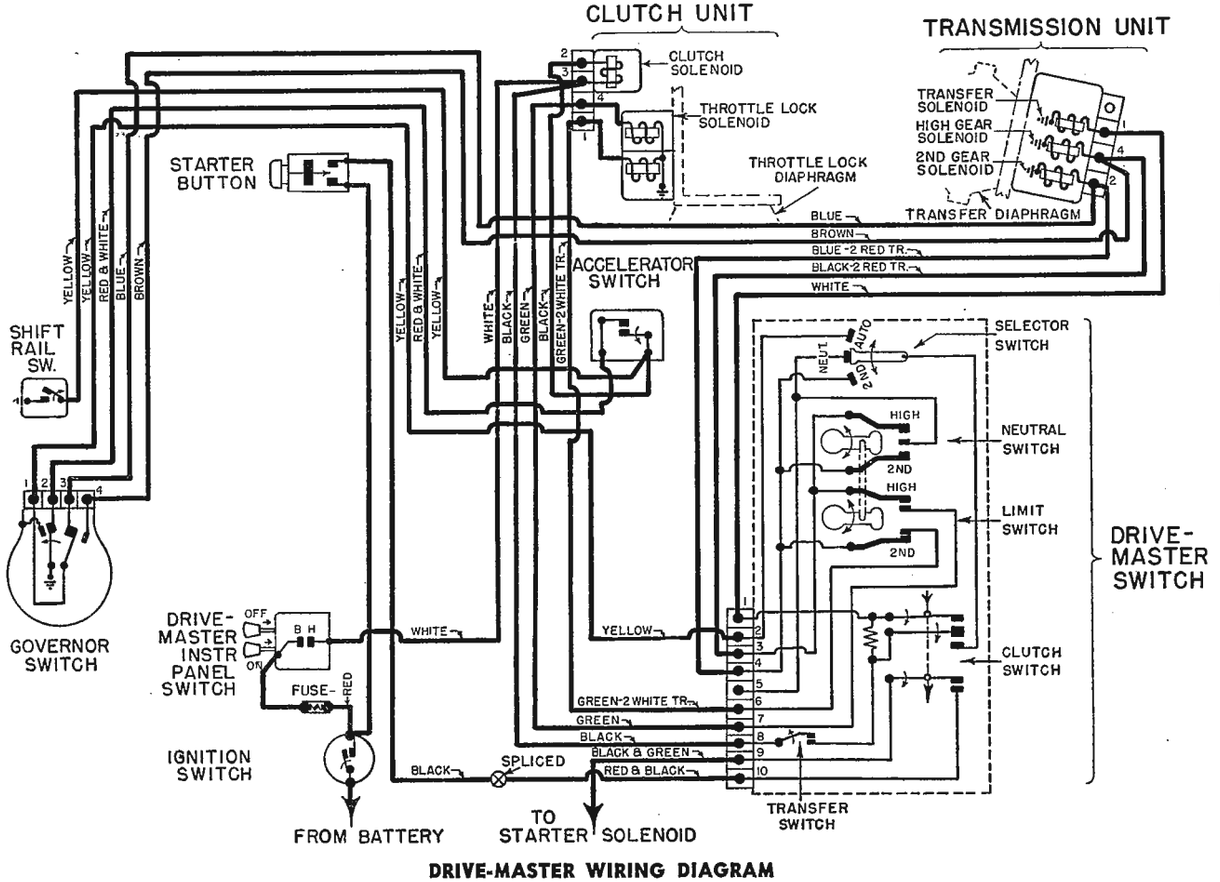
►*INSTALLATION CAUTION*—When re-installing shift shaft, lubricate detent balls with water-resistant grease and make certain detent ball springs correctly positioned as follows:

Hand Shift Lever Detent Ball Spring—Part No. 163442 (19 pound tension when compressed to 11/16"). Install this spring in Drive-Master mounting bracket pin for hand shift lever assembly.

Power Shift Lever Detent Ball Spring—Part No. 41236 (30 pound tension when compressed to 13/16"). Install this spring in shift shaft mounting bracket recess.

►*TRANSFER KEY HUB BUSHING REPLACEMENT*—If replacement of this bushing necessary, remove old bushing with driver having .625" pilot. Install new bushing (bushing inside diameter after assembly must be .625-.626").

NOTE—Shift shaft bushings also have inside diameter of .625-.626" to allow shaft clearance of .0025-.0035".

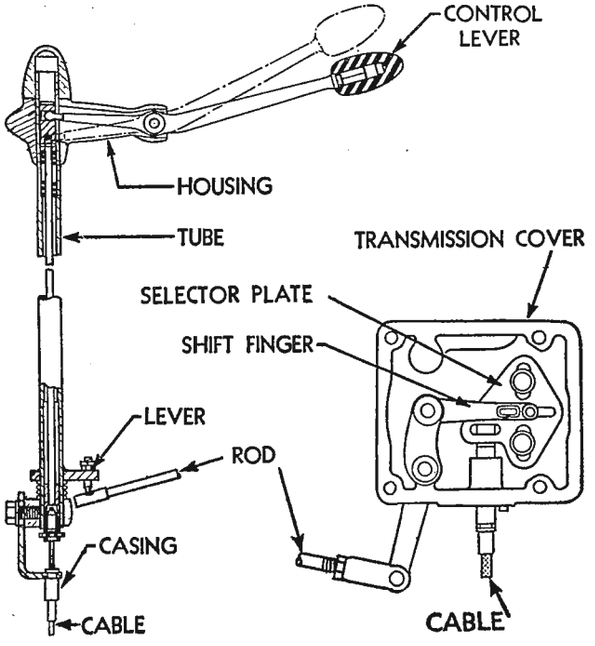


DRIVE-MASTER WIRING DIAGRAM

HUDSON 1939-40 HANDY-SHIFT

Six & Eight, All Models (1939-40)

DESCRIPTION: Handy Shift remote control with lever mounted on steering column beneath steering wheel. Shift lever linked to control rod and lever on transmission case (for gear engagement), selector cable and selector plate in transmission cover (for cross-shift). Backward and forward movement of the shift lever rotates the control tube and actuates the lever on the transmission case which is linked to the shifter lug engaging the shifter shafts in the transmission. Up and down movement of the shift lever actuates the selector cable and moves the selector plate in the transmission sidewise so as to engage the shifter lug with the correct shifter shaft.



ADJUSTMENT: Operating Rod (Gear Engagement). Hand lever should be at right angles to center-line of car in neutral position. To adjust, disconnect operating rod by removing cotter pin and clevis pin in yoke at transmission end of rod. See that shift lever on steering wheel and lever on transmission case are in neutral position, loosen locknut and turn yoke on rod until clevis pin can just be inserted without disturbing position of either lever. Tighten locknut and connect rod.

Selector Cable (Cross-shift)—Place steering column shift lever in 'up' position (low-reverse) at neutral and block in this position while adjustment being made. Loosen selector cable conduit bracket capscrew at lower end of steering column and pull up on conduit bracket until all slack removed from cable and cross-shift shaft in transmission is fully over on low-reverse side. Tighten bracket capscrew. Assure clearance of travel of spring lock in cable.

SERVICING: Remove horn button and steering wheel to remove any part of handy shift steering column unit. See above for transmission case end.

HUDSON 1941-47 HANDY-SHIFT

Six, All Models (1941 to 1947)
Eight, All Models (1941 to 1947)

TYPE:—Remote control type with steering column mounted gearshift lever. Design same as used on previous models except as follows:

Steering Column Unit—Cross-shift control cable ends protected by boots at both steering column and transmission case ends. Operating rod (gear engagement rod) has new type ends with adjusting clevis at forward (steering column) end of rod.

Transmission Case Shifter Mechanism — New type design used in conjunction with new synchromesh transmission. Gears are engaged by lever on inner end of shaft in side of transmission case which engages upper or lower shifter rail in case. This shaft and lever are shifted in or out (for cross-shift at neutral) by an inner lever on a vertical cross-shift shaft. Selector cable is connected to outer lever on this vertical shaft.

ADJUSTMENT:—Operating Rod (Gear Engagement)—With gearshift lever and transmission gears in neutral position, disconnect operating rod at lever on steering column by removing cotter pin and clevis pin, loosen locknut and turn clevis on rod until clevis pin can just be installed without disturbing position of transmission case shift lever and with gearshift lever in neutral and at right angles to centerline of car. Tighten locknut and connect rod.

Selector Cable (Cross-shift)—Place steering column shift lever in Low-Reverse or 'up' position at neutral and block in this position while adjustment being made. Loosen selector cable conduit bracket capscrew at lower end of steering column and move conduit bracket up until all slack removed from cable and shift lever at transmission case is fully over in Low-reverse position (lever to rear), tighten bracket capscrew securely. See that anchor on steering column end of cable (at lower end of control lever pushrod) has clearance at top and bottom of travel.

SERVICING:—Removal of steering column unit requires that horn button and steering wheel be removed first. Steering column can then be serviced as follows:

Gearshift Lever Removal—Remove control tube upper bracket clamp bolt (use Phillips type screwdriver), remove upper bracket and fulcrum bracket ring. Use Allen wrench (1941-42), or conventional wrench (1946-47) to remove the control lever fulcrum, withdraw control lever & anti-rattle washer. Remove selector cable anchor (at lower end of steering column unit), push end of pushrod up for access to control lever upper end. Assemble in same manner applying small amount of viscous chassis grease to bracket before installing.
NOTE—On 1946-47 cars, shift lever mounting bracket screws are self-locking, dowel type. Point of screw enters hole in jacket tube to positively anchor the bracket.

Steering Column Unit—Remove front seat cushion, accelerator pedal, floor mat, transmission opening cover, horn button and steering wheel. Disconnect control rod at steering column end, remove selector cable anchor bracket bolt, remove cable anchor and jacket tube bracket cap, pull jacket tube and control tube off steering column tube. Remove control tube upper bracket clamp bolt (Phillips type screw-driver), bracket, and bracket ring. Remove gearshift lever (see above). Remove fulcrum bracket setscrew, mark control tube and fulcrum bracket (to insure reassembly in same relative positions), press tube out of bracket. To remove lower bracket, remove clamp bolt and slide bracket off. Reassemble in same manner being careful to line up marks on control tube and fulcrum bracket. Adjust control rod and selector cable as directed above.

Transmission Case Shifter Mechanism—Refer to Hudson Transmission article for servicing data.

1948-51 HUDSON HANDY-SHIFT

6 & 8, All Models (1948-51)

►**DRIVE-MASTER CAUTION:** Handy-shift control used on Drive-master cars but should be adjusted in conjunction with other Drive-master units.
See "Hudson Drive-Master" data in this section.

DESCRIPTION: Remote control with steering column mounted gearshift lever. Design is same as used on previous Hudson models except for new gear engagement linkage as follows:

Gear Engagement Rods & Lever—New idler lever or bellcrank is pivoted on stud on steering gear mounting flange with forward rod extending from bellcrank to control tube on steering column, and rear rod extending from bellcrank to shift lever on transmission case. Linkage is adjusted by means of an adjusting clevis on the bellcrank end of the rear rod.

ADJUSTMENT: Check and adjust linkage in order as follows (Selector cable should only require adjustment if hard shifting, particularly in Second Gear, has been noted):

Gearshift Lever Position—Lever should be in crosswise (horizontal) position in neutral. If lever position not correct, remove clevis pin and adjust clevis on forward end of rear control rod at bellcrank on steering gear.

Gear Engagement Rod—Disconnect rear control rod at bellcrank on steering gear by removing clevis pin. Place gearshift lever in neutral position (see above). Make certain that the shift lever on side of transmission is in neutral (can be determined by feel), loosen locknut and adjust clevis on forward end of rear rod until clevis pin can just be inserted in clevis and bellcrank without disturbing position of gearshift lever or transmission shift lever.

Selector Cable (Cross-shift)—Move gearshift lever to extreme upper (Low-Reverse) position in neutral and block or hold lever in this position while adjusting. Loosen cable casing anchor bracket capscrew on steering column, pull anchor bracket up (screw hole slotted to permit this adjustment) until all slack removed from casing and shifter shaft inner lever on transmission case is fully over in the "Low-Reverse" position. Tighten anchor bracket capscrew and see that anchor has clearance at top bottom of travel.

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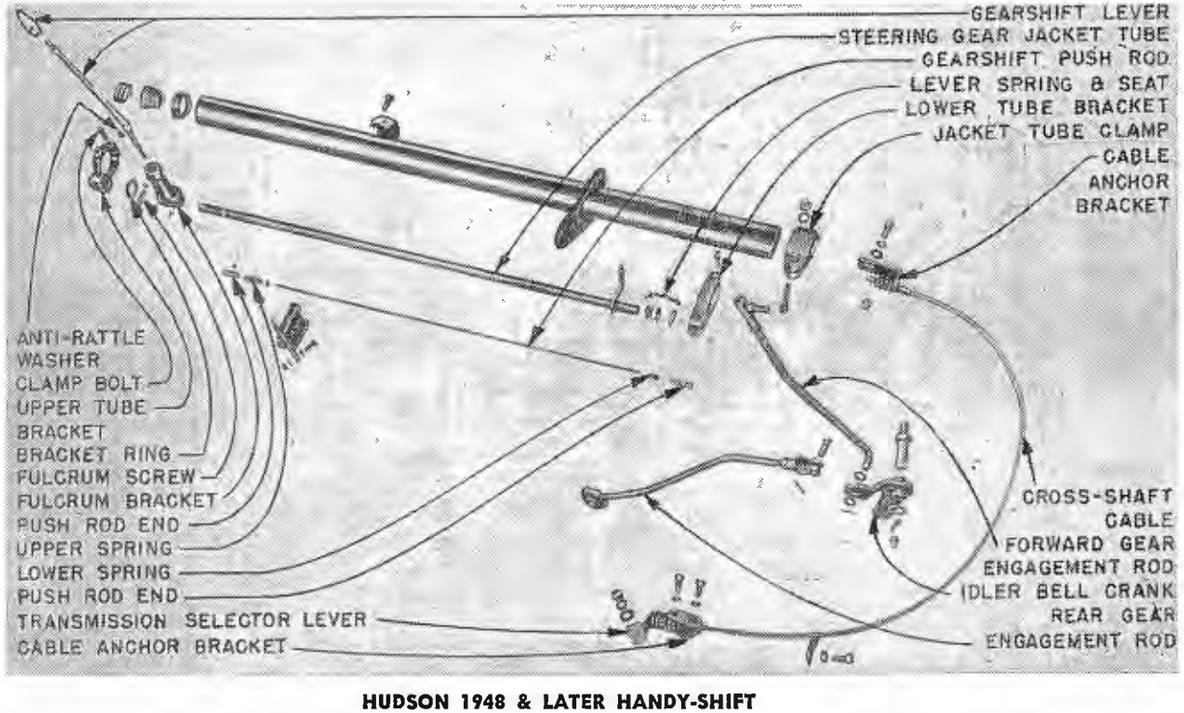


HUDSON 1948 & LATER HANDY-SHIFT

1948-51 HUDSON HANDY-SHIFT (Continued)

►*CAUTION*—Make certain that shift selector lever on transmission case (to which selector cable attached) is tight on its shaft and that bracket is tight on transmission case.

REMOVAL & INSTALLATION OF CONTROL UNITS: Gearshift pushrod (cross-shift selector cable rod) can be removed separately, or entire steering column gearshift unit can be removed as follows:

Gearshift Pushrod Removal: Remove steering wheel. Take out clamp bolt and remove control tube upper bracket and fulcrum bracket ring. Remove fulcrum screw from gearshift lever, remove lever and anti-rattle spring washer. Disconnect cross-shift cable at lower end of steering column unit by removing hairpin clip. Remove anchor bracket capscrew, pull pushrod down far enough to remove key attaching pushrod to pushrod upper end fitting, remove this end fitting, use a wire hook to remove compression spring and seat at upper end of pushrod. Pushrod can then be withdrawn from control tube.

Installation—Coat pushrod end fittings with viscous chassis lubricant when installing them in control tube, assemble parts by reversing removal instructions.

Gearshift Assembly Removal: Remove horn ring and steering wheel. Lift carpet around steering column, remove metal and rubber dustcovers at floor opening. Remove setscrew from gearshift lever fulcrum bracket and clamp bolt from control tube upper bracket. Remove retainer plate and steering jacket tube clamp at instrument panel. Disconnect cross-shift cable from pushrod at lower end of control tube by taking out hairpin clip. Free cable anchor bracket by taking out capscrew. Disconnect gear engagement rod (forward rod) at lever on lower end of control tube. Remove compression spring and spring seat washer from lower end of control tube. Control tube assembly can then be removed.

►**Steering Gear Jacket Tube Removal Note**—This tube can be removed as a unit with gearshift control tube attached by loosening steering gear housing mounting bolts to allow steering gear to drop sufficiently for clearance. Then loosen jacket tube clamp at steering gear housing, lift jacket tube by swinging the lever up and to the right and out through opening at floor cover. When installing jacket tube, reverse this procedure.

Installation: Assemble all parts by reversing removal instructions (above). Before installing control tube upper bracket, check condition of spacer ring (between gearshift lever fulcrum bracket and upper bracket) and replace ring if less than .025" thick. Adjust controls after installation completed.

►**Anchor Bracket & Cross-shift Cable Installation Caution**—These parts must be correctly positioned during installation as follows: Move gearshift lever to extreme upper position (Low-Reverse side in neutral) and hold in this position, pull selector cable bracket and tube upward until all slack removed from casing and control wire with transmission case shift lever fully over on Low-Reverse side. Tighten anchor bracket capscrew and make certain that anchor has clearance at top and bottom of travel.

Transmission Case Shifter Mechanism: *See "Hudson Transmission data.*

1949-51 FRAZER & KAISER

Frazer, All Models (1949-50-51)

Kaiser, All Models (1949-50)

DESCRIPTION: Remote control with steering column mounted gearshift lever. Design changed from that used on 1947-48 models in the following particulars:

Gearshift Lever & Upper Gearshift Bracket—New mounting bracket bolted on steering column tube with gearshift lever arm linked to shift shaft by drive pin in shaft. Cross-over spring which holds shaft and lever in lower (second-high) position located at lower end of shift shaft (no springs at upper end).

Shift Levers & Lower Gearshift Bracket—Similar to type used on previous cars except that cross-over spring located in bracket socket below shift shaft and **levers reversed from previous location** (second-high lever is UPPER lever).

Shift Rods & Idler Bellcrank—Idler bellcranks mounted on shaft on left frame side rail with upper (non-adjustable) shift rods linked to steering column shift rods, and lower (adjustable) rods linked to transmission case shift levers.

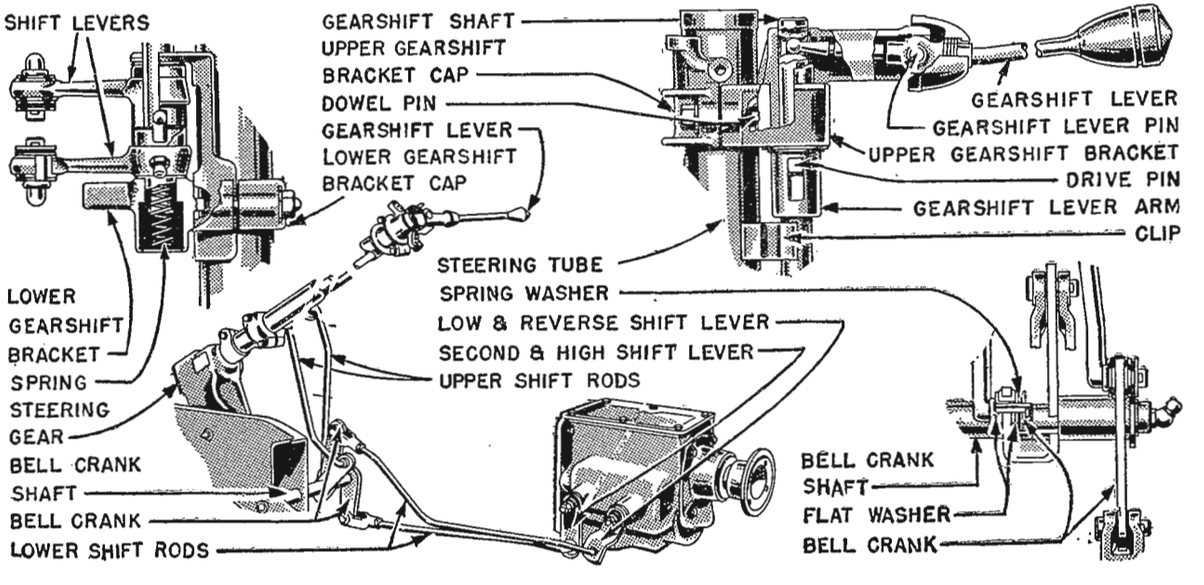
ADJUSTMENT: Shift Rods—Disconnect rear (adjustable) shift rods at idler bellcranks on left frame side rail, place gearshift lever in neutral position. Align lower shift levers and lock in this position by inserting ¼" drill rod through hole in each lever and locating hole in lower bracket. Check gearshift lever for free up-and-down movement in neutral to insure that shift shaft pin does not bind in shift lever slots. See that transmission gears and shift levers in neutral (can be determined by feel of detent poppet balls engaging neutral notches in shifter shaft cams). Adjust clevis on forward end of each rear shift rod so that rods can be connected without disturbing position of transmission gears and levers. Connect rods and remove locking rod from steering column levers.

Gearshift Lever Travel—Travel must be checked and adjusted to insure full gear engagement. Disconnect second-high shift rod at forward lever on transmission case, shift transmission into second gear by moving this lever to the forward position. Move gearshift lever and upper shift lever on steering column to second gear position (as far as possible upward). Check position of rod end in relation to hole in lever on transmission case. Rod end should be slightly short of lever hole to insure full engagement of gears before gearshift lever reaches end of travel. Do not change rod adjustment unless it is too long, or more than slightly short of lever hole. Repeat this check in each gear position (rod should be **slightly short** in Second & Reverse, **slightly long** in Low & High). Connect rods and recheck shift rod adjustment to see that gearshift lever has free up-and-down travel in neutral.

DISASSEMBLY: Disconnect shift rods at levers on lower end of steering column. Entire steering column unit can be freed from steering column tube by taking out upper and lower bracket bolts (steering column jacket cover can be removed for access to upper bracket by removing steering wheel and taking out attaching screws holding the two jacket cover sections together).

REASSEMBLY: Assemble parts by reversing disassembly order. When installing brackets on steering column, make certain that locating dowels enter holes in steering column tube.

TRANSMISSION CASE SHIFTER MECHANISM: *See Warner Transmission data.*



1949-51 FRAZER & 1949-50 KAISER TRANSMISSION CONTROL

1947-48 FRAZER & KAISER

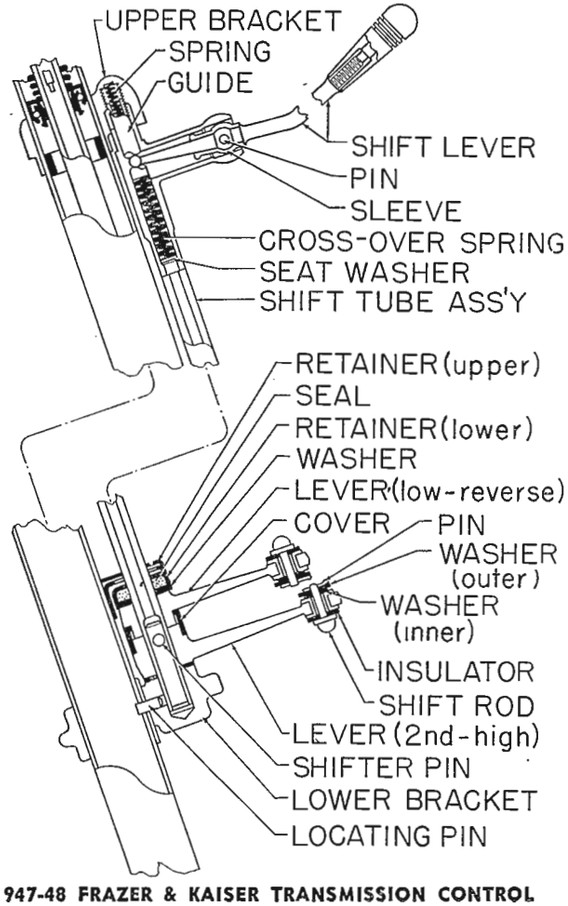
Frazer & Kaiser, All Models (1947-48)

DESCRIPTION: Remote control with steering column mounted gearshift lever under the steering wheel. Steering column unit consists of a single control tube mounted on brackets on steering column with lower end of tube engaging one or the other of the two levers mounted at this point. These levers are linked to shifter shaft levers on transmission case by rods which have adjustment at transmission case end. Control shaft is normally held down in the lower position (Second-High position). Shaft is raised by lifting up on gearshift lever (for Low-Reverse position).

ADJUSTMENT: With gearshift lever in neutral, disconnect control rods at transmission case, align levers at lower end of steering column by installing aligning pin (¼" drill rod) through hole in each lever and hole in bracket. See that each of the shifter shafts on the transmission is in neutral position (can be determined by feel of detents engaging neutral notch in shaft). Adjust each rod at transmission end by means of clevises provided so that shifter shafts will be in neutral position with steering column levers aligned with aligning pin. After adjustment completed, remove aligning pin from steering column levers.

►*CAUTION—Make certain that control rods do not extend through clevises far enough to bind on levers when operating control (correct this condition by shortening rods).*

DISASSEMBLY: Disconnect shift rods at levers on lower end of steering column, take out lower bracket mounting bolts, disassemble bracket and shift levers from shift tube (pin must be removed to permit upper low-reverse lever to be removed). Take out gearshift lever pivot pin, withdraw lever. Shift tube can then be moved downward to free it from guide pin in upper bracket on steering column tube (column jacket must be removed first). When reinstalling shift tube make certain that seat washer and cross-over spring installed in upper end of tube and that gearshift lever ball end engages guide pin.



1947-48 FRAZER & KAISER TRANSMISSION CONTROL

1951 KAISER & HENRY J

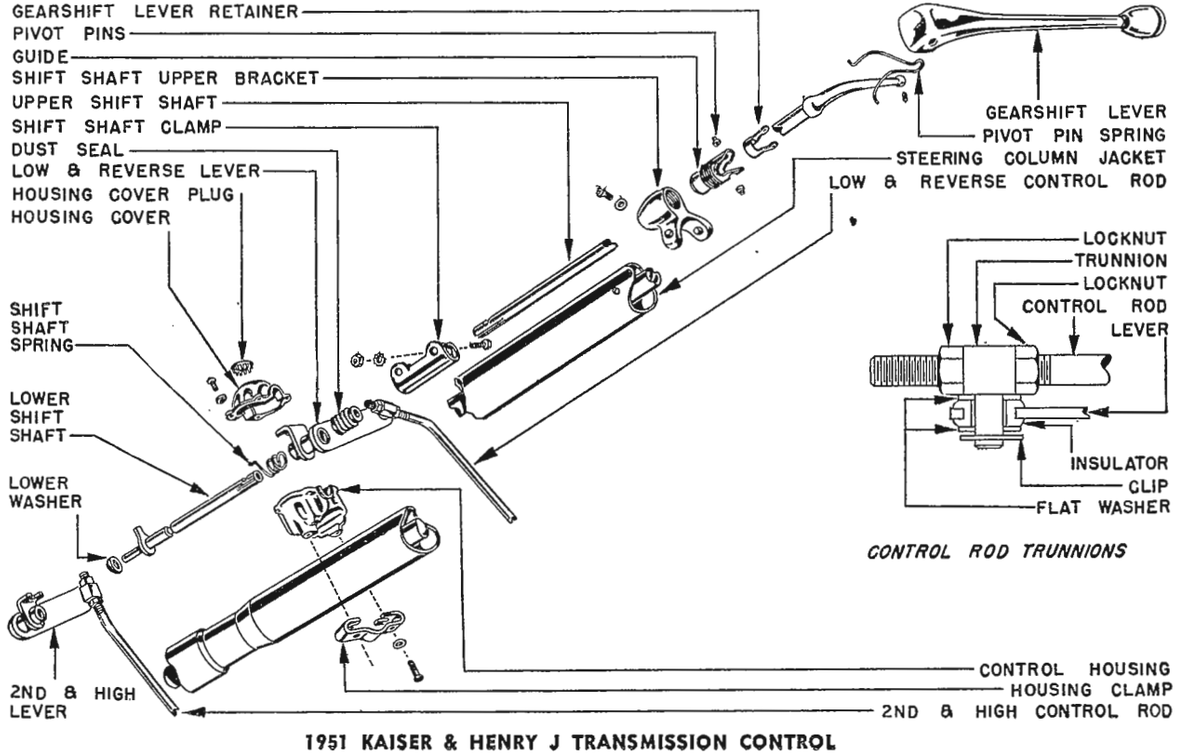
Henry J 4 & 6, K-513 & K-514 (1951)
Kaiser, All Models (1951)

DESCRIPTION: Remote control type with gearshift lever mounted on steering column. Gearshift lever is pivoted in mounting bracket on upper end of steering column and has engaging dog or lug on lower end of control shaft which engages one or the other of the two "inner levers" in the housing at the lower end of the steering column. These inner levers are linked to the shifter levers on the side of the transmission case by means of adjustable rods (see Adjustment below). Gearshift lever is normally in the "Second-High" (lower) position in which it is held by a spring at the lower end of the control shaft and must be raised, against spring tension, to shift lug into engagement with the "Low-Reverse" lever and rod (upper position).

ADJUSTMENT: Place gearshift lever in neutral position, loosen both trunnion nuts on each shift rod at levers on lower end of steering column so that rods are free. Remove inspection cap on control housing cover, install special aligning plug Gauge KF-69 through this hole (gauge will align gates in inner levers in neutral position). Make certain that each transmission case shift lever is in neutral position (can be determined by feel of detent plungers engaging notches in shifter shaft sectors). Tighten both trunnion nuts on each shift rod securely against trunnion using care **not to change rod and transmission lever positions or to spring control levers.**

REMOVAL: Disconnect both shift rods at control housing levers on steering column by taking out trunnion pin cotter pins. Take out two mounting screws in gearshift lever housing bracket under steering wheel, remove two capscrews in shift control housing bracket at lower end of steering column, remove bracket cap. Control shaft can be split at coupling above lower shift control housing and each section lifted out separately.

TRANSMISSION CASE SHIFTER MECHANISM: *See Warner Transmission data.*



CONTROL ROD TRUNNIONS

1951 KAISER & HENRY J TRANSMISSION CONTROL

NASH 1939

Nash 3920 Amb. 6, 3980 Amb. 8 (1939)
Nash-Lafayette, Model 3910 (1939)

NOTE: This type control used in conjunction with special transmission with constant-mesh gears (all speeds). See separate article on Nash Transmission for Transmission servicing data.

DESCRIPTION: Remote control with lever mounted on upper end of control tube under steering wheel. Control tube is mounted on bracket on steering column (upper end) and bracket on frame (lower end) to provide both forward-and-backward motion (for gear engagement), up-and-down motion (for cross-shift at neutral). Operating mechanism at lower end of steering column consists of a gear segment on the lower end of the control tube which meshes with one of two gear segments mounted on ends of two concentric cross-shafts. Levers at opposite ends of these shafts are connected to shift levers on transmission case by rods. Cross-shaft assembly is mounted on ball-and-socket type joints on frame bracket (left end), bracket on crankcase (right end) and outer shaft is mounted on ballbearings on inner shaft. A selector pin in the lower end of the shift lever control tube and a slotted selector plate on the bottom of the lower mounting bracket permits cross-shift to be made only in neutral position and also limits movement of shift lever in the various gear engaged positions. This cross-shift consists of lifting the shift lever and control tube assembly so that the control tube gear segment is lifted out of mesh with the cross-shaft lower gear segment (on inner shaft and connected to the forward or second-high shifter lever on the transmission case) and meshed with the cross-shaft upper gear segment (on outer shaft and connected to rear or low-reverse shifter lever on transmission). A centering spring on a rod connected between a bracket on the control tube lower mounting bracket and a lever on the lower end of the control tube assists in retaining shift lever in neutral or engaged positions and facilitates the lever return to neutral.

ADJUSTMENT: See that clearance between upper edge of selector pin in lower end of control tube and lower face of selector plate is 1/64" with shift lever in lower or second-high position (adjusted by changing position of upper mounting bracket—see Servicing data below). Disconnect rods linking cross-shaft levers and shift levers on transmission case, place steering column shift lever in neutral (selector pin in line with notch in selector plate), see that forward shift lever on transmission case in neutral position (detent plunger engaging center notch on shifter shaft sector), loosen ball stud mounting nut on inner cross-shaft lever (long lever, nearest engine), adjust position of ball stud so that rod can be connected without disturbing shift lever or transmission case lever, tighten ball stud nut. Adjust outer cross-shaft lever (small lever, nearest frame) ball stud in same manner with rear transmission lever in neutral and shift lever engaging upper gear segment with selector pin in line with selector plate slot. Check operation to make certain that cross-shafts operate freely and that levers and rods do not interfere with other parts in any position or during engine movement.

SERVICING: Control Tube Upper Mounting Bracket. Mounted on steering column by clamp bolts. Adjust position of bracket on steering column so that clearance between upper edge of selector pin in lower end of control tube and lower face of selector plate is 1/64" with shift lever in lower or second-high position.

Cross-Shaft Assembly:—Outer shaft ball bearing cups are driven in ends of shaft and bearing cones are fitted on inner shaft. Bearings should be packed with adhesive oil and rubber seal installed at outer end. Adjust by positioning second-high lever on inner shaft to control bearing endplay (lever is keyed to shaft and locked by clamp bolt.

Cross-shaft Adjustment—Gear segment mesh controlled by left hand (frame bracket) shaft mounting stud. To adjust, loosen locknuts on stud, turn stud with screwdriver to position shaft assembly so that gear segments mesh freely with minimum clearance, tighten both locknuts. Shaft is spring-loaded on engine bracket mounting stud to keep shaft in contact with frame bracket stud.

NASH 1940

NASH, SIX MODEL 4020, EIGHT MODEL 4080 (1940)
NASH-LAFAYETTE, MODEL 4010 (1940)

TYPE:—Remote control type with steering column mounted gearshift lever. Design not similar to type used on 1939 car models. Shifter lever on lower end of gearshift rod has two cone-shaped prongs which engage rubber grommets in shift levers mounted on threaded bracket on steering column, these levers being connected through rods and idler levers to shift levers on transmission case. Shifter lever is normally engaged with lower (Second-High) shift lever and is lifted up so as to disengage this lever and engage upper (Low-Reverse) shift lever when gearshift lever is moved up toward steering wheel in neutral.

ADJUSTMENT:—If overshift stops out of adjustment (caused by removal or dismantling of transmission etc.), adjust these stops as directed below first, then adjust connecting rods as follows: Install aligning pin, Tool J-1390, through holes in both shift levers and notch in mounting bracket between levers (pin will hold levers in neutral position while adjustment being made). Loosen setscrews and locknuts in connecting rod trunnions at outer end of each shift lever on transmission case cover, adjust each rod by carefully placing shift lever in neutral position (determine by feel of detent plungers engaging notch in shifter fork sector), tighten trunnion setscrew and locknut without disturbing lever position, remove aligning pin.

Overshift Stop Adjustment:—To adjust stops, loosen shift lever trunnion stopscrews so that levers can be moved freely. Move Second-High lever (front lever) to rear to engage Second Gear. Loosen locknut and back off second gear stopscrew (front screw on right hand side of case), make certain that detent plunger engaged in second gear notch in shifter fork sector (determine by feel), tighten stopscrew until very slight overshift or additional travel of lever toward rear is possible, then tighten locknut. Move Low-Reverse lever (rear lever) toward front to engage Low Gear, adjust stopscrew (rear screw on right hand side of case) in same manner as for second gear (above) to permit slight overshift of lever toward front. Then move Low-Reverse lever to rear to engage Reverse Gear, adjust reverse overshift stop (angle stop mounted on left rear transmission case cover screw) for minimum clearance with detent plunger engaged in reverse fork sector notch (stop must be parallel to lever and cover screw securely tightened). Then adjust connecting rods as directed above. NOTE—High Gear overshift stop is located within transmission case and cover must be removed to adjust this stop.

SERVICING:—**Gearshift Lever**—Lever pivoted on threaded bushing with fixed pivot and adjustable pivot screw. Threaded bushing turns in upper jacket tube bracket and must be installed with one full thread exposed above bracket to insure full travel and maximum bearing area of bushing threads in bracket. Lever must be securely fastened to threaded bushing by tightening adjustable screw and locked with capnut.

Shift Lever Assembly (Steering Column Unit)—Shift levers at lower end of control rod on steering column are mounted on threaded bearing tube which is mounted in lower support bracket and positioned by retaining screw and locknut in bracket. This threaded bearing tube also supports lower end of control rod and guides selector pin which allows cross-shift (up and down motion to engage one or the other shift lever) to be made only at neutral. If this assembly dismantled, screw shift levers on each end of bearing tube (one lever above bracket, other lever below bracket) with aligning pin bosses in until distance between inner faces of levers (not rubber grommets) is 1⅜". Install aligning pin through holes in both levers and notch in mounting bracket, adjust pronged shifter lever (keyed and clamped on control rod) up or down until prongs enter rubber grommets on levers and fully disengage from one lever when engaged in opposite lever, then tighten bearing tube retaining screw and locknut on side of lower support bracket. Screw on lower end of shift rod retains selector pin and limits up and down travel of control rod. This screw also retains rubber boot which seals lower end of bearing tube.

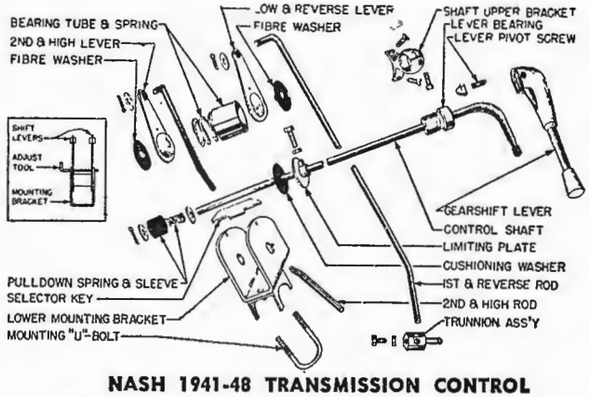
Idler Lever and Shaft—Idler levers are mounted on vertical shaft which is pivoted on crankcase flange at lower end and supported by tie rod extending to bracket on steering column at upper end. Adjust bracket on steering column so that shaft is vertical with engine idle. This mounting provides for engine movement due to torque reaction and noise is prevented by tension spring at lower end of shaft.

1941-48 NASH

"600" Six, All Models (1941 to 1948)
Ambassador Six, All Models (1940 to 1948)
Ambassador Eight, All Models (1941-42)

DESCRIPTION: Remote control type with steering column mounted gearshift lever. Steering column unit consists of a single control shaft mounted in upper and lower brackets on steering column with key in lower end which engages one or the other of the two levers mounted on the lower bracket. These levers are linked to shifter shaft levers on transmission case by adjustable rods.

ADJUSTMENT: With gearshift lever in neutral, install special aligning pin J-1390 through holes in both flanges of steering column lower bracket and through holes in both levers so that levers are aligned in this neutral position. Loosen locknut and back off setscrew on each rod trunnion on transmission case shifter shaft levers. Carefully position each shifter shaft so that gears are in neutral (can be determined by feel of detents engaging neutral notch in sector on inner end of shafts), tighten setscrews & locknuts, remove aligning pin.



NASH 1941-48 TRANSMISSION CONTROL

REMOVAL & DISASSEMBLY: Steering column unit must be disassembled to permit removal as follows:

►*CAUTION*—Gearshift control shaft upper bracket mounting screws are threaded into split ring within steering column jacket. Do not displace ring when removing screws (will require disassembly).

Steering Column Unit—Disconnect rods at levers on steering column, remove cotter pin in lower end of control shaft, remove plain washer, pull-down spring, rubber sleeve, and second washer from end of shaft. Remove lower mounting bracket "U" bolt, free mounting bracket locating dowel from hole in steering column. Rotate control shaft until selector key lines up with notch in mounting bracket, work bracket assembly down and off shaft (shifter levers, washers, bearing tube and spring will come off with bracket as an assembly). Lift out selector key (1940-42 cars—not necessary on later cars). Remove setscrew in limiting plate, slide plate and rubber washer off lower end of shaft.

Gearshift Lever, Shaft, & Upper Bracket—Take out gearshift lever pivot screw and pin, remove lever. Loosen upper bracket clampscrew, remove bearing hub from bracket. Remove two bracket capscrews (see CAUTION below), lift out shaft and bracket assembly.

►*CAUTION*—Bracket screws must be removed as follows to prevent displacing split ring within column jacket: Remove top screw, loosen bottom screw, then insert small drift in upper screw hole to hold split ring while bottom screw being removed. Remove bracket, replace one screw to hold ring in position until bracket re-installed.

INSTALLATION: Reverse the removal & disassembly directions above and note following points:

Gearshift Lever & Upper Bracket—Apply light film of Lubriplate to shaft and threaded part of bearing hub, screw bearing down in bracket so that clearance will exist between shift lever and bracket with lever in Low-Reverse position.

Lower Bracket & Lever Assembly—Apply light film of Lubriplate on all rubber surfaces, make certain that bracket locating tongue engages hole in jacket tube when bracket installed. Install bracket with slotted hole uppermost. See that levers and spring installed properly (fibre washer between each lever and bracket flange, spring within bearing tube between levers). Install pulldown spring and washer assembly on lower end of control shaft and install cotter pin.

Limiting Plate Adjustment—Must be adjusted so that control shaft selector key does not rub on lower flange of mounting bracket. To adjust, loosen locknut and back off adjusting setscrew. Engage control shaft with Second-High lever fully, then raise shaft slightly to provide clearance between key and lower flange of bracket, position limiting plate so that rubber cushioning washer is against bracket top flange, tighten setscrew and locknut.

1949-51 NASH

All Models (1949-51) with Synchro-mesh Trans.

►**Nash Rambler Note**—This control same as other models except for slightly different gearshift lever and operating shaft design. ***See Disassembly & Reassembly data below.***

►**Hydra-Matic Drive Control Note**—***See Hydra-Matic Drive Transmission data for control adjustment on Hydra-Matic Drive cars.***

DESCRIPTION: Remote control type with steering column mounted gearshift lever. Design similar to previous models except that entire steering column unit enclosed within steering gear jacket tube.

Rambler Gearshift Lever—Gearshift lever under steering wheel is pivoted in lower edge of instrument panel to right of steering column (chrome ball in panel opening serves as pivot). Steering column unit is same as used on other Nash models.

ADJUSTMENT: Place gearshift lever in neutral, lock shift levers at lower end of steering column by inserting J-1390 Aligning Tool through hole in mounting bracket and hole in each lever. Disconnect shift rods at levers on side of transmission case, check to see that transmission gears and shifter levers in neutral (can be determined by feel of detent balls engaging neutral notches of shifter shaft cams). Adjust transmission end of each shift rod so that rods can be connected without disturbing position of levers, connect rods, remove aligning tool from steering column levers, check gearshift lever for smooth up-and-down (cross-over) action in neutral.

DISASSEMBLY: Place gearshift lever in neutral, disconnect both shift rods at shift levers on steering column. On all models except Rambler (see Rambler Note below), remove steering wheel (see Steering Gear), remove ignition switch mounting bolt (1949 models only) and three screws mounting bearing retainer on steering column tube, lift bearing retainer out. Remove gearshift lever knob, use wrench on flat on lever to unscrew lever (NOTE—on 1949 cars where this flat not provided, screw two nuts on outer end of lever and lock nuts together, then use wrench on inner nut to unscrew lever), remove lever from housing. Remove dirt seal spacer retainer from between the shift levers at lower end of steering column, remove both halves of the spacer. Push selector pin in shifter operating shaft out and remove pin from beneath shaft. Pull operating shaft out through upper end of steering jacket tube (CAUTION—Inner Spring in lower end of operating shaft will come out with the shaft). Remove large Outer Spring and Spacer from below low-reverse shift lever, then remove shift levers, dirt seals, and bronze fulcrum from opening in jacket tube.

►**Rambler Gearshift Lever Removal Note**—Remove gearshift lever knob and gearshift lever nut, push lever toward instrument panel which will loosen chrome ball (lever pivot), slide ball off over end of lever. After disconnecting and removing housing assembly from steering column, maneuver gearshift lever and operating shaft through instrument panel

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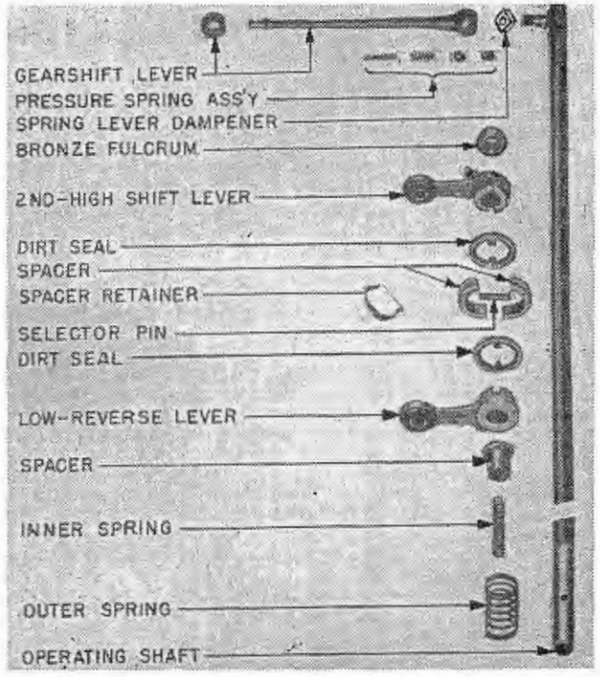

NASH 1949 & LATER TRANSMISSION CONTROL (RAMBLER SIMILAR)

1949-51 NASH (Continued)

hole and remove this assembly from inside the car. ***CAUTION—Note position of Spring Washer, Pressure Spring, and Spring Retainer on gearshift lever to insure reassembly in same relative positions.***

REASSEMBLY: On all models except Rambler (see Rambler Note below), insert the operating shaft through upper end of column jacket tube until end just visible in shift lever opening, lubricate bronze fulcrum and install on tube, install inner spring in end of tube. Place rubber dirt seal on hub of second-high operating lever with metal side of tongue facing down (to provide seat for selector pin), install lever on operating shaft with notch for selector pin downward. Place rubber dirt seal on low-reverse lever and install lever similarly except that metal tongue on seal and selector pin notch on this lever should face upward toward pin. Install spacer and large spring over lower end of operating shaft and push shaft down into place in tube. Turn shaft so that selector pin hole indexes with notches in shift levers, install selector pin, spacer halves, and spacer retainer. Adjust shift rods (see ADJUSTMENT above), install and tighten gearshift lever and knob. Lubricate shifter mechanism through lubricant fitting on shift lever.

►**Rambler Gearshift Lever Installation Note**—Install the gearshift lever and operating shaft assembly through the floorboard opening and rubber dirt seal, then assemble all parts of housing assembly on steering column. Then install gearshift lever spring washer, pressure spring, and spring retainer on gearshift lever, guide lever through hole in instrument panel, install chrome pivot ball and lever nut on gearshift lever, replace gearshift lever ball.

1939 OLDSMOBILE HANDI-SHIFT

SERIES 60 SIX, MODEL F-39 (1939)

SERIES 70 SIX, MODEL G-39 (1939)

SERIES 80 EIGHT, MODEL L-39 (1939)

DESCRIPTION: Remote control with steering column mounted shift lever. Shift lever pivoted on bracket on upper end of control shaft on steering column so that up-and-down motion of lever actuates selector rod (within control shaft) and selector cable (for cross-shift) while backward-and-forward motion of lever rotates control shaft and actuates control rod (for gear engagement). Shift lever normally held down in Second-High position by spring on lower end of selector rod and must be raised against spring tension for Low-Reverse.

ADJUSTMENT: Selector Cable. See that shift lever and transmission gears in neutral position, measure distance from lower edge of steering wheel rim to upper edge of shift lever. Distance should be **2 7/16-2 9/16".** To adjust, back off one nut on cable coupling at lower end of selector rod (top nut to increase distance, lower nut to decrease distance), tighten opposite nut. Make certain that both nuts tight after making adjustment.

Control Shaft Rod—With shift lever and transmission gears in neutral, shift lever should be approximately 1½" above (forward) horizontal position. To adjust, take out clevis pin at selector shaft lever (transmission case) end of control rod, make certain that transmission gears and selector shaft lever in neutral position, place shift lever in neutral position, install J-1082 gauge on selector cable anchor bracket on steering column so that control rod end (extending through control shaft lever) engages slot in gauge. Loosen locknut and adjust clevis on transmission case end of control rod until clevis pin can be entered in clevis and selector shaft lever freely, tighten locknut. NOTE—This adjustment should be made whenever control rod is disconnected at either end.

STEERING COLUMN UNIT SERVICING: To remove shift lever, use tool J-1044 to press in on both pivot pins and release lever. Use care not to lose pivot pins and spring or tension spring in socket on inner end of lever. Lever clearance in bracket controlled by shims assembled on pivot pins. Install shims as required to secure free fit but make certain that anti-rattle washer installed on one pin. When installing lever, make certain that tension spring in place in inner end of lever and that lever tip is inserted under plunger and plunger spring in upper end of control shaft.

TRANSMISSION UNIT SERVICING: Disassembly. Disconnect control rod from selector shaft lever, and selector cable clip from transmission case cable anchor bracket. Unscrew cable from selector shaft, remove cable, selector shaft lever and springs (selector cable connector locks lever on shaft). Remove transmission cover, use tool KMO-244 to take out setscrews in selector shaft shift fingers, withdraw shaft through side of case being careful not to drop shift fingers or cams into transmission case. Do not remove selector shaft oil seal unless new seal to be installed (seals cannot be re-installed).

Reassembly—With selector shaft installed in transmission case, place special aligning tool J-1066 in end of shaft (where selector cable normally attached), position selector cable anchor bracket so that tool is centered in anchor bracket selector cable slot, tighten anchor bracket mounting bolt. This adjustment important to preserve selector cable alignment and prevent wire binding in cable conduit. Remove tool, install selector shaft lever, selector cable (make certain that cable screw tight in selector shaft and that cable clip tight on anchor bracket), control rod and lever spring.

NOTE—Selector shaft lever spring has over-center linkage (no tendency to rotate shaft in neutral position) and must be correctly installed. Spring link must be below selector shaft and hooked to pin on transmission side of lever.

OLDSMOBILE 1939 HANDI-SHIFT

1940-50 OLDSMOBILE HANDI-SHIFT

Six, All Models (1940 to 1950)

Eight, All Models (1940 to 1948)

►**HYDRA-MATIC DRIVE NOTE:** Control data below applies to Synchro-mesh transmission cars only. Hydra-Matic Drive control is of different design and adjusted differently. ***See Hydra-Matic Drive Transmission data.***

DESCRIPTION: Remote control with steering column mounted gearshift lever. Design on all models is similar except for following changes:

1940 & Later Gearshift Lever & Selector Linkage: Changed from previous design as follows:

Gearshift Lever—Lever now pivoted on plain pin in control shaft bracket. Pin is retained by retainer ring and entire shift lever pivot assembly is enclosed by rubber boot.

Selector Rod & Lever Assembly—Selector control rod in control shaft on steering column now connected to new type selector lever and shaft assembly in transmission by connecting rod (no cable used). Adjustment provided on lower end of selector control rod at connection to lever.

1941 & Later Control Rod Linkage: New idler lever and redesigned linkage used as follows:

Control Rod (Gear Engagement) Linkage—New relay lever (idler lever) mounted on left side of engine with front non-adjustable rod connected between this idler lever and lever on steering column and additional rear adjustable rod connected between idler lever and gear shift lever on transmission case. Rear rod has adjusting clevis on transmission case end.

1949-50 Steering Column Unit: Design changed to new gearshift tube which is concentric with steering gear shaft in steering column and with different type shift levers and control rods (see illustration).

ADJUSTMENT (ALL 1940-48 MODELS): ***Two separate adjustments required:***

Selector Rod (Cross-shift) Linkage—See that both shift lever and transmission gears in neutral, check vertical distance from top of gearshift lever to lower face of steering wheel rim. This distance should be **2 11/16—2 13/16".** To adjust, remove cotter pin and take out lock pin in lever which engages adjusting screw on lower end of selector rod, turn adjusting screw up to reduce lever-to-wheel distance, down to increase this distance. Install lock pin from engine side making certain that it passes through waved spring washer on inside of lever, install cotter pin.

Control Rod (Gear Engagement)—With transmission gears in neutral, gearshift lever should be 1½" (1940), ½" (1941-47) above the horizontal. To adjust, disconnect shift rod at lever on transmission case (upper gear engagement lever), see that this lever in neutral position (can be determined by feel of detent balls engaging notches in shifter shafts).

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1940-50 OLDSMOBILE HANDI-SHIFT (Cont.)

Install aligning gauge J-1445 (1940), J-1609 (1941 on see Note) on lower end of control shaft and steering column so notch in gauge engages control shaft lever. Gauge will hold lever in correct neutral position 1½" (1940), ½" (1941 on) above the horizontal. Loosen locknut and turn adjusting clevis on transmission end of shift rod until clevis pin can just be inserted without disturbing position of transmission shift lever. Tighten locknut and connect rod, remove gauge. NOTE—This adjustment should be made each time shift rod is disconnected at either end. Improper adjustment may cause interference with brake pedal.

Aligning Gauge Note—New Part No. J-1872 gauge required for Series 66, 68 Convertible Models and all Series 98 Models which have larger (1¾") diameter steering column.

ADJUSTMENT (ALL 1949 & 1950 6 Cyl.): *Two separate adjustments required:*

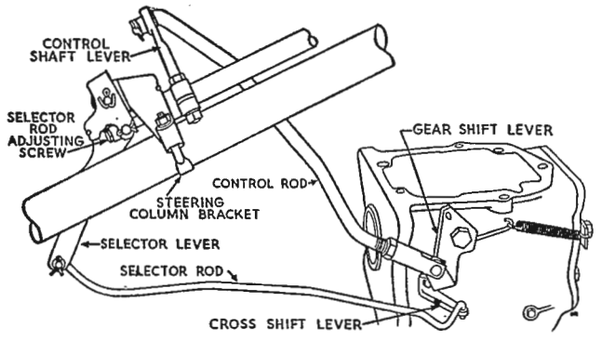
(1) Selector Rod (Cross-shift) Linkage—Place gearshift lever in neutral, disconnect selector rod from selector lever on steering column (upper lever), loosen locknut and adjust clevis at forward end of selector rod so clevis pin can just be inserted when vertical distance from top of steering wheel rim to top of gearshift lever knob is exactly 2 11/16". Tighten clevis locknut and connect rod.

(2) Shift Control Rod (Gear Engagement) Linkage—Place gearshift lever in neutral, disconnect shift rod from shift lever on steering column (lower lever), make certain that transmission gears in neutral, loosen locknut and adjust clevis at forward end of shift rod so that clevis pin can just be inserted when horizontal distance of gearshift lever knob center-line is exactly 1 3/16" above steering wheel horizontal center-line. Tighten clevis locknut and connect rod.

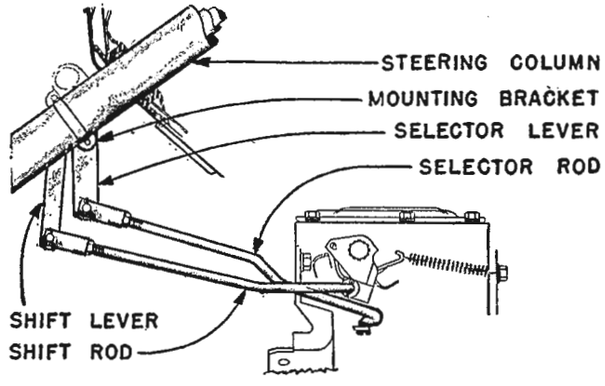
DISASSEMBLY & REMOVAL: As follows:

Gearshift Lever Removal—To remove lever, slide rubber cover toward outer edge to expose retainer ring, remove retainer ring, take out shift lever pivot pin, remove lever being careful not to lose shims and washers between lever and bracket. When reinstalling lever, make certain that anti-rattle spring in place on inner end of lever and that spring washer installed on pin on one side of lever and install shims (as required) on opposite side of lever so that lever operates freely without excessive sideplay or rattles.

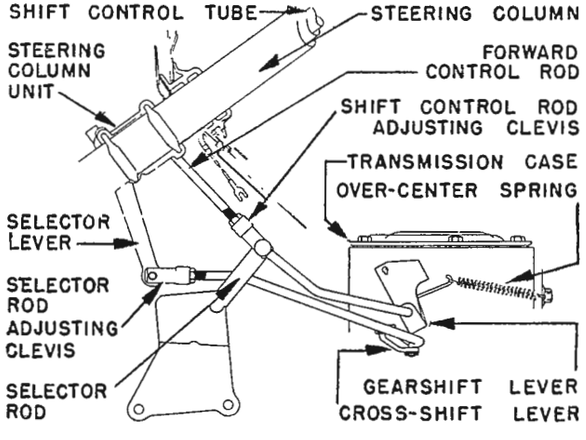
Transmission Case Shifter Mechanism—Selector shaft and shifter shafts (for gear engagement) are same design as used on previous models. See Transmission article for dismantling and servicing directions. CAUTION—Selector shaft must be removed through right side of case and installed on left side to avoid damage to oil seal. Lower lever must be removed from vertical cross-shift shaft before selector shaft is driven out (to permit upper lever on shaft to disengage from selector shaft).



OLDSMOBILE 1940-48 HANDI-SHIFT



OLDSMOBILE 1949 HANDI-SHIFT



OLDSMOBILE 1950 6 CYL. HANDI-SHIFT

1950 OLDSMOBILE 8

8 Cyl. Series 88 & 98 (1950)

►***This control not like type used on 1950 6 Cyl. or previous 8 Cyl. models.***

DESCRIPTION: Remote control type with steering column mounted gearshift lever. Gearshift lever is pivoted in carrier on upper end of steering column and operates a single shift tube within the steering column jacket. Shift tube has single engaging key at lower end which engages keyway in upper (Second-High) or lower (Low-Reverse) shift lever at lower end of steering column. Tube is normally held in upper Second-High position by cross-over spring at lower end and is moved down to engage Low-Reverse lever by lifting up on gearshift lever (key disengages one lever in picking up the other lever). Each lever is connected to a shift lever on the side of the transmission case by a rod which has an adjustable fitting at the transmission case end.

ADJUSTMENT: ***Horizontal adjustment only is required unless shift lever bowl (gearshift lever carrier) has been disturbed.***

Horizontal Adjustment—With both rods dis-connected at transmission case shift levers, move selector lever to Neutral, lift lever up midway through cross-over travel (shifter key will lock both lower shifter levers), move shift lever so that knob approximately 1 3/16" above steering wheel horizontal center-line, **hold lever in this position while adjusting.** Place both transmission case shift levers in neutral, adjust clevis on each rod so that rods can just be connected without disturbing lever positions, connect rods, check operation. If selector lever travel in neutral not smooth, or interference noted during the cross-over, recheck adjustment. Readjust either rod slightly to secure smooth cross-over.

Vertical Adjustment (when selector lever bowl removed or disturbed)—Disconnect both rods at shift levers on transmission case, allow lower (Low & Reverse) lever to swing counter-clockwise as far as possible (so that keyway out of alignment with key on shift tube). Remove horn button, steering wheel and direction signal switch assembly. Press shift lever tube assembly down until key contacts lower shift lever (pull up on selector lever in neutral), turn adjusting screw directly above selector lever in until it is tight against lever, then back screw off ½ turn, stake screw to prevent loosening in service.

NOTE—This setting will position selector lever for vertical clearance of approximately 2 31/32" from top edge of steering wheel to center line of lever knob with lever at rest in neutral (1/64" clearance between key in shift tube and lower lever).

DISASSEMBLY: Remove steering wheel (see Steering Gear data), remove upper bearing spring and seat. Unscrew and remove gearshift lever retainer cap, place lever in neutral position, drive pin out of lever boss on carrier, withdraw gearshift lever.. Unscrew and remove direction switch lever, disconnect direction signal feed wires at connectors near steering column, attach fishing wire to these feed wires (pull fishing wire into column as feed wires pulled out and leave this wire in column for use in re-installing feed wires). Take out four screws retaining direction

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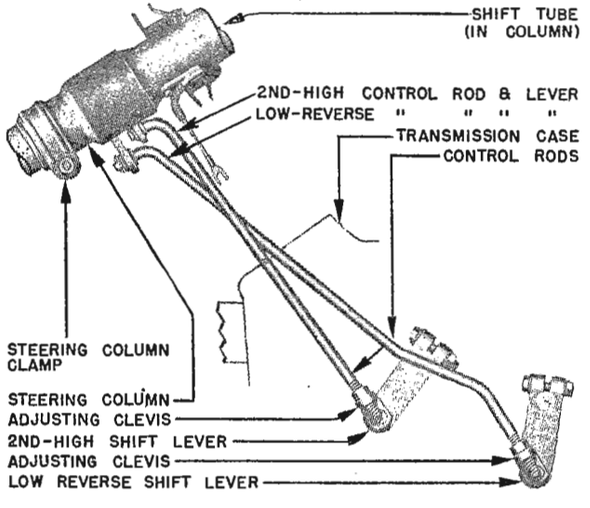
1950 OLDSMOBILE 8 (Cont.)

signal switch and housing on upper bearing retainer, pull switch feed wires and housing off. Take out three capscrews retaining carrier assembly on jacket, remove carrier, remove bearing and retainer by rotating them counter-clockwise. Remove cotter pins and dustcovers from lower shift levers on steering column, remove felt dust seal, slide shifter tube up and out of upper steering column jacket. Disconnect shifter levers from control rods, loosen clamp holding upper and lower steering column jackets. Raise front end of car, disconnect steering rod at pitman arm, take out steering gear-to-frame bolts. Lower the steering gear housing and shaft (with cross-over spring and seat) out of steering column. Lift low-reverse lever out of jacket, remove fiber spacer from between levers, turn second-high lever for clearance and remove from slot in jacket. Remove felt washer from recess above and below shift lever opening in jacket. Inspect lower bushing, bumpers, and washers for wear and remove and replace if necessary.

REASSEMBLY: Install all parts in reverse order of disassembly as given above and note the following precautions and adjustments:

Sealing Ring & Shifter Lever Lubrication—Saturate rings with engine oil and lubricate levers with Lubriplate before installation.

Fiber Spacer Installation—Lubricate spacer before installation, see that notch in spacer in line with back edge of levers (to align slot in spacer with slots in lever to permit key on shift tube to be entered when tube installed).



OLDSMOBILE 1950 8 CYL. TRANS. CONTROL

Upper Bearing Retainer—Lubricate retainer threads with Lubriplate, screw retainer into carrier until top face of retainer is 21/32" above shoulder on rim of carrier, install carrier over shift tube so that shoulder on retainer seated against upper end of outer jacket, tighten retainer screws to 7-9 ft.lbs.

Gearshift Lever Bumper Screw Installation & Adjustment—With gearshift lever installed and ball end of lever engaged in hole in upper end of shift tube ,depress lever until shift tube key clears low-reverse lever, rotate lever so that keyway is out of line with key, pull up on gearshift lever until key contacts face of low-reverse lever. Install rubber bumper in bumper screw (bumper must be completely seated in screw), turn screw in until bumper just contacts pad on lever (check by shaking outer end of lever and tightening screw until all longitudinal play eliminated), then **back off screw ½-turn** and lock screw by staking carrier metal into screw slot.

1951 OLDSMOBILE 8

8 Cyl. Series 88, Super 88, 98 (1951)

►***This control not like type used on 1950 Series (requires different adjustment and disassembly procedure).***

DESCRIPTION: Remote control type with steering column mounted gearshift lever. Control mechanism in steering column is similar to type used on Oldsmobile prior to 1950 (not same as 1950 type) with separate gear engagement lever and gear selector lever on lower end of steering column (see illustration).

ADJUSTMENT: ***Two separate adjustments required.***

Shift Rod (Gear Engagement) Linkage—Set transmission case shift lever in neutral position. Measure horizontal distance from center of gearshift lever knob to horizontal centerline of steering wheel. If this distance not 1¼", adjust by removing clevis pin on forward end of shift rod and adjusting clevis on rod.

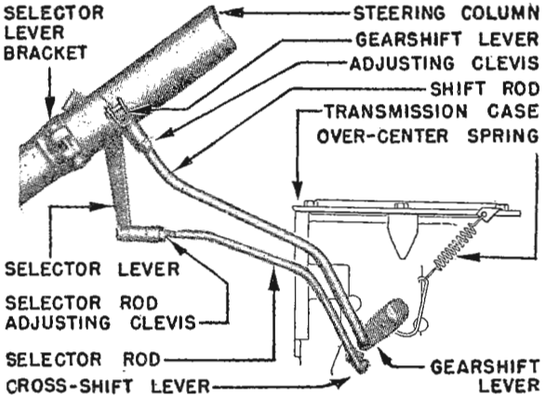
Selector Rod (Cross-shift) Linkage—Place gearshift lever in neutral position, disconnect selector rod at cross-shift lever on steering column, make certain that selector lever on transmission case is fully back against its rear stop. Adjust clevis on forward end of selector rod so that clevis pin enters clevis and cross-shift lever holes freely, **then lengthen rod by turning clevis three full turns,** connect rod by installing clevis pin. ***NOTE***—This setting will provide correct clearance between gearshift knob and steering wheel.

DISASSEMBLY: Disconnect battery cable and horn wire. Loosen (do not remove) steering gear-to-frame bolts. Remove filler plate screws on underside of floor panel at steering column. Disconnect shift rod from shifter lever on steering column. Remove selector lever from bracket on steering column, loosen selector lever bracket bolt,slide bracket down off upper jacket onto lower jacket. Remove nut and washer attaching brake pedal and rod to brake arm. Remove horn button and steering wheel (see Steering Gear data), remove spring and spring seat located directly below steering wheel. Remove gearshift lever. Turn back floor mat, remove brake pedal, take out remaining screws attaching filler pans to floor board, remove filler pans. Disconnect direction signal wires at connectors. Remove steering column-to-instrument panel bracket. Slide complete upper jacket assembly up off lower jacket and into driving compartment, remove this assembly from car. Remove ball stud from upper end of shift tube. Remove retainer ring at lower end of upper jacket assembly, slide shift tube and following parts out of upper jacket: large flat washer, rubber bumper, two small flat washers, coil spring, and spring retainer.

REASSEMBLY: Install all parts by reversing the disassembly procedure and note the following clearances:

Upper Jacket—Position upper jacket so that clearance between steering wheel and direction signal housing is 1/8-3/16".

Selector Lever Bracket—Position bracket so that clearance between bracket and lower shift lever is 1/16" with lever in its lowest position, then tighten bracket clamp bolt.



OLDSMOBILE 1951 8 CYL. TRANS. CONTROL

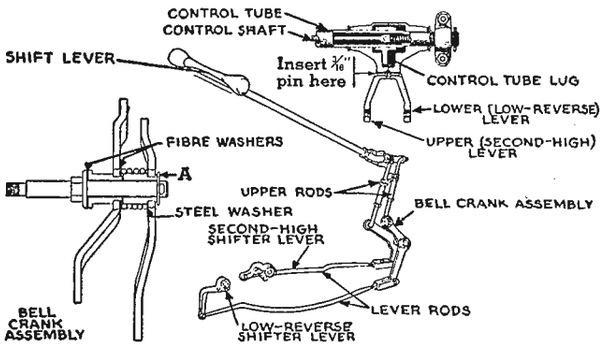
1939-42 PACKARD HANDI-SHIFT

ALL MODELS (1939-42) EXCEPT "CLIPPERS"

►CHANGES, CAUTIONS, CORRECTIONS

►**Gearshift Lever Vibration & Linkage Rattle Correction (1940)**—Caused by loss of dampening due to lubrication of bellcrank levers. See Bellcrank Friction Dampeners under Servicing (below) for adjustment and correction of this condition.

►**Control Lever Misalignment Caution**—For work on car in proximity to control rods or shift levers on transmission case, always install 3/16" lock pin through alignment holes in both levers on lower end of control tube on steering column to prevent accidental gear engagement (which can occur without movement of shift lever). **If this occurs, shift lever cannot be operated until gears and control rods reset in neutral position.**



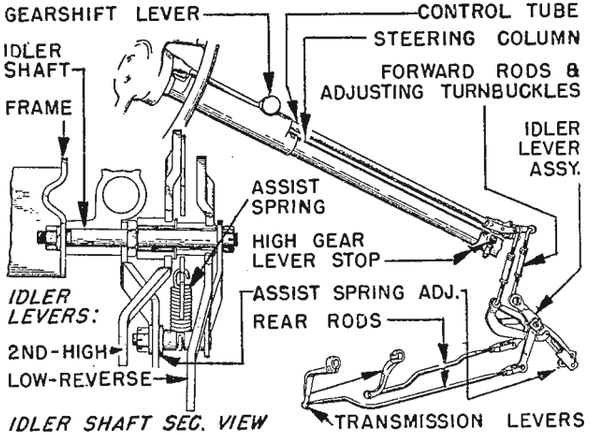
1939-41 PACKARD HANDI-SHIFT

DESCRIPTION: Handi-shift, remote control with gearshift lever on steering column below steering wheel. Shift lever is mounted on control tube which has a lug at the lower end to engage the operating levers which are mounted loosely on the lower end of the tube (these levers connected by rods to shift levers on transmission case cover). The lug normally engages the upper (Second-High) lever and is moved down to engage the lower (Low-Reverse) lever by lifting up on the shift lever which depresses the lug control shaft within the control tube (this shaft spring-loaded by spring at lower end). Each lever is connected to an individual lever on the transmission case by two adjustable rods and an intermediate bell crank (top lever on control shaft connected to left hand bell crank and forward lever on transmission, lower lever on control tube connected to right hand bell crank and rear lever on transmission). Interlock and detent balls and plunger are located in transmission cover and engage notches in sectors on the shifter lever shafts.

►**1941 & Later Models**—These models have special High Gear Steering Column Lever Stop and new Idler Assembly as follows (these units not used on 1940 and previous models):

High Gear Steering Column Lever Stop (Other Models)—Consists of an adjustable rubber bumper on steering column bracket which engages lever in third or high gear position so as to take up all slack in linkage. See Adjustment directions below.

Idler Lever Assembly (Other Models)—Second & High Idler Lever mounted on roller bearings on bracket shaft mounted on brake master cylinder (Low & Reverse idler lever mounted on plain bushings). Bearings are packed with lubricant at assembly and require lubrication only when disassembled. Over-center type assist spring is used on Second & High Idler lever (not used for Low & Reverse lever).



1942 PACKARD HANDI-SHIFT

ADJUSTMENT: See that the gearshift lever is in neutral, insert 3/16" rod or drill through alignment holes in both levers at lower end of control tube and leave this pin in place while adjustment being made. Disconnect control rods at bell cranks. place shifter levers on transmission in neutral position (determine by feel when detent ball engages center notch on shifter lever shaft sector within case). Adjust both control rods at each bell crank (adjust upper rod by loosening locknuts and turning adjusting sleeve, adjust lower rod by loosening locknut and turning clevis at bell crank end of rod) so that lengths are correct, connect rods, remove locking pin from steering column levers.

High-Gear Lever Stop (1941-42)—Loosen the locknut and adjust stop by turning mounting stud so that rubber cap on stop is compressed at least 1/8" with shift lever and transmission gears in 3rd. speed or High Gear position.

Assist Spring (1941-42)—Place the special Gauge ST-5209 on upper side of Second-High idler lever, loosen assist spring anchor bolt and position spring so that gauge makes contact with idler lever bearing (at center), assist spring anchor (forward end) and idler lever control rod hole in lever (rear end).

SERVICING: 1940 Bellcrank Friction Dampeners. Bell crank levers are spring-loaded and assembled with special friction washers to provide dampening effect and prevent noise or rattles (see illustration). To check adjustment, disconnect all rods at bell cranks, connect spring scale at upper end of longest (left hand) bell crank. Force required to move lever should be 2-3 lbs. If adjustment not correct, remove cotter pin and add additional washers under end washer 'A' to increase friction.

CAUTION—Bell cranks must not be lubricated (bushings are oil-impregnated type and shaft is zinc-plated). Lubrication will reduce dampening effect and may cause rattles or excessive vibration at steering column shift lever. If bell cranks have been oiled, disassemble, wash in gasoline, and reassemble dry.

Idler Lever Bellcrank (1941 & Later Cars)—Second and High Lever is mounted on roller bearings which are packed with lubricant at assembly. These bearings require lubrication only when disassembled.

1941-50 PACKARD "CLIPPERS"

ALL "CLIPPER" MODELS (1941-50)

►**Shifter Shaft Rattle Correction (1948 Cars)**—To correct complaints of shifter shaft rattles noted within steering column shroud, Anti-rattle Spring No. 377870, and Anti-rattle Spring Plug No. 338043, can be installed as follows: Remove steering wheel, install plug in end of shifter shaft, install spring by placing center of spring in groove around plug and snapping ends of spring in against re-inforcing wall of steering column wheel web cup.

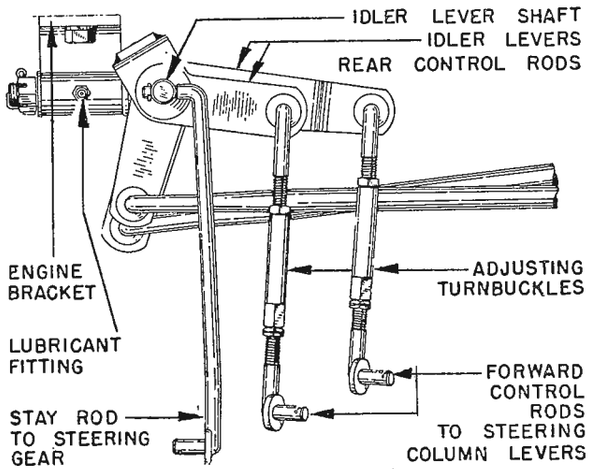
NOTE—This spring and plug installed in production on later 1948 cars.

DESCRIPTION: Handi-shift, remote control with steering column mounted gearshift lever. Gearshift control is same design as used on previous models. Idler lever assembly and control rod linkage has been changed as follows:

Idler Lever Assembly (Clipper Models)—Idler levers mounted on hinged bracket on engine with stay rod connecting top of idler lever shaft to steering gear case. No assist spring used. Lubricant fitting on idler lever hinge should be lubricated with chassis lubricant at 1000 mile intervals (idler levers packed with lubricant and require no attention). **Shift Lever Rods**—Forward rods (steering column levers to idler levers) have adjusting turnbuckle on rod. Rear rods (from idler levers to transmission shifter levers) are non-adjustable.

ADJUSTMENT: Disconnect both forward shift rods at idler levers on left side of engine. Place gearshift lever in neutral, install 3/16" pin or drill rod through holes in both levers on steering column to maintain this alignment during adjustment. Make certain that both transmission shifter levers are in neutral (can be determined by feel of detent ball engaging center notch on shifter lever shaft sector). Adjust each forward rod (loosen locknuts and turn turnbuckle) until rod end enters hole in idler lever freely without disturbing rod and lever positions. Connect rods and remove alignment pin from levers.

DISASSEMBLY & REASSEMBLY: Control mechanism on steering column is same design used on 1951 cars. ***See Packard 1951 control for all data.***



PACKARD CLIPPER IDLER LEVER ASSY.

1951 PACKARD

ALL "2400" SERIES (1951)

DESCRIPTION: Remote control type with steering column mounted gearshift lever. Design same as used on previous Packard models except for new idler lever assembly as follows:

Idler Lever Assembly—Idler levers mounted on horizontal shaft on left side of engine (inner end of shaft mounted on engine flywheel housing, outer end in bracket on top of left frame side rail).

Shift Lever Rods—Forward rods (from steering column levers to idler levers) have adjusting trunnion on forward end at steering column levers. Rear rods (from idler levers to transmission shifter levers) are non-adjustable.

ADJUSTMENT: Disconnect both forward shift rods at idler levers on left side of engine. Place gearshift lever in neutral, install ⅛" pin or drill rod through holes in both levers on steering column to maintain this alignment during adjustment. Make certain that both transmission shifter levers are in neutral (can be determined by feel of detent ball engaging center notch on shifter lever shaft sector). Adjust each forward rod (loosen locknuts and turn turnbuckle) until rod end enters hole in idler lever freely without disturbing rod and lever positions. Connect rods and remove alignment pin from levers.

REMOVAL: Remove horn ring and steering wheel (see Steering Gear data). Lift front floor mat for access to area around steering column. Remove steering gear-and-brake pedal floor opening cover. Disconnect both shift rods at levers on steering column. Loosen steering column U-clamp at steering gear housing, remove steering column bracket cap at instrument panel. Disconnect direction signal switch cables. Remove steering column jacket and shroud assembly.

DISASSEMBLY: Remove U-clamp at gearshift shaft lower pivot, remove lower pivot by unscrewing it from the end of the shaft. Remove lower gearshift shaft lever, drive out selector pin, remove selector and selector rod spring, remove upper gearshift shaft lever. Remove direction signal switch and windshield wiper control from steering column shroud. Remove gearshift lever. Slide draft pads off over end of steering column. Remove gearshift shaft upper spring lock from upper end of shroud, take out shroud-to-jacket attaching screws. Remove shroud and gearshift shaft from steering column jacket, remove shaft from shroud. Withdraw selector rod from within gearshift shaft.

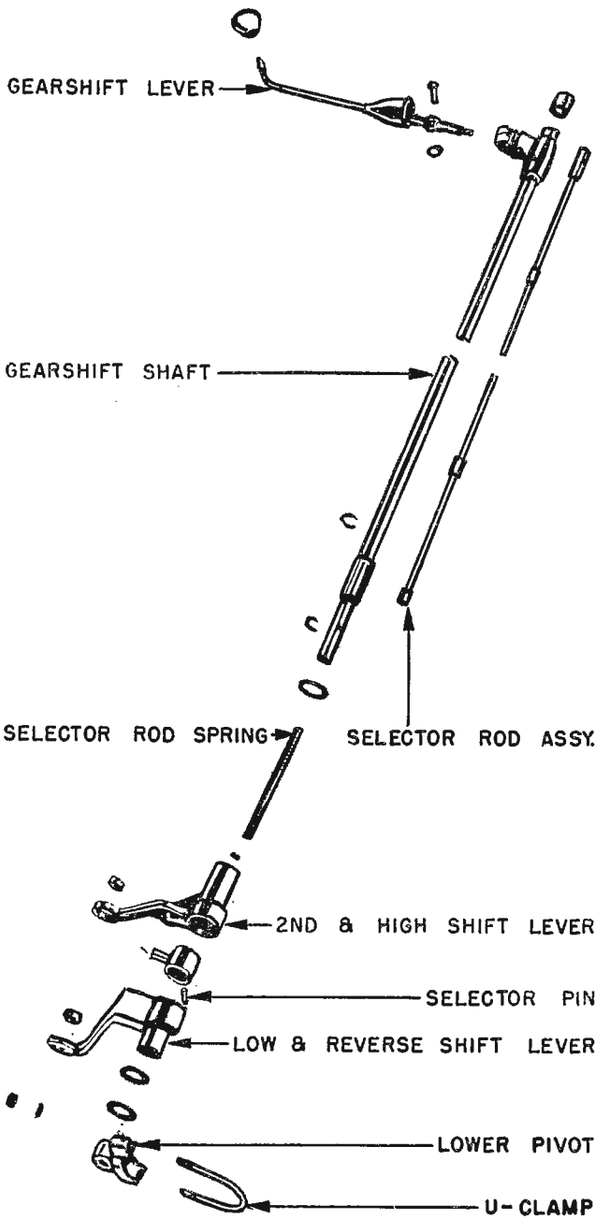
REASSEMBLY: Lubricate all moving parts with Lubriplate. Assembly parts by reversing the disassembly procedure and note the following points:

Gearshift Shaft—When installing gearshift shaft and shroud over steering column jacket, make certain that shaft enters bearing in jacket.

Selector Pin—After installing selector rod spring, spacer, and selector, hold spring compressed and drive pin into selector. Lubricate selector and shaft levers with Lubriplate.

Gearshift Shaft Lower Pivot—After installing lower lever and washer, lubricate lower pivot and thread it on end of gearshift shaft until clearance at lower shaft lever is .025". Engage pivot dowel in locating hole in column jacket and install the U-clamp.

INSTALLATION: Install steering column jacket and shroud assembly in car, install bracket cap but **do not tighten cap at this point.** Connect direction signal cable and windshield wiper control. Install steering wheel and horn ring. Adjust position of steering column jacket and shroud assembly so that clearance between wheel and shroud is approximately 1/16", then tighten U-clamp on jacket at steering gear housing and tighten bracket cap. Connect gearshift rods to shaft levers and adjust linkage (see Adjustment). Connect horn wire, replace floor cover and floor mat.



PACKARD HANDI-SHIFT (STEERING COLUMN UNIT)

PONTIAC 1939 SAFETY-SHIFT

Six & Eight, All Models (1939)

SPECIAL SERVICE NOTES: Shifter Rod Binding. Caused by misalignment of shifter rod and lever on lower end of steering column and will be most noticeable when shifting out of low gear. To check, disconnect rod at steering column lever, note position of rod end in relation to hole in lever as selector shaft moved in and out of low gear position. Correct by bending rod so that rod end enters hole in lever freely without binding.

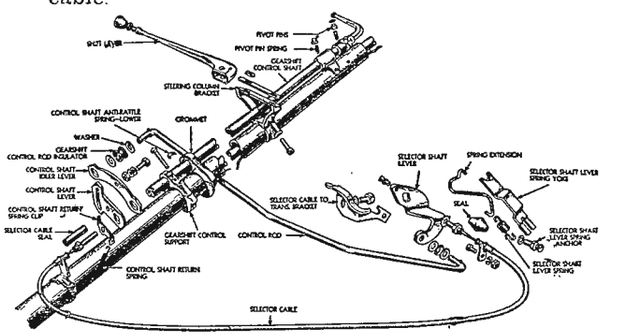
Shift Lever rattles or has excessive play—Install extra washers on shift lever pivot pins (make certain that one anti-rattle washer always used).

Shift Lever travel excessive—See that threaded selector cable end tight in selector shaft at transmission, tighten selector cable anchor bracket mounting bolt.

Shift Lever sticks or does not return to Second-High side at Neutral—See that selector cable not kinked or bent at sharp angles and that return spring correctly hooked to control shaft lower end and to underside of selector cable clip on steering column.

Shift Lever vibrates on rough roads—See that control shaft return spring correctly connected (above).

Control Shaft, Rod, or Cable rattles—See that anti-rattle spring installed between control shaft and lower support on steering column. Install special anti-rattle spring, #501772, on selector cable to prevent rattling against steering column, wrap speedometer cable with tape to prevent contact with cable.



PONTIAC 1939 SAFETY-SHIFT

DESCRIPTION: Remote control with shift lever mounted on steering column under steering wheel. Shift lever pivoted on bracket on steering wheel and engages shank of steering column control shaft so that up-and-down movement actuates selector cable (for cross-shift) and forward-and-backward movement actuates control rod (for gear engagement). Control shaft and shift lever held down in Second-High position by spring hooked to clip on lever at lower end of control shaft and must be raised against spring tension for Low-Reverse.

ADJUSTMENT: See that ⅛" clearance exists between control shaft upper bearing flange (shift lever pivot) and upper face of steering column support bracket (necessary for free movement of shift lever as bearing screws in and out of bracket as shaft rotates). Adjust by removing shift lever and screwing bearing in or out of bracket (see Servicing section below for directions). Adjust selector cable and control shaft lever as follows:

CONTINUED ON NEXT PAGE

PONTIAC 1939 SAFETY-SHIFT (Continued)

Selector Cable—Loosen locknut and turn selector cable screw in or out of control shaft lower end until distance from lower edge of steering wheel rim to upper edge of shift lever is 2⅞-3⅛" (turn screw in to raise lever, out to lower lever) in neutral position with control shaft retracting spring connected to hold shaft down in second-high position. Tighten locknut securely and replace rubber cable seal after making adjustment.

Control Rod Lever—With transmission selector shaft in neutral, steering column shift lever should be approximately horizontal. To adjust, loosen clamp bolt which locks idler lever and control shaft lever together (at lower end of control shaft), shift idler lever and control rod in relation to short shaft lever, tighten clamp bolt. NOTE—Shift lever can be lowered (moved toward driver) up to 1½" in neutral position if desired for less reach in shifting.

SERVICING STEERING COLUMN UNIT: Disassembly Remove steering wheel (use J-452 puller), remove shift lever (use J-1044 tool) by pressing in on pivot pin on either side of lever until pins clear holes in lever, being careful not to lose pivot pins and springs or anti-rattle spring in end of control shaft (within shift lever). Disconnect selector cable by unscrewing adjusting screw from lower end of control shaft, remove control rod and lever assembly (do not loosen clamp bolt locking both levers together—if this bolt loosened, levers must be adjusted when re-installed). Loosen clampscrews on control shaft lower support, remove support being careful not to lose flat anti-rattle spring which is in support keyway. Remove upper support screws from steering column mast jacket (use Phillips #2 screwdriver), pull upper support and control shaft upward parallel with steering column being careful not to lose anti-rattle spring and cup located in hole in underside of upper support.

Servicing—Clean all parts and apply Lubriplate or Delco Brake Lubricant as follows: inner and outer faces of control shaft upper bearing, shift lever pivot pin holes, pivot pins and springs, control shaft ends and flat at top, shaft hole in lower control shaft support, threaded hole in upper control shaft support, anti-rattle springs and cups.

Reassembly—Reverse disassembly directions given above. Make certain that anti-rattle spring installed in end of control shaft within shift lever, on one shift lever pivot pin, in cup in upper support bracket, and in lower support bracket keyway. Adjust selector cable and control shaft levers as directed in Adjustment Section above.

IMPORTANT NOTE—When installing control shaft upper bearing in upper support bracket, see that clearance between bearing flange and bracket is ⅛" (bearing screws in and out of bracket as shaft is rotated). Turning bearing ½ turn will change clearance 1/32".

SERVICING TRANSMISSION UNIT: Disassembly. Remove bolt in cable clip on transmission case bracket, back off cable screw in end of selector shaft, remove cable (this screw also holds selector shaft lever on shaft), remove selector lever and lever spring (spring is over-center type and has no tendency to rotate lever with shaft in neutral position). Remove transmission case cover, free shift fingers from selector shaft (use special J-1046 tool to back out setscrews locking fingers on shaft), withdraw shaft. **Servicing**—Clean parts and apply Lubriplate to transmission end of control rod (do not lubricate steering column end of rod which would damage rubber insulator), over-center spring yoke anchor, and selector shaft lever pin groove. **Reassembly**—Reverse disassembling directions. Make certain that selector shaft lever spring is correctly installed.

PONTIAC 1940-51 SAFETY SHIFT

6 & 8, All with Synchro-mesh Trans. (1940-51)

►CHANGES & CORRECTIONS

►**HYDRA-MATIC DRIVE NOTE:** Control data given below applies to Synchro-mesh Transmission cars Hydra-Matic Drive control is adjusted differently. *See Hydra-Matic Drive Transmission data for control linkage adjustment on Hydra-Matic Cars.*

►**1941 Control Rod Production Change (except Deluxe Models)**—A single shifter rod between steering column lever and shift lever on transmission case was used beginning with the following serial nos.

NOTE—This single rod can be installed on earlier cars (see installation directions below).

	Pontiac	Linden	South Gate
41-24	P6JB-25488	L6JB-6379	C6JB-4044
41-26	P6JC-4884	L6JC-2404	C6JC-1789
41-28	P8JB-19031	L8JB-4349	C8JB-3246
41-29	P8JC-7794	L8JC-3274	C8JC-1957

►**Installing Single Rod on First 1941 Cars**—New single rod furnished for service replacement on all cars. When installing new single rod on first cars (with front and rear rods and intermediate idler lever), proceed as follows: Remove clutch and brake pedal toe plate, cut off shifter rod idler lever bracket and re-install plate. Install the following new parts—506712 Gearshift Control Rod, 506713 Transmission Shifter Lever, 505760 Gearshift Control Shaft Idler Lever (these are levers to which rod attaches at front and rear ends). Discard old parts.

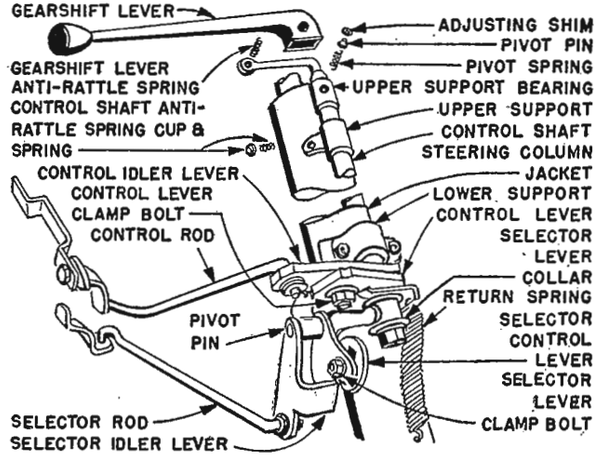
►**Hard Shifting Complaints**—To correct complaints, examine linkage and make following corrections:

Binding or Sticking of Clutch Driven Plate—Check for driven member hub binding on main drive gear splines, sticking of driven member to flywheel or pressure plate (caused by oil on facings resulting from oil leak at rear main bearing or at transmission case front bearing oil seal), or sticking of driven member facings due to vacuum between facings and flywheel or pressure plate. Correct by cleaning all mating surfaces (CAUTION—do not use petroleum products which may leave film). Facings on 6 Cyl. clutch driven members may be grooved to correct sticking due to vacuum (use 1950 8 Cyl. facings as guide in grooving facings).

Rear Shift Rod Alignment—On cars with front and rear control rods and intermediate idler lever, check rear shift rod and see that ends are parallel so that rod does not bind in transmission shift lever as gears engaged. See note above for installation of new type single rod to replace this double rod and idler lever assembly.

Idler Lever Bracket—Check idler lever bracket for looseness allowing lever to bind on rods. If bracket loose at mounting rivets, remove toe plate and securely weld bracket or remove idler lever and install new type single rod.

Control Shaft Toeboard Grommet—See that rubber grommet on steering column and shift control shaft at toeboard does not bind on shaft and prevent free up-and-down movement (required for cross-shift at neutral). Correct by trimming rubber at point where bind occurs and applying few drops of brake fluid to shaft.



PONTIAC 1940 & LATER SAFETY-SHIFT

Control Shaft & Gearshift Lever Clearance—If shoulders on shaft not machined low enough, they will strike gear shift lever fulcrum cups and prevent full Low and Reverse gear engagement causing hard shifting. To check this dimension, remove control shaft, place small square on shaft so that upper edge even with tops of shoulders on shaft, measure perpendicular distance from top of square to bottom of fulcrum ball on end of shaft. Distance should be 1 1/16". If incorrect, rework shaft as follows: If over-all length of shaft (from lower end to tops of shoulders at upper end) is more than 32 11/32"±1/32", file shoulders down to secure correct 1 1/16" fulcrum ball height. If over-all length of shaft within limits given above, bend ball end of shaft to secure correct fulcrum ball height.

DESCRIPTION: Remote control with steering column mounted gearshift lever. Same design as used on previous models except for new Selector Rod and Lever Assembly as follows (see Production Change Note above for different type used on late 1941 and and all later car models).

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PONTIAC 1940-51 SAFETY SHIFT (Continued)

Selector Rod & Lever Assembly—Control shaft on steering column has special collar which engages new selector control lever assembly, this lever being connected to new type selector shaft and lever assembly in transmission by selector rod (no cable used). Adjustment provided at steering column lever assembly (double levers clamped together by bolt, outer idler lever can be shifted after bolt has been loosened).

ADJUSTMENT: Gearshift Lever Clearance. Clearance between upper edge of control shaft upper support and shoulder on upper control shaft bearing which is screwed in the bracket must be ⅛" (1/8" min., 5/32" max.) to avoid interference when engaging gears. If clearance incorrect, remove gearshift lever (see Disassembly data), adjust by screwing bearing in or out of support bracket (½ turn of the bearing will change clearance 1/32").

Selector Rod (Cross-shift)—With gearshift lever in neutral on Second-High side (normal position), distance from lower edge of steering wheel rim to upper edge of gearshift lever should be 2 7/8"±1/8" (1940-48), 2¾" ± ⅛" (1949 on). To adjust with the shift lever in neutral, loosen clamp bolt holding selector control lever and selector control idler lever together (these are levers pivoted on lower suport bracket on steering column), see that selector rod and levers are in Second-High position (rod moved to rear as far as possible), place gearshift lever in correct position and tighten lever clamp bolt.

Control Rod (Gear Engagement)—With gearshift lever in neutral, lever should be approximately horizontal but can be varied approximately 1½" to suit individual operators. To adjust, loosen clamp bolt holding control shaft lever and control shaft idler lever together (these are levers mounted on lower end of control shaft on steering column), see that control rod and transmission case shifter lever are in neutral, move gearshift lever to desired position and tighten lever clamp bolt. Check to make certain that gearshift lever has full travel required for gear engagement without interference after making this adjustment.

REMOVAL & DISASSEMBLY: Remove front compartment floor mat and center floor panel. Remove horn button and steering wheel (see Steering Gear data). Disconnect return spring from lower end of control shaft, remove pivot pin from selector control lever and idler lever (CAUTION—do not loosen clamp bolts holding levers together which would disturb adjustment). Take out screw in lower end of control shaft, remove selector lever collar from shaft. Take out two screws (Phillips #2 screwdriver), pull upper support and control assembly straight up parallel to steering column CAUTION—do not lose anti-rattle spring and cup located in hole in underside of upper support). Remove gearshift lever using tool J-1044 to remove shift lever pins and springs. Unscrew upper bearing from upper support.

REASSEMBLY: Assemble all parts in reverse order of disassembly data above noting the special points listed below. Adjust gearshift lever position by screwing bearing in or out of bearing support (see Adjustment data above) before assembling the gearshift lever. Adjust control rods after assembly completed.

Lubrication of Moving Parts—Coat following parts and bearing points with Lubriplate before assembling: Control Shaft Upper Support Bearing, Anti-rattle Spring Cup, Gearshift Lever Pivot Pins, Springs & Shims, and inner surface of gearshift lever, Control Shaft flats and ball end, Anti-rattle Spring in ball end, Control Shaft bearing hole in lower support, and Selector Collar surface which contacts selector lever.

Gearshift Lever Assembly—One anti-rattle spring washer must always be used on gearshift lever pivot pin and shims should be installed as required to take up excessive clearance so that lever operates freely without excessive play or rattles. Re-install all shims found at this point and check lever after assembly completed. See Adjustment data for correct gearshift lever position.

Transmission Case Shifter Mechanism—Refer to Pontiac Transmission article for dismantling and servicing directions. CAUTION—Selector shaft must be removed through right side of case and installed on left side to avoid damage to oil seal. Lower lever must be removed from vertical cross-shift shaft before the selector shaft is driven out (to permit upper lever on shaft to disengage from selector shaft).

1939 STUDEBAKER COMMANDER & PRESIDENT

COMMANDER, MODEL 9A (1939)
PRESIDENT, MODEL 5C (1939)

NOTE: The transmission used with this control similar to standard type except for shift mechanism (two levers on cover on side of transmission case —forward lever for cross-shift, rear lever for gear engagement). See separate article for complete Transmission servicing data.

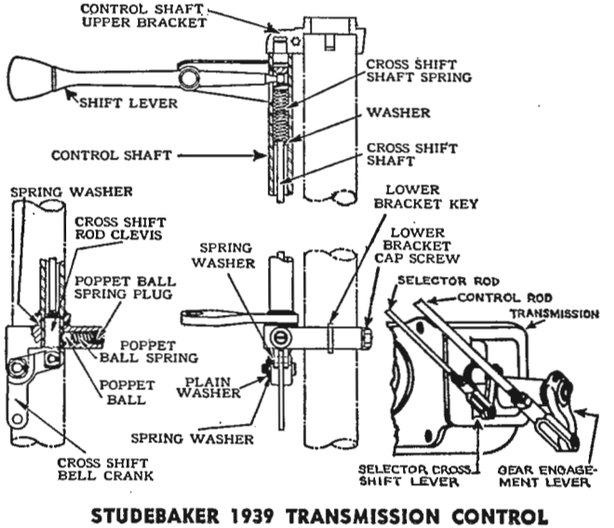
DESCRIPTION: Remote control with lever mounted on steering column. Shift lever pivoted on bracket on steering column control shaft so that up-and-down motion of lever actuates selector (cross-shift) shaft within control shaft and forward (cross-shift) lever on transmission case. Backward-and-forward motion of shift lever rotates control shaft and actuates rear (gear engagement) lever on transmission case. Shift lever normally held down in Second-High position by spring in control shaft below lever and must be lifted against spring tension for Low-Reverse.

ADJUSTMENT: Disconnect the control rods at transmission case levers by taking out clevis pins. Rotate shift lever to neutral position (can be determined by poppet ball at lower end of control shaft engaging shaft at this point). Disconnect cross-shift (inner) shaft from cross-shift bell crank at lower end of steering column assembly by taking out clevis pin. Set shift lever parallel with steering wheel and adjust cross-shift shaft length by turning clevis on lower end of shaft until upper edge of clevis slot lines up with lower face of lower bracket, install clevis pin connecting cross-shift shaft and bell crank. Without disturbing position of shift lever, move forward (cross-shift) lever on transmission case as far forward as possible, adjust length of control rod (loosen locknut and turn clevis on transmission end of rod) until clevis pin enters hole in rod clevis and cross-shift lever freely, install clevis pin. Set rear (gear engagement) lever on transmission case in neutral position (approximate center of travel—may be determined by detents engaging shift rails at this point), adjust length of control rod (loosen locknut and turn clevis at transmission end of rod) until clevis pin enters hole in clevis and lever freely, install clevis

SERVICING:—Disassembly—Disconnect both control rods at lower end of steering column unit. Take out shift lever fulcrum pin screw and pin, remove shift lever being careful not to lose spring washer on fulcrum pin. Remove plug on poppet ball boss on lower support bracket, take out spring and poppet ball. Disconnect cross-shift shaft from bell crank at lower end of steering column by taking out clevis pin. Remove lower support bracket capscrews, remove key from slot in steering column jacket, slide support bracket down on steering column until control shaft and bearing plug clear socket in upper support bracket, remove assembly. To remove inner cross-shift shaft, unscrew clevis from lower end of shaft, withdraw shaft, spring, washer, and insulator through upper end of control shaft.

Servicing—Apply Lubriplate to upper and lower ends of cross-shift shaft (these points packed with Lubriplate at assembly).

Reassembly—Reverse disassembly directions given above. When installing lower support bracket, slide bracket up on steering column until light tension placed on spring washer located between lower control lever and upper face of bracket (some tension required to prevent rattles, but bracket should not be pushed up so far as to cause excessive friction at this point). Key slot in steering column is elongated to permit this adjustment. Adjust both control rods as directed above.



STUDEBAKER 1939 TRANSMISSION CONTROL

1939-46 STUDEBAKER

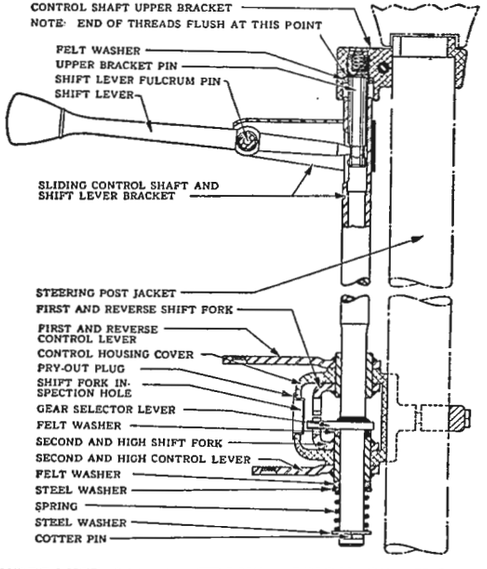
Champion, All Models (1939 to 1946)

Commander, All Models (1940 to 1942)

President, All Models (1940-41-42)

►**SPECIAL SERVICE TOOL NOTE:** (1940-46) Gauge No. J-1308-A required for adjustment of transmission control on 1940-46 cars. Gauge J-1308 (1939 Champion) can be worked over for 1940-46 cars by reducing over-all width across prongs from .750" to .672" by grinding equal amount (.039") off outer face of each prong and maintaining 1/16" chamfer at 45° on end of prong. With this change, gauge can be used both for 1939 Champion and all 1940-46 cars.

DESCRIPTION: Remote control with gearshift lever on steering column below steering wheel. Shift lever is pivoted at inner end in pin screwed in upper bracket and is linked to control shaft by fulcrum pin so that up-and-down movement of the lever (for cross-shift) lifts the entire control shaft and backward-and-forward movement (for gear engagement) rotates the shaft. An integral lug or lever on the lower end of the control shaft (within control housing on steering column) engages a fork attached to the lower control lever (second-high) and is lifted to engage the fork attached to the upper control lever (Low-reverse) when shift lever is lifted up toward steering wheel (lug normally held down in second-high position by spring on lower end of control shaft below control housing). Control levers are connected to shift levers on side of transmission case by adjustable rods (forward lever for second-high, rear lever for low-reverse). Control housing is entirely enclosed and provided with lubricant fitting so that it can be kept filled with chassis lubricant. **1940 & Later Cars**—Design is same as 1939 cars (above) except that cross-over travel of control shaft lug (up-and-down movement of control in neutral position) reduced to 3/8".



STUDEBAKER 1939-46 TRANSMISSION CONTROL

►*NOTE*—This reduced travel requires use of special gauge (or reworked gauge) for adjustment purposes. See Special Service Tool Note above.

ADJUSTMENT:—See that clearance between lower edge of instrument panel and control shaft is 1/16-1/8" (loosen clamp bolts and rotate steering column slightly to secure this clearance). Use special plug gauge (see "Special Service Tool Note" above) for special gauges) to align the control housing forks and levers in neutral position. To install gauge, pry out inspection plug in control housing cover, insert forked end of gauge in inspection hole, press up on control shaft until gauge prongs can be pressed in so as to engage both control lever forks, leave gauge in place until adjustments completed. Disconnect both rods at shift levers on transmission case, place each shift lever in neutral position (determine by feel of detent plungers engaging notches in sectors on shift lever shafts). Loosen locknut and adjust clevis on transmission end of each control rod so that clevis pins can just be inserted, connect rods,

SERVICING:—If control mechanism removed from steering column, coat upper bracket pin threads and shift lever ball with Lubriplate, turn pin into upper bracket so that end of thread on pin is flush with lower face of bracket. Make certain that key on lower control housing mounting bracket engages notch in steering column. Control housing lever and fork assembly cannot be dismantled.

Lubrication—Lubricate gear shift control box on steering column with chassis lubricant every 10,000 miles.

1947-50 STUDEBAKER

Champion, All Models (1947 to 1950)

Commander & Land Cruiser, All (1947 to 1950)

►**SPECIAL SERVICE TOOL NOTE:** New Gauge J-1308-B required for transmission control adjustment on these cars. Old type Gauge J-1308-A (1940-46 cars) can be reworked for use on these 1947 & later cars by milling out a section of the tool handle 7/16" by 1 3/8" long (at right angles to plane of gauge prongs) to provide clearance when gauge inserted in shift control box on steering column.

DESCRIPTION: Remote control with gearshift lever on steering column below steering wheel. Shift lever is pivoted at inner end in pin screwed in upper bracket and is linked to control shaft by fulcrum pin so that up-and-down movement of the lever (for cross-shift) lifts the entire control shaft; and backward-and-forward movement (for gear engagement) rotates the shaft. An integral lug or lever on the lower end of the control shaft (within control housing on steering column) engages a fork attached to the lower control lever (second-high) and is lifted to engage the fork attached to the upper control lever (Low-reverse) when shift lever is lifted up toward steering wheel (lug normally held down in second-high position by spring on lower end of control shaft below control housing). Control levers are connected to shift levers on side of transmission case by adjustable rods (forward lever for second-high, rear lever for low-reverse). Control housing is entirely enclosed and provided with lubricant fitting so that it can be kept filled with chassis lubricant.

ADJUSTMENT: Disconnect both shift rods at shifter levers on side of transmission case. Pry out inspection plug on control box cover on steering column, install special gauge J-1308-B (see Service Tool Note above) through plug hole to align control housing forks and levers in neutral. Make certain that both shift levers on transmission case are in neutral (can be determined by feel of detent plungers engaging notches in shift shaft sectors). Adjust each rod by turning clevis at transmission end of rod in **complete turns only** (required by shape of clevis) until rod can be connected without disturbing position of transmission levers. Connect rods, remove adjusting gauge, re-install control box plug.

REMOVAL: ***Procedure same for Champion & Commander except as noted:***

1) Disconnect battery cable (and horn wire on Champion).

2) Remove steering wheel (see Steering Gear data), remove steering post jacket bearing spring (and spring seat on Commander).

3) Remove gearshift lever ball cap, withdraw shift lever assembly from gearshift shaft. If shift lever to be disassembled, remove lever knob, retaining spring, and knob ferrule; then slide ball cap, spring retainer, and ball spring off lever; remove ball seat off opposite end of lever.

4) On Champion only, loosen gearshift shaft upper bracket clamp screw, remove bracket from post jacket, unscrew upper bracket pin, remove spring from within bracket, slip felt washer off pin. Remove lower half of steering post bracket, take out bolt and capscrew holding upper half of bracket on instrument panel, remove bracket, spacer, and anti-squeak pad. Remove steering post collar screws, slide collar and grommet up to end of jacket.

5) On Commander only, remove gearshift shaft upper bracket screws, remove bracket from post jacket. Unscrew upper bracket pin, remove felt washer from pin. Remove jacket bearing from bracket, remove spring from within end of shift shaft.

6) Disconnect both shift rods from control box levers on steering column.

7) On Champion only, loosen steering post jacket clamp, turn jacket and shift assembly so that control box is on left side of column, then pull entire assembly up through floor opening and into the car, slip jacket off steering post and remove assembly from the car.

8) On Commander only, remove control box upper clamp screw and key, loosen lower clamp screw, loosen steering gear housing-to-frame bolts. Remove lower half of steering post bracket, remove steering post collar screws, slide collar and grommet up on the jacket. Tip upper end of steering post down, slide jacket and shift assembly up and turn as necessary so that control box clears floor opening. Slide grommet and collar over control box, remove assembly from steering post, and lift out of the car.

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1947-50 STUDEBAKER (Cont.)

DISASSEMBLY: ***Procedure same for Champion and Commander except as noted:***

1) Remove control box clamp screws and clamp (and key on Champion).

2) On Champion only, lift shift shaft assembly out of jacket, remove jacket from collar and grommet. Remove collar and grommet from shift shaft using care not to tear rubber collar (use liquid soap).

3) On Commander only, remove rubber boot from upper end of shift shaft. Remove jacket lower plate screws, move plate toward control box and remove it from the shaft. Remove control box and shaft assembly from the jacket by pulling it out through lower hole in the jacket. Remove felt washer.

4) Remove inspection hole plug from control box cover, take out four screws and remove cover and gaskets. Lift shaft and lever assembly out of control box, slide second-and-high lever off end of shaft, remove lower felt washer from shaft.

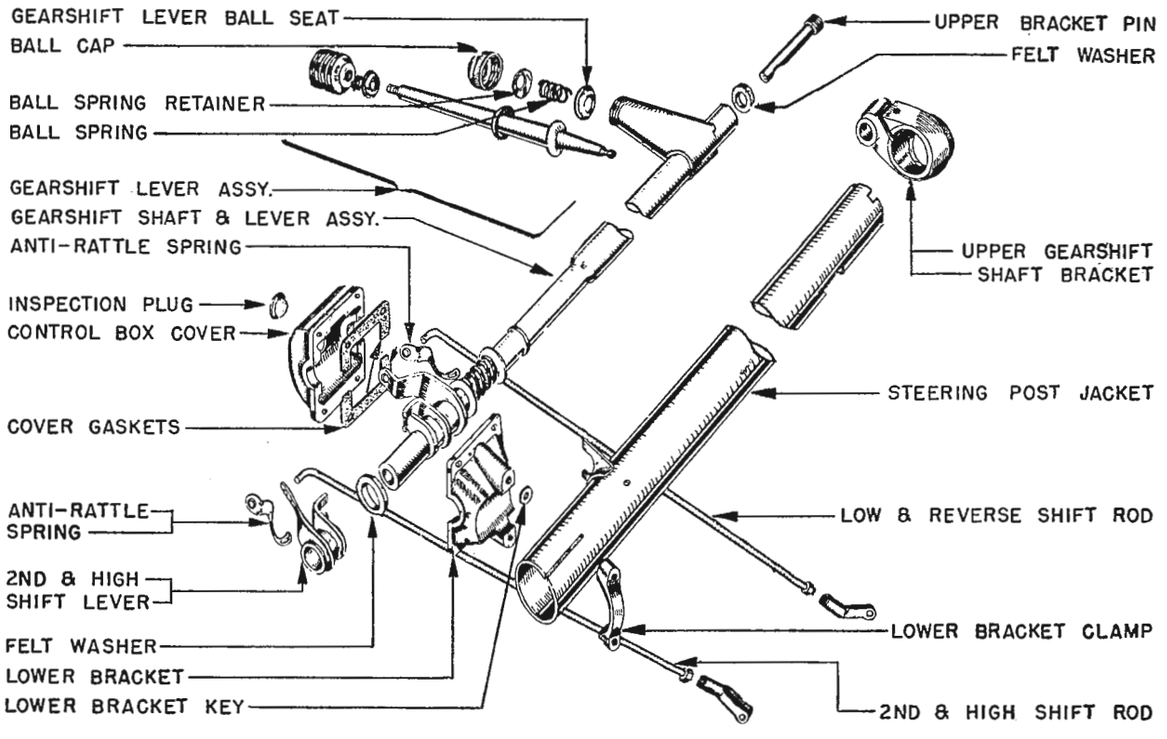
NOTE—Shift shaft and low-and-reverse shift lever are serviced as an assembly (together with spring and washers on Champion).

REASSEMBLY & INSTALLATION: Assemble parts and install gearshift control in reverse order of removal and disassembly procedure (above). Note following points when installing assembly in car:

Gearshift Shaft Upper Bracket Pin Installation: Screw pin in tight and then back pin off about ½ turn so that hole in pin will face shaft lever opening in shaft when installed.

Collar & Grommet and Rubber Boot Installation: Use liquid soap to facilitate installation and to avoid tearing these parts during installation.

Shift Control Adjustment: Adjust shift rods after installation completed. See Adjustment (above).



1947-50 STUDEBAKER TRANSMISSION CONTROL

1951 STUDEBAKER

Champion, Model 10G (1951)
Comm. & Land Cruiser V8, Model H (1951)

►**SPECIAL SERVICE TOOL NOTE**—New Transmission Shift Rod Adjusting Gauge No. J-4690 required for these models due to redesigned control box housing. Previous type gauges cannot be used.

DESCRIPTION: Remote control type of same design used on previous models except for new Control Box design (on steering column) requiring new Adjusting Gauge and different disassembly procedure.

ADJUSTMENT: Disconnect both shift rods at shift levers on side of transmission case. Place gearshift lever in neutral, remove lubrication fitting from control box housing on steering column, insert Transmission Shift Rod Adjusting Gauge No. J-4690 through lubricant fitting hole, engaging the flat on the tool with flats on shift levers, so that levers are aligned in neutral position. Make certain that transmission shift levers are in neutral (can be determined by feel of detent plungers engaging notches in shift lever shaft sectors). Adjust each rod by turning clevis on rear end of rod in **complete turns only** (required due to shape of clevis) until rods can be connected without disturbing lever position. Connect rods, remove adjusting gauge, replace lubricant fitting in control box housing.

REMOVAL: ***Procedure for all models is same except as noted:***

1) Disconnect battery cable (and horn wire on Champion Custom models).

2) Remove steering wheel (see Steering Gear data), remove steering post jacket bearing spring (and spring seat on all models except Champion Custom).

3) Take out gearshift lever screw, withdraw lever assembly from shift shaft.

4) On Champion Custom only, loosen gearshift shaft upper bracket clamp screw, remove bracket from post jacket, unscrew upper bracket pin, remove spring from within bracket, slip felt washer off pin. Remove lower half of steering post bracket, take out bolt and capscrew holding upper half of bracket on instrument panel, remove bracket, spacer, and anti-squeak pad. Remove steering post collar screws, slide collar and grommet up to end of jacket.

5) On all models except Champion Custom, remove gearshift shaft upper bracket screws, remove bracket from post jacket, unscrew pin from bracket, remove felt washer from pin. Remove jacket bearing from bracket and remove spring from within end of shift shaft.

6) Disconnect both shift rods from control box levers on steering column.

7) On Champion Custom only, loosen steering post jacket clamp and turn jacket so that control box assembly is on left side of column, then pull entire assembly up through floor opening and into the car, slip jacket off steering post, remove assembly from the car.

8) On all models except Champion Custom, loosen steering post jacket lower clamp and steering gear housing-to-frame bolts. Remove lower half of steering post bracket, remove collar screws and slide collar and grommet up on jacket. Tip upper end of steering post down, slide jacket and shift assembly up and turn as necessary so that control box clears floor opening. Slide grommet and collar over control box, remove assembly from steering post and lift it out of the car.

DISASSEMBLY: ***Procedure for all models is same except as noted:***

1) Remove control box clamp screws and clamp (and key on Champion).

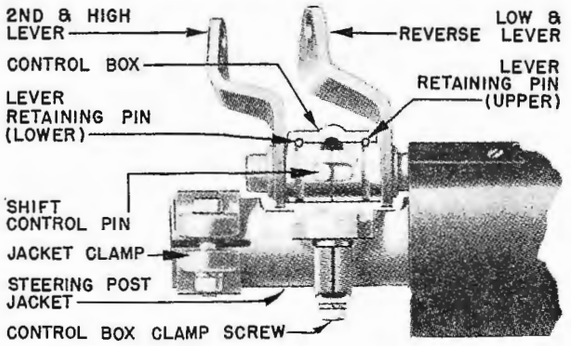
2) On Champion Custom only, lift shift shaft assembly out of the jacket, remove jacket from collar and grommet. Remove collar and grommet from

CONTINUED ON NEXT PAGE

1951 STUDEBAKER (Cont.)

shift shaft using care not to tear the rubber collar (use liquid soap on collar to slide it off shaft).

3) On all models except Champion Custom, remove jacket lower plate screws, move plate toward control box and remove it from the shaft. Remove control box and shaft assembly from jacket by pulling it out through the lower hole in the jacket.



STUDEBAKER 1951 CONTROL HOUSING

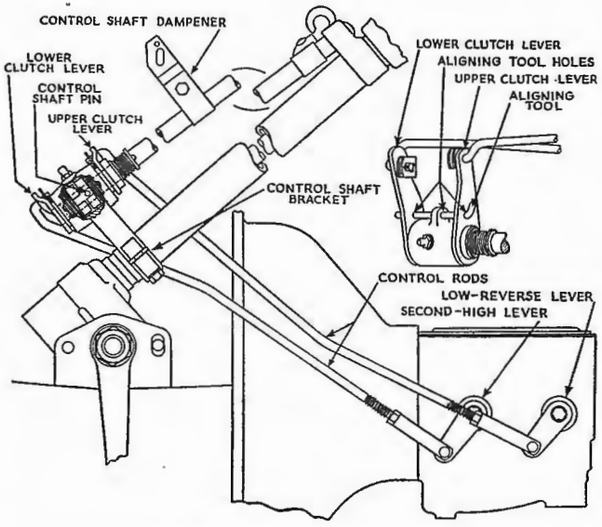
4) Use a small drift to drive out the second-and-high lever retaining pin (lower pin on side of control box housing), slide lever off shaft and out of control box housing. Drive out low-and-reverse lever retaining pin (upper pin), slide lever and shaft assembly out of control box housing. If low-and-reverse lever to be removed, press shift control pin out of shaft, slide lever off end of shaft.

REASSEMBLY & INSTALLATION: Assemble parts and install gearshift control in reverse order of removal and disassembly procedure (above). Note the following points when installing assembly in car:

Gearshift Shaft Upper Bracket Pin Installation: Screw pin in tight and then back pin off about ½ turn so that hole in pin will face shift lever opening in shaft when installed.

Collar & Grommet Installation: Use liquid soap to facilitate installation and avoid tearing the rubber collar during installation.

Shift Control Adjustment: Adjust shift rods after installation completed. See Adjustment (above).



WILLYS TRANSMISSION CONTROL

WILLYS

Model 440 Passenger Cars (1940)
Americar, Model 441 (1941), 442 (1942)
Jeep, Universal Model CJ-2A (1946)—First Cars
Sta. Wgn. & Sed. Del. 4-63 (1946-50)
Sta. Wgn. 473-SW & Sed. Del. 473-SD (1950-51)
Jeepster, Model VJ-2 (1948), VJ-3 (1949-50)
Jeepster, 4 Cyl. 473-VJ, 6 Cyl. 673-VJ (1950-51)
Sta. Sed. & Sta. Wgn. 6-63 (1948-49-50)
Sta. Wgn. 6 Cyl. 673-SW (1950-51)
①**Jeep Truck, Models 2WD & 4WD (1947-48-49)**

①—Floor-mounted gearshift used on 1949 trucks after Serial No. (2WD) 22536, (4WD) 34787.

►**Hard Shifting & Gearshift Rattle Complaints on First Cars**—If shift does not operate smoothly and positively, or rattles noted, correct as follows:

Shift Not Smooth & Positive—Check linkage and adjust control rods (see Adjustment).

Shift Sticks or does not Disengage—Check adjustment. If this does not correct trouble, check Clutch Clearance (see Removal & Installation data below), adjust clearance or replace Clutch Lever and Housing assembly.

Gearshift Rattles—Check Gearshift Lever Clearance and Control Shaft Dampener installation (see Removal & Installation data below).

NOTE—If gearshift lever is found to break at the weld (first cars only) and lever can not be welded, install new Control Shaft Assy. 638022.

DESCRIPTION: Remote control with shift lever on control shaft under steering wheel. Shaft has dog clutch at lower end (pin in shaft engages slots in levers) by which it is engaged with upper lever (connected to rear lever on transmission case) for Low-Reverse, or lower lever (connected to front lever on transmission case) for Second-High engagement. Control rods connecting steering column levers and transmission case levers have adjusting clevises at transmission case end.

ADJUSTMENT: Disconnect both control rods at transmission case levers by removing clevis pins, make certain that both levers are in neutral position (can be determined by feel of detents engaging notches in shifter lever shaft sectors). Place steering column shift lever in neutral position, install aligning tool (short piece of ¼" drill rod) through hole in each lever and hole in boss on steering column clutch housing (at lower end of control shaft) to hold levers in neutral position while adjustment being made. Loosen locknut and adjust clevis at transmission end of each control rod until clevis pin can just be inserted without disturbing position of transmission case lever. Tighten locknut and install clevis pin. Remove aligning tool. Check operation. If shaft pin strikes edges of slots in lever clutches, disconnect low-and-reverse control rod at transmission lever (rear lever) and lengthen or shorten rod slightly so that shaft pin engages both clutch slots smoothly.

REMOVAL & INSTALLATION: To remove the assembly from steering column, remove steering wheel, remove floor boards, disconnect control shaft dampener at cowl. Assembly can then be removed by taking out gearshift lever and freeing housing assembly clamp bracket at lower end of steering column. When re-installing, note following points:

Clutch Clearance—Clearance between faces of shift clutches must be .015-.031" (1/64" to 1/32"). Can be checked by removing lubrication fitting on clutch housing and inserting narrow feeler gauge through this hole. If clearance not correct or if clutch assembly has been dismantled, check clutch pin clearance in slots (must not exceed .009"—replace Clutch Lever and Housing Assembly #116221 if clearance excessive) and set up levers as follows: Screw upper clutch lever in housing as far as possible, then back lever out one full turn until alignment holes line up. Then screw lower clutch lever into housing until clutch face contacts upper clutch lever face, then back lever off ½ turn max. which will give correct clearance of .015-.031" between clutch faces. If alignment holes do not line up in this position, remove lower clutch lever and grind off clutch face squarely not more than .015". It is very important that lower clutch lever be backed off exactly ¼ turn from position where it contacts upper clutch lever and that alignment holes line up in this position. If correct clearance between clutch faces cannot be secured by this method, or if control shaft clutch pin has more than .009" clearance in clutch slots, replace entire Clutch Lever and Housing Assembly #116221.

Control Shaft Bracket Position—When installing steering column assembly, see that steering gear outer casing or jacket is positioned so that gear shift control shaft clutch pin bottoms in upper clutch slot when gear shift lever and shaft is in the uppermost position (Low-Reverse). If jacket and brackets installed too far down on steering gear shaft, gear shift control shaft will bottom in upper bracket and prevent clutch pin fully disengaging from lower (Second-High) clutch slots.

Gearshift Lever Clearance—Lever sideplay at fulcrum pin must not exceed .005" (excessive play will cause rattles). To reduce sideplay, add thin washer (.005-.010") under head of fulcrum pin or grind down shoulder on pin so that it will squeeze stamping closer to lever when installed. Also see that anti-rattle trigger spring on gearshift lever has suffcient tension on lever to dampen rattles.

Control Shaft Dampener—When installing dampener, see that it is positioned on cowl so that tension applied to shaft and that dampener cross bolt spacer short enough so that slight drag results on shaft when cross bolt is tightened.

SPICER TRANSFER CASE

Jeep, Ford & Willys Army Model (1942-45)
Willys Jeep, Universal CJ-2A (1946-47-48)
Willys Jeep, Universal CJ-3A (1949-50-51)
Willys 4-Whl. Dr. Sta. Wgn. 4x4-63 (1949)
Willys 4-Whl. Dr. Sta. Wgn. 4x473 (1950-51)
Willys Truck, 4WD (1947-50), 473-4WD (1950-51)

►**LUBRICATION CIRCULATION BETWEEN TRANSMISSION & TRANSFER CASE CHANGE**—Beginning with CJ-2A Serial Number 24196 (and all later models), two 7/16" holes and two 1/4" holes drilled on rear face of transmission case and two 7/16" holes drilled on front face of transfer case to provide circulation of lubricant between transmission and transfer case.

►***CAUTION—Correct gasket must be used to insure these lubrication holes being open.***

DESCRIPTION: Transfer case consists of an auxiliary transmission bolted on the rear face of the regular transmission and performing these functions:

1) Provides auxiliary speed range (Low & High) controlled by right hand shift lever (Low range useable only when Front Wheel Drive engaged).

2) Enables Front Wheel Drive to be engaged or disengaged (controlled by left hand shift lever).

3) Provides offset drive for front wheels to clear engine (drive for front and rear wheels taken from shaft at right of transfer case).

►***CAUTION—Manufacturer recommends that front-wheel drive not be used on dry hard-surfaced roads (will cause rapid tire wear and hard shifting of gears).***

REMOVAL: Transfer case is removed as a unit with transmission (see Transmission Removal data on car model page). Then separate transfer case from transmission as follows: Take out screws and remove rear cover, remove nut on end of shaft and pull gear off end of mainshaft, remove five transfer case mounting screws, pull transfer case off transmission while tapping on end of mainshaft with a soft hammer (CAUTION—Do not allow mainshaft to pull out of transmission case, this would allow transmission synchronizer parts to fall down in transmission case) leaving mainshaft and rear bearing in transmission, place transfer case on bench.

DISASSEMBLY: Take out four screws and remove rear propeller shaft universal yoke, hand brake assembly and brake linkage. Remove transfer case lower cover. Take out retaining screw and remove intermediate shaft lockplate (on rear face of case), drive intermediate shaft out toward rear of case, withdraw intermediate gear, thrust washers, and roller bearing from case. Take out plugs and remove detent poppet balls and springs from both shift rails, move front wheel drive shift rail to engaged (forward) position. Take out mounting screws and remove front output bearing cap and shaft assembly (see disassembly note below) taking care not to lose shift rail interlock plunger. Remove output shaft snap ring and thrust washer. Take out mounting screws and remove rear output bearing cap and shaft assembly (see disassembly note below) which will allow sliding gear and constant mesh gear to be removed from bottom of case. Remove setscrew in sliding gear shift fork, remove shift rail and lift out shift fork.

Front Output Bearing Cap Disassembly Note—Remove nut on end of shaft, pull universal joint yoke, remove oil seal. Take out setscrew in shift fork, remove front drive clutch gear and fork as a unit. Remove output shaft through rear of cap, pressing the shaft out of the bearing using care not to damage bearing. Remove bearing snap ring, remove bearing through rear of cap.

Rear Output Bearing Cap Disassembly Note—Remove nut on end of shaft, pull universal joint companion flange, remove oil seal. Remove speedometer driven gear assembly. Withdraw output shaft through inner end of cap. NOTE—Bearing cone is press fit on shaft and can be pressed off if necessary.

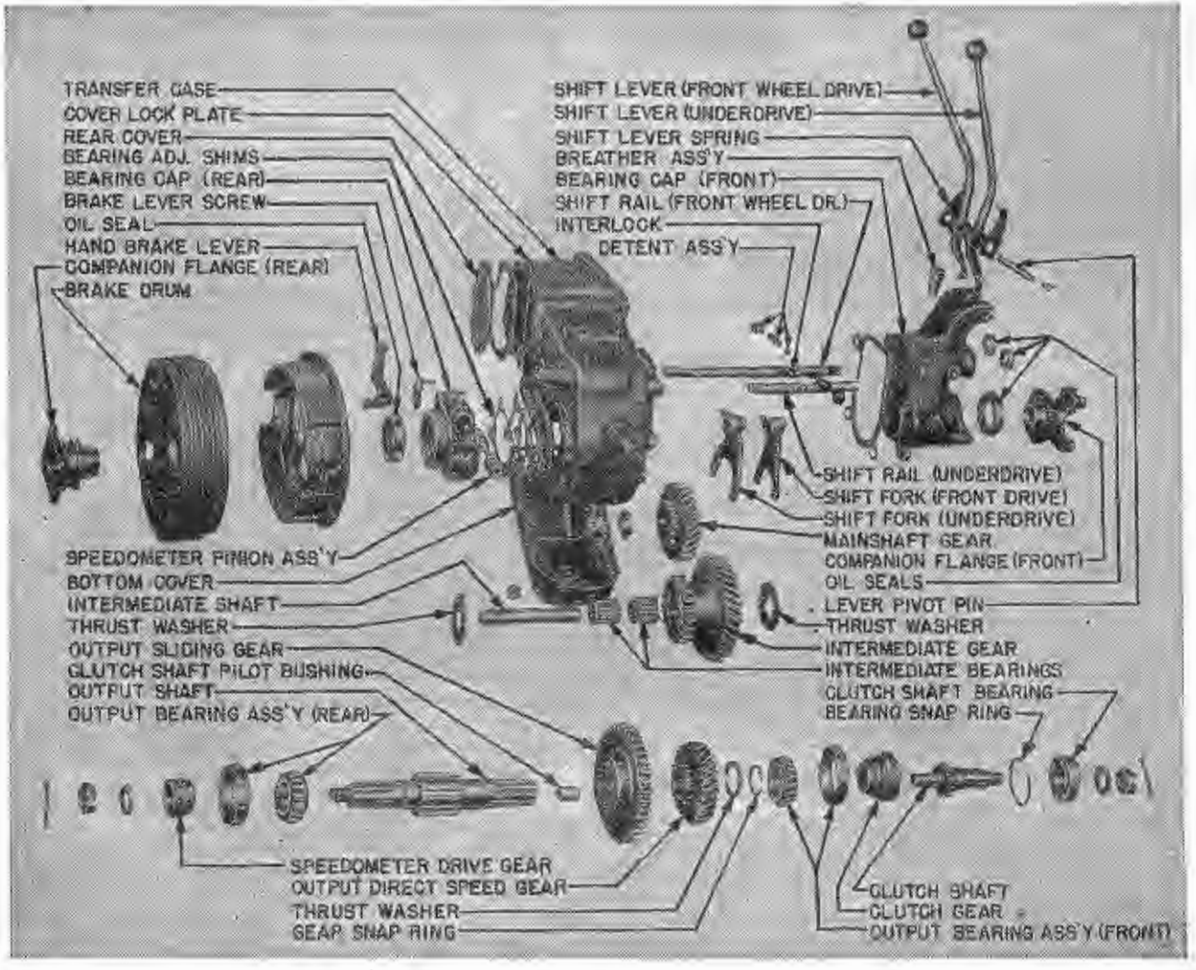
REASSEMBLY: Assemble parts in reverse order of disassembly directions given above and note the following points:

Output Shaft Bearing Adjustment—Install shims between rear output shaft bearing cap and transfer case, as necessary, so that shaft endplay is .004-.008" with front and rear bearing cap mounting screws tight.

Transfer Case Mounting on Transmission—Make certain that countershaft and reverse idler shaft lockplate (on rear face of transmission case) is properly positioned so that it fits into recess in front face of transfer case when transfer case installed.

Lubricating Hole Check—When replacing either transmission or transfer case, check for lubricating holes (see Lubrication Circulation Change above), use matching parts (drilled or undrilled) and correct gasket.

►***CAUTION—Gasket used with these drilled cases must have matching holes at these oil circulation holes.***



SPICER TRANSFER CASE (FOR FOUR-WHEEL DRIVE)

WARNER TRANSMISSIONS (WITH R1 OVERDRIVE)

Pierce Arrow 8 & 12, All Models (1936-37)

MODEL AS1-T82A

Pierce Arrow 8 & 12, All Models (1938)

NOTE: These models have a Model R1 Overdrive unit in separate case bolted on rear face of transmission case and driven from transmission mainshaft through splined coupling. See separate article (following) for Overdrive servicing data.

DESCRIPTION: Constant-mesh, synchro-mesh (2nd & high), all helical gear type. Same design as other Warner transmissions without overdrive and serviced in same manner. *See "Warner Transmission (No Overdrive)" for transmission data.*

REMOVAL OF TRANSMISSION: *See "Transmission" on car model page.*

OVERDRIVE REMOVAL: To remove overdrive unit, take out mounting screws in overdrive case flange on rear face of transmission case flange, pull unit straight back to disengage shaft from splined coupling of transmission mainshaft. Overdrive case retains rear bearing when in place. With overdrive unit removed, transmission is serviced in same manner as other types without overdrive.

TRANSMISSION OVERHAUL (Disassembly & Reassembly): *See following Warner Transmission data.*

OVERDRIVE OVERHAUL (Disassembly & Reassembly): *See Warner R1 Overdrive data (below).*

WARNER R1 OVERDRIVE

Pierce Arrow 8 & 12, All Models (1936-38)

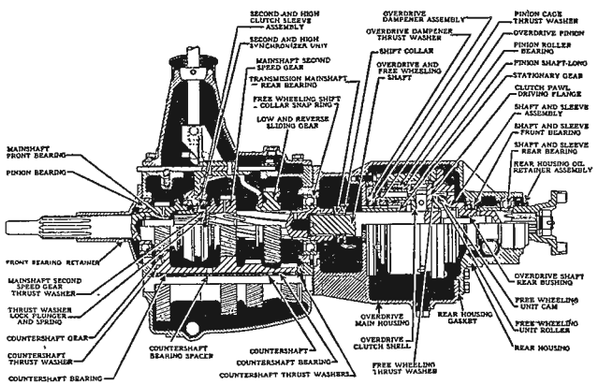
DESCRIPTION & OPERATION: Overdrive consists of a planetary gear system with a centrifugally operated actuating clutch and a free wheel unit built in the overdrive case. The outer ring or internal gear of the planetary system is part of the 'sleeve and shaft assembly' permanently connected to the rear axle, while the small central 'sun' gear is stationary (bolted directly to the front face of the overdrive case—spring loaded dampener built in sun gear mounting on some models). The planet gears (pinion assembly) are driven by the engine when overdrive is operative and revolve freely at other times. Overdrive is driven by a sliding shaft splined to the transmission mainshaft which can be shifted backward and forward by means of the dash control button.

Direct Drive Position. Shaft shifted to rear so that clutch teeth at rear end engage free wheel cam and sleeve and shaft assembly. Drive transmitted directly to rear axle. Free wheeling locked out and overdrive inoperative (centrifugal clutch assembly free and not positively driven).

Free wheel & Overdrive Position. Shaft shifted forward to engage free wheel cam and clutch pawl driving flange. Drive transmitted to rear axle through free wheel cam and rollers (free wheel operative at speeds below overdrive cut-in point). Clutch assembly is rotated at engine speed and as speed increases to cut-in point, weights tend to fly out and engage clutch shell which is part of planetary pinion assembly (pinned together by pinion shafts). However pinions and clutch shell rotate at less than engine speed (being driven by ring gear which is part of sleeve and shaft assembly) so that clutch pawls cannot engage. When car is allowed to free wheel (accelerator pedal released momentarily), speed of clutch drops down to pinion speed and pawls engage in notches in shell. Engine then drives pinion assembly and, as pinions rotate on their shafts as the assembly is rotated, ring gear is rotated at more than engine speed so that sleeve and shaft assembly drive rear axle at greater than engine speed (overdrive). When engine speed decreases to a point approximately 8-10 M.P.H. below cut-in point, clutch pawl springs withdraw pawls from engagement with shell (car must free wheel momentarily to allow this disengagement to occur) and engine again drives car through free wheel cam and rollers.

ADJUSTMENT:—Cut-in point for overdrive is set at factory and should not require adjustment. To adjust, remove the adjusting hole plug on top of case), drain lubricant, place transmission gears in neutral, rotate propeller shaft until holes in free wheel case and clutch shell line up with hole in case. Then engage high gear, depress clutch pedal so that slight drag placed on shaft, rock propeller shaft back and forth to rotate clutch pawl flange until adjusting screw head is visible in hole. Turn screw clockwise or in to increase cut-in speed, counter-clockwise or out to decrease cut-in speed) (two full turns will change cut-in speed 6 M.P.H.). Rock shaft again to bring second adjusting screw in line with hole, repeat adjustment. Adjust both screws equally. NOTE—one screw has double slot in head so that they can be distinguished to avoid possibility of adjusting same screw twice. Check to see that screws have not been turned so far that they interfere with the clutch shell.

First Type (Without Adjusting Plug). On these models, remove drain plug at bottom of case, drain lubricant, adjust through drain plug hole in same manner as directed above.



SERVICING:—Disassembly. Take out rear housing capscrews, withdraw rear housing and shaft and sleeve assembly, and free wheel assembly. Remove clutch shaft shifting collar snap ring, withdraw clutch pawl assembly, pinion assembly, and shaft through rear of case. To remove stationary sun gear, turn down lockwasher lips, mark mounting flange and case to insure reassembly in same position, remove mounting screws. Damper assembly cannot be serviced and should not be dismantled. Sun gear can be removed by taking out lock ring and pressing gear out of damper member.

Overdrive Shaft & Sleeve Assembly:—Sleeve is riveted to shaft flange and should not be removed. To remove assembly from rear housing, remove propeller shaft flange and speedometer drive pinion, press shaft out of housing toward front, remove oil seal from rear. When reassembling, see that rear ball bearing seated against shoulder in housing and snap ring at rear engaged in slot, front roller bearing seated against snap ring in housing at rear, and that speedometer drive gear snap ring at forward end of gear installed with open end at oil escape hole in shaft.

Pinion Gear Assembly:—Helical type gears can be disengaged and engaged with sun and ring gear by rotating assembly slightly. When spring-loaded spur gears used, line up gear halves against spring tension when meshing these gears (springs tend to rotate gear sections to take up backlash, insuring quiet operation).

Overdrive Assembly:—Install sun gear and damper assembly using new lock washers under screw heads and turning lips up against screws to prevent loosening. See that oil holes in damper plate and case line up to insure lubricant circulation. Install damper thrust washer, overdrive shift rail fork and spring, shift rail (compress spring and install horseshoe lock), planet pinion cage, pawl core, pawl core shell, clutch shaft (from rear of case), shift collar and lock ring, free wheeling cam. Install free wheeling roller springs, compress springs and install rollers. Install free wheeling cam thrust washer and lock in place with cotter pins. Install rear retainer and shaft and sleeve (annulus gear) assembly, adjust endplay as directed below.

Overdrive Endplay Adjustment. See that all gaskets previously used between overdrive housing and rear housing flange are replaced (these gaskets control endplay). To determine correct gasket when new parts have been installed, assemble rear housing (omitting all gaskets), using two screws drawing up finger tight. Use feeler gauge to check clearance between main housing flange and rear housing flange. Assemble gaskets equal in thickness to this clearance plus .015-.025" for endplay (use micrometer to check gasket thickness) and install this gasket pack under rear housing flange.

WARNER TRANSMISSIONS WITHOUT OVERDRIVE

Pierce Arrow 8 & 12, All Models (1937)

(WITH R6 OVERDRIVE)

Nash & Nash-Lafayette, Some Cars (1939)

DESCRIPTION: Constant-mesh, synchro-mesh, helical gear (second and high), sliding gear (low and reverse). Main drive gear and shaft mounted on ball bearing in front of transmission case. Mainshaft mounted on roller bearing (front), ball bearing (rear). Counter gear cluster mounted on bronze bushings, or roller bearings (caged type or loose rollers) on stationary countershaft. Reverse idler has a bronze bushing on stationary shaft. Second speed and high gears engaged by sliding clutch

CONTINUED ON NEXT PAGE

WARNER TRANSMISSIONS (Continued)

sleeve (splined on synchronizing unit spline sleeve) which engages clutch teeth on second speed and main drive gear hubs.

Synchronizing Unit. Consists of synchronizing cones on main drive gear and second speed gear and drums on ends of sliding sleeve splined to mainshaft within sliding clutch sleeve. These two sleeves are centered by spring-loaded detent balls which engage a groove in the outer clutch sleeve and move as a unit when the clutch sleeve is shifted to engage second or high until the synchronizing drum and cone engage. When synchronization is completed, clutch sleeve engages clutch teeth on gears.

REMOVAL OF TRANSMISSION: *See "Transmission" on car model page.*

DISASSEMBLY (Transmissions without Overdrive): Remove the transmission case shift lever, cover, shifter shaft and fork assemblies, being careful not to lose lock balls and springs. Remove universal joint flange nut, pull flange. Take out rear bearing retainer screws, withdraw rear bearing retainer, mainshaft, second speed gear and synchronizing unit as an assembly, being careful not to allow clutch sleeve to move on inner synchronizing sleeve which will allow detent balls and springs to jump out. See note below for types where rear bearing mounted directly in case so that mainshaft assembly cannot be withdrawn through rear of case. Take out screw in countershaft and reverse idler locking plate screw and remove plate, drive out countershaft toward the rear (on types where loose roller bearings used, use dummy shaft or arbor to drive out countershaft leaving the arbor in the gear cluster until it is re-installed, arbor will prevent rollers falling out). Take out screws in bearing retainer on front of case, pull clutch shaft main drive gear and bearing assembly out toward front. Lift out counter gear cluster, being careful not to lose thrust washers and spacers. To remove reverse idler, drive shaft out toward rear (on types with loose roller bearings, rollers will fall out and care should be taken that they are not lost).

NOTE—When rear mainshaft bearing mounted directly in case, pull mainshaft assembly to rear until bearing is free of case, tip shaft up and remove synchronizing unit, and if necessary second speed gear (see dismantling instructions below). Remove bearing snap ring, push shaft forward and remove through top of case.

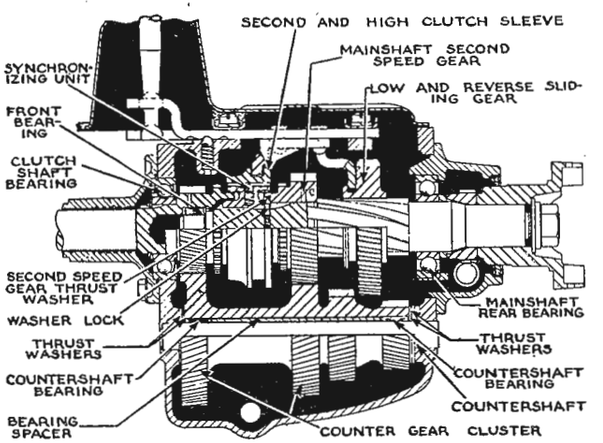
Countershaft Locking Key Note. On models where locking plate not used, countershaft and reverse idler shaft retained by key in recess in rear face of case which engages slot in shaft. On these models, drive countershaft out to the rear (with rear bearing adapter free) until key is exposed, remove key drive shaft out (use dummy shaft or arbor).

Mainshaft & Bearing Assembly:—Bearing is press fit on mainshaft (press bearing on and off shaft). Bearing is retained in case by snap ring at rear, or by snap ring at forward end.

Synchronizing Unit:—Mark outer clutch sleeve and inner synchronizing sleeve before dismantling and assemble in same positions. Use care not to lose detent balls and springs (wrap in cloth when pushing clutch sleeve off so that balls will be caught when they spring out). Use special assembling clips when reassembling. Install on mainshaft with longer hub on both sleeves toward front (see illustration).

Second Speed Gear: Use wire to depress plunger, free washer, turn washer so that prongs on inner edge line up with splineways on shaft, pull washer and gear off, taking care not to lose lock plunger and spring. When installing thrust washer, see that it is turned so that prongs engage slots in splines and that it is locked in place by plunger. Gear endplay controlled by thrust washer thickness (furnished in various thicknesses) is .003-.008".

NOTE—On some models, additional thrust washer used at rear of gear against shoulder on shaft. This washer locked in place by pin or by locking plunger and spring in same manner as front washer.



Counter Gear Assembly:—See that bearing spacer installed in gear cluster between bearings. On types with loose rollers, see that rollers installed around arbor, coat end of gear with cup grease to hold rollers in place. Install steel spacers or thrust washers next to gear at each end (not used at front end on some models), bronze washers between steel spacers and case. Install countershaft from rear, driving out arbor toward front (when used). Gear endplay is adjusted by selecting thrust washers of correct thickness and should be .002-.008".

DISASSEMBLY (Transmission & Overdrive): Remove shift lever, cover, shifter assembly, use care not to lose lock balls and springs. Lock transmission by shifting into two gears at once, remove drive shaft nut at universal joint flange, pull flange. Remove speedometer drive pinion. Take out screws mounting overdrive unit on transmission case, withdraw overdrive housing (free wheeling rollers will fall out, take care not to lose rollers). Remove free wheeling cam locking screw on rear end of shaft, withdraw free wheeling cam and cage assembly, remove ring or annulus gear and bushing assembly. This completes overdrive removal (stationary sun gear integral with adapter which serves as mainshaft rear bearing retainer).

REASSEMBLY: Assemble all parts in reverse order of disassembly directions above.

WARNER R6 OVERDRIVE (NO "KICK-DOWN")

Nash & Nash-Lafayette, Some Cars (1939)

DESCRIPTION: Planetary gear unit with centrifugal pawl type engagement. Engages when accelerator pedal released momentarily at car speed above cut-in point (control button must be in "in" or unlocked position). No provision for "kick-down" (car speed must be reduced to below cut-in speed).

ADJUSTMENT: Cut-in point should not require adjustment. To adjust, remove large adjusting hole plug on top of case, jack up rear end of car, turn propeller shaft until one hole in clutch shell lines up with adjusting hole. Engage high gear, rotate propeller shaft until one adjusting screw head lines up with hole in shell. Turn screw in to increase cut-in speed, out to decrease cut-in speed. Two full turns will change cut-in speed approximately 6 MPH. Turn screws only in half-turns so that locking washer is engaged to prevent screw turning in service. After adjusting one screw, turn propeller shaft ¾ revolution so that second adjusting screw is lined up, adjust this screw equally. **Important**—both screws must be adjusted equally. One screw has single slot, opposite screw has double slot so that they may be distinguished (use care not to adjust same screw twice). Check adjustment and make certain that screws not turned out so as to strike clutch shell.

REMOVAL OF OVERDRIVE: *See "Overdrive" or "Transmission" on car model page.*

TRANSMISSION DISASSEMBLY & REASSEMBLY: *See Warner Transmission data on this page.*

OVERDRIVE DISASSEMBLY & REASSEMBLY:

Housing & Driveshaft Assembly—To remove shaft, drive shaft out of housing with brass drift. Operate shifting arm while removing shifting sleeve from housing. See that shifter collar engages groove in sleeve when sleeve replaced in housing. Install shifter sleeve and housing after overdrive has been assembled on transmission case, starting housing upside down until lockout rod touches adapter plate and then rotating housing into correct position (manipulate lever to assist assembly).

Free wheeling Cam & Roller Assembly:—Fill cage openings with cup grease to hold rollers in place while assembling, rotate cage assembly counterclockwise on cam (viewed from rear) while installing overdrive mainshaft (drive shaft). Make certain that oilite thrust washer on face of free wheel cam is installed with chamfered side toward front of car.

Ring Gear & Clutch Assembly:—To remove clutch assembly, take out snap ring in rim at rear, lift clutch out. Press out overdrive clutch plain bearing using a plug of correct size, take out clutch pawl adjusting screws taking care to measure distance from top of each screw to marks on clutch core first, and counting the number of 'clicks' (half-turns) while removing the screws. When installing, turn screws in exactly this same number of clicks so that the original cut-in speed setting will not be disturbed. When installing clutch pawl sleeve, lock pawls in engaged position, press sleeve in flush with forward face of overdrive clutch, free pawls.

Stationary Sun Gear & Pinion Assembly:—Pinion assembly can be removed by rotating gears off sun gear (gears are helical type). When installing sun gear (adapter plate) see that paper gaskets are in place on each side. Oilite thrust washer should be installed on pinion gear hub at rear.

WARNER HORIZONTAL TRANSMISSIONS

WITHOUT OVERDRIVE

Model AS2-T88.
Studebaker Comm. 9A & Pres. 5C (1939)

WITH R6 OVERDRIVE

Model AS7-T88—See Note
Studebaker Comm. 9A & Pres. 5C (1939)

NOTE: AS7-T88 Transmission. This model is equipped with Type R6 Overdrive mounted in separate case bolted on rear face of transmission case. Transmission mainshaft extends through into overdrive case serving as mounting shaft for Planetary Pinion, Annulus Gear and Pawl, and Free Wheeling Cam assemblies.

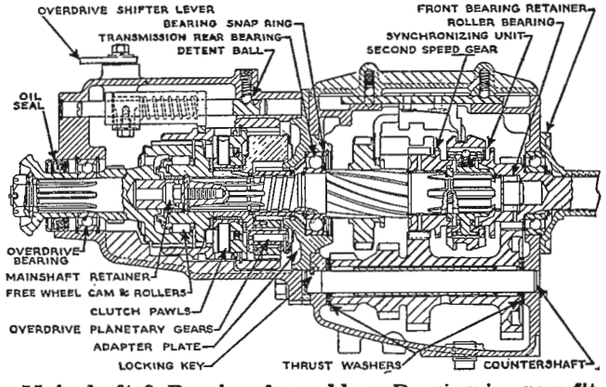
DESCRIPTION: Constant-mesh, synchro-mesh, helical gear (second and high), sliding gear (low and reverse). Clutch shaft and main drive gear mounted on ball bearing in front end of transmission case. Mainshaft mounted on roller bearing (in main drive gear hub) at front end and ball bearing (in bearing retainer) at rear end. Counter gear cluster mounted on roller bearings on stationary shaft with thrust washers at each end. Reverse idler gear mounted on bronze bushing on stationary shaft (countershaft and reverse idler shaft retained by locking plate on rear face of case). Second and high gears engaged by sliding clutch sleeve (splined on clutch gear which is splined on mainshaft) which engages clutch teeth cut on the main drive gear and second speed gear hubs.

Wire Bound Strut Blocking Synchronizer. Both of the synchronizer rings are free in the ends of the inner clutch sleeve and they are actuated by three struts which fit in slots in inner clutch sleeve and engage notches in the rings. Struts are centered in outer clutch sleeve by a locking wire or ring (engaging notches in the struts) and move with the outer clutch sleeve to force the synchronizer rings against the cones on the gear hub for synchronization. Teeth on the outer rim of the synchronizer rings block or prevent gear engagement until synchronization completed when the final movement of the outer clutch sleeve causes the clutch teeth on the rim of the sleeve to slide past the synchronizer ring teeth and engage the clutch teeth on the gear hub. Inner clutch sleeve is stationary on mainshaft and does not move during synchronization and gear engagement.

REMOVAL OF TRANSMISSION: *See "Transmission" on car model page.*

DISASSEMBLY: (Transmissions without Overdrive): Take out cover screws and remove cover, remove shifter rods or rails and forks taking care not to lose interlock balls and springs. Lock transmission by shifting into two gears at once, remove nut on rear end of mainshaft, pull rear companion flange and brake drum (on models using shaft type parking brake). Remove capscrews on rear bearing retainer, take out screw and remove countershaft locking plate, use dummy shaft or arbor and drive countershaft out to rear leaving arbor in counter gear cluster to retain loose bearing rollers (see note below for removal of countershafts with locking keys). Pull rear bearing retainer and mainshaft assembly through rear of case as a unit (if synchronizing unit allowed to slide off shaft and removed separately, see that sleeve not allowed to come off clutch gear which will cause detent balls and springs to fly out). Take out front bearing retainer capscrews (on front of the case) and withdraw the retainer. Main drive gear must be removed at rear (tap gear forward slightly, remove bearing snap ring at bearing hole in case, drive gear back into case and remove through rear end. Lift out counter gear assembly taking care not to lose the loose bearing rollers at each end or the thrust washrs. To remove reverse idler gear, drive shaft out to rear using a brass drift.

Countershaft Locking Key Note. On models where locking plate not used, countershaft (and reverse idler shaft) retained by key in recess in rear face of case which engages slot in shaft. On these models, drive countershaft out to rear (with rear bearing adapter removed) until key is exposed, remove key and drive shaft out (use dummy shaft or arbor and leave arbor in counter gear cluster to retain bearing rollers until shaft is reinstalled).



Mainshaft & Bearing Assembly:—Bearing is press fit on mainshaft and is held in place by companion flange and nut at rear end of shaft (speedometer drive gear acts as spacer on shaft). Bearing is retained in recess in rear retainer by snap ring at forward end (remove snap ring to remove bearing).

Synchronizing Unit (Wire Bound Strut Type): Install struts in inner sleeve, install lock wire so that it engages notches in struts with open end of wire midway between two struts (synchronizer will not operate if wire installed with open end at strut so that strut free to move endwise). When installing inner sleeve and strut assembly in outer sleeve, narrow strips of .003" feeler stock can be installed directly over each strut to prevent wire disengaging from strut slot when it is contracted to enter sleeve. CAUTION—Make certain that hook on open end of lock wire is engaged between two clutch teeth in outer sleeve. Remove feeler strips used for assembly before installing synchronizer on mainshaft. See Second Speed Gear Assembly for installation instructions.

Second Speed Gear Assembly (with Wire Bound Strut type Synchronizer):—Second speed gear and inner sleeve or hub of synchronizer mounted as an assembly on the mainshaft and retained by snap ring on forward end of shaft. To disassemble, remove snap ring in front of synchronizer inner sleeve, withdraw synchronizer assembly and second speed gear. When reassembling, make certain that second speed gear endplay is .003-.014" with synchronizer inner sleeve pressed forward against snap ring.

Main Drive Gear & Bearing:—Bearing retained on clutch shaft by thrust washer and snap ring at forward end (within bearing retainer). If bearing removed, use new snap ring selected for tight fit in groove (furnished in various thicknesses). Front bearing for mainshaft (roller type) located within drive gear hub and rollers are retained by snap ring at rear end of gear hub.

Counter Gear Assembly:—See that bearing spacer installed in gear cluster between bearings and that rollers are in place around dummy shaft or arbor (end of gear can be coated with grease to retain rollers during assembly). Install gears with steel and bronze thrust washer at each end (steel washer toward gears, bronze washer toward case), insert countershaft from rear end, pushing out arbor as shaft is installed. Check endplay with feeler gauge between bronze thrust washer and rear of case with gear cluster forced toward front. Endplay should be .002" minimum, .008" maximum. Adjust by changing thrust washers (furnished in three thicknesses). Make certain that locking plate and screw installed to retain countershaft and reverse idler shaft.

DISASSEMBLY (Transmission and Overdrive): Remove cover, shifter rods or rails and forks taking care not to lose interlock balls and springs. Remove universal joint flange nut and flange (use puller). Remove speedometer drive pinion. Take out mounting screws in overdrive mounting flange on rear face of transmission case, hold mainshaft in forward position, withdraw overdrive housing and rear shaft assembly (take care not to lose free-wheeling rollers which will be free to fall out). Take out capscrew in rear end of transmission mainshaft, withdraw free-wheeling cam and cage assembly, overdrive clutch pawl core and annulus gear assembly, and planetary pinion cage assembly. Remove snap ring on mainshaft at rear end of stationary sun gear. Remainder of transmission disassembly is same as transmission without overdrive (preceding) except as noted below. *See Warner R6 Overdrive for Overdrive data.*

Transmission Mainshaft Rear Bearing. Bearing retained in adapter plate by snap ring in bearing recess on forward side. Bearing positioned on mainshaft by thrust washer and snap ring at rear (accessible after removing bearing and shaft assembly from adapter). When reassembling, select snap ring for tight fit in groove (furnished in four thicknesses).

Countershaft and Reverse Idler Shaft Locks. Shafts are locked in place by woodruff key in recess in rear face of transmission case (under adapter plate) which engages notch in shaft. To remove shaft (on models with hole in adapter plate in line with countershaft hole in case), tap adapter plate to rear about ¼", drive countershaft to rear until key clears case, use long screwdriver inserted between case and adapter plate and remove key, then drive countershaft out through adapter plate hole. On other models, adapter plate and mainshaft assembly must be removed before countershaft can be driven out.

Counter Gear Endplay. Should be .002" minimum, .011" maximum. Adjusted by installing thrust washers of correct thickness.

REASSEMBLY: Reassemble all units in reverse order of disassembly directions given above.

1939-46 WARNER TRANSMISSIONS
(NO OVERDRIVE)

Car Model	Warner Model
Chrysler 6, Model C22 (1939)	
Chrysler 8, Model C19 (1939)	
Crosley, All Models (1939-42)	AS1-T92
De Soto, Model S6 (1939)	
Dodge, Model D11 (1939)	
Jeep, Army Model (1942-45)	AS2-T84J.
Nash '600', All Models (1941-42)	AS3-T84G
Plymouth, P7 & P8 (1939)	
Studebaker Champion, G (1939)	AS1-T84F
Studebaker Champion, 2G (1940)	AS5-T84F
Studebaker Commander, 10A (1940)	AS1-T86C
Studebaker President, 6C (1940)	AS1-T86C
Studebaker Champ. All (1941-42)	AS1-T84G
Studebaker Comm., All (1941-42)	AS1-T86D
Studebaker Pres., All (1941-42)	AS1-T86D
Willys, All Models (1939)	
Willys, Speedway 440 (1940)	AS3-T84D
Willys, Deluxe 440 (1940)	AS4-T84F
Willys, Pickup & Panel 440 (1940)	AS3-T84D
Willys, All Models (1941-42)	AS5-T84G

(WITH R6 & R7 OVERDRIVE)

Car Model	Warner Model
Chrysler 6, Model C22 (1939)	AS3-T86A
Chrysler 8, Models C23, C24 (1939)	AS5-T85A
DeSoto, Model S6 (1939)	AS3-T86A
Nash "600", 4140 (1941), 4240 (1942)	AS4-T84G
Studebaker Champ. G (1939)	AS2-T84F
Studebaker Champ 2G (1940)	AS6-T84F
Studebaker Champ. 3G, 4G (1941-42)	AS2-T84G
Studebaker Champ. 6G (1946)	AS2-T84G
Studebaker Comm. 9A, Pres. 5C ('39)	AS7-T88
Studebaker Comm. 10A, Pres. 6C ('40)	AS2-T86C
Studebaker Comm. 11A, 12A (1941-42)	AS2-T86D
Studebaker Pres. 7C, 8C (1941-42)	①AS2-T86D
Willys, 441 (1941), 442 (1942)	

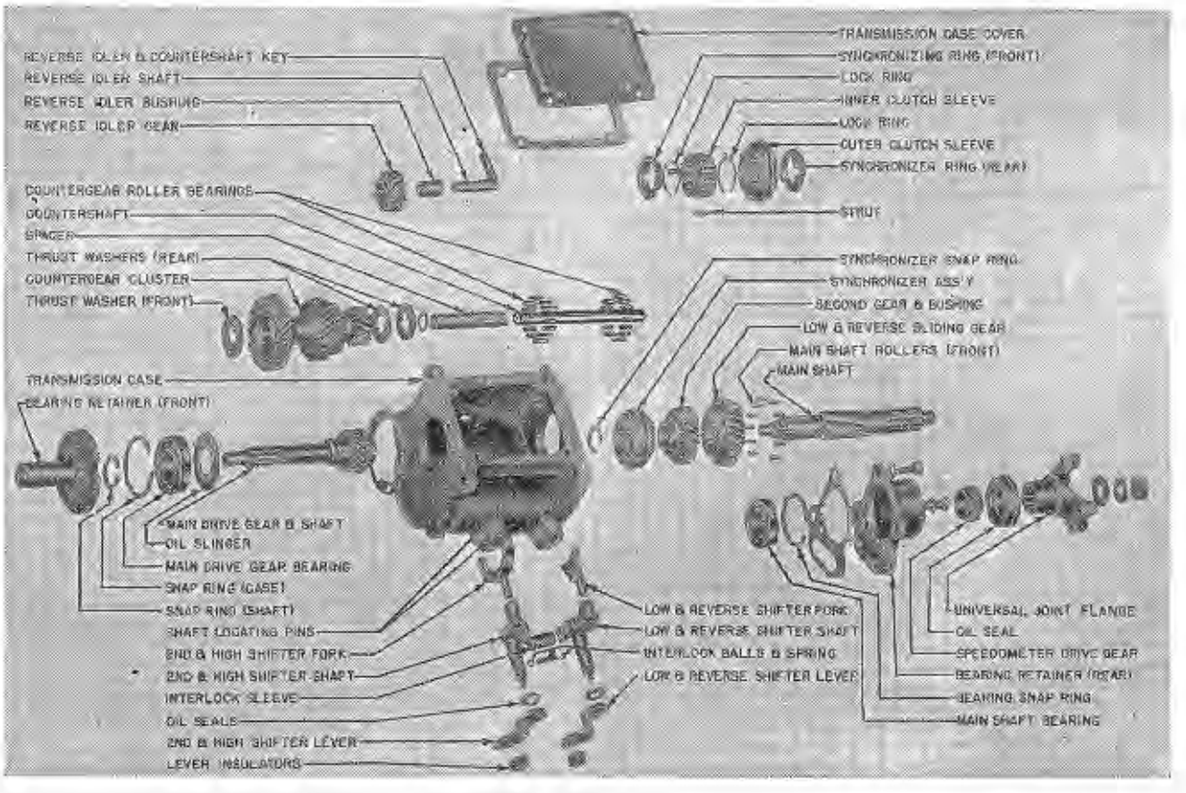
①—See Production Change Note below for Late 1942 Transmission changes.

►CHANGES & CORRECTIONS

►**Studebaker Champion (1939-40) Correction for Shifting into 2 Gears at once**—If this occurs on 1939 & early 1940 cars, when gears shifted forcibly with car standing still or with heavy lubricant, correct by disassembling transmission and installing #199652 Interlock assembly as follows: Remove transmission cover drive out pin in low-reverse shaft pull shaft out of case as far as possible, remove old detent plungers and spring, install new assembly, reassemble transmission. When installing low-reverse shaft pin, coat pin with shellac and drive pin in ⅛-3/16" beyond surface of pin hole. NOTE—This trouble should not be experienced on later 1940 cars.

►**Studebaker Pres. (late 1942) Overdrive Production Change**—The R7C Overdrive listed above was used on early 1942 cars only. Beginning with Serial No. 7147625, a new type R9C Overdrive was used (Transmission Model T86D-R9C). This R9C Overdrive is special electrical control type without centrifugal pawls. Refer to separate article (following)

►**Studebaker 1941 Overdrive Free-wheel Unit Bearing Change**—To correct complaints of free-wheel slippage when "kicking" down into direct drive, high speed vibration, or grease leaks at rear bearing retainer caused by wear in free-wheeling cam bearing (bushing within free-wheel cam), this bushing should be replaced by new type Torrington Needle Roller Bearing No. 515378 (this bearing used in production on Late 1941 and all 1942 cars). To install this bearing, disassemble overdrive unit (see Servicing data below), remove bushing, install new type bearing by pushing on face of bearing marked with word "Torrington."



WARNER 1939-46 TRANSMISSIONS (NO OVERDRIVE)

DESCRIPTION: Constant-mesh, synchro-mesh (2nd, High), sliding gear (Low & Reverse), all helical gear type. Main drive gear mounted on ball bearing in front end of case. Mainshaft mounted on pilot roller bearing in main drive gear hub (front end), ball bearing in bearing retainer or overdrive adapter bolted to rear of case (rear end) and extends through into overdrive unit. Counter gear cluster mounted on roller bearings on stationary countershaft with spacer between bearings and thrust washer at each end. Reverse idler gear mounted on plain bushing on short shaft which is retained by key which engages slot in case at rear end.

Overdrive Unit (R6, R7): Same as other Type R6 overdrive units except for sun gear mounting and control as follows: Sun gear is free to revolve on transmission mainshaft and is held stationary (for overdrive) by a spring-loaded, solenoid controlled clutch pawl mounted on the overdrive adapter plate. The pawl slides between two guide plates and in the inner position engages the sun gear blocker plate so as to prevent rotation of the sun gear. When the pawl is withdrawn by the solenoid to free the sun gear, a balk ring (assembled loosely on blocker plate) is dragged around sufficiently to block the pawl in the withdrawn position (when torque reversed by accelerator pedal release, balk ring returned to original position so that pawl can engage), but is prevented from further rotation by lugs on the rim of the ring.

►**Steering Column Gear Shift Note**—Used on all car models except Bantam and Crosley cars. See separate "Transmission Control" articles for data.

Crosley Transmission—This transmission is similar to other types except that no synchronizing mechanism is used (second speed gear shifted forward to engage clutch teeth on main drive gear for direct drive). Torque tube is bolted on rear end of case with adapter for universal joint on 1941-42 model only. This transmission serviced in same manner as other models after torque tube or adapter removed. Disregard Synchronizer data.

Willys Note—Low & Reverse sliding gear is straight spur type (other gears helical). See Willys Transfer Case Note (below) for data on transmission used on 4-wheel drive models.

Jeep Transfer Case—2-speed transfer case (Spicer Model 18) is mounted directly on rear of transmission case with transmission mainshaft rear bearing mounted in the transfer case housing. See Spicer

CONTINUED ON NEXT PAGE

1939-46 WARNER TRANSMISSIONS (Continued)

Transfer Case article for complete data on this unit. CAUTION—Transfer case must be partially dismantled (drive gear removed from mainshaft) before it can be taken off the transmission case.

Synchronizer Assemblies:—Type used on each car (except Crosley—none used) as follows:

Drag Ring Type Blocking Synchronizer (Chrysler C22, De Soto, Dodge, Plymouth P8)—Synchronizer rings are loose in ends of inner clutch sleeve and are actuated by a drag or friction ring within the outer clutch sleeve which contacts lugs on the synchronizer rings (initial movement of outer clutch sleeve carries drag ring with it and forces synchronizer rings in contact with cones on gear hubs). Teeth on synchronizer rings block or prevent gear engagement until synchronization completed when final movement of outer clutch sleeve causes clutch teeth on rim of sleeve to slide past teeth on synchronizer ring and engage clutch teeth on gear hub. Inner clutch sleeve is stationary on mainshaft **Blocking Lug Type Synchronizer (Chrysler C23, C24)**—Synchronizer rings loosely mounted in ends of inner clutch sleeve and retained by snap rings. Rings are actuated in usual manner by the inner clutch sleeve (inner and outer clutch sleeves centralized by poppet balls and springs and move as a unit for synchronization). Three lugs on synchronizer rings (in recesses in inner clutch sleeve) block or prevent gear engagement until synchronization has been completed when the final movement of outer sleeve engages clutch teeth on gear hub.

Wire Bound Strut Blocking Type (Graham, Studebaker)—Synchronizer rings are free in ends of inner clutch sleeve and are actuated by three struts which fit in slots in inner clutch sleeve and engage notches in the rings. Struts are centered in outer clutch sleeve by a locking wire or ring engaging notches in the struts and move with the clutch sleeve to force the synchronizer rings against the cones on the gear hubs for synchronization. Teeth on the outer rim of the synchronizer rings block or prevent gear engagement until synchronization completed when final movement of outer clutch sleeve causes clutch teeth on rim of sleeve to slide past teeth on rings and engage clutch teeth on gear hubs. Inner clutch sleeve is stationary on shaft.

Double Blocker-Double Spring Type (All 1940-46 Models)—Synchronizer rings are free in ends of inner clutch sleeve and are actuated by three shifting plates or struts which fit in slots in inner clutch sleeve and engage notches in synchronizer rings. Struts are centered in outer clutch sleeve by two wire springs (within struts on either side of inner clutch sleeve web) and move with the outer clutch sleeve to engage the synchronizer rings with the cones on the gear hubs. Inner clutch sleeve is stationary on the shaft and does not move (retained together with second speed gear by lock ring in groove in shaft). Blocking action is same as on other types of blocking synchronizers.

Synchronizer (Other Models)—Conventional type with inner and outer sleeves centered by poppet balls and springs (synchronizer rings or cones fixed in inner sleeve).

Gearshift Mechanism (All 1940-46 Cars)—Consists of shifter shafts and lever installed in side of transmission case. Each lever operates independently (rear lever for Low & Reverse, forward lever for Second & High) with forks on inner ends of lever shafts engaging sliding gear (Low-Reverse), synchronizer clutch sleeve (Second-High). Interlock and detent plungers are mounted in boss in case between levers and engage notches in sectors on inner ends of lever shafts (On Studebaker T86C, T86D, interlock plunger only mounted as above with separate detent plungers mounted in holes in each end of case and accessible by taking out plugs which close outer ends of these plunger holes).

REMOVAL OF TRANSMISSION: *See "Transmission" on car model page.*

TRANSMISSION & OVERDRIVE OVERHAUL NOTES:

Chrysler 1940-41 Overdrive Note—Adapter plate and overdrive case are held together by three special screws inserted in holes in front face of adapter plate. Overdrive assembly must be removed from the transmission as a unit with the adapter plate and mainshaft assembly, and screws removed with C-557 tool before adapter plate removed.

Nash 4140, 4240 Note—No universal joint companion flange used and rear bearing retained by snap ring on shaft at rear of bearing. This snap ring must be removed first in order to remove overdrive case without disturbing shaft and free-wheeling assembly (shaft will come out otherwise).

Studebaker 1941-46 Note—No universal joint companion flange used and rear bearing retained by oil seal and retainer housing bolted on rear end of overdrive case and by snap ring installed on shaft at rear of bearing. When removing overdrive case, first remove retainer and take out snap ring (use special pliers #187) so that case can be withdrawn without disturbing free-wheel roller assembly.

Gearshift Mechanism (All 1940-46 Cars)—When disassembling transmissions with shifter shafts in side of transmission case, drive out shaft lockpins (in shaft boss on case) and pull shafts out as far as possible. When reassembling transmission, make certain that interlock and detent plungers and springs properly installed. See Gearshift data.

DISASSEMBLY OF OVERDRIVE TRANSMISSION: See Overhaul Notes above. Overdrive can be disassembled first, if overhaul of unit required *(see Warner K6 & K7 Overdrive following)*, or it can be removed as a unit if overdrive case not allowed to separate from adapter plate (this procedure possible on transmissions where mainshaft assembly can be removed through rear of case as a unit). Then proceed with disassembly as directed for Transmissions without Overdrive below.

DISASSEMBLY OF TRANSMISSION (Without Overdrive): See Overhaul Notes above. Remove transmission cover, mark both synchronizer rings and both synchronizer clutch sleeves to insure reassembly in same positions. Drive out shift lever shaft lockpins (in holes in shaft bosses on outside of case) from below, pull levers out as far as possible to allow removal of mainshaft and gears. On Studebaker & Nash, remove main drive gear bearing retainer (on front of case), remove large snap ring from bearing outer race and small snap ring from shaft, install special thrust yoke J-1525 (Nash & Stude. Champ.), J-1526 (Stude. Comm. & Pres.), on mainshaft to take endthrust of the puller and prevent damage to synchronizers, use puller plate J-1298 and puller HM-925 to remove main drive gear bearing from front of case. On other models, main drive gear and bearing can be removed as a unit after countershaft has been removed to drop countergear cluster and disengage drive gear from countergear. Remove nut on rear end of driveshaft, use puller to remove universal joint yoke (on models where separate front yoke used), remove speedometer pinion, take out rear bearing retainer or transmission extension mounting screws (overdrive case screws on overdrive transmissions) and remove retainer, slide main shaft and rear bearing assembly to rear until bearing free of case. On Nash and Studebaker (where main drive gear bearing previously removed), lift drive gear up so that it clears countergears, remove drive gear from front of case. On all models, push mainshaft assembly away from shifter shafts, remove second & high shifter fork, remove snap ring from forward end of mainshaft (in front of synchronizer unit inner clutch sleeve), slide synchronizer unit, second speed gear, and low speed gear off mainshaft and withdraw shaft from rear of case, lift synchronizer and gears out through top of case. To remove countergear assembly, remove lockplate from slot at rear end of countershaft, drive countershaft out toward rear using dummy shaft or arbor and leaving this arbor in countergear cluster to retain bearing rollers until asssembly re-installed in case (arbor will be driven out by countershaft as shaft installed). Lift out countergears and thrust washers, noting location of each washer.

►**Bantam & Willys Disassembly Note**—Mainshaft assembly cannot be removed through rear of case and must be dismantled and removed as follows: Pull shaft back until rear bearing is clear of case, tip forward end up and remove synchronizer as a unit (use care not to allow outer clutch sleeve to move on inner sleeve which will release poppet balls and springs), remove second speed gear and low speed gear, then remove shaft.

►**Crosley Note**—No rear bearing retainer used on this model and bearing is held in case by lock ring on each side of outer race. To remove mainshaft and bearing, remove speedometer gear snap ring, speedometer gear and key, rear bearing snap rings, rear bearing and oil retainer washer, then pull mainshaft out through rear of case.

Mainshaft & Bearing Assembly:—Shaft and bearing can be removed from adapter plate by removing snap ring in adapter at front of bearing, and pulling shaft and bearing forward. To remove bearing, take out snap ring on shaft at rear of bearing, remove thrust washer, press bearing off shaft. Reassemble in same manner.

Second Speed Gear Disassembly (With Drag Ring & Wire Bound Strut Type Synchronizers):—Gear and inner clutch sleeve of synchronizer unit retained on shaft as an assembly by a snap ring in front of the synchronizer unit. To remove, take out snap ring, withdraw synchronizer unit and gear from shaft. Do not remove bushing from gear (serviced as an assembly). When reassembled, second speed gear endplay should be .003-.008" (Chrysler models), .003-.014" (others) with synchronizer pressed forward against snap ring.

(With Double Blocker, Double Spring Synchronizers). Gear and inner sleeve or hub of synchronizer

CONTINUED ON NEXT PAGE

1939-46 WARNER TRANSMISSIONS (Continued)

mounted on shaft as an assembly and retained by snap ring in front of synchronizer. To remove, take out snap ring, withdraw synchronizer and gear from shaft. When reassembling, check second speed gear endplay with synchronizer hub pressed forward against snap ring. Endplay should be .004-.008" (controlled by snap ring thickness).

(With Blocking Lug Type Synchronizer)—Gear retained by thrust washer and locking plunger at forward end. To remove gear (with synchronizer unit off shaft), press down on locking plunger to release washer, rotate washer until notches on inner rim line up with splines on shaft, withdraw washer and gear, being careful not to lose locking plunger and spring which will fly out when gear removed. Install in same manner, making certain that washer turned so it engages shaft splines and that locking plunger engages washer to prevent turning and loosening in service.

Synchronizer Disassembly: Mark inner and outer clutch sleeves and both synchronizer rings to insure reassembly in same relative positions (on some types synchronizer rings are loose and can be lifted off directly). See Reassembly data for installation of synchronizer parts.

REASSEMBLY (All Models): Reverse disassembly directions and note data on sub-assemblies below.

Mainshaft Installation: See that low & reverse gear properly engaged with shifter shoe when installing gear on shaft. When installing countergear cluster, install thrust washers at each end in same relative positions as removed and insert countershaft through rear end of case. Make certain that countershaft lockplate engages slots in both countershaft and reverse idler shaft.

Main Drive Gear Endplay—Endplay controlled by thickness of bearing retainer snap ring and snap ring should be selected for snug fit so that bearing has no endplay on shaft. These snap rings furnished in various thicknesses.

Mainshaft Endplay—Controlled by rear main bearing snap ring thickness. Bearing retainer snap rings (on shaft and under bearing retainer on case) should be selected for snug fit in grooves.

Synchronizer Assembly: Assemble parts in accordance with marks made before disassembly and in following order for each type:

Drag Ring Type—Install drag ring on inner clutch sleeve so that depressions on ring are directly in line with synchronizer ring lug holes in sleeve and retain in this position with three pins inserted through lug holes so as to pass over ring in slot at center of sleeve while sleeve being inserted in outer clutch sleeve. Make certain that open ends of drag ring straddle a tooth on the outer clutch sleeve and line up marks on inner and outer sleeves, then remove assembling pins and install synchronizer rings with spreader spring behind high speed synchronizer ring installed so that three raised fingers on spring are toward ring (spreader spring not used for second speed synchronizer ring). See Second Speed Gear data for installation instructions.

Lug Type—Synchronizer rings retained by snap rings and can be lifted out when snap ring removed. See that rings are free to turn with snap ring in place. Backlash between inner and outer clutch sleeves should be .000-.001" (sleeves are selective fit). Pressure required to break poppets so that outer sleeve slides on inner sleeve should be 26-34 lbs. (Chrysler C23, C24).

Wire Bound Strut Type—Install struts on inner sleeve, install lock wire so that it engages notches on struts with open end of wire midway between two struts. When installing inner sleeve and strut assembly in outer sleeve, narrow strips of .003" shim stock can be installed directly over each strut to prevent wire disengaging from strut notch when it is contracted to enter outer sleeve. CAUTION—See that hook on end of lock wire is engaged between two clutch teeth on outer sleeve. Remove feeler strips used for assembly. See Second Speed Gear

Double Blocker, Double Spring Type—Install struts with open face toward inner clutch sleeve and hooked end of each spring wire engaged in same strut (free ends of springs will be between this strut and next strut in each direction—springs installed in opposite direction). See Second Speed Gear data above for installation on shaft.

Second Speed Gear Assembly (Locking Plate Type on Chrysler C18, DeSoto S5, Dodge D8, Plymouth P5,6) Gear retained by thrust washer and special locking plate on forward end. To disassemble, for gear removal, bend up three fingers on lock plate which engage groove in thrust washer, slide lock plate off shaft and discard (do not re-use lock plates). Rotate washer to line up notches and splines on shaft, remove washer and gear. To reassemble, use new lock plate, make certain that thrust washer turned so that it engages shaft splines and that lock plate locked in washer grooves to prevent loosening.

Second Speed Gear Assembly (Drag Ring & Wire Bound Strut Type Synchronizers):—Second speed gear and inner sleeve or hub of synchronizer mounted as an assembly on mainshaft and retained by snap ring on forward end of shaft. To disassemble, remove snap ring in front of synchronizer inner sleeve, withdraw synchronizer assembly and second speed gear. When reassembling, make certain that second speed gear endplay is .003-.008" (Chrysler, DeSoto, Dodge, Plymouth), .003-.014" (others) with synchronizer inner sleeve pressed forward against snap ring.

Second Speed Gear Assembly (Double Blocker, Double Spring Type Synchronizers):—Gear and inner sleeve or hub of synchronizer mounted on mainshaft as an assembly and retained by snap ring at forward end of synchronizer. To disassemble, remove snap ring, withdraw synchronizer assembly and gear. When reassembling make certain that second speed gear has .004-.008" endplay with synchronizer hub pressed forward against snap ring (endplay adjusted by installing snap ring of correct thickness). See that synchronizer ring turns freely after assembly (gears not engaged). Clearance between front face of second speed gear and rear face of synchronizer outer sleeve should be .035" maximum when shifted into Second Gear.

Second Speed Gear Assembly (Lug Type & Conventional Synchronizers):—Synchronizer assembly is free on shaft and can be removed as an assembly. Second speed gear is retained by a snap ring locked by a spring-loaded plunger in the shaft. To remove gear, depress plunger (under washer on front of gear), rotate washer to line up notches with splines on shaft, withdraw washer, remove gear being careful not to lose plunger and spring. Install gear in same manner, make certain that washer turned so that lugs engage notches in shaft splines and that plunger engages washer to prevent turning

Main Drive Gear & Bearing Assembly:—To remove bearing, remove snap ring on shaft in front of bearing, take off thrust washer, press bearing off shaft. Install bearing with shielded side toward gear, use new snap ring and make certain that it is snug fit in groove. When installing gear and bearing assembly in transmission see that retainer fits properly on case and that bearing snap ring is held snugly between retainer and case so that gear has no endplay.

Counter Gear Assembly:—If bearings removed from counter gear, use grease to hold rollers in place and install rollers on dummy shaft or arbor in gear cluster. Install steel washer next to gear and bronze thrust washer between steel washer and case at each end (steel washer not used at front end on Chrysler C23, C24). Drive countershaft in from rear end (displacing arbor at front) and make certain that locking key installed in notch at rear end of shaft so as to engage slot in case. Check endplay with feeler gauge. Endplay should be .002-.008" (On Chrysler models, adjust by selecting thrust washers of correct thickness—washers furnished in three thicknesses, A—thinnest, B, C—thickest).

Gearshift Mechanism:—Shifter shafts can be withdrawn through case after nut on outer end of lever shaft removed and lever taken off. When reassembling shafts, see that interlock and detent plungers and springs are properly installed and that plungers engage sectors on inner ends of shifter shafts. Install oil seal in recess in case at outer ends of shafts, coat shaft lock pins with Permatex or shellac, see that shaft grooves lined up with lockpin holes, drive pins in 1/8-3/16" past flush position.

Transmission Extension Housing Bearing (1941-42 Studebaker Models):—This is an outer race and needle bearing assembly installed in housing. Use bearing remover tool J-1606 to remove old bearing and to install new bearing assembly.

1946-51 WARNER TRANSMISSIONS

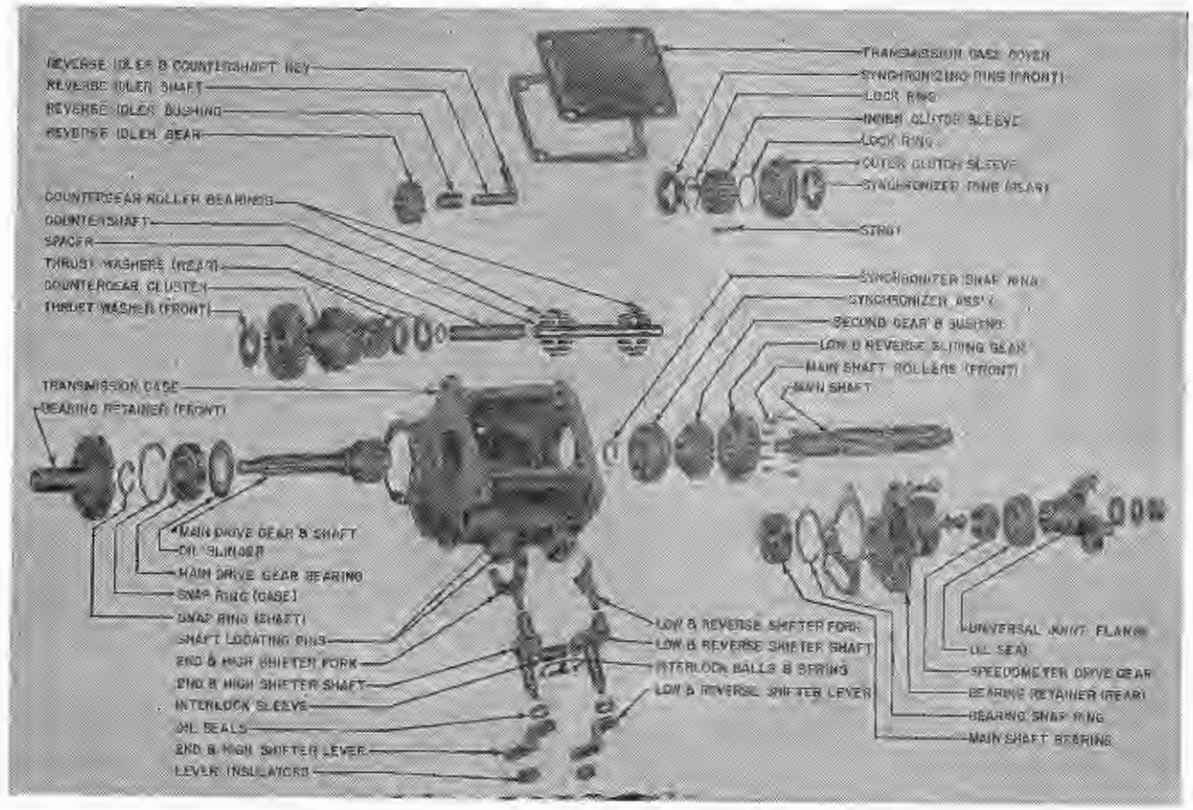
(WITHOUT OVERDRIVE)

	Warner Model
CROSLEY	
1946-51	AS1-T92
HENRY J	
1951 4 Cyl. & 6 Cyl.	AS40-T96
FRAZER & KAISER	
1947-48	AS11-T86E
1949-50	AS23-T86E
1951	AS49-T86E
NASH	
Rambler (1950-51)	AS35-T96
Ambassador (1949-51)	AS25-T86E
STUDEBAKER	
Champion (1946)	AS1-T84G
Champion (1947-51)	AS1-T96
Commander (1947-50)	AS1-T86E
Commander (1951)	AS53-T86E
WILLYS	
Jeep CJ-2A (1946-47)	②AS3-T90A
Jeep CJ-2A, 3A (1947-51)	③AS1-T90C
Station Wagon 4-63, 6-63 (1946-50)	AS1-T90E
Sta. Wgn. 473-SW, 673-SW (1950-51)	AS37-T96
Sta. Wgn. 4 Whl. Dr. 4x4-63 (1949)	AS1-T90C
Sta. Wgn. 4 Whl. Dr. 4x4-73 (1950-51)	AS1-T90C
Sedan Del. 4-63 (1946-50)	AS1-T90E
Sedan Del. 473-SD (1950-51)	AS37-T96
Jeepster VJ-2, VJ-3 (1948-50)	AS1-T96E
Jeepster 473-VJ, 673-VJ (1950-51)	AS37-T96
Truck 2T & 2WD (1947-50)	④AS1-T90E
Truck 4T & 4WD (1947-50)	⑤AS1-T90A
Truck 473-HT (1950-51)	AS39-T96
Truck 473-4WD (1950-51)	AS1-T90C

(WITH OVERDRIVE)

	Warner Model
HENRY J	
1951 4 Cyl. & 6 Cyl.	①AS41-T96
FRAZER & KAISER	
1947-48	AS12-T86E
1949-50	AS24-T86E
1951	①AS50-T86E
NASH	
Rambler (1950-51)	①AS36-T96
Ambassador (1949-50)	AS26-T86
Ambassador (Late 1950 & 1951)	①AS46-T86E
STUDEBAKER	
Champion (1947-49)	AS2-T96
Champion (1949-51)	①AS24-T96
Commander (1947-49)	AS2-T86E
Commander (1949-50)	①AS32-T86E
Commander (1951)	①AS54-T86E
WILLYS	
Station Wagon 4-63 (1947-49)	AS12-T96
Station Wagon 6-63 (1948-49)	AS20-T96
Sta. Wgn. 4-63 & 6-63 (1949-50)	①AS28-T96
Sta. Wgn. 473-SW & 673-SW (1950-51)	①AS28-T96
Jeepster VJ-2 (1948-49)	AS18-T96
Jeepster VJ-2 & VJ-3 (1949-50)	①AS30-T96
Jeepster 473-VJ & 673-VJ (1950-51)	①AS30-T96

①—Overdrive with "Centered" Ring Gear.
②—Steering Column Mtd. Gearshift.
③—Floor Mounted Gearshift.
④—AS1-T90D (with floor mtd. gearshift lever) used beginning Serial No. 22536.
⑤—AS1-T90C (with floor mtd. gearshift lever) used beginning Serial No. 34787.



WARNER 1946-51 TRANSMISSIONS (NO OVERDRIVE)

►**LINCOLN 1949-51 TRANSMISSION:** *See "Ford, Lincoln, Mercury" Transmission data.*

►CHANGES, CAUTIONS, CORRECTIONS

►**WILLYS MAINSHAFT BEARING CHANGE:** On late 1949 cars, mainshaft rear bearing changed from shielded type to non-shielded type (same as used in transmissions without Overdrive). Non-shielded bearing is Part No. 646568 (supersedes No. 641447).

►**"CENTERED RING GEAR" TYPE OVERDRIVE:** These units do not have driveshaft front bearing (see illustration for location of this bearing) and shaft is piloted at the planetary ring gear in a machined flange which is integral with the overdrive case.

►**Steering Column Mtd. Gearshift**—Used on all cars except Crosley & Willys Jeep. *See individual "Transmission Control" data.*

►**Willys 4-Wheel Drive Transfer Case**—Two-speed (Spicer Model 18) Transfer Case on transmission with transmission mainshaft rear bearing mounted in transfer case housing. See Spicer Transfer Case

►***CAUTION—Transfer case must be partly dismantled before it can be removed from the transmission.***

DESCRIPTION: Three-speed, all helical gear type. Constant-mesh, synchro-mesh (Second & High), sliding gear (Low & Reverse). Synchronizers are Double-Blocker, Double-Spring type. Transmission case has a top cover for access to gears, and shifter mechanism is located in side of case (individual shifter shaft assembly for Low-Reverse and for Second-High).

Crosley Transmission—Similar to other types except that no synchronizing mechanism is used (second-speed gear shifted forward to engage clutch teeth on main drive gear for High) and gears are spur type. Torque tube is bolted on rear end of case with adapter for universal joint. This transmission disassembled in same manner as other types after torque tube or adapter removed (disregard all synchronizer data).

Willys 4-Whl. Drive & Truck Note—Transmission has spur type sliding gear and floor-mounted gearshift (entire gearshift mechanism lifts off as unit with top cover). Transfer case is mounted on rear end (see Willys Transfer Case Note above).

Synchronizer Unit: Synchronizer rings are free in ends of inner clutch sleeve and are actuated by three struts which fit in slots in inner clutch sleeve and engage notches in the rings. Struts are centered in outer clutch sleeve by a locking wire or ring engaging notches in the struts and move with the clutch sleeve to force the synchronizer rings against

CONTINUED ON NEXT PAGE

1946-51 WARNER TRANSMISSIONS (Continued)

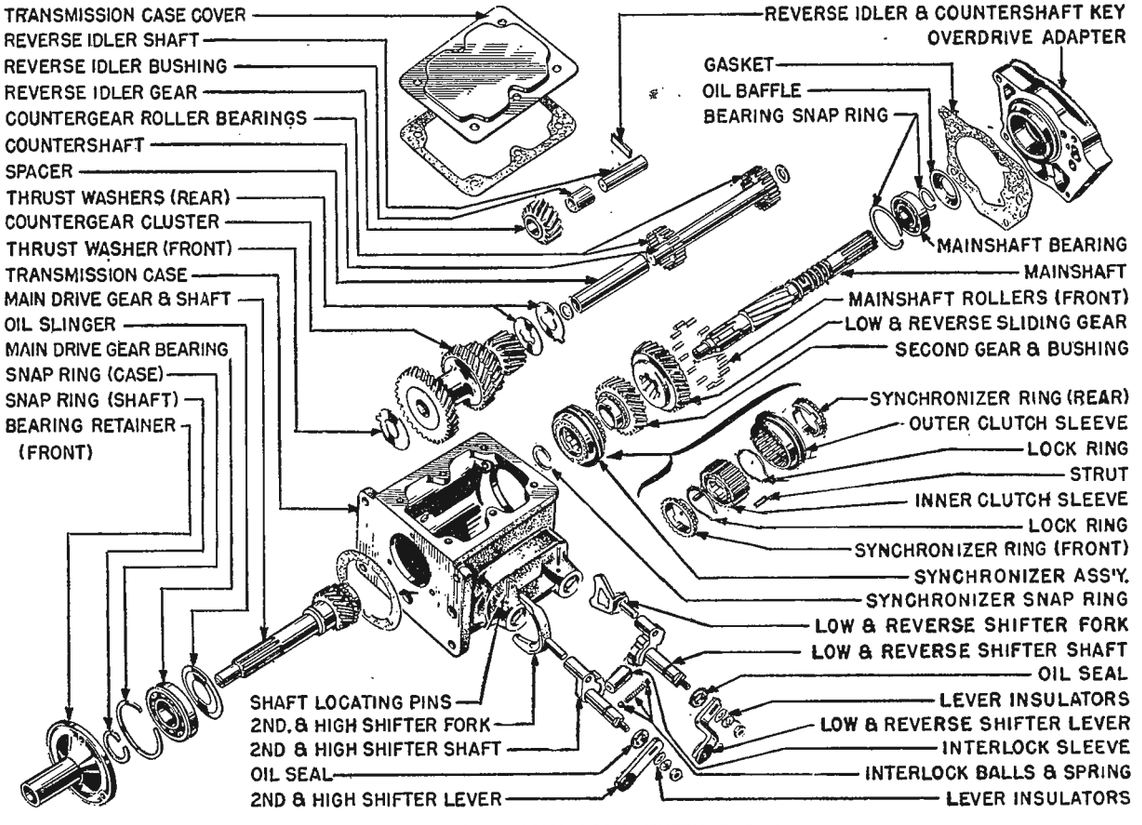
the cones on the gear hubs for synchronization. Teeth on the outer rim of the synchronizer rings block or prevent gear engagement until synchronization completed when final movement of outer clutch sleeve causes clutch teeth on rim of sleeve to slide past teeth on rings and engage clutch teeth on gear hubs. Inner clutch sleeve is stationary on shaft and does not move during synchronization and gear engagement.

Overdrive Unit (Type R10): New design, solenoid operated type (no centrifugal pawls). Overdrive does not have centrifugal pawl assembly and control is effected by engaging sun gear pawl to hold sun gear stationary (for Overdrive), or disengaging pawl to allow sun gear to rotate freely (Direct Drive below cut-in speed, and Kick-down Direct Drive—power transmission through overdrive unit is same in both cases). New type Solenoid is used with this type overdrive. Solenoid pushes pawl in (for overdrive) when energized, and pawl is withdrawn by spring when solenoid is not energized.

REMOVAL OF TRANSMISSION OR OVERDRIVE: *See "Transmission" and "Overdrive" on individual car model pages.*

DISASSEMBLY OF OVERDRIVE TRANSMISSION: Overdrive can be disassembled first, if overhaul of unit required *(see Warner R10 Overdrive following)*, or it can be removed as a unit if overdrive case not allowed to separate from adapter plate (this procedure possible on transmissions where mainshaft assembly can be removed through rear of case). Then proceed with transmission disassembly as directed for Transmission Without Overdrive below.

DISASSEMBLY OF TRANSMISSION (Without Overdrive): Take out all the transmission case cover screws, remove cover and gasket. Mark synchronizer parts (rings, sleeve, hub) to insure reassembly in same relative positions. Take out capscrews and remove bearing retainer on front of case. On Studebaker & Nash, take out bearing snap rings on bearing and shaft, install special Synchronizer Ring Protector J-3042 (Nash), J-1525 (Stude. Champ. 1946), J-2040 (Champ. 1947 on), J-2039 (Stude. Comm. to prevent damage to synchronizer, use Puller J-1298N (Nash), Plate J-1298 and Puller HM-925 (Studebaker) to remove bearing from shaft. (NOTE—on other cars, gear and bearing assembly can be removed after countergear cluster has been dropped to provide clearance). Take out rear bearing retainer capscrews or the overdrive case screws (overdrive models), remove bearing retainer from shaft (on models where bearing mounted in recess in retainer, pry retainer out so that puller can be engaged, use puller to remove retainer). Slide speedometer gear off mainshaft (if gear does not come out with retainer and bearing assembly). Tip mainshaft toward right as far as possible (on models where rear bearing mounted directly in case, move shaft to rear until bearing clears case), disengage Second & High Shift Fork and Low & Reverse Shift Shoe and lift these parts out. On models where opening in rear of case permits, withdraw complete mainshaft assembly through this rear opening. On other models, remove main drive gear (lift gear through top of case if bearing removed previously, otherwise tap gear and bearing assembly out through front of case using a soft drift and taking care not to damage gear teeth). If mainshaft cannot be removed as an assembly, remove snap ring from groove at forward end of shaft, slide synchronizer assembly, second speed gear, and sliding gear off shaft (lift these parts out through top of case), remove mainshaft through rear of case. Lift out countergear assembly. Drive reverse idler shaft out at rear of case (use brass drift), lift gear and bushing out. To remove shifter shaft assemblies, remove levers on outer ends of shafts, drive out lockpins in shaft bosses on side of case, push shaft and lever assemblies through and remove from within the transmission case.



WARNER 1946-51 TRANSMISSIONS (WITH OVERDRIVE)

►***CAUTION—When removing shifter shafts, do not lose detent balls, springs, and interlock plunger (in boss in case between lever sectors).***

►**Nash Mainshaft & Bearing Retainer Disassembly Note**—To remove shaft from retainer (extension housing), remove bearing snap ring from groove in retainer, press shaft out toward front (bearing and speedometer gear will come out with shaft). To remove bearing from shaft, remove snap ring at rear of speedometer gear, remove gear, remove woodruff key from slot in shaft, then press bearing off shaft. If shaft bushing in retainer requires replacement, see Reassembly data.

REASSEMBLY: Reverse disassembly directions given above and note special data on sub-assemblies as follows:

Shift Mechanism: Install complete detent and interlock assembly (plunger, spring, poppet balls, and spacer pin on Frazer & Kaiser) in correct order in boss in case, insert shift shaft and levers from within, insert shift shaft lockpins loosely in holes in case to hold levers in place, check and adjust interlock plunger clearance (see below), then drive shaft lockpins down into place, install new oil seal on outer end of each shaft, install outer levers.

Interlock Plunger Clearance—.001-.007" (Willys & Nash), .001-.005" (Others) clearance between end of plunger and shift lever sector with one lever in neutral and other lever in any gear. To check, place one lever in neutral, move other lever to any gear position, use feeler gauge between end of plunger and lever sector. Adjust by installing plunger of correct length. Plunger furnished in five lengths and marked for identification as follows: Unmarked —1.299", A—1.295", B—1.291", C—1.287", D—1.303".

Second Speed Gear: Retained on mainshaft as an assembly with synchronizer unit by snap ring at forward end of shaft. To remove gear, use snap ring

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1946-51 WARNER TRANSMISSIONS (Continued)

pliers to take out snap ring, slide synchronizer unit off shaft (as an assembly), slide gear off. Install second speed gear with clutch teeth and synchronizer hub end forward (toward synchronizer). NOTE—Second speed gear furnished as an assembly with bushing.

Low & Reverse (Sliding) Gear: Can be removed from shaft after synchronizer unit and second speed gear removed (above). See Mainshaft Assembly (below).

Reverse Idler Gear & Shaft: Position gear with offset (longer end of hub) toward front of case, drive shaft in until lockplate slot lines up with rear face of case.

Countergear Cluster: To assemble, install dummy shaft and spacer in gear cluster, install bearing rollers and bearing retainer washer in each end of gear, using grease to retain parts, install bronze thrust washer on each end with tongue of front washer forward (to engage notch in case), tongue of rear washer forward (to engage notch in gear), install steel thrust washer on rear and install entire assembly in case. Drive countershaft in from rear (pushing dummy shaft out at forward end) until lockplate slot lines up with rear face of case. check countergear endplay which should be .002-.006" (Frazer & Kaiser), .012-.018" (Willys Jeep). Install lockplate to retain countershaft and reverse idler shaft.

Willys Jeep & 4T Truck Bearings—Countershaft has double bearings (two sets of bearing rollers in tandem) at each end of countergear. Install one set of bearing rollers, bearing washer, second set of rollers, second bearing washer, at each end.

Main Drive Gear Assembly: If removed and installed as an assembly, this assembly must be re-installed before countershaft inserted (countergear cluster at bottom of case to provide clearance). Use driver to install bearing on shaft. On Nash and Studebaker where gear installed in case without bearing, use Synchronizer Protector Ring J-3042 (Nash), J-2040 (Champ.), J-2039 (Comm.) to take thrust when driving bearing on shaft and into case. Select snap rings (large ring on bearing, small ring on shaft) for snug fit without endplay. Bearing snap ring furnished .086", .089", .092", .095" thick. With main drive gear installed, select gasket of correct thickness (furnished in four thicknesses) so that retainer will be tight fit on case when installed.

►*CAUTION—Bearing must not have endplay on shaft or in case.*

Mainshaft Assembly: If synchronizer and gears removed from shaft, install sliding gear with shift fork channel toward rear (Studebaker Champion & Willys models), or toward the front (All other models). Install second speed gear with the clutch teeth toward front, install synchronizer (see below) with clutch sleeve offset toward front, install snap ring in shaft groove to retain these assemblies, check endplay with a feeler gauge inserted between back face of second speed gear and shoulder on shaft. Endplay should be .003-.014" (Frazer & Kaiser), .003-.010" (Nash) and is controlled by snap ring thickness.

Synchronizer Assembly—If synchronizer dismantled, assemble parts according to marks made previously. Install spring in each end of hub with free end of each spring engaging the same strut and springs pointing in opposite directions. Make certain that struts engage slots in synchronizer rings.

Transmission Mainshaft Rear Bearing—To remove mainshaft and rear bearing from adapter plate, remove bearing snap ring from groove in front face of adapter. use soft hammer on rear end of shaft to tap shaft and bearing out. lift off oil baffle, remove bearing snap ring from groove in shaft, use puller to remove bearing from shaft.

Mainshaft Installation: When installing mainshaft in case. make certain that pilot bearing rollers in place in recess in main drive gear (use grease to hold rollers until mainshaft inserted). Engage Low & Reverse Shifter Shoe in sliding gear with offset in same direction as channel in gear (see above), engage Second & High Shifter Fork in synchronizer sleeve channel.

Rear Bearing Retainer: On models where rear bearing mounted in retainer, bearing can be lifted out after snap ring removed (speedometer gear accessible with bearing out). Oil seal should be replaced with special driver. When reassembling, make certain that bearing snap ring is snug fit in groove (furnished .086", .089", .092", .095" thick). When installing retainer, use new gasket, tap retainer in place on shaft with special driver (see special Nash Note below). install universal joint companion flange, flat washer, lockwasher, and nut. Tighten nut securely.

►*CAUTION—Speedometer drive gear will slip if companion flange nut not securely tightened.*

►**Nash Bearing Retainer Note**—Bearing retainer has extension housing with additional driveshaft bearing (Oilite bushing) in front of oil seal at rear end of housing. To replace bushing (with oil seal removed), assemble felt oil ring on bushing, press bushing in from rear end of housing until shoulder on bushing is ¼" from shoulder in bearing cap (CAUTION—this clearance necessary to prevent compressing oil ring). To assemble retainer, install bearing on mainshaft, install speedometer gear (CAUTION—see that woodruff key in place in shaft groove within gear), install snap ring in shaft groove selecting ring for snug fit so that bearing is tight on shaft. Install shaft assembly in bearing retainer and install snap ring to retain bearing selecting snap ring for snug fit so that shaft and bearing do not have any endplay in retainer.

Transmission Cover & Gasket Installation: Some transmissions are vented by means of holes in cover gasket and hole in cover. These parts must be installed as follows:

Nash—Cover and gasket marked "FRONT". Install with these marks toward front of case.

Studebaker—Install gasket with two holes toward rear of case, cover with single hole toward front.

►*CAUTION—Gasket and cover must be correctly installed to prevent lubricant loss through this vent.*

Overdrive Reassembly: *See "Warner R10 Overdrive" (following).*

WARNER R6 & R7 OVERDRIVES

Car Model	Warner Model
Chrysler 6, Model C22 (1939)	①AS3-T86A
Chrysler 8, Models C23, C24 (1939)	①AS5-T85A
Chrysler 6, C25 (1940)	④AS1-R7B
Chrysler 8, C26, C27 (1940)	④AS1-R7B
Chrysler 8, C30, C33 (1941)	⑤AS1-R7B
DeSoto, Model S6 (1939)	①AS3-T86A
DeSoto, Model S7 (1940)	④AS1-R7B
Hudson 6 & 8, All Models (1940)	③AS13-R6
Nash 6, Model 4020 (1940)	③AS12-R6
Nash 6, 4160 ('41), 4260 ('42)	④AS1-R7C
Nash "600", 4140 ('41), 4240 ('42)	①AS4-T84G
Nash 8, Model 4080 (1940)	③AS12-R6
Nash 8, 4180 ('41), 4280 ('42)	④AS1-R7C
Nash Amb. 6, 4660 (Early 1946)②	④AS1-R7C
Nash-Lafayette, 4010 (1940)	③AS12-R6
Packard, 6, 8, Super 8 Models ('39)	③AS9-R6
Studebaker Champ. G (1939)	①AS2-T84F
Studebaker Champ. 2G (1940)	①AS6-T84F
Studebaker Champ. 3G ('41), 4G ('42)	①AS2-T84G
Studebaker Champ. 5G (1946)	①AS2-T84G
Studebaker Comm. 9A, Pres. 5C ('39)	①AS7-T88
Studebaker Comm. 10A, Pres. 6C ('40)	①AS2-T86C
Studebaker Comm. 11A ('41), 12A ('42)	①AS2-T86D
Studebaker Pres. 7C (1941)	①AS2-T86D
Studebaker Pres. 8C ('42) See Note	①AS2-T86D
Willys, 441 (1941), 442 (1942)	①

①—Transmission with R6 or R7 Overdrive.
②—Before Service Serial No. N6-120026 (R10 Overdrive after this number). See Production Change Note for various types of controls used.
③—Type R6 Overdrive. ④—Type R7 Overdrive.
⑤—Type R7 Overdrive (part of Vacamatic Overdrive Transmission.

►CHANGES, CAUTIONS, CORRECTIONS

►**Overdrive Units on Chrysler, DeSoto, Hudson, Nash, Packard Models)**—These overdrives are used in conjunction with transmissions manufactured by the car factories. Refer to separate articles on each make of Transmission for transmission servicing data. Overdrive servicing data is given below.

►**Overdrive Control Note**—The R6 & R7 Overdrives have 'kick-down' type electrical control. See Warner Overdrive Control article (following) for complete adjustment data and specifications for Solenoid, Relay, and Throttle Switch adjustment.

►**Nash Early 1946 Overdrive Control Production Changes:** The R7C Overdrive Unit (Cars from Service Serial No. N6-86001 to N6-120026) was used with two different types of controls.
See "Warner R6 & R7 Overdrive Controls".

►**Nash Amb. 6 (Late 1946) Overdrive Change**—New type Warner R10 Overdrive used on cars after Service Serial No. N6-120026. *See "Warner R10 Overdrive".*

►**Chrysler 8 (1941) Overdrive Note**—Used in conjunction with Chrysler Vacamatic Overdrive Transmission. See Vacamatic Overdrive Transmission.

►**Studebaker Pres. (1942) Overdrive Change**—Used on first cars only. Beginning with Serial No. 7147625, Type R9C Overdrive was used. See separate article on Type R9 Overdrive for data on this type.

REMOVAL OF OVERDRIVE: *See "Overdrive" or "Transmission" on car model page.*

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WARNER R6 & R7 OVERDRIVES (Continued)

DISASSEMBLY: Remove speedometer pinion. Take out five overdrive screws on transmission case, pull case and rear shaft assembly to rear using extreme care not to lose free-wheeling rollers which will be free to drop out and to prevent adapter plate moving away from transmission case (if transmission not being dismantled also). On all models except Packard, nut on universal joint companion flange can be removed, flange removed with puller, and shaft held in place while case is withdrawn without disturbing overdrive free-wheeling cam and roller assembly, if desired. Rear shaft assembly should then be removed. Take out capscrew in free-wheeling hub (on rear end of mainshaft), remove washer, bushing, and free-wheeling cam and roller assembly. Remove overdrive clutch pawl, ring gear, and pinions as an assembly (do not pull ring gear off pinions unless servicing required—pinions are split type on some models and must be wound up before being meshed in ring gear). Remove adapter snap ring and thrust plate. Take out two mounting screws and withdraw solenoid taking care not to lose shims (gaskets) under solenoid mounting plate. Remove solenoid base plate and plunger assembly by tilting base and pawl to disengage plunger, remove gasket, spring, pawl, and pawl guide plates. Remove snap ring on mainshaft at rear of sun gear, withdraw sun gear assembly.

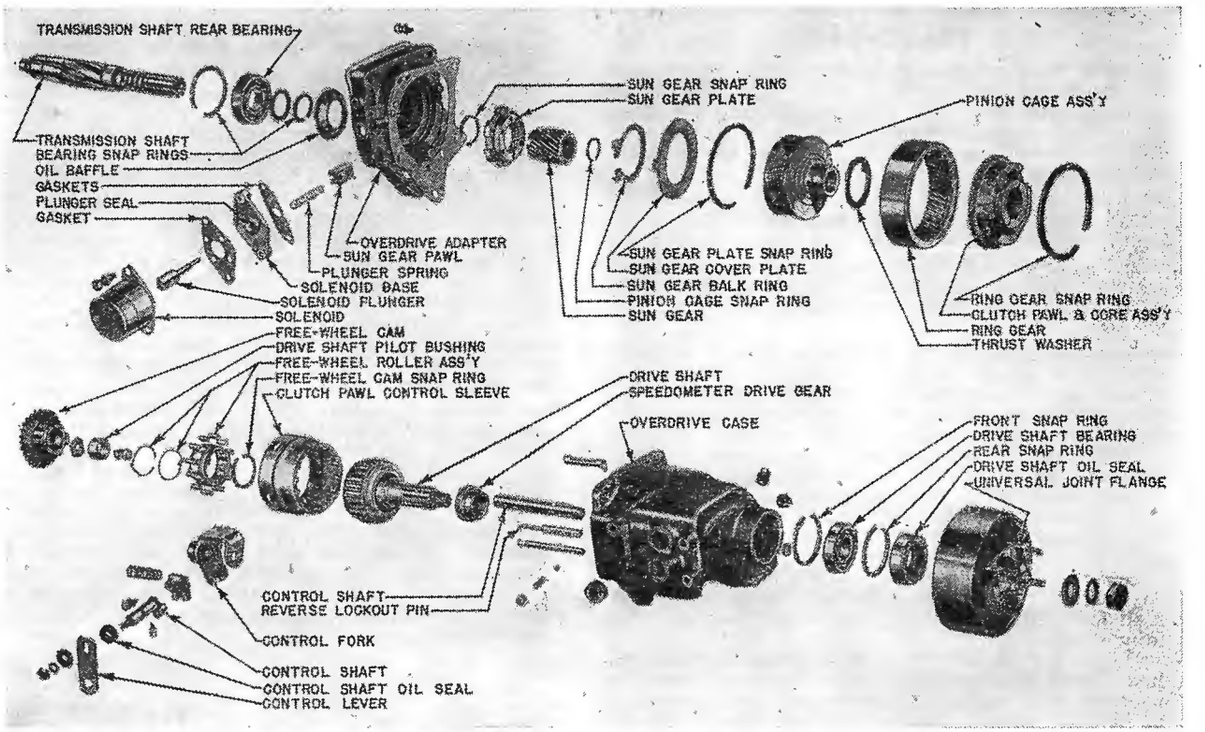
►***CAUTION—Note the following important points:***

Overdrive Shift Mechanism (1941-46 Cars): On all models except Chrysler, new limiting pin installed in side of case to limit travel of overdrive shift shaft and fork (replaces spring-loaded ball type detent). To disassemble shift control, remove lockwire and withdraw reverse lock-out pin through front of case, rotate shift fork and disengage shift collar, remove shift collar. To remove shift shaft and fork assembly, take out limiting screw on side of case, remove setscrew in fork (work through hole in case after removing plug from this hole), withdraw shaft, lift fork out. To remove shift lever and shaft, take off nut on outer end of shaft, remove lever, loosen setscrew in case, withdraw shaft from within case. Reassemble shift mechanism in same order.

Overdrive Mainshaft & Bearing Disassembly (except Packard):—Bearing is retained in overdrive case by snap ring installed at each side of outer race and is positioned on shaft by speedometer gear hub (front), universal joint yoke hub (rear). Oil seal is assembled in end of case and can be removed with a puller after universal joint yoke has been removed. Do not remove oil slinger (spun on).

(Packard Models):—Two types of rear bearings used as noted below. On cars with first type bearing, universal joint flange nut (at rear end of shaft) controls bearing pre-load, **do not loosen this nut which will disturb bearing adjustment.** See bearing pre-load adjustment instructions below if bearings dismantled or adjustment disturbed. On later cars (may be identified by letter 'M' stamped on side of universal joint flange), this nut does not control bearing adjustment and should be kept tight.

IMPORTANT SERVICE NOTE—This second type bearing adjustment (Solid Spacer No. 341264, Belleville Spring Washer No. 341266) should be installed on all first cars (with compressible spacer type adjustment) whenever overdrive disassembled.



WARNER TYPE R7 OVERDRIVE (TYPE R6 SIMILAR)

Overdrive Unit Rear Bearing (First Type)—Consists of two ball bearings with compressible spacer on shaft between inner races. Bearing adjustment controlled by tension of universal joint flange nut on rear end of shaft. If bearings dismantled or bearing adjustment lost by loosening of universal flange nut, install bearings with snap rings in place in housing between bearing outer races, use new spacer on shaft between bearings and adjust as follows: Clamp universal flange in vise with overdrive case vertical, tighten flange nut slightly, check force required to spin overdrive case on shaft using spring scale hooked in mounting hole on boss at rear of case (first reading should be oil seal drag only), tighten nut a little at a time and repeat check until 3¼-4¼ lbs. additional pull required to spin case.

NOTE—If nut tightened so that bearing pre-load of 5 lbs. or more (net after subtracting oil seal drag), install new spacer sleeve and repeat adjustment.

Overdrive Unit Rear Bearing (Later Type)—Solid spacer used on shaft between bearings and bearings pre-loaded by Belleville spring washer assembly between bearings (spring washer rims engage bearing snap rings in housing). With this type assembly, universal flange nut should be tightened securely (does not adjust bearings). NOTE—Cars with this type bearing adjustment assembly may be identified by "M" stamped on side of universal flange yoke.

Sun Gear & Plate Disassembly: To remove sun gear from plate, remove snap ring at end of sun gear, slide plate off gear. Check balk ring friction on sun gear plate, 8-10 lb. pull should be required to rotate ring clockwise on plate. When installing sun gear, make certain that oil slots in plate and gear line up. **Sun Gear Pawl & Balk Ring Clearance**—Clearance between end of pawl and face of lug on balk ring should be .015" with balk ring rotated to block out pawl. If solenoid assembled, clearance can be checked by energizing solenoid so that pawl is withdrawn. Adjust by adding or removing solenoid gaskets.

Overdrive Solenoid: See following article on Warner Overdrive Control for solenoid data.

Pinion Cage Disassembly: To remove pinion assembly, pull pinions out of ring gear. Assembly cannot be dismantled (oil slinger which is spun on pinion cage retains pinion shaft pins). When remeshing split type pinions in ring gear, wind up narrow half of each split pinion 1½ teeth so that marked teeth on wide and narrow halves of pinion are together, mesh ring gear with pinions held in this position. When installing pinion gears, mesh wide half of each split pinion with sun gear, then install ring gear so that it meshes with narrow half of each pinion only, revolve sun gear counter-clockwise (transmission mainshaft must be held from turning which may be accomplished by shifting transmission into two gears at once) until pinions are wound up approximately 1½ turns and marked pinion teeth are together, then push ring gear into place so that pinions fully meshed with ring gear and sun gear.

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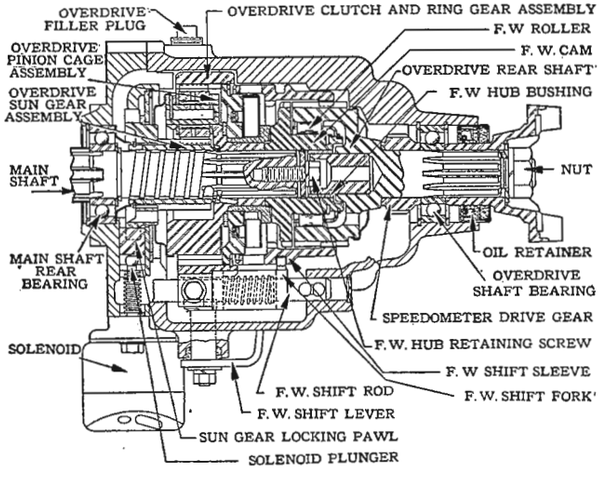
WARNER R6 & R7 OVERDRIVES (Continued)

Ring Gear & Clutch Pawl Disassembly: Take out snap ring in inner rim of ring gear, remove clutch pawl and core assembly from ring gear. Clutch pawl adjusting screws, washers, and springs can be removed but no further disassembly is possible (clutch core must be concentric with gear teeth and cannot be reamed sufficiently accurately in the field, parts are not furnished separately). CAUTION—If adjusting screws removed, count number of notches or 'clicks' as each screw is turned out so that screws can be replaced in exactly same position. These screws control cut-in speed (see adjustment directions below).

Clutch Pawl & Pinion Cage Thrust Washers—Bronze thrust washers between clutch pawl hub and pinion cage should be installed with projection on washer engaging notch on hub (washer can be retained with cup grease while assembling parts). Clutch core assembly endplay should be .005-.010" with all parts installed and mainshaft screw tight.



ASSEMBLY & INSTALLATION: Reverse disassembly directions and note following points: Make certain that snap ring installed on mainshaft in back of sun gear assembly (this ring limits sun gear and planet pinion gear assembly endplay); see that planet pinions are correctly wound up before being meshed in ring gear (split type only); make certain 2 pawl guide plates in position (when used), turn sun gear so that lobe on plate is in line with pawl slot, install pawl with relief notch toward rear. Pack free-wheel rollers in cage with grease to retain rollers while rear shaft being installed. Install case by placing shaft assembly in vertical position, invert case (with clutch collar in case and engaging control fork) and lower on shaft so that collar engages teeth on free-wheel sleeve and cam. When installing overdrive unit on transmission, make certain that reverse lock-out pin in place and install mounting screw with star washer in lower right hand hole of case (to prevent oil leaks).

ADJUSTMENT (Cut-in Speed) Should not require adjustment but can be adjusted in same manner as on previous models by removing plug on top of overdrive case, turning shaft until hole in clutch shell and adjusting screw in clutch pawl assembly (two screws—adjust in succession) line up with hole in case, and turning adjusting screw in to increase cut-in speed, out to decrease cut-in speed. Make certain that screws not turned so far as to cause interference. With standard setting, cut-in speed should be as follows:

Car Model	Cut-in Speed
Chrysler, DeSoto ('39-40-41)	25 MPH.
Hudson ('40)	30-35 MPH.
Nash '40-42	33 MPH.
Packard ('39)	30 (26-30) MPH.
Studebaker ('39)	30 MPH.
Studebaker Champ. '40-46	32-36 MPH.
Studebaker Comm. & Pres. ('40)	28-32 MPH.
Studebaker Comm. & Pres. '41-42	32-36 MPH.
Willys '41-42	32 MPH.

CAUTION—Both adjusting screws must be adjusted exactly alike. One screw marked by single slot, opposite screw has double slot, to avoid possibility of adjusting same screw twice.

Overdrive Lock-out Control Adjustment:—To adjust loosen screw which holds control wire on lever at overdrive case, push hand control button at instrument panel in as far as possible and then pull button out ⅛" (to insure full travel of lever), move control lever on overdrive case to extreme rear position (Overdrive position), tighten control wire screw and locknut securely.

Reverse Lock-out Plunger (Nash 1940)—Reverse lock-out pin is actuated by lever mounted on adjustable stud in rear end of transmission case. To check adjustment, place transmission gears in reverse, see that overdrive is locked out, check clearance between lock-out lever and roller on end of shift fork plate. Clearance must not exceed .005". Adjust by screwing lever mounting stud in or out of transmission case.

WARNER R6 & R7 OVERDRIVE CONTROL

Chyrsler 6 & 8, All Models (1939-40)
Chrysler 8, All Models (1941)—See Note
DeSoto, All Models (1939-40)
Hudson 6 & 8, All Models (1940)
Nash 6, All Models (1940-42)
Nash Amb. 6, 4660 (Early 1946)—See Note
Nash 8, All Models (1940-42)
Nash-Lafayette, Model 4010 (1940)
Packard 6, 8, Super 8, All Models (1939)
Studebaker Champ., All Models (1939-46)
Studebaker Comm., All Models (1939-42)
Studebaker Pres., All (1939-42)—See Note
Willys, Passenger Car Models (1941-42)

►**Chrysler 8 (1941) Control Note**—Control used in conjunction with special Vacamatic Overdrive Transmission. Refer to separate article for Chrysler Vacamatic Transmission data.

►**Nash Amb. 6 (Early 1946) Production Change**—Two different types of controls used as follows:

Service Serial No. N6-86001 to N6-95333—Delco-Remy Relay No. 1116798 and Solenoid No. 1118004. Same as units used on previous Nash models.

Service Serial No. N6-95333 to N6-120026—Auto-Lite Relay No. HRT-4001 and Solenoid No. SSB-4002. Same as units used on other cars (not like units used on previous Nash cars).

►**Nash Amb. 6 (Late 1946) Overdrive Change**—New type R10B Overdrive (with different control system) used on cars after Service Serial No. N6-120026.
See "Warner R10 Overdrive Controls."

►**Studebaker Pres. (Late 1942) Overdrive Change**—R7C Overdrive used on first 1942 cars only. Beginning with Serial No. 7147625, a new type electrical control overdrive R9C was used with different type control design. Refer to separate articles (following) for data on these late 1942 cars.

►**Packard 1939 Overdrive Production Change**—On cars without Reverse Switch (original equipment on later cars), manufacturer recommends that this switch and new type relay (with extra terminal for switch connection) be installed. See illustration for wiring connections for this new type equipment.

DESCRIPTION: Control system consists of operating solenoid (on overdrive case), control relay, and accelerator pedal operated throttle 'kick-down' switch which makes it possible to return to Direct Drive (from Overdrive) at speeds above the overdrive cut-in point, at the will of the operator, simply by depressing the accelerator pedal beyond the wide open throttle position so as to close the throttle switch contacts.

Nash Models (1940-Early 1946) with Delco-Remy Control Units—Transmission solenoid used on this model does not have ignition contacts or provision for cutting out ignition in order to allow solenoid to disengage sun gear pawl. Ignition control is effected by a second relay unit in the Transmission Relay case. On all cars with overdrive, the customary ignition feed wire (from ammeter to ignition switch) is omitted, and the switch feed is taken through the transmission relay Series Relay contacts. The high initial current draw of the transmission solenoid (when accelerator pedal depressed to close throttle switch contact which causes closing of transmission relay Shunt Relay contacts and allows current to flow through both transmission solenoid windings) causes the Series Relay contacts to open and opens the ignition circuit so that the ignition is cut out. As soon as the transmission solenoid withdraws the sun gear pawl, the bottoming of the solenoid plunger opens the solenoid contacts so that current flow through the pull-in coil is interrupted. The remaining current flow through the solenoid hold-in coil (approx. 1 ampere) is not sufficient to hold the Shunt Relay contacts open, the contacts close and ignition is restored. As soon as accelerator pedal is released (opening throttle switch contacts), transmission relay Shunt Relay contacts open and current flow through solenoid hold-in coil is interrupted. The solenoid plunger spring then causes the pawl to re-engage in the sun gear plate slot.

Nash 1946 Amb. 6 (No. N6-95333 to N6-120026) with Auto-Lite Control Units—Control relay and solenoid

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WARNER OVERDRIVE CONTROL R6 & R7 (Continued)

operate in same manner as other cars (below) with ignition interrupter contacts built in solenoid (relay is single type).

Other Models—Operate in same manner as in '41-42 (small plunger in transmission solenoid closes ignition contacts and shorts out ignition, large plunger then withdraws pawl and opens ignition contacts so that ignition is restored).

OPERATION: With car operating in overdrive (for all accelerator pedal positions between idle and wide-open throttle) the solenoid pawl is held in the 'in' position by a spring on the solenoid plunger stem to engage the sun gear blocker plate and prevent rotation of the sun gear. When the accelerator pedal is fully depressed (for return to Direct Drive), the closing of the throttle switch completes the relay circuit, closing the relay contacts so that the overdrive solenoid is energized. Current flows through both solenoid coils (solenoid main contacts which control 'starting coil' are normally closed) and the solenoid operates in successive steps as follows: 1) small plunger 'B' is drawn in so that contactor 'C' completes circuit from 'IGN' terminal to ground, cutting out the ignition momentarily by shorting out the breaker contacts and grounding the coil directly, causing the engine to miss several firing impulses; 2) As soon as pressure on gear teeth removed (by engine not firing), the solenoid plunger 'F', to which the sun gear pawl is attached, is drawn in so that the sun gear blocker plate and sun gear are released and allowed to rotate for direct drive. 3) This movement of the large plunger 'F' forces the small plunger 'B' out, first opening the ignition contacts and restoring the ignition, and then opening the main solenoid contacts so that the current flow through the 'starting coil' is interrupted. Current continues to flow through the fine 'holding coil' winding and this is sufficient to hold the pawl out of engagement (see specifications below for relative starting and holding coil current draw). When the accelerator pedal is returned to any position below wide open throttle, the opening of the throttle switch contacts opens the relay and solenoid circuits. The sun gear pawl spring then engages the pawl in the sun gear blocker plate and the car returns to Overdrive.

NOTE—The entire solenoid operation is so rapid and the ignition is cut out for so short an interval that it is not apparent to the operator. If for any reason the solenoid is unable to withdraw the pawl, the combined current draw of the starting and holding coils will cause the relay fuse (in ammeter lead at relay) to blow, restoring the ignition. The car will then operate in a normal manner except that it will not be possible to return to direct drive from overdrive.

CAR WIRING CIRCUITS: See individual car wiring diagrams in Car Model Section for complete transmission control wiring diagrams.

FUSES: Fuses located on solenoid relay to protect solenoid circuits (not used on all models). If solenoid does not withdraw sun gear pawl, for any reason, fuse will blow which will restore ignition and allow car to be driven normally except that overdrive 'kick-down' feature will not operate. CAUTION—Do not use fuse of any other capacity than that shown in following table (no fuse used on early Nash or Packard models.

Car Model	Fuse Capacity
Chrysler '39	14 amperes
Chrysler '40-41	20 amperes
Hudson '40①	20 amperes
Nash '46②	20 amperes
Studebaker '39-40-41	14 amperes
Studebaker '41-46	20 amperes
Willys '41-42	20 amperes

①—On first Hudson cars, fuse located in holder in relay case. After car No. 48622, fuse mounted in clip on bottom of relay.

②—On cars with Auto-Lite control units only (fuse mounted on HRT-4001 Relay).

ADJUSTMENT: Adjust the throttle switch linkage on each car model as directed below whenever linkage is disconnected or disturbed by carburetor linkage adjustment, removal of units, etc.

Chrysler, DeSoto Models—Depress accelerator pedal until throttle valve just reaches wide open position (remove air cleaner and sight down carburetor barrel to determine this position), hold in this position while making adjustment. Loosen locknut and turn switch plunger contact screw until clearance between contact screw head and switch plunger is exactly 3/32", tighten locknut.

Hudson Models—Contact disc on accelerator connecting rod should just contact throttle switch plunger with throttle valve wide open. To adjust, remove air cleaner (to observe throttle valve), open throttle until valve is just wide open, loosen adjusting nuts above and below contact disc on rod, move contact disc up or down until it contacts switch plunger, tighten mounting nuts.

Nash & Nash-Lafayette—Throttle switch is mounted on the dash and is cable operated. To adjust, loosen locknut and adjust switch position on mounting bracket so that contacts close when throttle is wide open and spring on carburetor throttle shaft pulley just begins to compress. Check accelerator pedal over-travel and adjust stopscrew on floor board so that pedal has sufficient travel beyond full-throttle position to operate switch.

Packard Six, Eight, Super Eight—Depress accelerator pedal until throttle valve is just wide open, hold in this position, loosen locknut on switch plunger tappet screw (on accelerator cross-shaft lever) and adjust screw so that clearance between face of screw and end of switch plunger is exactly .046", tighten locknut. See that accelerator pedal has sufficient over-travel to close switch contacts before bottoming on floor boards.

Studebaker Champion, Commander, President—Depress accelerator pedal until throttle valve is just wide open and throttle lever contacts wide open throttle stop, hold in this position, loosen locknut on switch mounting stud, turn switch in or out of mounting bracket until small shoe on idler lever (Champion, Commander), end of accelerator rod (President) just contacts switch plunger, tighten locknut.

Willys—Adjust position of switch on mounting bracket so that contact shoe on end of accelerator rod just contacts switch plunger (maximum clearance 1/32") with carburetor throttle valve wide open. See that linkage has sufficient over-travel to close switch contacts.

OVERDRIVE SOLENOID REMOVAL: If necessary to remove solenoid (for transmission and overdrive removal or for servicing), take out two capscrews in mounting flange, withdraw solenoid case without disturbing base plate and plunger assembly.

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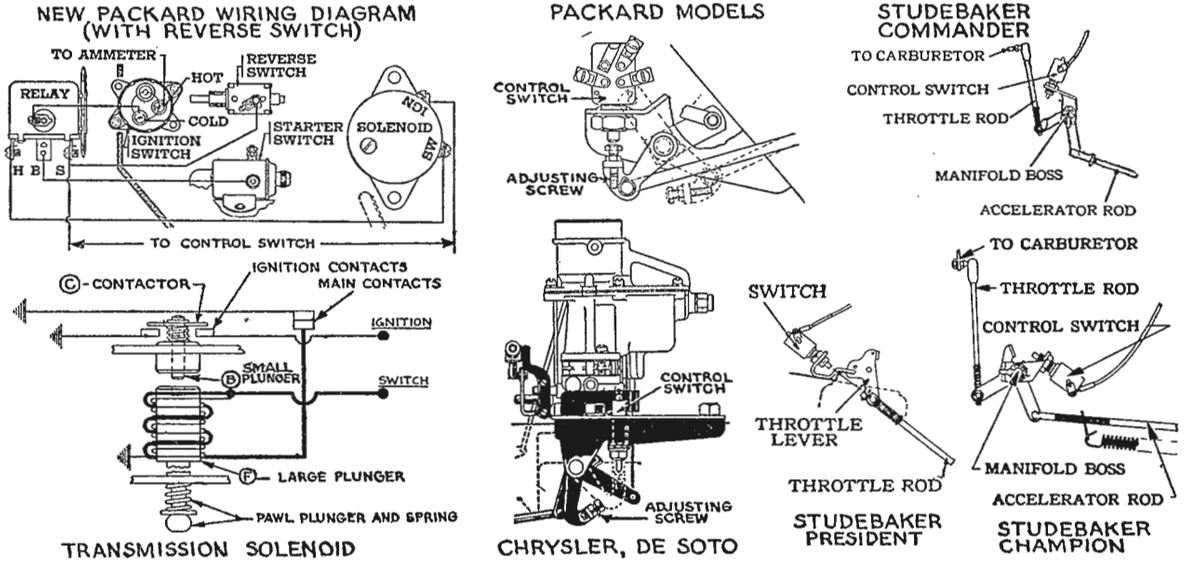


OVERDRIVE CONTROLS (WARNER TYPE R6 & R7 OVERDRIVES)

WARNER OVERDRIVE CONTROL
R6 & R7 (Continued)

CAUTION—Do not lose gaskets under solenoid assembly. These gaskets control pawl mesh and must be replaced when solenoid installed.

Servicing—No servicing required other than to keep contacts clean and parallel so as to make good electrical contact. To remove cover for contact inspection, disconnect wires, take out flat headed screw, pull cover off base. See that lower face of contact disc on plunger 'B' and contact plates (which short out ignition) are clean and smooth. Resurface main contacts (which control 'starting coil' circuit) with a file, if necessary, to secure smooth parallel contact surfaces. Check contact gaps and solenoid performance (see specifications below).

SOLENOID & RELAY SPECIFICATIONS: Various makes and types used on these cars as follows:

Overdrive Control Units

Car Model	Control Relay	Solenoid
Chrysler 6 ('39-40)	A-L. HR-4201	A-L. SSB-4001
Chrysler 8 ('39-41)	A-L. HR-4201	A-L. SSB-4001
DeSoto ('39-40)	A-L. HR-4201	A-L. SSB-4001
Hudson 6 & 8 ('40)	A-L. HR-4201	D-R. 1569
Nash ('40-46) ②	D-R. 1116798①	D-R. 1118004
Nash ('46) ③	A-L. HRT-4001	A-L. SSB-4002
Packard ('39)	RBM. No. 4780	D-R. 1569
Studebaker ('39)	A-L. HR-4201S	D-R. 1569
Studebaker ('40)	A-L. HR-4201	D-R. 1118001
Studebaker ('41)	A-L. HR-4201	D-R. 1118013
Studebaker ('42-46)	A-L. HRB-4301	D-R. 1118013
Willys ('41-42)	A-L. HR-4201AS	D-R. 1569

A-L.—Auto-Lite. D-R.—Delco-Remy.

①—D-R. No. 1116827 also used on 1942 cars.
②—1946 cars before Service Serial No. N6-95333.
③—1946 cars from Service Serial No. N6-95333 to N6-120026.

Specifications for each type of equipment are as follows:

AUTO-LITE SOLENOIDS

Small Plunger 'B'—Should close with 2.5 volts min., 4 volts max. (6 volt units), 5 volts min., 8 volts max. (12 volt units) with large plunger 'F' 3/8" from bottom.

Large Plunger 'F'—Should exert pull of 21 lbs. min. (70° F.), 15 lbs. min. (210° F.) when 3/8" from bottomed position.

Contact Gap (main contacts)—.047" plus or minus .015" with large plunger 'F' bottomed in coil.

Current Draw (At 70° F.)—'Both coils' figure is for both Holding and Starting coils together (main contacts closed). 'Holding Coil' figure is for Holding coil only (main contacts open—plunger bottomed in coil).

Six Volt Units

	Min. — Amperes — Max.	Volts
Both Coils	29.0 — 31.0	3
Holding Coil	1.2 — 1.3	6

Twelve Volt Units

Both Coils	14	15	6
Holding Coil	.55	.65	12

AUTO-LITE RELAYS

Contact Gap—.026" (HR-4201, S, SA), .034-.038" (HRB-4301), .015" Minimum (HRT-4001). Adjust by bending armature stop.

Air Gap—.012-.017" (except "HRT"), .031-.034" (HRT-4001) with contacts closed. Adjust by changing height of stationary contact.

Closing Voltage—2.5-3.5 volts (HR-4201, S, SA), 2.8-3.6 volts (HRB-4301), 4.0 volts max. (HRT-4001).

Current Draw—Measure between 'TH.SW' and 'IGN. SW.' terminals. Current should be 1.07-1.15 amperes at 6.0 volts (HR-4201, S, SA—winding resistance 5.2-5.6 ohms), .44-.46 ampere at 6.0 volts (HRB-4301 winding resistance 12.9-13.5 ohms), .35-.39 amperes at 6.0 volts (HRT-4001—winding resistance 15.5-17.1 ohms).

R-B-M RELAYS

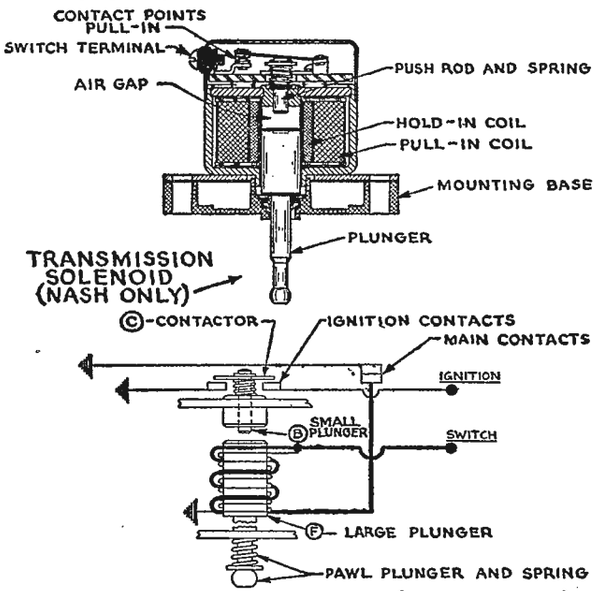
Contacts Close—3.5-4.5 volts.
Current Draw—3/4 ampere.
NOTE—No fuse used with this relay on Graham and Packard models.

DELCO-REMY SOLENOIDS

Model 1569 (Six Volt), 1573 (Twelve Volt)

No. 1118001, 1118013 (6 volt)

Small Plunger 'B'—Should close at 5.0 volts, (6 volt units), 6-10 volts (12 volt units) with 3/8" gap of large plunger.



TRANSMISSION SOLENOID (ALL OTHERS)

Large Plunger 'F'—Should close against 16 lb. pull with 3/8" plunger air gap at 6.3 volts max. (6 volt units), 12.6 volts max. (12 volt units) with both coils operating.
Contact Gap (main contacts)—.020-.060" with large plunger 'F' bottomed in coil.
Contact Spring Tension—10-13 ounces.

Current Draw—'Both Coil' figure is for both starting coil and holding coil together (main contacts closed), 'Holding Coil' figure for holding coil only (main contacts open—plunger bottomed in coil).

Six Volt Units

	Amperes	Volts
Both Coils	28-34	6.0-6.38
Holding Coil	.9-1.1	6.0-6.35

Twelve Volt Units

Both Coils	24.5-27.5	12.0-12.75
Holding Coil	.66-.72	12.0-12.75

Model No. 1118004 (Nash)

NOTE—This solenoid does not have small plunger and ignition contacts. Both windings are connected to the single solenoid terminal (starting coil circuit is opened by the opening of the main contacts as the plunger bottoms in the coil, holding coil only then holds plunger in coil).

Solenoid Plunger—Should close against 16 lbs. pull with 3/8" plunger air gap at 6.3 volts maximum.

Current Draw—28-34 amperes at 6.0 volts (Both coils—main contacts closed), .9-1.1 amperes at 6.0 volts (Holding coil only—main contacts open).

DELCO-REMY RELAYS

Model 1116798 & 1116827 (Nash)

NOTE—This unit consists of two separate relays which operate as follows: **Series Relay**—Winding connected in series with shunt relay contacts. All current for solenoid goes through this winding. When armature attracted to core, contacts open and break ignition circuit (all ignition current goes through this series relay contacts). Current draw of solenoid holding coil is not sufficient to hold armature down and closing of contacts restores ignition as soon as transmission solenoid operates (which cuts out solenoid starting coil and causes solenoid current to drop from approximately 30 amperes to 1 ampere—see solenoid specifications above). **Shunt Relay**—Winding is connected in throttle switch circuit and contacts control current flow to transmission solenoid (closing of contacts when armature attracted to core completes solenoid circuit, contacts remain closed until throttle switch contacts are opened).

Series Relay Specifications

Contacts Open—13.0-16.0 amperes.
Contacts Close (Armature released)—6 amps. min.
Contact Gap—.030".

Shunt Relay Specifications

Contacts Close—3.0-4.0 volts.
Contact Gap—.025".
Air Gap—.012" (with contacts closed).

TROUBLE SHOOTING: If overdrive not operating, check for blown fuse on relay. This fuse will blow if control system does not operate properly. If fuse blows continuously, check wiring circuits for grounds or shorts, make certain that ignition circuit is shorted out momentarily when solenoid first energized (necessary to relieve gear load so that solenoid can withdraw pawl), see that pawl plunger operates freely without binding.

WARNER R9 OVERDRIVE

Car Model	Warner Model
Hudson 6 & 8, All Models (1941-42)	①AS1-R9B
Hudson 6 & 8, All Models (1946-47)	①AS2-R9B
Packard 6 & 8, All Models (1940)	① AS1-R9
Packard 6, All Models (1941-48)	①AS2-R9
Packard 8, All Models (1941-49) ③	①AS2-R9
Packard Super 8, All (1940-49) ④	①AS1-R9A
Packard Cust. 8, All (1940-49) ⑤	①AS1-R9A
Studebaker Pres., 8C (1942) See Note	②R9C

①—Overdrive only (used with own transmission).
②—Part of T86D-R9C Transmission & Overdrive.
③—R11 Overdrive also used on Eng. Nos. 272006 to 285157 and on all later cars.
④—R11 Overdrive also used on Eng. Nos. 424978 to 427710 and on all later cars.
⑤—R11 Overdrive also used on Eng. Nos. 610359 to 611500 and on all later cars

►CHANGES & CORRECTIONS

►**INSTALLATION OF R11 OVERDRIVE ON PACKARD CARS WITH R9 OVERDRIVE**—R9 Overdrive ASSEMBLIES not available (except as noted below —individual parts still available), and new R11 Overdrive Assembly is furnished for these cars in special kit containing necessary installation parts. **R11 Installation data**—See "Warner R11 Overdrive." *NOTE*—R9 Transmission & Overdrive Assembly, Part No. 901147, is available for "2000" & "2100" Series Packard Super Eight.

►**Packard Correction for locking of overdrive after transmission shifted into Reverse**—***See "Warner R9 Overdrive Control" (following) for installation of Reverse Lock-out Switch and removal of overdrive wiring harness connector.***

►**Hudson & Packard Overdrive Note**—Overdrive is used in conjunction with transmissions built by each car manufacturer. Refer to separate transmission articles for transmission servicing data.

►**Studebaker Pres. Note**—This Overdrive Transmission used on Late 1942 cars only (beginning with Serial No. 7147625).

DESCRIPTION: Simplified overdrive without centrifugal clutch pawls. Ring gear mounting plate is linked directly to final drive shaft by shift collar (shift collar also engages free-wheel cam when overdrive locked out) so that engine drives rear wheels through overdrive pinion gears (when overdrive operative) or through free-wheel mechanism (for direct drive below overdrive cut-in speed and also for the "kick-down" direct drive).

OPERATION: Overdrive cut-in and cut-out is controlled electrically by a solenoid which operates in exactly opposite manner from the kick-down solenoids used on models with centrifugal clutch pawls (solenoid plunger pushes pawl in to engage sun gear for overdrive, pulls pawl out to disengage sun gear for both direct drive below cut-in speed and for kick-down direct drive). Pawl is pushed in electrically and is pulled out by a spring within the solenoid case. ***See Transmission Control article (following) for solenoid description and servicing data.***

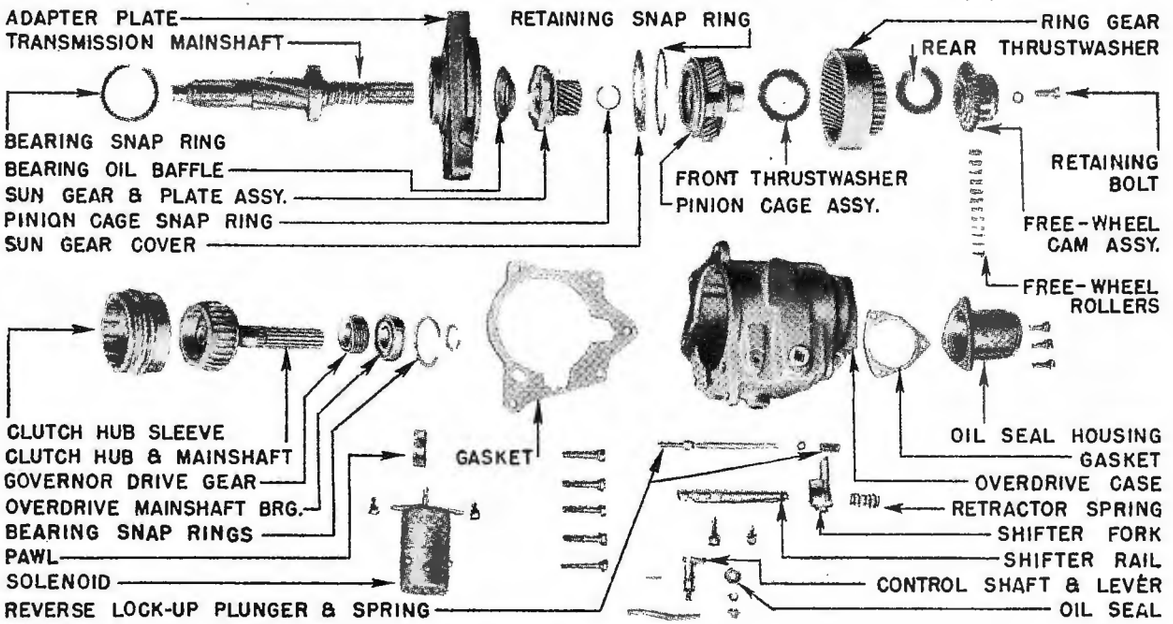
REMOVAL OF OVERDRIVE: ***See "Overdrive" on car model page.***

TROUBLE SHOOTING & TESTING: ***See Warner R9 Overdrive Control data (following).***

DISASSEMBLY: After transmission and overdrive assembly removed from car, take out five bolts attaching overdrive case and adapter to transmission case, separate overdrive case from adapter, withdraw overdrive case and mainshaft assembly (CAUTION—free-wheel rollers will drop out, make certain that all of the 12 rollers are accounted for). Take out free-wheel cam retaining bolt (in rear end of mainshaft), remove lockwasher and retaining washer, then slide free-wheel cam assembly off shaft. Remove clutch hub rear thrustwasher from shaft. Remove clutch hub, ring gear, and pinion cage assembly as a unit (CAUTION—Split pinions will unwind if these parts separated). Remove pinion cage snap ring from groove in shaft, remove sun gear cover snap ring from groove in adapter plate, slide oil collector ring and cover off, remove sun gear assembly (gear, plate, and balk ring). Adapter plate and rear bearing are removed as an assembly with the transmission mainshaft (see Transmission disassembly data). Disasemble all sub-assemblies as follows:

Sun Gear & Plate Disassembly—Remove snap ring from sun gear plate, slide gear out of plate (CAUTION—do not attempt to remove balk ring from plate). Check balk ring friction drag on plate by mounting plate in vise and using spring scale to check pull required to rotate ring on plate (spring hooked to step in balk ring and parallel with step). Pull should be 8-10 lbs. (with ring rotating—greater pull required to start ring moving).

Overdrive Solenoid (All Models)—Solenoid is special Delco-Remy unit. To remove the solenoid and pawl rod assembly **without disassembling overdrive,** see special instructions under Solenoid Testing data (in Warner R9 Overdrive Control following). Otherwise, disassemble overdrive as directed below, then disengage pawl from ball end of pawl rod and remove solenoid and pawl rod assembly by taking out two mounting screws in base mounting flange. ***See "Warner R9 Overdrive Control" (following) for complete solenoid testing and adjustment data.***



WARNER TYPE R9 OVERDRIVE

Hub, Ring Gear, & Pinion Cage Disassembly—Pull pinion cage assembly out of ring gear (split pinions will unwind as they are freed from ring gear). Remove ring gear snap ring, withdraw clutch hub from ring gear. Inspect clutch hub bushing. If bushing requires replacement, use Bushing Remover & Replacer J-1568 (Hudson) to install new bushing.

►***CAUTION—Pinions must be properly wound up when reassembled. See Reassembly data.***

Free-wheel Cam Disassembly—Remove cam roller retainer snap ring, pull roller retainer partly off cam for access to retainer spring, pull end of spring out of hole in free-wheel cam, free second spring in same manner, remove retainer and springs from cam. Mainshaft pilot bushing is light press fit in cam and can be removed and replaced if required.

Overdrive Mainshaft Disassembly—Unscrew governor and remove from case. Remove nut and washers on rear end of shaft, use puller to remove universal joint companion flange from shaft. Pull mainshaft out through forward end of case (CAUTION—Clutch hub sleeve and governor drive gear will remain in case and should be lifted out after mainshaft removed). Take out mainshaft bearing inner snap ring, tap bearing out toward front of case, drive oil seal out toward rear of case.

Shift Control Disassembly—Remove nut and washers on outer end of control shaft, take off control lever. Remove control shaft setscrew, withdraw control shaft from case. Remove plug on side of case, use socket wrench inserted through plug hole to remove shifter head screw and lockwasher. Remove shifter rail stopscrew, withdraw shifter rail, retractor spring, and fork.

Adapter Plate Disassembly—After transmission disassembled, adapter plate parts can be removed as

CONTINUED ON NEXT PAGE

WARNER R9 OVERDRIVE (Cont.)

follows: Take out rear bearing snap ring, withdraw transmission mainshaft and bearing assembly. Take out two solenoid base-to-adapter screws, withdraw solenoid, solenoid base, and pawl. To remove interlock plungers, drive out expansion plugs in adapter at end of each plunger hole. To remove interlock lever, drive out lever fulcrum pin.

►*CAUTION—Interlock plungers furnished in different lengths and must be selected for correct reverse gear lock-out. See Reassembly data.*

REASSEMBLY: Reassemble all sub-assemblies and install these parts in case in reverse order of disassembly data and note the following:

Sun Gear Pawl Interlock Plunger (Hudson)—Consists of two plungers and an intermediate lever installed in the adapter plate flange so that one plunger engages the shifter rail and forces the other plunger into engagement with the sun gear pawl with the overdrive locked out which prevents the pawl operating. Long plunger (shift rail plunger) furnished in six different lengths. Install plunger of correct length so that clearance between lower end of plunger and tip of interlock intermediate lever is .008-.021" with long plunger in shift rail groove and top of short plunger against the sun gear pawl.

►*CAUTION—See Overdrive Installation data (at end) for special procedure to insure correct operation of interlock in service.*

Sun Gear Pawl Interlock Plunger (Packard 6 and 8 1941-48): Same as Hudson type (above) with two plungers and intermediate lever. Long plunger is furnished in three sizes for adjustment.

Sun Gear Pawl Interlock Plunger (Packard Super 8 and Custom 8, Studebaker Pres.). Single short plunger installed in hole in overdrive case engages notch in side of sun gear pawl when the control button is operated to lock-out the overdrive. Plunger prevents pawl engaging sun gear. Clearance between end of interlock plunger and side of pawl should be .010" in overdrive position.

Sun Gear & Plate Assembly Installation—Assemble sun gear in plate with two oil slots in gear aligned with slots in plate, install snap ring in plate to retain gear. When installing this assembly in adapter, make certain that solenoid pawl properly positioned in slot in balk ring.

Solenoid & Pawl Assembly—Install solenoid base and solenoid with one gasket between base and adapter, and one gasket between solenoid and base. After solenoid installed, check clearance between end of pawl and step on balk ring with pawl out to end of solenoid plunger maximum travel. Clearance must be .015". Adjust by using not more than two gaskets between solenoid and base. *See Warner R9 Overdrive Control (following) for solenoid data.*

Shift Control Installation—Place shifter rail retractor spring and fork in case before inserting shift rail, make certain that wide groove in rail is in line with stopscrew hole in case. Install new control oil seal before installing control shaft. Make certain that shifter rail fork guide pin engages notch in shifter fork when installing this pin.

Overdrive Mainshaft Installation—When installing rear bearing, select snap ring for snug fit in groove. This ring furnished in five thicknesses for selective fit on Hudson (see Packard Note below). Install new oil seal in rear end of case (on Hudson, seal should protrude 9/32" beyond rear face of case). Make certain that clutch hub sleeve installed with shallow groove to front and that shifter rail fork engaged in fork groove in sleeve. Install speedometer gear with shoulder toward rear.

Free-wheel Cam & Roller Installation—If roller retainer removed, insert springs in retainer with ends pointing in clockwise direction, install retainer on cam, use small screwdriver to work springs around cam and insert ends in holes in cam. Install retainer snap ring (on Hudson, use Snap Ring Replacer J-1499 with Pilot J-1499-2). Use grease to hold free-wheel rollers in retainer until assembly inserted in pocket in mainshaft (NOTE—rubber band can also be used around rollers).

Hub, Ring Gear, & Pinion Gear Installation—After sun gear assembly installed, install pinion cage assembly and clutch hub front thrustwasher (CAUTION—lip on washer must be engaged in cutout in pinion cage on sun gear and washer should be coated with grease). Lock transmission gears (to facilitate winding up pinions), and use a punch or wedge inserted through side of pinion cage assembly to lock the forward halves of the three split pinions. Install ring gear to point where it engages the rear or narrow halves of all three pinions, then **wind up pinions by rotating ring gear clockwise 1½ teeth** (teeth on narrow half pass 1½ teeth on wide half of pinions) so that marked pinion teeth line up, push ring gear fully into place so that it meshes with both halves of all pinions. Remove wedges. Complete assembly by installing clutch hub rear thrustwasher (coat washer with grease) and free-wheel cam assembly, then install retaining washer, lockwasher, and bolt.

Driveshaft Rear Bearing (All Packard)—Bearing is new type double-row ball bearing which is pre-loaded in assembly so that no pre-load adjustment or special installation directions required.

OVERDRIVE INSTALLATION (On Transmission Case): Use new gasket between overdrive case and adapter. Make certain that solenoid and pawl assembly correctly installed (pawl must engage notch in balk ring). Move shift control lever to forward position, tilt overdrive case at slight angle and rotate overdrive mainshaft in counter-clockwise direction while pushing case forward into position (CAUTION—this procedure necessary to enter free-wheel cam rollers in pocket in mainshaft). Align overdrive case, adapter, and transmission (see Hudson Note below), install and tighten all overdrive case-to-transmission bolts.

►*HUDSON OVERDRIVE INSTALLATION CAUTION*—To install overdrive case, use Overdrive Aligning **Pilot J-1579 to align case so that interlock lever and plungers will have clearance for correct operation. Install pilot in lower hole of overdrive case so that it engages** hole in adapter plate and **transmission. Leave pilot in place until the other four mounting bolts have been installed and tightened, then remove pilot and install last mounting bolt.**

►*PACKARD OVERDRIVE INSTALLATION CAUTION*—Capscrews with drilled heads must be installed with special copper gasket and flat washer in lower left and bottom holes on overdrive case (to prevent oil leaks). After screws properly tightened, secure them with safety wire.

WARNER R9 OVERDRIVE CONTROL

Hudson 6 & 8, All Models (1941 to 1947)
Hudson 6 & 8, All Models (1948-49)
Packard 6 & 8, All Models (1940 to 1948)
Packard Super & Cust. 8, All (1940 to 1948)
Studebaker Pres., 8C (1942) No. 7147625 Up

►**NOTE:** Hudson 1948-49 models have new R10 Overdrive, but use Warner R9 Overdrive Control.

►CHANGES & CORRECTIONS

►**Hudson 1941 Governor Change to Correct Complaints of Overdrive Cutting-in Late or not Operating:** Governor changed and new type with **reversed oil groove in shaft bushings to prevent oil working up into switch body** used on later cars. **This new Governor Switch, Part No. 162867, used on later cars and may be identified by purple dots on terminal screw heads and purple band around switch body. Install this new switch on early cars to correct complaints of overdrive cutting in late (25-30 MPH.) or not operating.**

►**Packard 1941-47 Clipper Reverse Switch Installation to correct locking of overdrive after transmission shifted into Reverse**—Caused by incorrect electrical or mechanical operation. Install Reverse Lock-out & Backing Light Switch furnished in Kit No. 394484 as follows: Mount switch on gear shifter shaft mounting bracket on steering column with wire terminals up, and position switch so that plunger depressed and contacts opened (between switch terminals #1 and #2) when switch lever moved to Reverse position (Low-Reverse shifter shaft engages switch plunger). Disconnect wire at Overdrive Relay #1 terminal (cut this wire back to point where it enters harness). Connect long wire furnished in kit between starting switch "hot" terminal and #1 terminal on Lock-out Switch, routing wire along wiring harness. Connect short wire (with fuse cartridge) between #2 terminal on Lock-out Switch and #1 terminal on Overdrive Relay. Install fuse and check operation. Adjust switch, as necessary, so that overdrive circuit is open (#1 relay terminal not live) with gearshift lever in Reverse Position.

NOTE—See 1948 Packard wiring diagram for circuits using this lock-out "Safety" switch (this switch used in production on 1948 Cars).

BACKING LIGHT NOTE—Lock-out Switch terminals #3 and #4 used only when backing lights installed.

►**Packard Overdrive Control Wiring Connector Removal:** To correct complaints of locking of overdrive after transmission shifted into Reverse, check for short-circuits in electrical circuits caused by water or corrosion inside overdrive wiring harness connector (see 1948 Packard wiring diagrams). If this trouble noted, or to eliminate possibility of trouble at this point, remove connector, splice and solder wires together, tape wires and apply coat of shellac over tape.

NOTE—This connector not used on late 1948 cars.

DESCRIPTION: Special design, electrical control with 'kick-down' direct drive feature. New type Transmission Solenoid is 'push type' and pushes pawl in to engage sun gear mounting plate slot (to hold sun gear stationary for overdrive) when solenoid is energized. Spring in solenoid case pulls pawl out to disengage sun gear (for direct drive) when solenoid circuit is broken. Both solenoid windings

CONTINUED ON NEXT PAGE

WARNER R9 OVERDRIVE CONTROL (Continued)

(Pull-in Coil and Hold-in Coil) are energized to engage pawl for overdrive, Hold-in coil only is energized during entire period in which car is in overdrive. Solenoid is controlled by a Lock-out Switch (operated in conjunction with the lock-out control knob on the instrument panel), Governor Switch, Throttle kick-down Switch, and two unit relay (Control Relay and Timing Relay) as follows:

Control & Timing Relay—Consists of two units, a double contact (upper and lower contacts) Control Relay which controls the transmission solenoid circuit, and a single contact Timing Relay which controls the ignition 'cut-out' which permits the sun gear pawl to be withdrawn for direct drive.

OPERATION: Overdrive Engagement. Throttle switch and lock-out switch contacts are normally closed (control knob pushed in). At cut-in speed of 22 M.P.H., governor switch contacts close which completes circuit for Control Relay winding. Control relay upper contacts open and lower contacts close which completes circuit for both pull-in and hold-in coils in transmission solenoid. This causes the solenoid plunger to bottom in the coil, compressing the pawl spring, and causing the pawl to be pushed into engagement with the sun gear mounting plate slot so that the overdrive is operative (spring engages pawl as soon as accelerator pedal released momentarily). On Packard, dash indicator light controlled by solenoid upper contacts lights to indicate that overdrive should be engaged, light goes out as soon as overdrive is engaged).

Overdrive Disengagement—When the overdrive engages, the timing relay contacts close (this relay winding is connected in series with the solenoid hold-in coil) and the solenoid upper contacts also close, but the ignition is not cut out because the control relay upper contacts have already opened (all three sets of contacts are connected in series in the ignition cut-out or ground circuit). When the throttle switch contacts are open (when accelerator pedal depressed fully for kick-down direct drive) or governor switch contacts open (for return to direct drive at speeds below 17 M.P.H.), the control relay upper contacts close first and, since the other two sets of contacts are also closed, the ignition is shorted or cut out momentarily to allow the solenoid spring to disengage the pawl from the sun gear for direct drive. The timing relay winding circuit is opened by the opening of the control relay contacts (which occurs before the control relay upper contacts close) but the 'time delay' feature causes short interval to elapse before timing relay contacts open (restoring the ignition).

ADJUSTMENT: Lock-out Control Button Linkage. Button should clear bracket by ⅛" when pushed in to insure full travel of control travel on overdrive case. To adjust, loosen control cable at binding screw on lever on left side of overdrive case, push control button in as far as possible, then pull button out ⅛" (all models except Hudson), ½" (Hudson). Move the control lever on overdrive case to rear as far as possible, then move lever forward until a resistance just felt, tighten binding screw.

Throttle Kick-down Switch Adjustment:

Hudson Throttle Switch (1941)—Adjust switch whenever carburetor linkage adjusted or disconnected. To check setting, remove carburetor air cleaner to observe throttle valve, depress accelerator so that throttle valve just wide open, loosen nuts on accelerator pedal rod and adjust position of contact washer on rod so that it is just contacting throttle switch plunger, tighten both nuts

Hudson Throttle Switch (1942-49). Switch must open and relay operate just after throttle is fully open. If relay does not operate, loosen locknut and adjust throttle switch up under accelerator pedal until pedal just contacts switch plunger with throttle wide open. If relay does not operate when pedal depressed beyond wide open throttle position, replace throttle switch.

Packard Throttle Switch—Should be adjusted whenever carburetor linkage adjusted or disconnected. To check setting, remove air cleaner (to observe throttle valve), open throttle until valve is just wide open. If tappet screw on accelerator link lever does not contact throttle switch plunger at this point, adjust by loosening locknut and turning screw in or out of lever.

Studebaker Throttle Switch—Depress accelerator pedal until throttle valve is wide open and throttle lever contacts wide open throttle stop, hold in this position, loosen locknut on switch mounting stud, adjust switch on mounting bracket until end of accelerator rod just contacts switch plunger.

Governor: Mounted on rear end of overdrive case and driven from final driveshaft. Controls cut-in speed (overdrive can be engaged at any speed above point where governor contacts close).

►*CAUTION—Governor is not adjustable.*

Hudson Note—Governor is special two-terminal type (used also for Vacumotive Drive control). Overdrive lead should be connected to cadmium plated terminal (Vacumotive Drive terminal is copper-plated).

Packard Note—This Governor used only for Overdrive control. Special two-terminal type used on cars with Electromatic Clutch control also. Overdrive lead should be connected to 'AD' terminal of this type governor (Electromatic Clutch lead connected to 'EC' terminal).

Car Model	Cut-in Speed
Hudson (All Models)	22 MPH.
Packard '40	22 MPH.①
Packard '41-48 (Overdrive Only)	22 MPH.
Packard '41-42 (Electromatic Clutch)	20 MPH.
Studebaker '42	20 MPH.

①—Std. Governor No. 355075. 26MPH.—No. 347478 Governor. 33 MPH.—No. 354943 Governor.

FUSES: Hudson—No fuse is used.

Packard—30 ampere. Located in a fuse container in the line between the starting switch and the Solenoid Relay '1' terminal. Do not use fuse of any other capacity at this point.

Studebaker. Fuse is located in socket on side of control relay mounted on front of dash.

TROUBLE SHOOTING: Failure of the overdrive to operate satisfactorily may be caused by **mechanical** failure (of overdrive unit or control units) or by **electrical** failure (of control units and wiring).

OVERDRIVE DOES NOT ENGAGE

1. Mechanical Causes:

1) Sun Gear Pawl sticking or broken, or Interlock Plungers sticking and locking pawl in outer position. Remove solenoid (see Solenoid Testing data), check pawl for free operation. *NOTE*—Overdrive must be disassembled for pawl removal.

2) Solenoid Plunger sticking, Pawl Rod out of adjustment. Check for correct installation and adjustment. See Solenoid adjustment data.

3) Balk Ring faulty or incorrectly installed (may be indicated by spasmodic or harsh engagement). Check balk ring friction drag (see Disassembly data above). Make certain that sun gear plate and balk ring correctly installed with pawl in slot in balk ring (overdrive cannot engage if pawl rides on solid portion of balk ring).

2. Electrical Causes:

1) Fuse blown or open-circuit in control wiring.

2) Governor, Relay, or Lock-out Switch defective (contacts sticking open). See Control Unit Testing (following).

3) Solenoid defective (pull-in or hold-in coil open, pull-in coil contacts sticking open). See Control Unit Testing (following).

OVERDRIVE DOES NOT DISENGAGE OR NO "KICK-DOWN"

1. Mechanical Causes:

1) Sun Gear Pawl sticking or broken. Remove solenoid (see Solenoid Testing data), check pawl for free operation and correct engagement with pawl rod ball end. *NOTE*—Overdrive must be disassembled for pawl removal.

2. Electrical Causes:

1) Governor or Relay defective (contacts sticking closed). See Control Unit Testing (following).

2) Ignition cut-out or ground wire open-circuited or disconnected at ignition coil or distributor.

OVERDRIVE CANNOT BE LOCKED OUT

1. Mechanical Causes—Shift control cable out of adjustment, disconnected, or broken. Shift control mechanism in overdrive case incorrectly assembled.

2. Electrical Causes—Lock-out Switch shorted.

OVERDRIVE NOT LOCKED OUT IN REVERSE

►*CAUTION*—Above condition may result in transmission being in two gears at once (overdrive and reverse) and this "lock up" will cause damage to overdrive mainshaft if engine power applied.

1. Mechanical Causes:

1) Lock-out collar sticking. May be caused by wrong type or cold lubricant (drain and refill with correct type lubricant).

2) Burred or worn splines on free-wheel clutch cam, overdrive mainshaft, or in lock-out collar. Check for free movement of lock-out collar by disconnecting control cable at shift control lever on overdrive case and operating control by hand.

3) Sun Gear Pawl sticking, broken, or not properly engaged on pawl rod. Remove solenoid (see Solenoid Testing data), check pawl for free operation. NOTE—Overdrive must be disassembled for pawl removal.

4) Solenoid Plunger sticking or Pawl Rod out of adjustment. Check for correct installation and adjustment. See Solenoid Testing & Adjustment data.

2. Electrical Causes:

1) Governor or Relay contacts sticking in closed position.

2) Control wiring or control unit terminals grounded.

3) Lock-out Switch or Kick-down Switch grounded.

►*PACKARD REVERSE SWITCH NOTE*—This switch used on "2200" Series and can be installed on pre-

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WARNER R9 OVERDRIVE CONTROL (Continued)

vious series cars to prevent locking up of transmission in reverse. *See Change & Correction data.*

TESTING & ADJUSTMENT (Control Units): Switches and Governor should be serviced by replacement. Relays and Solenoids should be checked and adjusted as follows:

Control Relay (Hudson & Packard Models): Delco-Remy No. 1116823 (std. 6 volt), 1116802 (Exp. 12 volt). Relay is special two-unit type (Control Relay and Timing Relay) and each unit is adjusted differently as follows:

Control Relay

Air Gap—.012" (lower contacts closed), .032" (lower contacts open). Check first with armature held down so lower contacts closed, adjust by loosening two screws on hinge bracket on back of relay and raising or lowering armature, see that gap uniform across whole surface of core. Then check air gap with armature released (upper contacts closed), adjust by bending upper contact support—do not loosen hinge bracket screws.

Contact Gap—.022" (top contacts) with lower contacts held closed. Should be correct if air gaps correct (above) and contact spring not bent.

Closing Voltage—3.4-4.0 (6 volt units), 6.8-8.0 volts (12 volt units). CAUTION—This voltage will attract armature and close **lower** contacts (upper contacts open as lower contacts close). To check closing, connect battery and variable rheostat to relay terminals #1 and 5, increase voltage and note when contacts close. To adjust, bend spring hanger at upper and lower end of spiral armature spring.

Timing Relay

Air Gap—.031" with contacts open. Adjust by bending upper armature stop—**do not disturb armature hinge bracket mounting screws.**

Contact Gap—.022". Adjust by bending lower contact support.

Closing Voltage—.6-1.1 volt (6 volt units), 1.2-2.2 volts (12 volt units). To check closing, connect battery and variable rheostat to terminals #3 and 4, increase voltage and note when contacts close.

'Time Delay' Action—.1-.2 seconds (between instant current flow through winding is stopped and opening of contacts). To check timing action on car, operate engine at medium speed, close **control relay** lower contacts by hand (timing relay contacts will close), release control relay contacts and note interval before timing relay contacts open (lag should be noticeable). Adjust by bending spring hangers on upper and lower end of spiral armature spring (increase spring tension to shorten time interval).

Control Relay (Studebaker): Auto-Lite Model HRB-4301. This is a conventional single unit relay (similar to horn relays, etc.).

Contact Gap—.034-.038" (bend armature stop).

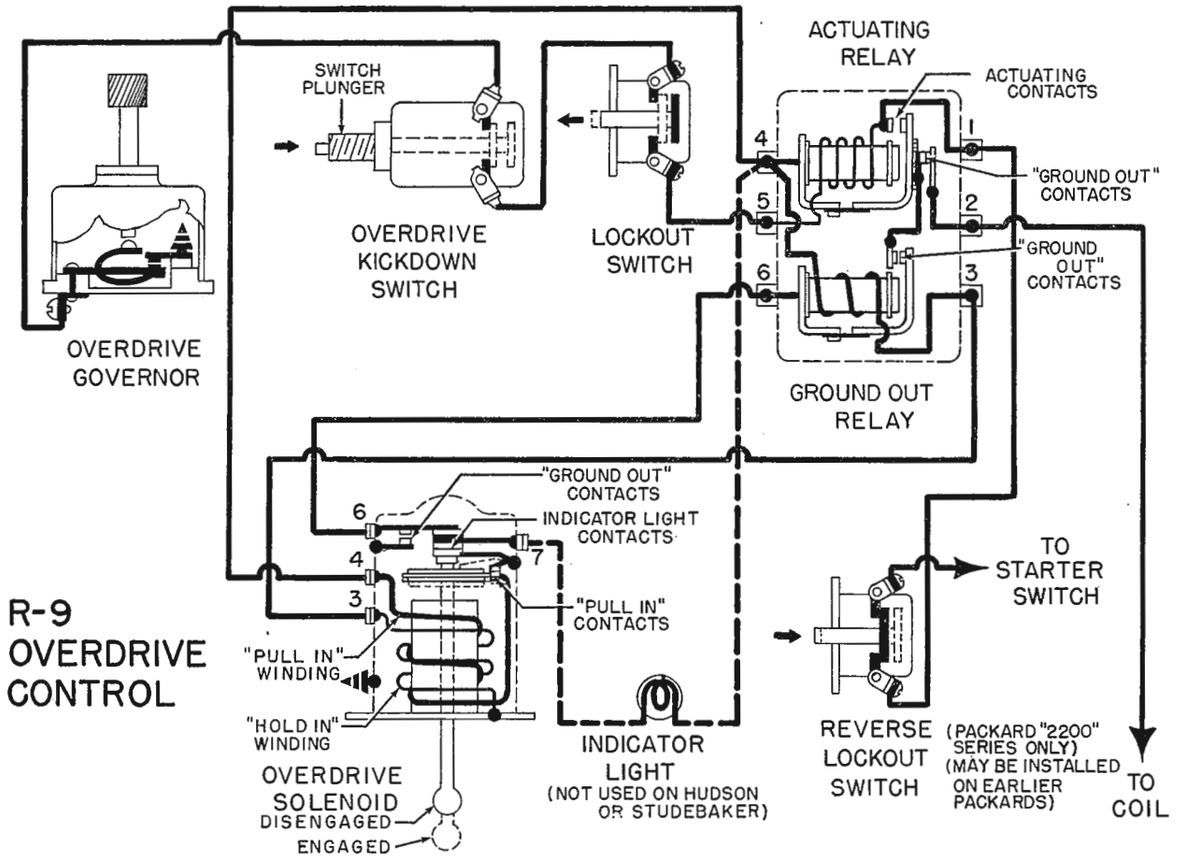
Air Gap—.012-.017" with contacts closed. Adjust by raising or lowering stationary contact support.

Closing Voltage—2.8-3.6 volts. Adjust by changing armature spring tension (bend lower sprg. hanger).

Coil Winding Current—.44-.46 amperes at 6.0 volts (coil winding resistance 12.9-13.5 ohms).

Transmission Solenoid (All Models): Delco-Remy No. 1118005 (Std. 6 volt), 1118007 (Export 12 volts). Solenoid cover can be removed for inspection and servicing by removing two nuts on studs on cover.

CAUTION—Pawl rod must not be forced into solenoid with cover removed. This will damage the contact plate flat springs.



R9 OVERDRIVE CONTROL WIRING DIAGRAM

►***SOLENOID REMOVAL (for Checking & Adjustment):*** The solenoid can be removed without disassembling the overdrive by following procedure: With ignition switch turned on and overdrive control button pushed in, ground the overdrive control terminal on the governor ("AD" terminal on Packard, Cadmium plated terminal on Hudson) which will energize the solenoid and extend the solenoid plunger. Take out two solenoid mounting screws, tilt solenoid to rear to disengage ball end on pawl rod from milled slot in pawl. Disconnect solenoid leads, withdraw solenoid assembly. **Installation Note**—Reverse the above procedure and energize the solenoid after the leads have been connected to facilitate engaging ball in pawl slot.

Solenoid Operation Test—Plunger actuating voltage should be 4.9 volts (6 volt units), 6.8 volts (12 volt units) max. at room temperature. To check performance, block pawl rod so that it cannot move out of solenoid when plunger is actuated, remove solenoid cover, connect voltmeter, battery, and variable rheostat between terminals #3 and 4 (connect these terminals together) and ground on solenoid case. Increase voltage and note voltage reading at point where plunger is actuated.

Pull-in Coil Contact Gap—With solenoid bottomed in coil, pull-in coil contact gap should be .018-.040". Remove solenoid cover to check these contacts. See Pawl Rod Adjustment below.

Solenoid Current Draw—To check current connect battery and ammeter between #4 terminal and ground on solenoid case (Pull-in Coil), or #3 terminal and case (Hold-in Coil). This check must be made at specified voltage. 'Both Coil' figure below is for both Pull-in and Hold-in Coil together, 'Hold-in Coil' figure is for Hold-in coil only.

6 Volt Units

Both Coils.....31.0-36.0 amperes at 6.0 volts.
Hold-in Coil.....1.4-1.6 amperes at 6.0 volts.

Pawl Rod Adjustment—With pawl rod assembly removed from solenoid, check length from lower face of adjusting nut on upper end of pawl rod to lower edge of plunger. This distance should be 2.022-2.037". To adjust, press down on locking spring below adjusting nut so that prong on spring clears notch in nut, turn nut on plunger. CAUTION—Use care not to distort locking spring and see that prong on spring engages notch in nut after adjustment completed.

WARNER R10 OVERDRIVE

TRANSMISSION WITH OVERDRIVE

FRAZER & KAISER	Warner Model
1947-48	AS12-T86E
1949-50	AS24-T86E
1951	①AS50-T86E
HENRY J	
1951 4 Cyl. & 6 Cyl.	①AS41-T96
NASH	
Rambler (1950-51)	①AS36-T96
Ambassador (1949-50)	AS26-T86E
Ambassador (1950-51)	①AS46-T86E
STUDEBAKER	
Champion (1947-49)	AS2-T96
Champion (1949-51)	①AS24-T96
Commander (1947-49)	AS2-T86E
Commander (1949-50)	①AS32-T86E
Commander (1951)	①AS54-T86E
WILLYS	
Sta. Wgn. 4-63 (1947-49)②	AS12-T96
Sta. Wgn. 6-63 (1948-49)③	AS20-T96
Sta. Wgn. 4-63, 473-SW (1949-51)	①AS28-T96
Sta. Wgn. 6-63, 673-SW (1949-51)	①AS28-T96
Jeepster VJ-2 (1948)	AS18-T96
Jeepster VJ-3 (1949-50)	①AS30-T96
Jeepster 473-VJ, 673-VJ (1950-51)	①AS30-T96

OVERDRIVE UNIT ONLY

HUDSON	⑤Warner Model
All (1948-49)	AS1-R10D
All (Early 1950)	AS2-R10D
All (Late 1950 & 1951)	①AS3-R10D
NASH	
"600" (1947-48)	AS1-R10B
"600" (1949)	AS6-R10B
Statesman (Early 1950)	AS6-R10B
Statesman (Late 1950 & 1951)	①AS8-R10B
Ambassador (1946-48)④	AS2-R10B
Ambassador (Early 1949)	AS5-R10B

①—Overdrive with "Centered Ring Gear."
②—Up to Serial No. 91904 in 1949.
③—Up to Serial No. 14822 in 1949.
④—Beginning 1946 Service Serial No. N6-120026.
⑤—Overdrive Unit only (used with transmission furnished by car manufacturer).

►**1949-51 FORD, LINCOLN, MERCURY OVERDRIVE:** *See "Ford, Lincoln, Mercury Overdrive" (Warner R10) for complete data.*

►CHANGES, CAUTIONS, CORRECTIONS

►**HUDSON 1950 OVERDRIVE CONTROL CHANGE**—New simplified control system (new Solenoid, Relay, and control circuits) used on 1950 models. *See "Warner R10, R11 Overdrive Control" data.*

DESCRIPTION: Overdrive is solenoid operated type (no centrifugal pawls) with governor control and accelerator controlled "kick-down." Engagement and disengagement is effected by movement of the sun gear pawl, the solenoid plunger pushing the pawl in to engage the sun gear for overdrive, and withdrawing the pawl for direct drive (direct drive below the cut-in speed and "kick-down" direct drive). See Overdrive Control section below for data All models are similar except as follows:

Hudson R10 Overdrive—Has sun gear pawl interlock plunger which engages notch in pawl to prevent pawl movement when overdrive locked out (on other R10 overdrives, pawl locked out directly by shifter rail).

"Centered Ring Gear" Overdrives—These models do not have front bearing on overdrive mainshaft (single bearing only in rear of case) and the assembly is piloted at the planetary ring gear in a machined flange which is integral with the overdrive case. See illustrations of both types.

REMOVAL OF OVERDRIVE: *See "Overdrive" on car model page.*

TROUBLE SHOOTING & TESTING: *See "Warner R10 & R11 Overdrive Control" following.*

DISASSEMBLY OF OVERDRIVE: Remove Lock-out Switch, remove governor by unscrewing it from housing. On Nash models, take out mounting screws and remove Torque Tube Adapter, remove oil seal with Puller J-2497, then remove snap ring from shaft directly in back of driveshaft rear bearing. On all other cars, remove nut on rear end of shaft, use puller to remove universal joint companion flange. Drive out tapered pin holding control lever shaft in overdrive case, pull shaft out as far as possible to disengage operating cam from shift rail. Remove four mounting screws holding overdrive case on transmission case, withdraw case while tapping on rear end of shaft with a soft hammer to prevent the shaft coming off with the housing (this would allow free-wheel rollers to drop out). Then disassemble each part of the overdrive as follows:

Overdrive Solenoid—Remove mounting capscrews and lockwashers at mounting flange, rotate solenoid clockwise ¼ turn to disengage plunger from pawl, withdraw solenoid and plunger assembly.

Overdrive Case (incl. control parts)—Remove reverse lock-up spring from housing, take off nut and remove control lever from shaft, remove control shaft from within case, remove shaft oil seal. If both bearings remain within case (see "Driveshaft Bearing Change" above), use brass drift to tap front bearing out, lift out speedometer and governor drive gears, remove oil seal from rear of case, take out rear bearing rear snap ring, use brass drift to tap bearing out at rear of case.

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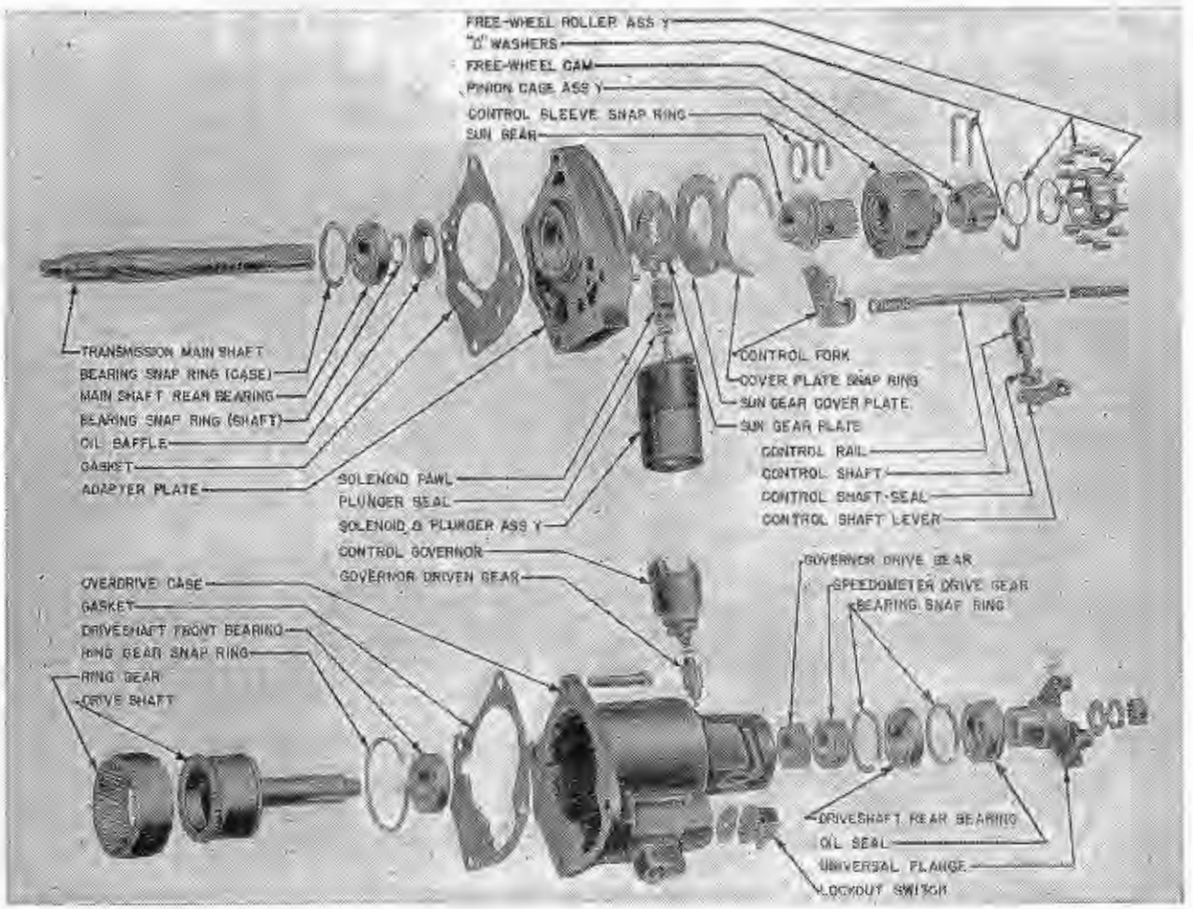


WARNER TYPE R10 OVERDRIVE (FIRST TYPE—NOT CENTERED RING GEAR)

WARNER R10 OVERDRIVE (Cont.)

NOTE—On Nash, speedometer and governor gears are keyed on shaft and these gears will remain on the shaft with the front bearing when overdrive case is removed leaving rear bearing to be removed as directed above.

Driveshaft & Planetary Gears—Install one screw to hold adapter plate in position on transmission case. Pull driveshaft off to rear (CAUTION—catch free-wheel rollers as they fall out). Ring gear can be removed from driveshaft by taking out snap ring at rear end of gear. Remove retaining clip ("C" washer) from shaft at rear of free-wheel cam, slide free-wheel unit and pinion cage assembly off rear of shaft (these units can be separated by taking out retaining clip or "C" washer at rear of pinion cage). Remove overdrive sun gear and shift rail assembly as a unit by sliding them off rear of shaft.

Adapter Plate Sun Gear Parts—Remove large snap ring from adapter plate (in front of sun gear cover plate), withdraw sun gear cover plate, sun gear blocker assembly (with balk ring), and solenoid pawl. NOTE—Adapter plate is removed as a unit with transmission mainshaft, gears, and synchronizer. Do not disturb adapter plate unless transmission being disassembled.

REASSEMBLY OF OVERDRIVE: Assemble parts in reverse order from disassembly directions (above) and note the following important points:

Transmission Mainshaft Rear Bearing Installation—After installing bearing on shaft, select proper thickness snap ring so that bearing will have no endplay when snap ring installed in shaft groove. Insert baffle in adapter, install mainshaft and bearing, select snap ring of correct thickness (furnished in various thicknesses) so that there will be no clearance between ring and bearing when snap ring installed in adapter groove.

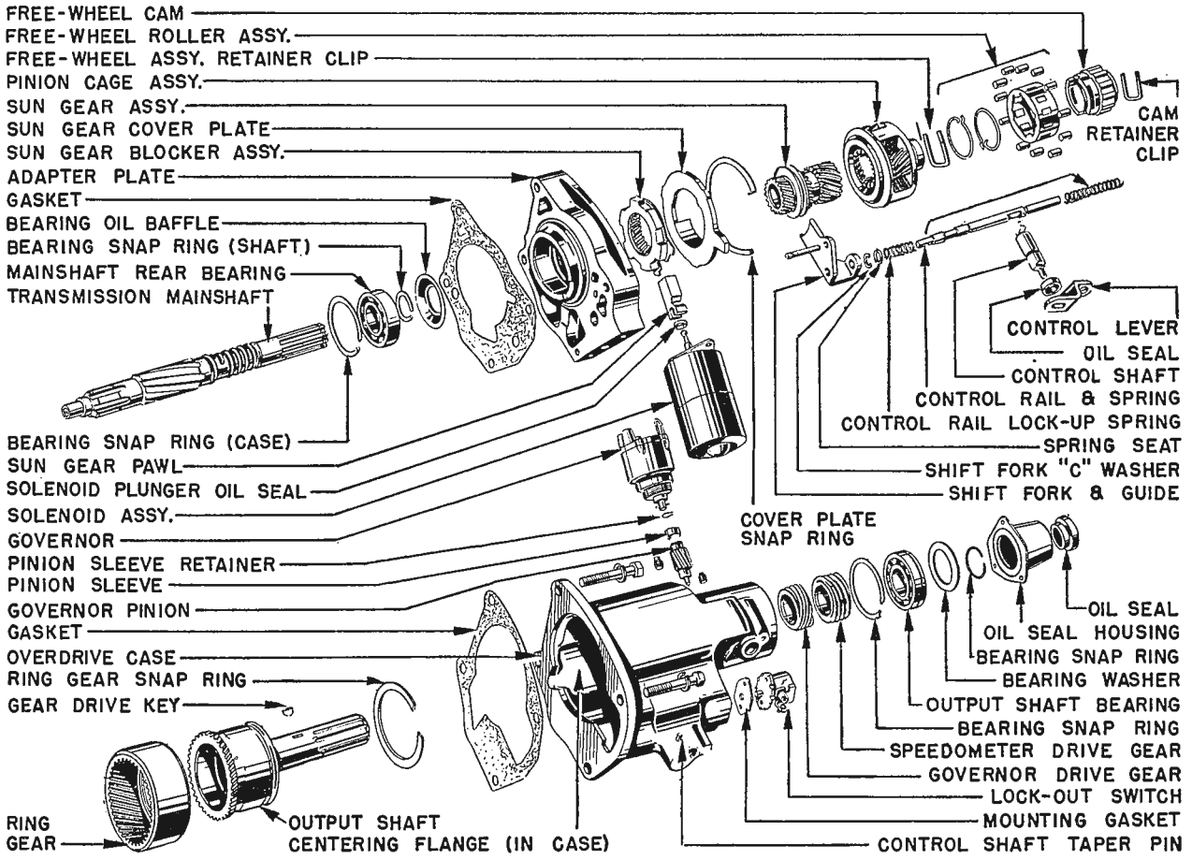
►*CAUTION—Bearing must not have endplay on shaft or in adapter plate.*

Sun Gear Balk Ring—With sun gear assembly removed, check friction drag of balk ring on plate by clamping the plate in a vise and using a spring scale hooked to the step on the balk ring (scale held parallel to step) to measure the pull required to rotate the ring on the plate. This pull should be 4-6 lbs. (new ring—may fall to 1-1½ lbs. after ring thoroughly broken in) with the ring turning (greater pull will be required to start ring rotating). Replace balk ring if friction drag not correct.

Sun Gear Blocker, Pawl & Solenoid—Install pawl with notched side upward, rotate blocker assembly so that opening in balk ring is opposite pawl. When installing solenoid, insert plunger stem with solenoid turned 90° from mounting position, then rotate solenoid 90° counter-clockwise to engage pawl and install mounting screws.

►**Hudson Interlock Plunger Note**—Interlock plunger must engage notch on side of pawl. This plunger furnished in six lengths for selective fitting so that clearance between end of plunger and side of pawl should be .008-.021" with opposite end of plunger contacting shifter rail (not sleeve). Check with pawl fully engaged in slot in sun gear.

Free-Wheel Assembly—If free-wheel cam retainer and springs removed from free-wheel cam, first note position of springs and replace in exactly same positions. Springs must place tension on cam so that it is held normally in a counter-clockwise position (viewed from rear) in retainer with rollers on "high" ends of cam ramps (outward or engaged position).



WARNER TYPE R10 OVERDRIVE (LATER—CENTERED RING GEAR)

Overdrive Pinion & Free-Wheel Installation—With these parts installed on shaft, and retaining clips ("C" washers) properly installed, insert free-wheeling rollers in cage and use heavy grease to hold them in position, turn cage and rollers counter-clockwise to low or disengaged position (use a rubber band looped around assembly to provide sufficient pressure on rollers to hold them in this position against the spring tension), then install driveshaft and ring gear assembly.

Overdrive Case and Control Mechanism—Make certain that rear bearing snap rings are properly seated and snug in grooves (rear snap ring furnished in various thicknesses). On Nash, install front bearing and speedometer and governor drive gears on driveshaft (CAUTION—make certain that woodruff key in place in shaft to position both gears). On other cars, install speedometer and governor gears in rear end of case, then tap front bearing in place. Install new shifter shaft oil seal in recess in case, then install shifter shaft from within case. When installing case, see that shift fork properly engaged in sun gear shifting collar and that shift rail parts correctly assembled. After case installed, push shifter shaft in to engage notch in shift rail, install shifter shaft lockpin, check operation of shift mechanism for correct operation without binding. On Nash, install snap ring in driveshaft groove directly back of rear bearing, install oil seal. On all models except Nash, install universal companion flange, tighten nut on end of shaft securely.

►*CAUTION—Universal companion flange nut must be securely tightened to prevent governor and speedometer drive gears slipping on shaft.*

OVERDRIVE CONTROL: *See Warner Type R10 & R11 Overdrive control data (following).*

TRANSMISSION DISASSEMBLY & REASSEMBLY: *See Warner Overdrive Transmission data.*

WARNER R11 OVERDRIVE

PACKARD	①Warner Models
Eight, "2200" Series (1949)②	AS3-R11
Super 8, "2200" Series (1949)③	AS4-R11
Cust. 8, "2200" Series (1949)④	AS4-R11
Eight, "2300" & "2300-5" (1949-50)	AS3-R11
Super 8, "2300" & "2300-5" (1949-50)	AS4-R11
200 & 300 "2400" Series (1951)	AS6-R11

①—Overdrive unit only (used with Packard Transmission.

②—Beginning Engine No. 285157 (both R9 & R11 Overdrives used from Eng. No. 272006 to 285157).

③—Beginning Engine No. 427710 (both R9 & R11 Overdrives used from Eng. No. 424978 to 427710).

④—Beginning Engine No. 611500 (both R9 & R11 Overdrives used from Eng. No. 610359 to 611500).

►CHANGES, CAUTIONS, CORRECTIONS

►**PACKARD OVERDRIVE FAILURE TO ENGAGE (First cars with R11 Overdrive)**—Caused by incorrect length of Overdrive Reverse Plunger (Overdrive will not engage in 2nd. or High—may be engaged in Low), or of Overdrive Shift Rail (Overdrive will not engage in Low). After determining exact cause by road-testing car (make certain that electrical control system not at fault if overdrive will not engage in any gear), correct trouble as follows:

Will not engage in 2nd. & High—Remove transmission case cover, grind approximately .020" from face of left hand pad on Low-Reverse Shifter Fork to permit full forward travel of overdrive reverse plunger.

Will not engage in Low—If this condition not caused by failure of electrical control system, disassemble overdrive and check overdrive shifter rail to make certain that rail moves far enough forward so that undercut in rail aligns with solenoid pawl (to permit pawl to operate). If not, grind approximately .020" off end of shifter rail.

►**INSTALLATION OF R11 OVERDRIVE ON PREVIOUS MODELS (to replace original R9 Assembly)**—R11 Overdrive Assembly and other necessary parts furnished in kits (Part No. 410603 for 2201, 02, 11, 22, 32; No. 410604 for 2206, 13, 26, 33). Install these assemblies as follows:

"2100" Series Cars

1. Remove transmission cover and change Direct & Second Speed Shifter Fork Shaft. Install new shaft No. 379004 or remove shaft from old cover and install in new one.
2. Install Overdrive Assembly and control units in same manner as on "2200" series (following).

"2200" Series Cars

1. Remove old Overdrive Relay. Cut off all six wires close to harness and tape wire ends.
2. Drill 9/64" hole at point 1½" toward center of car from outer attaching screw hole of relay, use rubber spacer at this hole and install new Relay.
3. Remove old Kick-down Switch. Cut off wires and tape wire ends. Install new Kick-down Switch.
4. Install new Wiring Harness along main wiring harness and attach with strap clamps (8 provided). Connect harness wires at relay, starter, ignition coil, kickdown switch, ignition switch and lockout switch.

See Warner R11 Overdrive Wiring diagram on following page.

5. Check type of front universal joint and if car equipped with Spicer Universal, remove flange from old overdrive and install this flange on new R11 overdrive (Overdrive furnished with flange for Mechanics Universal—not necessary to make this change if car has Mechanics universals).
6. Install R11 Transmission and Overdrive assembly. Re-install rear engine support channel **turned end-for-end** so that lockout cable bracket holes are on left side.
7. Cut solenoid wires and governor OVERDRIVE wire close to old harness and tape wire ends. Do not cut governor ELECTROMATIC CLUTCH wire. Connect wires in new auxiliary harness to solenoid and governor, connect Electromatic Clutch wire in old harness to governor.

►*CAUTION—Do not disturb Electromatic Clutch wire in old harness. This wire must be connected to governor.*

8. Replace original speedometer pinion with correct replacement type: No. 412442 (17 tooth), No. 412443 (18 tooth), No. 412444 (19 tooth).

►*CAUTION—Speedometer gear in R11 overdrive is different than R9 type and will not operate with R9 pinion.*

9. Move overdrive lockout cable to left side of engine and install new cable bracket and clamp at support channel mounting holes. Install cable clamps at Electromatic Clutch control valve rear mounting screw hole and at lower flywheel cover mounting screw hole.

DESCRIPTION: The R11 overdrive differs from the R9 overdrive used on previous models as follows:

Overdrive Lockout Shift Mechanism—Overdrive is locked out by shifting the sun gear to the rear, out of engagement with the stationary sun gear plate, and into engagement with planetary pinion cage assembly, so that the gears are locked together. No separate shift collar is used.

Sun Gear Pawl Lockout Mechanism—Pawl is held

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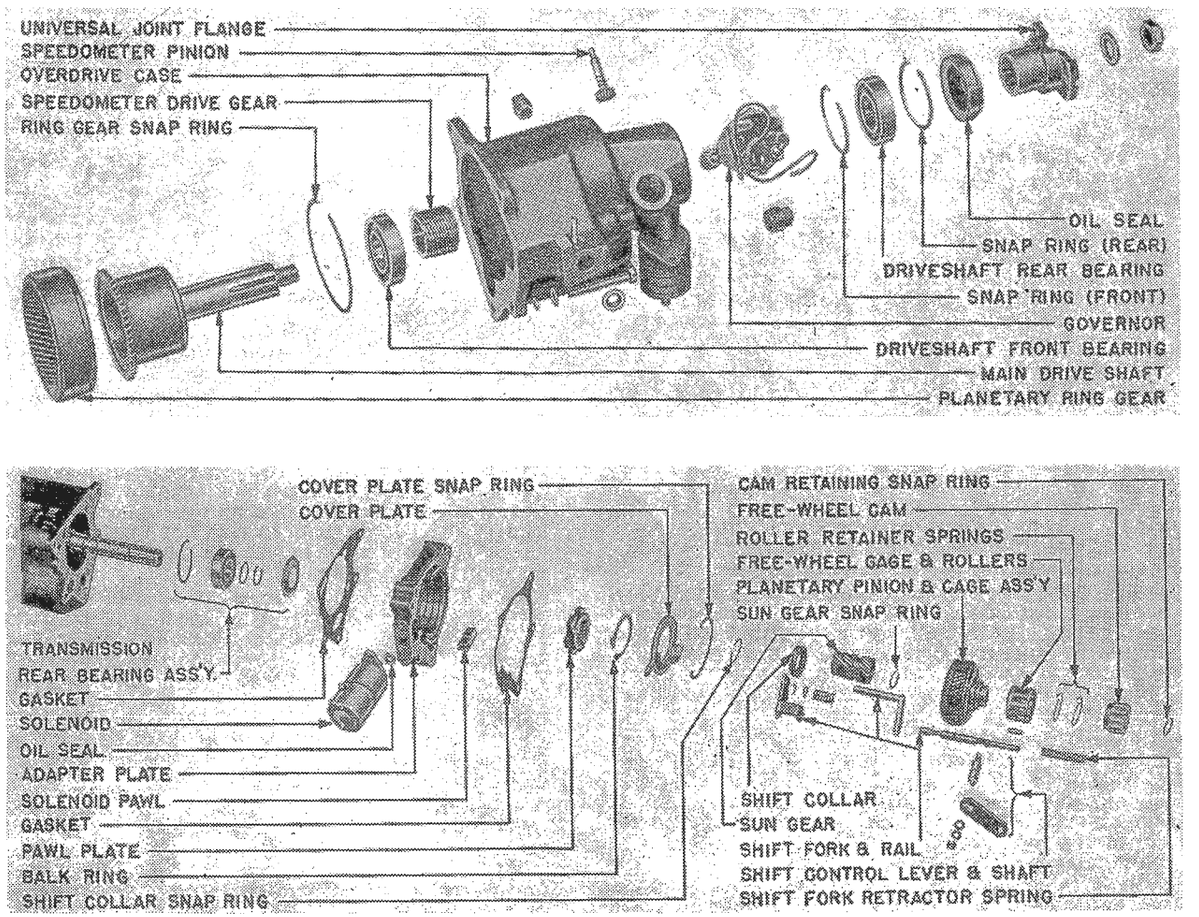


WARNER R11 OVERDRIVE

WARNER R11 OVERDRIVE (Continued)

in disengaged position (for Reverse and when overdrive locked out) by engagement of the shift rail in a notch on the side of the pawl (no interlock plungers used).

Control System—New two-terminal solenoid and single unit relay used with simplified circuits. *See wiring diagram for units and connections.*

REMOVAL OF OVERDRIVE: *See "Overdrive" on car model page.*

TROUBLE SHOOTING & TESTING: *See "Warner R10 & R11 Overdrive Control" following.*

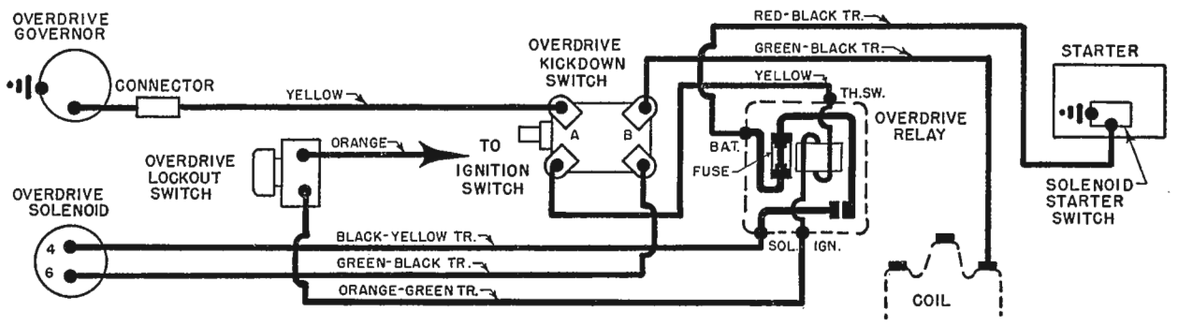
DISASSEMBLY OF OVERDRIVE: Remove governor (special wrench J3227), remove solenoid by taking out two retaining screws and rotating solenoid approximately ¼ turn clockwise to disengage plunger from pawl. Drive tapered pin retaining control shaft up and out of boss in case, work shaft and lever outward as far as possible to disengage shaft from shifter rail. Take out five overdrive case-to-adapter mounting screws CAUTION—do not disturb two screws retaining adapter on transmission). Remove overdrive case and drive shaft by pulling to rear away from the adapter (CAUTION—do not lose shift rail retractor spring or free-wheel rollers which may drop down into case). Then disassemble all parts of overdrive as follows:

Overdrive Case (including Control Parts)—Remove nut retaining universal joint flange on rear end of shaft, use puller J2576 to remove flange from shaft. Remove shaft through forward end of case by tapping on rear end with soft hammer to free shaft from bearing. Drive front bearing out of case using a brass drift inserted through rear bearing. Lift speedometer gear out. Pull oil seal at rear end of housing (Axle Shaft Oil Seal Remover J943-B may be used by grinding down tool legs to engage retainer). Remove rear bearing rear snap ring from housing, drive rear bearing out through rear of case. Remove control lever retaining nut, remove lever from shaft, work shaft through into case and remove. Remove large snap ring at rear of planetary ring gear, remove gear from shaft hub.

Planetary Gears & Free-wheel Parts—Remove snap ring which retains free-wheel cam on mainshaft, slide free-wheel roller retainer and cam assembly, and planetary pinion and cage assembly, off shaft (CAUTION—see that none of the 12 free-wheel rollers are lost). Remove forward pinion cage assembly retaining snap ring from shaft (CAUTION—mark this ring to insure re-installation of same ring or similar thickness—this ring thickness not variable). Pull reverse plunger, shift fork, and shift fork assembly out of adapter and at same time slide sun gear to rear and off end of shaft.

Adapter Plate Sun Gear Parts—Remove snap ring retaining stationary sun gear plate cover in adapter, remove cover, sun gear plate and balk ring, and pawl.

REASSEMBLY OF OVERDRIVE: Wash all parts thoroughly in kerosene and check for broken, chipped, or scored gear teeth; nicked or burred splines; rough bearings; roughness or flat spots on free-wheel rollers. Lubricate all parts with transmission oil and reassemble in reverse order of disassembly, noting the following important points:



WARNER R11 OVERDRIVE CONTROL WIRING

Sun Gear Balk Ring—See that ring installed on gear plate with chamfered side of ring toward slotted hub on plate. Check balk ring friction or drag by lubricating plate and ring with transmission oil and using spring scale hooked to balk ring step. Pull required to turn ring on plate (scale held parallel to step on ring) should be 3½-5½ lbs. (CAUTION—this is pull while turning ring—greater pull may be required to start ring turning).

Stationary Sun Gear Assembly—Install sun gear plate, then install pawl with groove upward, install sun gear plate cover, install retaining ring of correct thickness so that plate held tightly against seat in adapter (this ring furnished .062", .066", .070"), install solenoid (see note below). Engage shift fork in sun gear groove, then install reverse plunger, shift rail, shift fork, and sun gear as an assembly.

Solenoid Installation Note—Insert plunger in adapter with solenoid turned ¼-turn to right or clockwise from normal mounting position, push solenoid in until plunger engages pawl, then rotate solenoid ¼-turn counter-clockwise to lock plunger in pawl, install and tighten solenoid mounting screws.

►*CAUTION—Solenoid terminal screws must be toward rear (toward overdrive case) when installed.*

Planetary Gears & Free-wheel Assembly—Install marked pinion cage assembly retaining snap ring in groove in shaft behind sun gear (CAUTION—If same ring as marked during disassembly not re-installed, use new ring .062" ± .002" thick at this point). After installing pinion and cage assembly and the free-wheel cam assembly, install retaining snap ring in groove in shaft, selecting ring of correct thickness to prevent any endplay of pinion or free-wheel cam assembly on shaft (this ring furnished .062", .068", .074" thick). Install free-wheel rollers in retainer, use rubber band looped around retainer to hold them in place, rotate retainer to left or counter-clockwise so that rollers on lowest point of cam.

Overdrive Case & Drive Shaft—Parts are first assembled in case and then installed as follows:
Assembly—Install lockout lever shaft from within case, turn shaft so that cam on inner end upward, install lever on shaft in overdrive position (nearly against bottom of stop on case. Press rear bearing into case or tap bearing in with brass or fiber drift until bearing seated against forward snap ring (NOTE—if this front snap ring removed, use ring .087" ± .002" thick at this point). Install bearing rear retaining snap ring, selecting ring of correct thickness so that bearing held tightly against front ring (this ring furnished .087", .090", .093", .096" thick). Install new oil seal in rear of case, pressing seal in until shoulder on seal retainer is flush with end of case. Insert speedometer driving gear through front end of case, press or tap front bearing in place in case. Assemble planetary ring gear on drive shaft hub, selecting retaining snap ring of correct thickness so that ring gear has no endplay (this ring furnished .055", .057", .059" thick). Coat bearing and seal surfaces on drive shaft with Lubriplate, install shaft through front end of case (align speedometer gear with finger inserted through rear of case to permit entering shaft). Install universal joint flange, tighten retaining nut to 200-225 ft. lbs. Install governor and speedometer pinion and shaft.

Installation—Work lockout shaft and lever as far as possible out of case, install shift rail retractor spring on end of shift rail, place new gasket on face of adapter. Install case assembly (may be necessary to turn mainshaft to line up pinions and ring gear, or to rotate case slightly to permit shift rail to enter pilot hole in case). Do not attempt to remove rubber band from free-wheel rollers (band will be pushed off by roller race and will be dissolved by lubricant). Install and tighten overdrive case retainer screws (CAUTION—use copper gasket between case and washer on screws having drilled heads—these screws must be secured with lockwire). Push lockout shaft and lever inward to engage shift rail, install tapered retaining pin to lock shaft in position.

►*CAUTION—Universal companion flange nut must be securely tightened (200-225 ft. lbs.) to prevent speedometer drive gear slipping on shaft which would cause faulty overdrive action (this gear drives governor) as well as speedometer fluctuation.*

OVERDRIVE CONTROL: *See "Warner Type R10 & R11 Overdrive Control" data.*

►*WIRING DIAGRAM NOTE—See wiring diagram on this page for connections when installing this R11 Overdrive on previous Packard models.*

TRANSMISSION DISASSEMBLY & REASSEMBLY: *See Packard Transmission data.*

WARNER R10 & R11 OVERDRIVE CONTROL

Ford, 6 Cyl. & V8 Models (1949-51)
Frazer, All Models (1947-51)
①Hudson 6 & 8, All Models (1950-51)
Henry J, 4 Cyl. & 6 Cyl. (1951)
Kaiser, All Models (1949-51)
Lincoln & Cosmopolitan (1949-51)
Mercury, All Models (1949-51)
Nash, All Series (1946-51)
②Packard, All Models (1949-51)
Studebaker, All Models (1947-51)
Willys 4 & 6, All Models (1946-51)
①—With new simplified control system.
②—Cars with "R11" Overdrive only.

►**1941-48 LINCOLN**—*See "1941-48 Lincoln Overdrive Control" for 1941-48 Special R10 control data.*

►CHANGES, CAUTIONS, CORRECTIONS

►**Hudson R10 Overdrive Control Production Change:** Simplified control system described below used only on 1950 and later Hudson cars. 1948-49 cars with R10 Overdrive have same type control used with previous R9 Overdrive. *See "Warner R9 Overdrive Control" for data on 1948-49 cars.*

►**Ford, Lincoln, Mercury Prolonged Shorting-out of Ignition on Kick-down:** See "Ford, Lincoln, Mercury Overdrive" for instructions on installation of insulating strip in solenoid cover.

►**Ford & Mercury Overdrive Production Change (Elimination of Lock-out Switch):** Ford Overdrives (beginning with 1951 production) and Mercury Overdrives (beginning January 1951) do not have any provision for Lock-out Switch and Governor is connected to "A" terminal on Kick-down Switch.

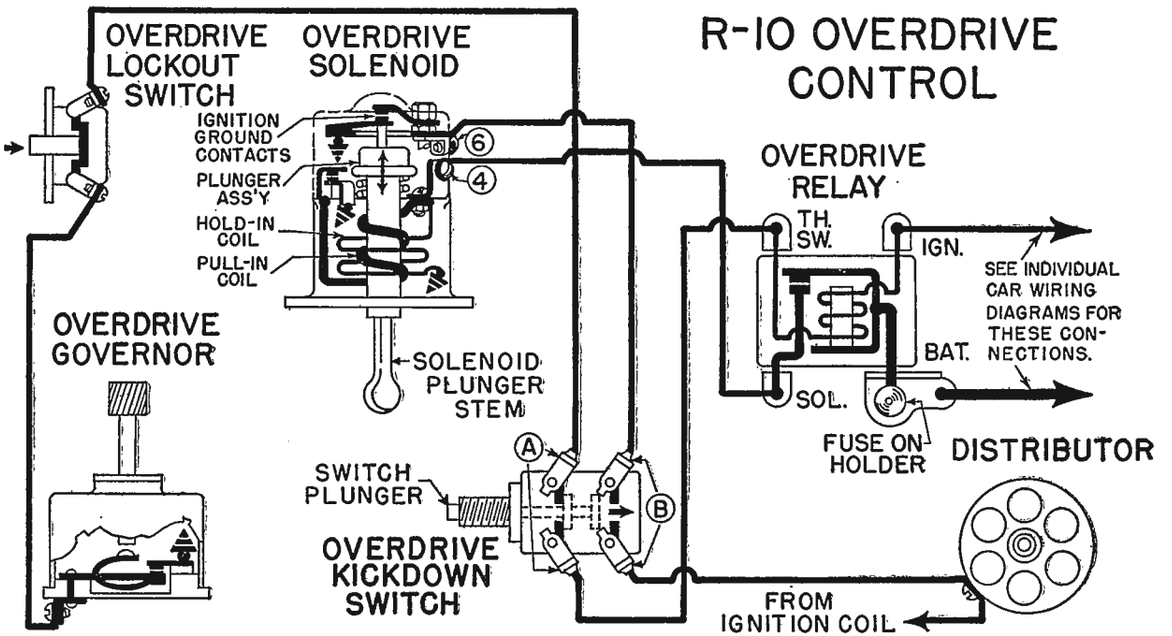
►**Ford, Lincoln, Mercury Overdrive Lock-out Switch Removal:** If Lock-out Switch defective on early overdrive units where this switch installed originally (see Production Change above), both switch wires should be detached and connected together so that switch eliminated from the circuit (CAUTION—wires should be soldered together for good connection and taped for protection from moisture and grease). Leave switch installed to act as cover for switch mounting hole (if switch cannot be used for this purpose, make up sheet metal cover for installation over switch mounting hole).

►**Ford Overdrive Governor Production Change:** First type governor superseded by later type which is interchangeable with first type on all cars except Convertible. Identify governors as follows:
First Type—Unpainted body with Bakelite top.
Later Type—Body painted Black, top unpainted.

►**Overdrive failure to engage or improper cut-in and cut-out speed Correction Caution:** Before replacing governor to correct this condition, make certain that **companion flange nut on rear end of overdrive mainshaft is tight** (looseness of this nut will allow governor drive gear to slip on shaft).

DESCRIPTION: Control units consist of a Governor (cut-in speed controlled by closing of governor contacts, cut-out speed by opening of contacts), Solenoid (solenoid pushes pawl in to engage overdrive, return spring on solenoid plunger pulls pawl out to disengage overdrive). Throttle Kick-down Switch (switch breaks solenoid circuit when accelerator pedal fully depressed causing overdrive to disengage for "kick-down" direct drive), Control Relay, and Lock-out Switch (switch mounted on overdrive case and actuated by control shaft to open governor circuit when overdrive "locked out" by control button on instrument panel.

NOTE—1951 Ford and Mercury (with AS4-R10D Overdrive) do not have Lock-out Switch.



TROUBLE SHOOTING: Failure of the overdrive to operate satisfactorily may be caused by **mechanical** failure (of overdrive unit or control units), or by **electrical** failure (of control units and wiring).

OVERDRIVE DOES NOT ENGAGE

1. Mechanical Causes:

1) Dash control out-of-adjustment or not correctly positioned (control button on instrument panel should be ¼" out with shift lever on overdrive case in extreme rear position).

2) Shift Rail (in overdrive case) binding due to incorrect assembly or housing misalignment.

3) Balk ring faulty or incorrectly installed (may be indicated by spasmodic or harsh engagement). Check balk ring friction drag (see Disassembly data above). Make certain that sun gear plate and balk ring correctly installed with pawl in slot in balk ring (overdrive cannot engage if pawl rides on solid portion of ring).

4) Sun gear pawl broken, sticking or incorrectly installed. Remove solenoid (see Solenoid Testing) and check pawl for free operation.

5) Solenoid plunger sticking. See Solenoid Testing.

6) Governor drive pinion broken, driving gear on overdrive mainshaft loose.

2. Electrical Causes:

1) Fuse blown or open circuit between governor and relay, control wiring incorrect, loose connections or broken wires.

2) Governor, Relay, Lock-out Switch, or Kick-down Switch defective or plunger sticking.

3) Solenoid defective (pull-in or hold-in coil open, pull-in coil contacts sticking open). See Solenoid Testing.

OVERDRIVE DOES NOT DISENGAGE OR NO "KICK-DOWN"

1. Mechanical Causes:

1) Solenoid incorrectly installed (jamming pawl in overdrive position) or solenoid pawl rod sticking. Plunger spring weak or broken.

2) Sun gear pawl sticking, broken, or not properly engaged on pawl rod ball end. Remove solenoid and check pawl for free operation.

2. Electrical Causes:

1) Governor, Relay, or Kick-down Switch defective. Control wiring incorrect. Kick-down Switch out of adjustment.

2) Ignition cut-out or ground wire broken or disconnected (between Solenoid terminal #6 and kick-down switch, or between kick-down switch and distributor or ignition coil).

ENGINE STALLS ON "KICK-DOWN"

1. Electrical Causes:

1) Solenoid defective. Ignition ground contacts sticking closed or grounded.

2) Ignition cut-out or ground wire between Solenoid terminal #6 and kick-down switch.

3) Kick-down Switch defective (ignition cut-out terminals grounded).

ENGINE DOES NOT DRIVE CAR IN OVERDRIVE POSITION (Drives only when Overdrive locked out).

1. Mechanical Causes: Free-wheel clutch rollers broken, roller cage sticking in disengaged position, clutch cam or rollers worn.

OVERDRIVE CANNOT BE LOCKED OUT

1. Mechanical Causes: Dash control cable disconnected or out of adjustment. Shift rail (in overdrive case) binding due to misalignment of overdrive housing).

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WARNER R10 & R11 OVERDRIVE CONTROL (Cont.)

TESTING & ADJUSTMENT OF CONTROL UNITS: Control units should be serviced by replacement.

Governor: Governor should be replaced if operation unsatisfactory or cut-in and cut-out speeds not correct. See CAUTION below before replacing unit.

►***CAUTION—Before replacing governor*** **(if overdrive does not engage, or if cut-in and cut-out speeds not correct, make certain that universal joint companion flange nut on rear end of overdrive driveshaft is tight. Looseness of this nut will allow governor and speedometer drive gears to slip on overdrive shaft.**

Overdrive Control Governor

Car Model	Cut-in Speed (MPH)	Part No.
Ford	26	①Ford No. 8M-6943
Frazer	26.5	K-F No. 200908
Henry J	23.5	K-F No. 212385
Hudson All ②	18.5-21	④No. BZ-165829
Hudson Pacemkr.③	18.5-21	⑤No. BO-164415
Hudson Others③	18.5-21	⑥No. BT-303291
Kaiser ('49-50)	26.5	K-F No. 200908
Kaiser ('51)	26.5	K-F No. 209597
Lincoln & Mercury	26	①Ford No. 8M-6943
Nash	29	⑦Nash No. 311914
Packard	22	⑧Packard No. 418447
Studebaker	31-32	⑨Studebaker No. 520454
Willys	29	⑩Willys No. 643117

①—Auto-Lite No. TGE-4006.
②—Cars without Drive-Master.
③—Cars with Drive-Master (or Supermatic Drive).
④—Auto-Lite No. TGA-4002 (TGA-4005 late '51).
⑤—Auto-Lite No. TGB-4001.
⑥—Auto-Lite No. TGB-4003 superseded by TGB-4004.
⑦—Auto-Lite No. TGE-4001 or TGE-4005.
⑧—Auto-Lite No. TGA-4004.
⑨—Auto-Lite No. TGE-4003.
⑩—Auto-Lite No. TGE-4002 superseded by TGE-4007.

Governor Testing—Governors can be tested by being driven on the bench and the RPM. noted at which the contacts close (on acceleration) and open (on deceleration). Contact closing and opening RPM. should be correct and the difference between these two points must not be less than the "Min. Diff." figure listed in the table below. Parts are not furnished for service and defective governors should be replaced.

►***CAUTION—On some governors, one set of contacts open and second set of contacts close AT THE SAME RPM.***

Governor Specifications

Auto-Lite Model	Contacts: Closing RPM.	Opening RPM.	Diff.
TGA-4001	⑫740	⑪535	80
TGA-4002	⑭740	⑬535	80
TGA-4003	710-770		80
TGA-4004	⑯460	⑮353	63
TGA-4005	740	535	90
TGB-4001, 2	⑰⑲430	⑱300	30
	⑳㉒700	㉑535	80
TGB-4003, 4	㉓㉕430	㉔300	30
	㉖㉘700	㉗535	80
TGE-4001	632	463	90
TGE-4002, 3	800-870	630	90
TGE-4005	740	535	80
TGE-4006	531	410	63
TGE-4007	1055	780	90

⑪—Copper-plated terminal circuit contacts close and cadmium-plated terminal circuit contacts open.
⑫—Copper-plated terminal circuit contacts open and cadmium-plated terminal circuit contacts close.
⑬—Terminal (with 3/16" hole) circuit contacts close and terminal with (5/32" hole) circuit contacts open.
⑭—Terminal (with 3/16" hole) circuit contacts open and terminal with (5/16" hole) circuit contacts close.
⑮—Green Lead circuit contacts close (completing circuit to ground) and Yellow Lead circuit contacts open.
⑯—Yellow Lead circuit contacts close (completing circuit to ground) and Green Lead circuit contacts open.
⑰—Circuit "A" (Terminal "BL" to "Y") and Circuit "C" (Terminal "B" to "Y") contacts.
⑱—Circuit "A" contacts close and circuit "C" contacts open.
⑲—Circuit "A" contacts open and circuit "C" contacts open.
⑳—Circuit "B" (Terminal "R.W" to Ground) and Circuit "D" (Terminal "R" to Ground).
㉑—Circuit "B" contacts close and circuit "D" contacts open.
㉒—Circuit "B" contacts open and circuit "D" contacts close.
㉓—Circuit "A" (Terminal "3" to "1") and Circuit "C" (Terminal "4" to "1").
㉔—Circuit "A" contacts close and circuit "C" contacts open.
㉕—Circuit "A" contacts open and circuit "C" contacts close.
㉖—Circuit "B" (Terminal "2" to Ground) and Circuit "D" (Douglas Terminal to Ground).
㉗—Circuit "B" contacts close and circuit "D" contacts open.
㉘—Circuit "B" contacts open and circuit "D" contacts close.

Solenoid: Various types used as listed below.

►***SOLENOID REMOVAL CAUTION***—**Solenoid must be disengaged from pawl for removal as follows: Take out two mounting capscrews, rotate solenoid clockwise ½-turn to disengage plunger from pawl (will align plunger flats with pawl slot), withdraw solenoid and plunger assembly.**

Overdrive Solenoid

Car Model	Solenoid Part No.
Ford exc. Sta. Wgn. & Convt.	㉙D-R 1118132, 55
Ford Sta. Wgn. & Convt.	㉚D-R 1118138
Frazer	D-R 1118132
Henry J	D-R 1118155
Kaiser	D-R 1118132, 1118155
Hudson	D-R 1118134, 1118147, 1118155
Lincoln & Mercury	㉙D-R 1118132, 1118155
Nash	D-R 1118132, 1118155
Packard	D-R 1118132, 1118155
Studebaker	D-R 1118132, 1118155
Willys	D-R 1118132, 1118155

㉙—Ford Part No. 8M-6916-A.
㉚—Ford Part No. 8A-6916-C (supersedes 8M-6916-A).

Solenoid Testing—Solenoid can be tested on the bench (after removal from transmission) as follows:

Solenoid Winding—Connect battery to solenoid terminal #4, ground other battery terminal to solenoid mounting flange (meters can be used to check winding current draw—see specifications below). With solenoid energized, solenoid pawl rod should move out and hold in the outward position. If pawl does not move out, coils are defective. If pawl chatters, hold-in coil is defective.

Ignition Grounding Contacts—With solenoid energized as for coil test (above), connect test lamp between battery terminal and solenoid terminal #6. Lamp should light indicating that ignition ground contacts are closed. Disconnect battery lead at solenoid #4 terminal. Pawl rod should snap in and test lamp should go out (indicating that ignition ground contacts have opened).

Solenoid Specifications
(Delco-Remy No. 1118132, 34, 38, 47, 55)

Current Draw (Both Coils)—26.2-28.4 amperes at 5 volts.
Current Draw (Hold-in Coil—Pawl rod in Overdrive Position)—1.2-1.4 amperes at 5 volts.
Contact Opening (on case and coil assy.)—.022-.040" with plunger against stop.

Control Relay: All relays are single unit type.

Car Model	Control Relay Part No.
Ford (all models)	Ford No. 8M-6915
Frazer & Kaiser	Auto-Lite HRT-4001, 4001A
Henry J	Auto-Lite HRT-4001
Hudson	①Hudson No. BT303107
Lincoln & Mercury	L-M No. 8M-6915
Nash	Auto-Lite HRT-4101
Packard	RBM. Model 3600-2
Studebaker	Auto-Lite HRT-4001
Willys	Auto-Lite HRT-4001

①—New single unit type with fuse mounted on side

Control Relay Specifications
(Auto-Lite HRT-4001, 4001A, 4101)

Contacts Close—4.0 volts maximum. Adjust by bending lower spring hanger to change armature spring tension.
Contacts Open—.6-1.0 volt. Adjust by varying height of stationary contact (these relays designed to open slowly).
Contact Gap—.015" minimum.
Air Gap—.031-.034" with contacts open. Adjust by bending armature stop.

Throttle Kick-down Switch: Switch is mounted so that switch plunger is actuated by accelerator pedal or by throttle linkage (contacts plunger in wide open position, additional movement of pedal actuates switch by depressing plunger).
Adjustment—Loosen locknut on threaded switch stem, turn switch up or down so that accelerator pedal (or linkage) just contacts switch plunger with accelerator linkage and carburetor throttle valve in wide open position. Make certain that accelerator pedal has sufficient additional travel to actuate switch.

Lock-out Switch: Does not require adjustment. Switch contacts should be open (governor circuit broken) when overdrive locked out by pulling out button on instrument panel, and contacts should be closed when button pushed in for overdrive operation.

Overdrive Fuse: In cartridge type holder or on fuse block attached to control relay on all cars.

Fuse Capacity

Ford	30 amperes
Frazer, Henry J, Kaiser	20 amperes
Hudson	30 amperes
Lincoln & Mercury	30 amperes
Nash (1949 & earlier)	20 amperes
Nash (1950 & later)	30 amperes
Packard	30 amperes
Studebaker	20 amperes
Willys	20 amperes

BUICK DYNAFLOW DRIVE

Series 40 & 50 (1949-51)—Optl.
Series 70 (1948-51)—Std.

►CHANGES, CAUTIONS, CORRECTIONS

►**TRANSMISSION IDENTIFICATION (For Production Change & Parts Interchangeability Data):** Serial No. (first cars) or Identification No. (later cars) stamped on bottom face of transmission case on left side directly to rear of High Accumulator.

IDENTIFICATION NO. CAUTION—Where identification number used instead of serial number (prefix C, D, E and later), the **number following this letter (1, 2, 3, etc.) indicates manufacturing date and production changes** and is not a serial number.

	Serial Numbers
1948 & Early 1949 Series 70	A-1 to A-98355
Early 1949 Series 50	B-1 to B-52325
	Identification No.
Late 1949 Series 50	D-1, 2, 3 etc.
Late 1949 & 1950 Series 70	C-1, 2, 3 etc.
1950 Series 40 & 50	E-1, 2, 3 etc.
1951 Series 40 & 50	F-1, 2, 3, etc. & H-1, 2, 3 etc.
1951 Series 70	G-1, 2, 3 etc. & J-1, 2, 3 etc.

►**1951 BAND ADJUSTMENT CAUTION:** Floor pan openings not provided and bands cannot be adjusted on the car (transmission must be out of the car for access to band adjustment screws).

CAUTION—Bands on 1951 cars must be properly adjusted BEFORE transmission installed in car.

►**ENGINE & TRANSMISSION VIBRATION CORRECTION (When Repl. Crankshaft or Flywheel Installed):** If vibration due to change in balance by installation of new parts, correct by installing balance weights on primary pump cover. *See instructions at end of TRANSMISSION INSTALLATION data.*

►**STARTING ENGINE BY TOWING OR PUSHING CAR:** On Dynaflow cars, place control lever in neutral "N" position until car reaches a speed of 15 MPH. and then move lever to "L" position, or when car reaches a speed of 30 MPH. move lever to "D" position, to crank engine. Place lever in neutral "N" position to warm up engine.

►**USE OF EMERGENCY LOW FOR ADDITIONAL BRAKING ON GRADES:** Car speed should be reduced to below 40 MPH. before control lever is moved from Drive "D" to Low "L".

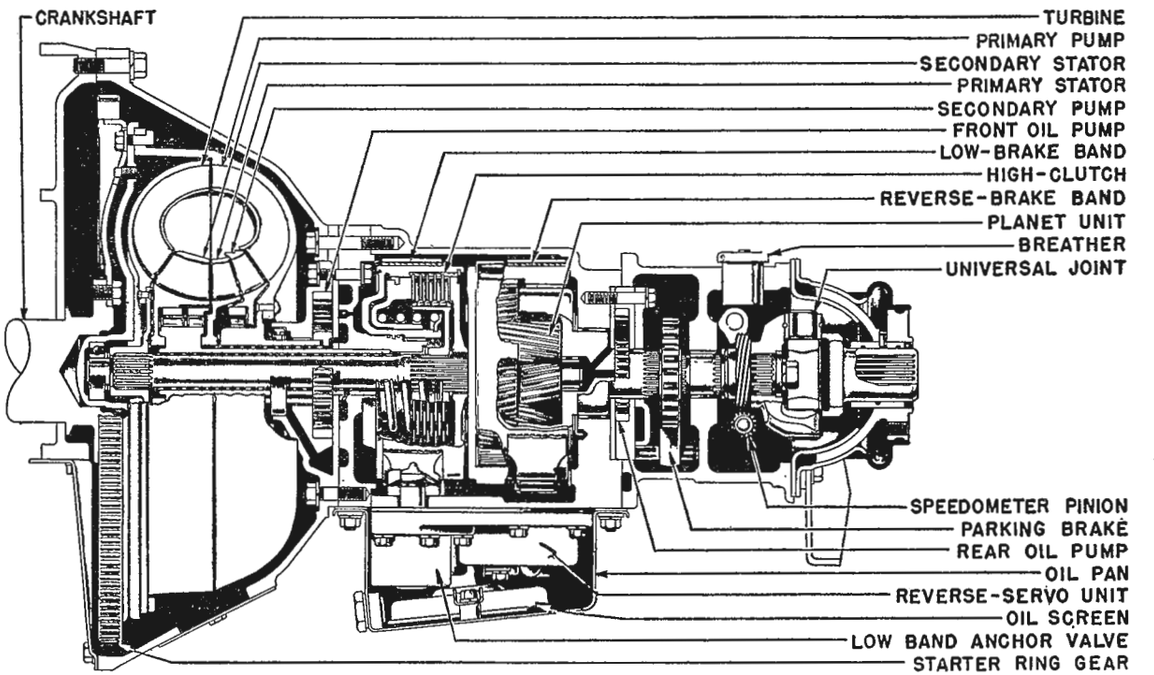
►**TOWING DYNAFLOW CARS:** If Dynaflow Drive disabled, **car must not be towed with control lever in any driving range.** Car can be towed with lever in Neutral "N" position only at speeds **under 30 MPH.** but long distance tows not recommended.

Neutral Safety Strap Installation—Can be installed over shift lever to lock transmission in neutral for towing when neutral position cannot be obtained or held by means of regular transmission control.

►**FRONT OIL PUMP & RELATED CHANGES (Beginning Trans. No. A-56000 & B1):** New cast iron type pump cover (and shorter heavier pump body with two locating dowels) supersedes previous type with recessed steel cover. **When installing this new cast iron pump cover to replace recessed steel cover, install all related parts as follows:**

Converter Primary Pump—New **shorter** primary pump must be used with cast iron pump cover. Can be identified by length of 1 13/16" from FLAT face of flange to end (first type 1⅞" from STEP on flange to end).

Reaction Shaft Flange—New ⅛" longer studs must be used with cast iron pump cover. These longer studs can be used with recessed steel cover (added length will not cause interference). First type Reaction Shaft Flange can be used by installing new square head bolts. See Reaction Shaft Bolt change.



BUICK DYNAFLOW DRIVE

►**FRONT PUMP INTERCHANGEABILITY:** Only new heavier pump body (see above) furnished for service in two types for all installations:

1) **Without Dowels and Dowel Holes**—Use with first type recessed steel pump cover.

2) **With Dowels**—Use with new cast iron pump cover.

►**REACTION SHAFT FLANGE BOLT CHANGE (Beginning Trans. No. A-86000 & B-29000):** First type pump mounting studs with welded nuts superseded by square head bolts. Bolts can be installed to replace studs by running a 5/16" drill through the tapped stud holes, reaming holes to 21/64", and pressing in new square head bolts.

CAUTION—Holes must not be reamed oversize and flange must be supported when pressing bolts in. **Bolts must be press fit in flange.**

►**REAR OIL PUMP CHANGE (Beginning Trans. No. A-36000 & B-1):** Pump changed from separate body-and-cover design to one-piece integral type. **This new one-piece pump can be used to replace original type.**

►**VALVE & SERVO BODY CHANGES:** ***Three types used in production and for leakage corrections:***

1) **Trans. No. A-1 to A-2999**—Has been replaced by second type (following) as service correction for oil leaks. **Install second type Valve & Servo Body with second type Anchor Piston whenever this first type removed for any reason.**

CAUTION—Change transmission number by adding "-3" to number when above parts installed.

2) **Trans. No. A-3000 to A-41999**—May be identified by added ribs, change of left center bolt to a stud, adding of stud at center lower flange, and adding of boss and screw on lower flange. These changes require change in spacer plate and gaskets, and longer bolts where ribbing added. Low Band Anchor Piston changed from servo body spacer plate to transmission case (diameter of holes in spacer plate and gasket increased) and width of piston top land increased.

3) **Trans. No. A-42000 & B-1 Up**—New type which can not be installed in earlier transmissions due to changes in transmission case. May be identified by change of left center stud back to a bolt (same as 1), addition of bolt and copper washer in center, and Allen head screw added between low band anchor and reverse servo pistons.

NOTE—Beginning Trans. No. C-5, D-5, E-5; servo body spacer plate upper gasket changed due to change in case at reverse band anchor (see Reverse Ring Gear and Reverse Anchor Change Note).

►**OIL PAN & OIL SCREEN CHANGES:** First type oil screen and integral suction pipe superseded by **separate** screen and suction pipe beginning Trans. No. C-1 & D-1. **New type screen can be used to replace**

CONTINUED ON NEXT PAGE

BUICK DYNAFLOW DRIVE (Cont.)

earlier type and has rubber grommet at center for snug fit on suction pipe. New type suction pipe has cork gasket and coil spring for sealing.

New Oil Pan & Filler Pipe (Beginning Trans. No. C-2 & D-2): Pan has filler pipe extending forward on right side of car so that oil level can be checked and oil added from under-hood. This pan and oil filler can be installed on early cars if second type oil screen and separate suction pipe also used.

CAUTION—Filler pipe connecting hose is **neoprene** type marked by red stripe to prevent confusion with regular hose used between thermostat housing and water pump.

►**TRANSMISSION CASE CHANGES:** ***Various types used which are interchangeable only when other changes made as follows:***

1) Beginning Trans. No. A-42000 & B-1—Two tapped holes added for additional valve and servo body bolts (see 3rd. type Valve & Servo Body data above).

2) Beginning Trans. No. C-2 & D-2—Oil filler base removed (used with new oil pan having extended under-hood filler pipe). See Oil Pan Changes.

3) Beginning Trans. No. C-5, D-5, E-5—Transmission case openings changed to fit new forged type reverse band anchor. See Reverse Band Anchor Changes (following).

►*TRANSMISSION CASE REPLACEMENT CAUTION*—Only latest type case (3 above) furnished for service. May be used with either 2nd. or 3rd. type Valve & Servo Body but **must be used with new type Oil Pan & Under-hood Filler Pipe and forged type Reverse Band Anchor.**

►**REVERSE RING GEAR CHANGE (Beginning Trans. No. A-42275 & B-1):** Separate front thrustwasher eliminated and reverse ring gear width increased 1/16" to compensate for this thickness. First type Narrow Ring Gear (2 11/16" overall) **must never be used without thrustwasher.** Later type Wider Ring Gear (2 3/4" overall) can be used in earlier transmissions by discarding original thrustwasher but **thrustwasher must never be used with this wider ring gear.**

►**REVERSE BAND ANCHOR CHANGE (Beginning Trans. No. C-5, D-5, E-5):** New one-piece forged anchor superseded previous two-piece type and is used with new band which has full width ends. These new parts require use of new transmission case with enlarged opening and new servo body spacer plate upper gasket (see Transmission Case Changes above).

►***REVERSE ANCHOR REPLACEMENT CAUTION—It is recommended that forged type anchor be used to replace earlier type whenever transmission disassembled for any reason.*** Forged type anchor may be used with early type narrow-end reverse band but **transmission case must be altered as directed below.** NOTE—only forged type Reverse Anchor and corresponding type Reverse Band and Transmission Case furnished for service.

Transmission Case Alteration (for installation of Forged Reverse Band Anchor)—Remove solid web between two reverse anchor openings in case by cutting grooves approximately 1/32" deep with a chisel (leave semi-circular area around hole near edge of new opening—anchor has notch to clear this area) between the openings and then knocking out web by tapping on center with hammer. File all edges to remove burrs and ridges. (CAUTION—keep chips and filings out of case). Check to see that operating lever works freely between ears on anchor and that servo body spacer plate screws are securely tightened.

CAUTION—On Trans. No. A-1 to A-2999, install second type Valve & Servo Body when making above changes.

►**LOW ACCUMULATOR SPRING & CAP CHANGE (Beginning Trans. No. C-5, D-5, E-5):** See illustration for latest type springs and cap used to provide softer engagement of Low Band and smoother Low Range Shift. **These new parts can be used to replace earlier type parts.**

►**PRIMARY PUMP COVER & FLYWHEEL BOLT CHANGE:** Various types used as listed below and **all primary pump-to-cover bolts must be of same length and installed in same locations as originally to maintain converter balance.**

1) Trans. before No. C-3, D-3, E-3—Short bolts (15/16") used without balance weights and where balance weights thin enough to allow full thread engagement, longer bolts (1 5/32") used with thick balance weights.

2) Trans. beginning No. C-3, D-3, E-3—All bolts 1 5/32" (same bolts as used to attach converter to flywheel).

3) Trans. beginning No. C-4, D-4, E-4—New nuts 21/64" thick used (supersedes 17/64" nuts). Only these new thicker nuts furnished for service.

CAUTION—New 21/64" nuts cannot be installed individually. If one nut used to replace earlier 17/64" type, REPLACE ALL NUTS.

4) Trans. F-261 through F-265 & G-261 through G-265. Special nuts used on these transmissions (trial run) can be identified by the slotted portion being turned down leaving hexagonal portion below the slots.

CAUTION—If any of these nuts replaced by regular production type nut, the nut diametrically opposite should also be replaced to maintain proper balance.

5) Trans. beginning F-341 & G-341. New type Primary Pump and Cover assemblies used with only 15 bolts and nuts (12 for cover-to-pump and 3 for pump-to-flywheel).

See Reassembly data for nut tightening sequence.

►**LOW BAND ANCHOR PISTON PRODUCTION CHANGE (Beginning Trans. No. E-9 & C-9):** Anchor piston not used on these and later transmissions and band strut is anchored by a shaft in the transmission case. ***Disregard all Low Servo Anchor Piston data (in Valve & Servo Body Disassembly & Assembly section) when working on these later transmissions.***

►**HIGH CLUTCH PISTON PRODUCTION CHANGE (Beginning Trans. No. F-164 & G-164):** New High Clutch Piston with redesigned ball check valve (ball changed to opposite side of piston, relief hole enlarged, relieved area provided on face of piston for oil discharge). This later type piston, Part No. 1343578, is interchangeable with previous type and will be furnished for service for all transmissions.

►**SECONDARY PUMP PRODUCTION CHANGE (Beginning Trans. No. F-168 & G-176):** New secondary pump assembly with cast boss which bears directly on primary pump hub (eliminates thrust washer used at this point with previous type pump). This new Secondary Pump, Part No. 1341727 (40, 50), 1341725 (70), is interchangeable with previous type and will be furnished for service replacement for all transmissions.

CAUTION—Thrust washer must be discarded when this later type Secondary Pump used to replace first type.

►**PRIMARY PUMP PRODUCTION CHANGE (Beginning Trans. No. F-341 & G-341):** New design Converter Primary Pump and Cover assemblies (has "O" sealing ring in place of flat gasket and chamfer on inside corner of cover mounting flange for this ring) provides more positive seal against oil leakage. **New and previous type covers are not interchangeable** and new type can be identified by having only 15 assembly bolts.

►*PRIMARY PUMP REPLACEMENT CAUTION*—New type Primary Pump only will be furnished for service replacement and **whenever pump replaced, new type Cover, Seal, and related parts must be installed also.** First type Cover will be furnished and can be replaced separately on cars having previous type primary pump. New type Primary Pump and Cover require different installation instructions and clearance shimming data (see Reassembly data).

►**HIGH CLUTCH PLATE PRODUCTION CHANGE (Series 70 Trans. Beginning No. G-310):** New internally splined clutch plates used which are not interchangeable singly with previous type plates. These new plates may be identified by facing material (on one side, outer diameter faced with cork, inner diameter with "Krafelt"; on opposite side, outer diameter faced with "Krafelt", inner diameter with cork).

►*REPLACEMENT CLUTCH PLATE CAUTION*—Above type plates not furnished for service at this time. If replacement of plates required, **install entire pack of regular service internally and externally splined clutch plates.**

►**PARKING LOCK APPLY SPRING CHANGE (Beginning Trans. No. A-11064 & B-1):** New 3-coil type spring used (supersedes earlier 2-coil type). New spring requires new parking lock operating lever assembly with 1/16" longer spring step. Only the new 3-coil spring is furnished for service.

►*PARKING LOCK REPLACEMENT CAUTION*—Manufacturer recommends that new 3-coil spring be installed on early cars whenever it is necessary to repair parking lock pawl. **New Parking Lock Operating Lever (with 1/16" longer spring step) must also be installed when spring changed.**

DESCRIPTION

The Dynaflow Drive consists of: (1) Torque Converter Assembly mounted directly on the flywheel in the bell housing, and (2) Planetary Gear Unit mounted in the transmission case directly behind the torque converter. Torque Converter action is entirely automatic while the Planetary Unit is controlled by the driver through a Control Lever on the steering wheel (provides Emergency Low, Reverse, Neutral, and Parking—see Operation below). The operation and control of the transmission is through hydraulic system for which oil pressure is supplied by two oil pumps built in the transmission (forward pump in recess in rear face of bell housing, rear pump in recess at rear of transmission case). An oil cooler on the side of the transmission case maintains oil at operating temperature.

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BUICK DYNAFLOW DRIVE (Cont.)

Torque Converter Description: Torque converter consists of the five independent rotating members listed and the operation of the unit varies in accordance with car speed and load conditions as described below (transition from one type of operation to another is gradual so these phases should not be considered as distinct "steps").

(1) Primary Pump (Driving Member). Integral with rear half of case bolted directly on flywheel. Pump is positively driven by the crankshaft at engine speed at all times.

(2) Turbine (Driven Member). Splined on converter shaft and transmits drive to transmission.

(3) Secondary Pump. Mounted on primary pump hub with overrunning "free-wheel" clutch which allows this pump to rotate faster than primary pump when unit is operating as a torque converter.

(4 & 5) Primary & Secondary Stators. Mounted on stationary "reaction" shaft (tubular shaft fixed in transmission case) with overrunning "free-wheeling" clutch in each stator hub. Stators are locked or held stationary when unit is operating as a torque converter (reaction members) but free-wheel when torque multiplication not required.

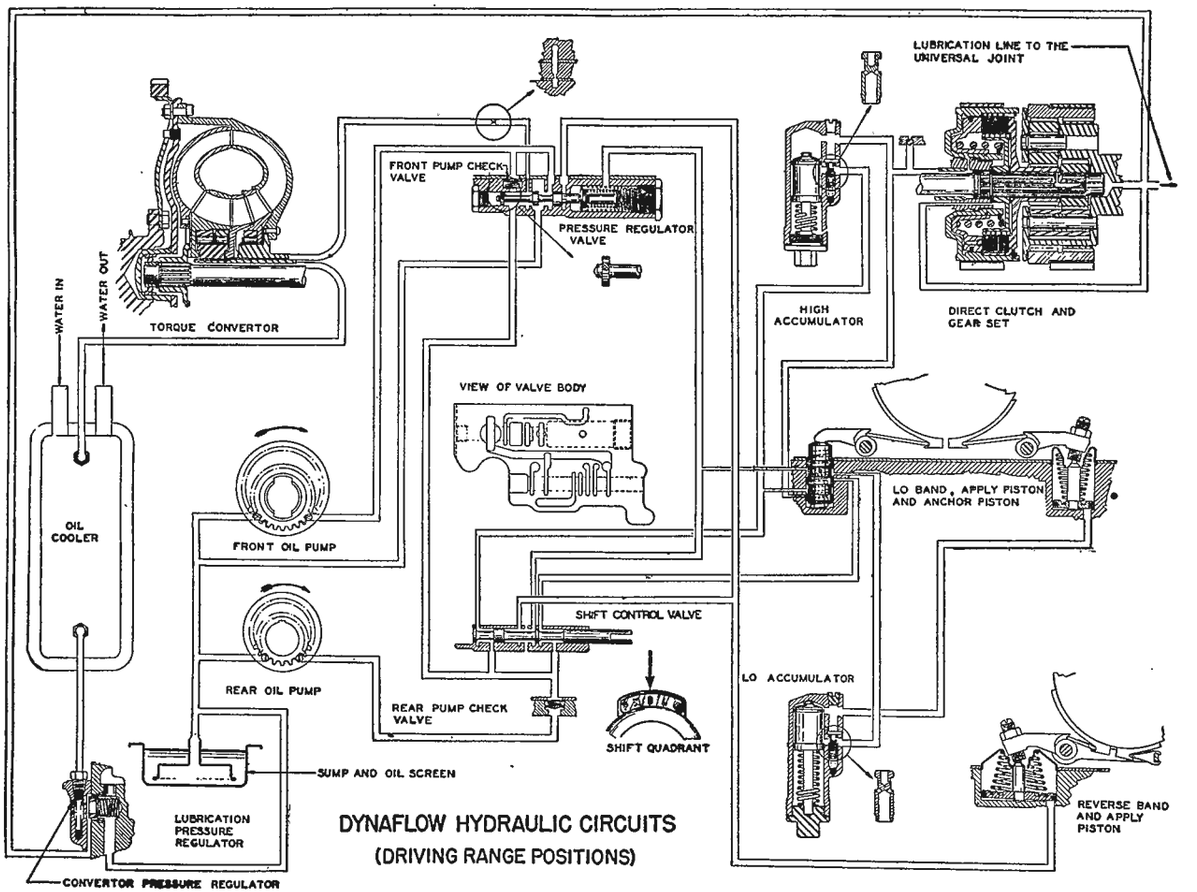
Planetary Unit Description: Planetary unit consists of parts listed below. Operation of unit depends on the position of the Shift Control Valve (linked to control lever on steering column) which directs application of hydraulic pressure in the planetary unit hydraulic mechanism as described below.

(1) Sun Gears—Consist of two gears in tandem on drive (input) shaft. Front Sun Gear (Low Range Reaction Gear) is integral with the Direct Drive Clutch (locked to shaft when clutch engaged) and meshes with the Reverse Planet Pinions. Rear Sun Gear (Reverse Sun Gear) is splined on the drive shaft (acts as driving gear for Low & Reverse) and meshes with the Low Planet Pinions.

(2) Planetary Pinions—Consist of three Reverse Planet Pinions (larger short gears) and three Low Planet Pinions (smaller long gears) mounted alternately on the Planet Carrier and all meshing together. The Reverse Planet Pinions mesh with the forward sun gear (Low Range Reaction Gear) and with the Reverse Gear (large internal gear controlled by the Reverse Brake Band). The Low Planet Pinions mesh with the rear sun gear (Reverse Sun Gear). The Planet Carrier is integral with the output shaft.

(3) Low Range Drum & Clutch—Mounted on drive shaft in front of the planetary pinion. Inner clutch member is splined on drive shaft and rotates with the shaft. Outer clutch member incorporates the Low Range drum and front sun gear (Low Range Reaction Gear) as well as the clutch engaging hydraulic piston and disengaging spring. Clutch engagement is controlled by the High Accumulator which permits rapid initial movement and smooth final engagement. A ball check valve is built in the clutch piston to insure complete draining of oil from the chamber when clutch disengaged for Reverse and Neutral. Check valve is positively closed by contact between ball and steel clutch plate when clutch engaged.

(4) Low Range Brake Band & Engaging Mechanism—Band holds Low Range Drum and front sun gear (Low Reaction Gear) stationary when it is applied by the servo "apply" piston acting through the lever and strut engaging one end of the band (servo action is controlled by the Anchor Piston and "Lo" Accumulator). This action requires a boosted oil pressure of 180 lbs. (normal pressure 90 lbs.) which is secured by boosting the Pressure Regulator Valve spring pressure hydraulically. Low Range operation also requires that the clutch be disengaged and this disengagement is secured by opening the clutch pressure line (Anchor Piston acts in conjunction with Shift Control Valve).



BUICK DYNAFLOW DRIVE HYDRAULIC CIRCUIT—DRIVING RANGE POSITION

(5) Reverse Brake Band & Engaging Mechanism—Band holds Reverse Gear (internal gear) stationary when it is applied by the servo "apply" piston acting through the lever and struts engaging both ends of the band.

Oil Pumps & Hydraulic Control System: See the Hydraulic Circuit illustration for details of Dynaflow control units. These units operate as follows:

Front Oil Pump—This pump is driven by the engine and is of large capacity to provide necessary pressure and volume of oil for starting, low speed, and reverse operation. At car speeds above 45 MPH., rear pump takes over and front pump idles (oil bypassed back to suction side through oil pressure regulator). A check valve in the pump delivery line prevents oil bleeding back through the idling pump.

Rear Oil Pump—This pump driven from output shaft (driven by rear wheels when car pushed or towed) to operate direct drive clutch and fill torque converter when front pump not operating. Acts in conjunction with front pump at speeds below 45 MPH. and supplies all oil at speeds above 45 MPH. when front pump idles.

Pressure Regulator Valve—Controls pressure in main oil supply line (see Converter & Lubrication Pressure Regulator below) and limits pressure to 90 lbs. (80-90 lbs.) except when pressure boosted for Low Range operation. This boost is effected by supplementing regulator spring pressure with hydraulic pressure (acting on regulator stem piston) which increases pressure in system to 180 lbs. (160-180 lbs.).

Converter & Lubrication Pressure Regulator—Converter is filled with oil from metering orifice in Pressure Regulator Valve and returns to the oil sump through the Oil Cooler and Converter Pressure Regulator which maintains pressure in this circuit

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BUICK DYNAFLOW DRIVE (Cont.)

at 50 lbs. Oil is bled from this circuit at the regulator for lubrication of the transmission units (front oil line for Low Range Drum Bushing and Clutch Plates, rear oil line for Transmission Rear Bushing, Planetary Gears, Rear Bearing Retainer Bushing, and Universal Joint). Pressure in the lubrication circuits is maintained at 15 lbs. by the regulator.

Shift Control Valve—This valve is controlled by lever on steering wheel and directs oil flow for planetary unit operation (see Planetary Unit Operation above).

OPERATION

Dynaflow Drive Torque Converter automatically provides a torque multiplication ranging from an equivalent gear reduction of 2.24-2.4 to 1 (for Starting, Heavy Loads, and Acceleration) to an equivalent "High" 1 to 1 ratio (for Light Loads and Steady Driving when torque converter acts as a simple Fluid Coupling). The Planetary unit is controlled by the driver and provides definite gear ratios (in addition to the varying ratio of the torque converter) depending on the control lever position as follows:

Drive Range ("D" Lever Position)—Bands are released and clutch is engaged. This locks the front sun gear to the drive shaft, and as rear sun gear is splined on the drive shaft, no rotation of the gears is possible (both gears meshed with reverse pinions and tend to rotate pinions at two different speeds). The entire planetary gear assembly turns as a unit and the output shaft rotates at the same speed as the input shaft with resultant gear ratio of 1-1.

Low Range ("L" Lever Position)—Low Range Band is applied and clutch is disengaged (band holds front sun gear stationary). Drive shaft turns rear sun gear which meshes with Low Planet Pinions, and as these pinions also mesh with the Reverse Pinions which mesh with the stationary front sun gear, the reverse pinions "walk" around the sun gear rotating the Planet Carrier and output shaft in the **same direction as input shaft but at slower speed** to provide a gear reduction of 1.82-1.

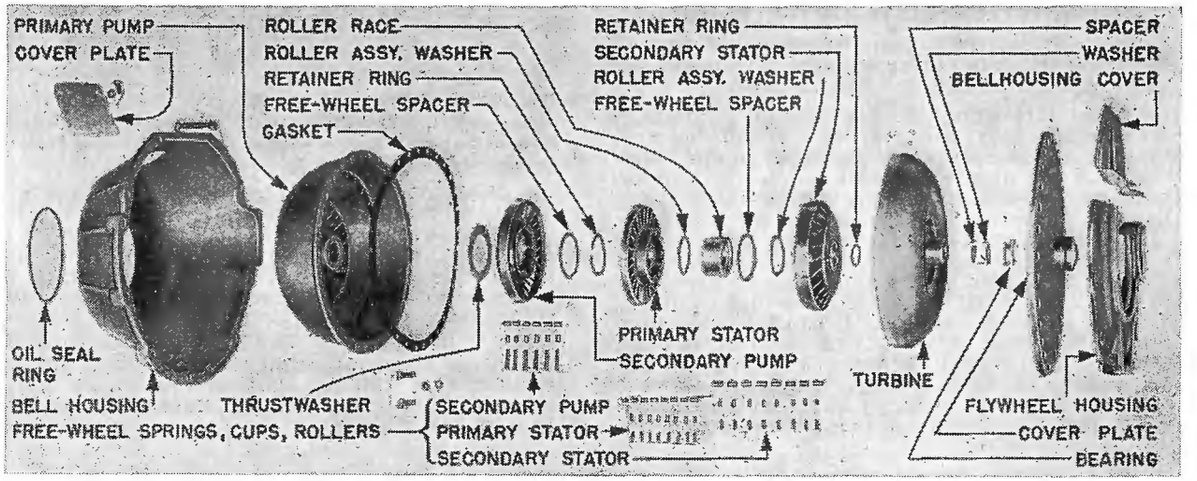
Reverse ("R" Lever Position)—Reverse Band is applied and clutch is disengaged (band holds internal Reverse Gear stationary). Drive shaft turns rear sun gear which meshes with Low Planet Pinions, and as these pinions also mesh with the Reverse Pinions which mesh with the stationary internal gear, these Reverse Pinions move around the gear in a direction opposite to their direction of rotation, rotating the Planet Carrier and output shaft in **opposite direction to input shaft and at slower speed** to provide a gear reduction of 1.82-1.

Neutral ("N" Lever Position)—Both bands are released and clutch is disengaged. With all gears free to spin, no power is transmitted through the planetary unit and output shaft is stationary.

Parking Mechanism Operation: Control lever is linked to a stationary pawl anchored in the transmission case. Moving lever to park "P" position, engages pawl with ratchet wheel splined on output shaft in bearing retainer housing at rear of transmission and locks the drive shaft.

LUBRICATION

Check oil level and add oil as required at 1000 mile intervals, drain and refill at 15000 mile intervals.



DYNAFLOW DRIVE TORQUE CONVERTER & BELL HOUSING

►***CAUTION—Oil must be warm and engine must be idling when checking oil level, warm up oil before draining.***

Checking Oil Level: With oil warm and engine idling with control lever in Parking "P" position, check oil level as indicated on oil level rod in filler hole (see locations below). If level more than 1" below "FULL" mark, add recommended oil to bring level up to FULL mark on rod. Distance between upper FULL mark on rod and the lower LOW (1948-49), ADD OIL (1950 & Later) mark is 1" or equal to approximately 1 pint of oil, oil level must never be above "FULL" mark.

►***CAUTION—If oil level is consistently low when checked (indicating loss of 1 pint or more per 1000 miles), check transmission thoroughly for oil leaks.***

►**Oil Gauge Rod Location**—Changed during 1949:

1948 & Early 1949 Cars—On right side of transmission case under front floor, accessible by lifting floor mat and removing floor pan cover.

Beginning Late 1949 Cars—In engine compt. between battery and engine, accessible by lifting right side of hood.

►***CAUTION—Do not confuse Dynaflow Oil Gauge Rod with Engine Oil Gauge Rod located near this same point.***

Draining & Refilling: With oil warm, drain transmission case by removing drain plug in oil pan, drain torque converter, after removing bell housing cover for access to drain plugs, by loosening one plug and turning converter until second plug is downward and removing this plug. Re-install and tighten all drain plugs. Install 3 quarts of recommended oil through filler opening in case. Start engine and allow it to idle with control lever in Parking "P" position, add additional oil to bring level up to point 1¾" below "FULL" mark on oil gauge rod. Recheck oil level after transmission warmed up. Oil level should then be at full mark on rod.

►***CAUTION—DO NOT FLUSH transmission when changing oil.***

Capacity—(40, 50) 8½ qts. (70) 10 qts. *NOTE*—1¾ pints additional required if transmission completely dry (after overhaul etc.).

Recommended Oil—Use only "Special Buick Oil for Dynaflow Drive" or "Automatic Transmission Fluid, Type A" with AQ-ATF number embossed on can.

LINKAGE ADJUSTMENT

LINKAGE ADJUSTMENT: Adjust all units in order and exactly as follows:

Manual Control Linkage: Transmission must be thoroughly warmed up (driven approximately 20 miles under traffic conditions with frequent starts and stops) and oil level must be correct. Then proceed as follows:

(1) Place shift control level in Neutral "N" with detent plunger centered in detent notch, move lever until stop pin is against stop in dial housing, note movement of dial pointer. Repeat this operation in Low "L" position. Dial pointer movement should be approximately equal in both positions. If not, loosen control detent mounting bolts on steering column jacket, shift detent until dial pointer travel is equal. Place lever in Low "L" position, carefully bend dial pointer, if necessary, so pointer is in line with "L" on dial.

(2) Check parking mechanism by placing car on ramp or steep grade with control lever in Parking "P". Parking lock should hold securely. Place control lever in Neutral "N" and allow car to roll. If "clicking" ratchet noise heard, or if parking lock did not hold car on grade, adjust as follows: Place control lever in Parking "P" position, disconnect shift rod from shift idler lever on steering column, pull forward on rod and move car slightly to make certain locking pawl fully engaged (CAUTION—do not jerk on rod). Check movement at lower end of shift lever on left side of transmission case by pressing forward on lever (against spring tension) until definite stop is felt. This movement should be 1/8-3/16" beyond the parking "P" position. If spring travel not within these limits, control valve is out of adjustment (requires removal of torque ball). If spring travel correct, pull shift rod forward against stop, adjust shift rod clevis until clevis pin can just be entered in hole in idler lever with control detent engaged in

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BUICK DYNAFLOW DRIVE (Cont.)

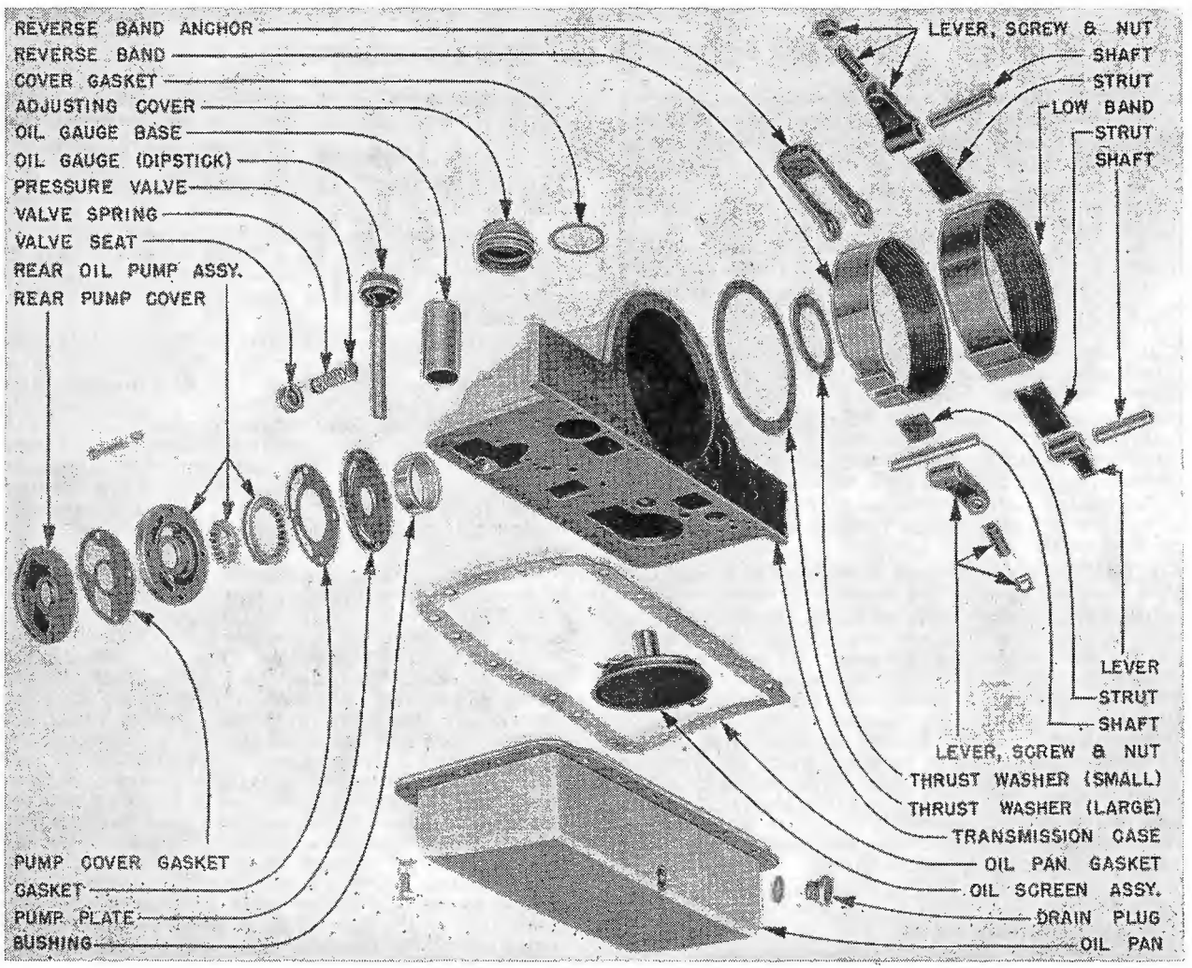
Parking "P" position, then **lengthen rod by unscrewing clevis 3 full turns,** connect rod temporarily (may require readjustment in next step).

(3) Place shift control lever in Neutral "N" position with detent fully engaged, install Shift Control Linkage Adjustment Gauge No. J3085 on dial housing with line under "N" centered on dial pointer. With transmission warm and engine idling at 600 RPM., move control lever from Neutral "N" to Drive "D" position slowly. Clutch should engage (noted by immediate decrease in engine speed) when tip of dial pointer is behind long gauge mark midway between "N" and "D" on speed ratio dial (width of mark is allowable variation in shift point). Move control lever from Drive "D" to Neutral "N" position slowly. Clutch should disengage (noted by immediate increase in engine speed) when tip of pointer is behind midway mark on gauge. If clutch engagement and disengagement points not correct, readjust clevis on shift rod at shift lever (see (2) above), being careful not to disturb Parking adjustment. Do not connect shift rod permanently until adjustment (4) completed.

►*CAUTION—When making above adjustment, do not change shift rod length so much that parking lock fails to hold or pawl contacts ratchet wheel in Neutral (check as directed in (2) above).*

(4) Check operation in Low "L" and Reverse "R" positions. Detents should be engaged and shift points should occur when tip of dial pointer is directly behind mark midway between "D" & "L" (Low), midway between "L" & "R" (Reverse). If shifts do not occur at correct points, check for bent transmission shift lever, bent valve operating upper lever, or lever loose or incorrectly seated on shaft.

(5) After above adjustments completed, tighten clevis nut on shift rod clevis and permanently install clevis pin with plain washer and spring washer on each side of clevis.



TRANSMISSION CASE, REAR OIL PUMP, & SERVO BAND ASSYS.

►*CAUTION—Neutral Safety Switch and Back-up Light Switch must be checked after changing control detent and shift rod adjustments.*

Throttle Linkage & Dash Pot—Must work freely and smoothly. *See adjustment data under "Carburetor" on Buick car model pages.*

Starter Vacuum Switch: If operation not correct after carburetor linkage and dash pot adjustments made, *See "Stromberg Starter Switch" and "Carter Car Starter" in Electrical Equipment Section for checking and adjustment of these switches.*

Neutral Safety Switch: Located on control lever linkage at lower end of steering column and connected in starter control circuit so that starter operative only with Dynaflow control lever in Neutral "N" or park "P" position. Switch should be closed in neutral and should remain closed until lever moved toward Drive position enough to move outer end of control lever pointer 5/32" (if switch opens with less than ⅛" pointer travel, starter may not operate in neutral; if more than 3/16" pointer travel required to open switch, starter may operate in Drive "D" position and cause starter to move car). Check and adjust switch as follows:

Checking Neutral Switch—Ground coil terminal on distributor so that engine can be cranked without starting. Firmly set parking brake. Place Dynaflow control lever in neutral "N" position (check to see that detent firmly engaged). Install Shift Control Linkage Adjustment Gauge J3085 on dial housing so that short line under "N" is centered on dial pointer. Move control lever to Driving "D" position, turn ignition on, depress accelerator pedal to close starter vacuum switch. Move control lever slowly from "D" toward "N", note position of center of dial pointer at instant starter begins to operate, release accelerator pedal. Center of dial pointer should be within limits of short line to right of "N" mark on gauge (provides required limits of 1/8-3/16" out of neutral). If not within these limits, adjust as directed below.

Adjust Neutral Switch—Place control lever so dial pointer centered on short line to right of "N" mark on gauge J3085 and hold the lever in this position while adjusting. Loosen the two mounting bolts on switch bracket at lower end of steering column, raise switch up as far as possible. With ignition switch turned on and accelerator pedal depressed, tap switch down until starter just begins to operate, then tighten switch mounting bolts being careful not to change switch position. Recheck switch adjustment.

Back-up Light Switch: Check and adjust after transmission control detent adjusted as follows:

1948 Switch—Place control lever in Reverse "R" position, check clearance between switch operating arm and nearest edge of switch mounting bracket. If this clearance not 15/32", loosen two switch mounting screws and shift switch on bracket (screw holes are slotted).

1949 & Later—Place control lever in Low "L" position, check clearance between switch operating arm and lower edge of control shaft lower lever. If this clearance not 0" to 1/16", loosen two switch mounting screws and shift switch on bracket (screw holes slotted).

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BUICK DYNAFLOW DRIVE (Cont.)

BAND ADJUSTMENT

►*1951 BAND ADJUSTMENT CAUTION—Floor pan openings not provided and bands cannot be adjusted with transmission in car (bands must be correctly adjusted before transmission installed).*

LOW & REVERSE BAND ADJUSTMENT: Adjust only if chatter or slip in low and reverse severe or objectionable, (slight chatter as car starts in reverse, disappearing when car in motion, is normal). Adjust bands as follows:

(1) Remove front floor mat, insulation pad, and transmission opening cover from floor pan.

(2) Use tool J2655 to remove band adjusting cover and gasket (Covers are shallow sheet metal cups on upper right (Low), left (Reverse) of transmission case.

(3) Loosen locknut and turn adjusting screw clockwise until considerable resistance felt indicating that band in full contact with drum or ring gear.

(4) Back off screw until trace of endplay noted when prying up on locknut with screwdriver, then **back off screw additional six complete turns,** hold screw from turning and tighten locknut snug.

(5) Note position of adjusting screw slot, use torque wrench to tighten locknut to 20-25 ft. lbs., check screw slot to make certain that screw position not changed.

(6) Install band adjusting cover **using new gasket.**

NOTE—Both Low and Reverse Bands adjusted alike as directed above.

TESTING HYDRAULIC UNITS

If performance not satisfactory, make following tests **with transmission thoroughly warmed up and at operating temperature:**

Oil Level: Check oil level, add fluid as necessary to bring level up to FULL mark on dipstick, recheck performance with correct oil level. If car has been losing oil at rate of 1 pint or more each 1000 miles, make thorough check for oil leaks.

Manual Control Linkage: Check and adjust manual control linkage. See Linkage Adjustment.

Hydraulic Control System Pressures: Use Transmission Oil Pressure Gauge J-2575. Support rear end of car solidly with wheels off floor so that transmission can be operated. Remove transmission cover in floor pan for access to pressure take-off points. Connect gauge and make tests as follows:

Front Oil Pump—Connect pressure gauge at pipe plug opening on left side of reaction shaft flange. Run engine at 500 RPM., check pressure with selector lever in **Low, Drive, and Reverse range.** Repeat tests at 1000 RPM. and at 1800 RPM. in **Low and Drive Range only.** See table below for correct pressures. Low or erratic pump pressure indicates air leaks in suction line, improper pressure regulator valve action, or excessive pump clearances.

Front Oil Pump Pressures

Selector Lever—	Low	Drive	Reverse
500 RPM.	100 lbs.	90 lbs.	100 lbs.
1000 RPM.	160 lbs.	90 lbs.	
1800 RPM.	180 lbs.	90 lbs.	

Rear Oil Pump—Connect pressure gauge at pipe plug opening in lower flange at front end of rear bearing retainer. Run engine at 500 RPM., check pressure with selector in **Low & Drive Range.** Repeat test at 1000 RPM. and 1800 RPM. See table below for correct pressures. Low or erratic pump pressure indicates air leaks in suction line (this will affect both pumps), improper pressure regulator valve action, excessive pump clearances, or leak in valve and servo body passages between pump and regulator valve.

Rear Oil Pump Pressures

Selector Lever—	Low	Drive
500 RPM.	75 lbs.	90 lbs.
1000 RPM.	125 lbs.	90 lbs.
1800 RPM.	175 lbs.	90 lbs.

High Accumulator—Connect pressure gauge at pipe plug opening on top of accumulator body (left side of car). Place selector lever in **Drive** range. Run engine and check pressure at 500 RPM. (should be 80 lbs.), and at 1000 RPM. and 1800 RPM. (should be 85 lbs.). Low accumulator pressures may be caused by leakage past accumulator body gasket. If accumulator pressure more than 10 lbs. lower than front oil pump pressure, check for leakage between accumulator and multiple disc clutch and for restricted or plugged metering orifice in accumulator dump valve.

Low Accumulator—Connect pressure gauge at pipe plug opening on top of accumulator body (right side of car). Place selector lever in **Low** range. Run engine and check pressure at 500 RPM. (should be 90 lbs.), at 1000 RPM. (should be 150 lbs.), and at 1800 RPM. (should be 170 lbs.). Low accumulator pressures may be caused by leakage past accumulator body gasket. If accumulator pressure more than 10 lbs. lower than rear oil pump pressure, check for leakage between accumulator and low servo and for restricted or plugged metering orifice in accumulator dump valve.

TROUBLE SHOOTING

CAR WILL NOT MOVE (Rear wheels may be locked or free).

1) With selector in any Range (rear wheels free).

If car will not move for 1-8 minutes after standing over night—Check front pump oil pressure (see Testing) after allowing car to stand for several hours. If zero pressure noted, check pump for excessive clearances allowing pump to lose its prime. Check alignment of bell housing and converter primary pump hub.

►*CAUTION—If this condition found, inspect Clutch and Bands for excessive wear due to slippage caused by low oil pressure.*

If car will not move after extended operation in Reverse—Check for air leaks in pump suction line (at rear oil pump gaskets), or excessive clearance in front pump (at pump gears and cover). Check alignment of bell housing and converter primary pump hub.

2) With selector in any Range (rear wheels locked). Parking lock engaged. Broken parts in transmission or rear axle. Parking brake applied.

3) With selector in Drive Range. Check front oil pump pressure and High Accumulator pressure. If OK, check for sticking Low Band Anchor Piston, remove and inspect Clutch for worn or sticking clutch plates, leaking clutch seal rings. If High Accumulator pressure low, also check rear pump Check Valve for correct installation and proper seating, check for leaks at accumulator body gasket, reaction flange gasket, clutch piston outer seal and clutch ball check valve, and leaks at sealing rings on reaction shaft flange and low drum.

4) With selector in Reverse Range. Check reverse band for displaced operating strut caused by too loose adjustment, improper installation, or broken band anchor (indicated by free up and down movement of band operating lever). If band assembly OK (no free movement of lever), check servo operation by running engine and shifting into Reverse. Remove Valve & Servo Body and check for reverse servo piston seal leaks.

EXCESSIVE SLIPPAGE (High engine speed in relation to car speed, or poor acceleration).

1) In all Speed Ranges. Low oil level. Incorrect manual control linkage adjustment. Air leak in oil pump suction pipe at oil screen sealing ring. Low front oil pump pressure caused by wear or excessive clearances in pump. Leaks at front pump cover or reaction shaft flange, pressure regulator valve, Valve & Servo Body gasket. Pressure regulator valve defective.

2) In Drive Range. Incorrect manual control linkage adjustment. If High Accumulator pressure low, check for leak at accumulator body gasket; if gasket OK, check for leaking clutch sealing rings, sticking clutch piston, worn or sticking clutch plates.

3) In Low Range. Incorrect manual control linkage adjustment. Incorrect low band adjustment. Low band and drum worn or scored. If Low Accumulator pressure low, check for leak at accumulator body gasket; if gasket OK, remove Valve & Servo Body and check for gasket leaks or leaks at low servo piston seal.

4) In Reverse Range. Incorrect manual control linkage adjustment. Reverse band out of adjustment, strut out of place, or anchor broken. If front oil pump pressure low, remove Valve & Servo Body and check for gasket leaks and leaking reverse servo piston seal.

CAR CREEPS (Forward or Backward).

1) Creeps forward with selector in Neutral. Incorrect manual control linkage adjusment. Sticking low servo piston (check by removing low band adjustment cover). Sticking clutch caused by warped, binding, or incorrectly assembled clutch plates (not stacked properly with "dish" in same direction).

If Car Creeps only when engine accelerated to 2500 RPM—Check clutch vent ball checks in clutch piston and reaction shaft flange.

2) Creeps forward with selector in Reverse or backward with selector in Low. Incorrect manual control linkage adjustment.

SHIFTS ARE ROUGH.

1) Low-to-Drive Shift. Incorrect Low Band adjustment. If High Accumulator pressure low, check for leak at accumulator body gasket and for dump valve or accumulator piston sticking down (top land of piston should be visible through top port in body). Sticking low band anchor piston (remove Valve & Servo Body to check), or incorrect piston location (see piston shimming data in Valve & Servo Body Reassembly). Valve & Servo Body gasket leaks. Clutch plates worn or binding.

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BUICK DYNAFLOW DRIVE (Cont.)

EXCESSIVE CHATTER OR CLUNK WHEN STARTING

►*CAUTION—Slight "clunk" when shifting into Low or Reverse is normal, and slight chatter when car starting to move in reverse (disappearing as soon as car in motion) is also normal.*

1) In Low & Reverse Range. Incorrect Low or Reverse Band adjustment. Engine and transmission mountings loose or incorrectly adjusted, thrust pad at transmission mounting broken (see Engine Mountings in Buick Special Data). Clutch plates warped, sticking, or incorrectly assembled (not stacked properly with "dish" in same direction). Reverse ring gear bushing worn. Planet pinion needle bearing rough.

NOISE IN TRANSMISSION.

►*CAUTION—Hum or low whine in Neutral or Parking is normal (due to free rotation of all planetary gears) and slight hum in Low and Reverse may be expected.*

1) Buzzing Noise. Low oil level. Front pump check valve hanging up on edge of gasket between valve and servo bodies. If noise noticed in Parking or Neutral, pressure regulator valve clearance in body may be excessive or orifice in valve land oversize (correct by replacing valve and body).

2) Clicking Noise. If noticed in all ranges, may be caused by foreign material in converter. If noticed only when car in motion, may be caused by parking lock pawl contacting ratchet wheel due to incorrect manual control linkage adjustment.

3) Abnormal Hum or Whine (see Caution above). If noted in all ranges, may be caused by worn parts or excessive front pump clearances (front pump noise will increase in Low and decrease at car speeds above 45 MPH. in Direct Drive). Check front pump for excessive clearances by testing for low pump pressure. If noise noted in all ranges except Direct Drive, may be caused by trouble in planetary gears (gears locked out in Direct Drive).

4) Squealing or Screeching following installation of Front Oil Pump. Pump driving gear installed backward. On transmissions before Serial No. A-56000, may be caused by installation of thick front pump cover **without changing** converter primary pump (see Production Change note on Front Oil Pump & Related Changes).

►*CAUTION—Above condition must be corrected WITHOUT FURTHER OPERATION OF TRANSMISSION or severe damage will result.*

REMOVAL FROM CAR

Transmission and Torque Converter are removed as a unit as follows:

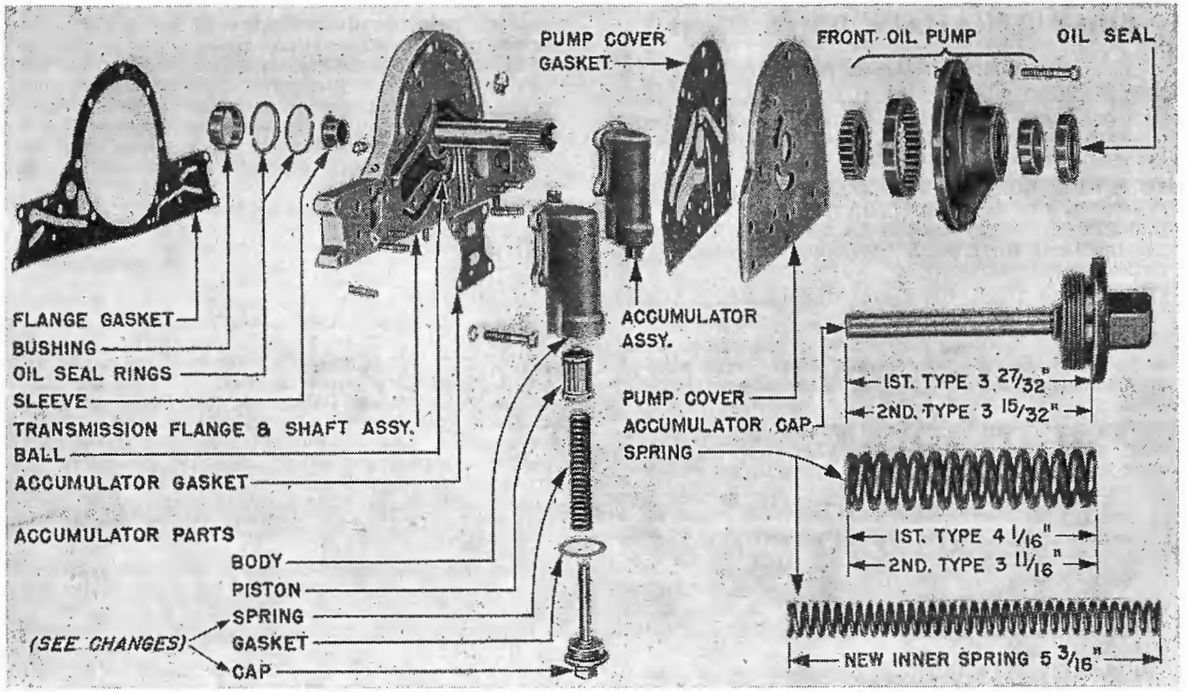
1) Remove bell housing dowel bolt to rear of starter solenoid using an offset brass drift and working from under the hood on the right side (this bolt cannot be removed from beneath car).

2) Support car securely on stands under frame with frame rails at least 20" above floor.

3) Disconnect torque tube at torque tube ball and move rear axle back to disengage propeller shaft from universal joint.

4) Remove bell housing cover and bell housing hand hole cover.

5) Drain converter and transmission oil pan (see draining data under LUBRICATION).



REACTION SHAFT FLANGE, ACCUMULATOR, & FRONT OIL PUMP ASSY. (SHOWING LOW ACCUMULATOR SPRING CHANGE)

6) Disconnect oil cooler pipes at transmission case connectors, free oil cooler bracket from transmission and tie oil cooler up to frame out of the way.

NOTE—Oil cooler can be removed by disconnecting water hose connections.

7) Disconnect oil filler pipe (later under-hood type) at hose connector. Disconnect transmission control rod at both ends and remove rod. Disconnect speedometer cable.

8) Disconnect thrust pad from transmission support by removing three nuts and taking out plate and adjusting shims. Remove two bolts and plate attaching mounting pad to transmission support.

9) Install engine support bar under rear end of engine oil pan, adjust support snugly under pan.

NOTE—Support bar can be made up of piece of 2x4 straight grain hardwood with 5/8" bolt at each end (bolts 25" center-to-center). Bolts should have 2½" hook at upper end to engage frame side rail and sufficient threaded length at lower end to allow support bar to be adjusted under oil pan.

10) Install hoist in front compartment (will require removal of floor pan opening cover) or transmission jack to support transmission weight.

11) Raise engine and transmission with engine support bar (9) and jack or hoist (10) to relieve load on transmission support. Remove support by taking out bolts in frame X-member, remove thrust pad from thrust plate on transmission.

12) Mark flywheel, converter primary pump, and cover with paint to insure reassembly in exact same relative positions.

CAUTION—This is necessary to maintain balance.

13) Disconnect converter from flywheel by taking off nuts on mounting bolts (nuts on front face of flywheel and are accessible through housing cover opening on front of bell housing).

14) Lower engine and transmission just enough so that top bolts in bell housing are accessible (can be removed from above if floor pan cover removed), disconnect bell housing by taking out all attaching bolts.

►*CAUTION—Make certain that both engine and transmission securely supported before loosening these bolts.*

15) Move transmission straight back to disengage converter pump cover from crankshaft, then lower transmission and remove from beneath car.

DISASSEMBLY

►**DISASSEMBLY CAUTION:** *CLEANLINESS IS EXTREMELY IMPORTANT when disassembling and working on transmission. Thoroughly clean exterior before disassembling, use CLEAN tools on a CLEAN workbench, provide CLEAN storage space for all parts, and separate parts to avoid nicking or burring of ground and polished surfaces.*

DISASSEMBLY OF TRANSMISSION (into Major Components): With transmission on bench, first remove shift lever by taking off retaining nut and lockwasher on shaft while holding lever forward (to avoid strain on linkage), remove oil cooler and pipes if this unit removed with transmission, remove both band adjustment covers and gaskets using Remover Tool J-2655, remove oil gauge rod (first

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BUICK DYNAFLOW DRIVE (Cont.)

type transmission). Remove both pipe plugs in primary cover to completely drain converter. Then place transmission on bench with oil pan upward and remove various sub-assemblies as follows:

Converter & Bell Housing Removal—Take out all primary pump cover nuts and bolts (CAUTION—insert punch in drive bolt holes through bell housing hand hole to keep cover from turning), screw three 5/16"-18 capscrews into tapped holes in pump cover to loosen cover, remove cover. Remove converter spacer and shim washers (on input shaft or in bearing recess in pump cover). Press on end of input shaft (to prevent shaft coming out) and withdraw converter turbine. Check stators for freewheel clutch slippage before removing these parts (stators should rotate freely in clockwise direction but lock when turned in opposite direction), use narrow pointed tool to remove retaining ring from reaction shaft, **remove both stators as a single unit** (CAUTION—separating stators will allow clutch parts to fly out). Check secondary pump for freewheel clutch slippage (pump should rotate freely in clockwise direction but lock when turned in opposite direction). Pull primary and secondary pumps off reaction shaft and **immediately** check for evidence of oil leakage (streaks of fresh oil on back of primary pump and fresh oil running down face of front oil pump indicate leakage past oil pump seal—if leakage noted, check for loose bell housing bolts). Take out bell housing attaching bolts, remove bell housing, check rubber oil seal for uniform compression (if seal not compressed uniformly, check around oil pump and in bell housing opening for burrs or foreign material preventing uniform seal compression). ***See Overhaul data for disassembly of converter stators and pump.***

Oil Pan and Valve & Servo Body Removal—***Not necessary to remove other parts prior to this operation.*** Remove oil pan and gasket. On transmissions with first type oil screen, examine oil screen suction pipe impression on sealing ring in servo body recess (ring should show full impression of end of suction pipe indicating no air leakage at this point), remove sealing ring. On transmissions with second type oil screen, lift screen away from suction pipe, remove suction pipe spring support and retaining spring, remove suction pipe and cork gasket from recess in servo body. Disconnect valve operating rod from upper valve operating lever by inserting screwdriver blade through hole in case and pressing rod away from lever (ball stud on lever engages spring socket in rod). Loosen all valve & servo body attaching screws slightly but **do not loosen slotted safety nuts on valve-to-servo body studs,** turn all screws out evenly to relieve anchor piston spring tension, (not necessary on C-9, E-9 and later transmissions), pry assembly upward lightly to free gasket, push shift control valve and lower operating lever inward to align lever with transmission case opening, lift assembly off while supporting anchor piston to prevent it falling out (piston not used on C-9, E-9 and later models). Use care to avoid slotted end of shift control valve which has sharp edges when lifting on assembly. Remove gasket and check for evidence of oil leaks. Remove reverse band operating strut (support strut with finger extended through adjustment hole to prevent it falling into case, release strut by raising operating lever). ***See Overhaul data for disassembly of valve & servo body.***

Reaction Shaft Flange, Front Oil Pump, and Accumulator Removal—***Converter & Bell Housing and Oil pan must be removed first but Valve & Servo Body need not be disturbed.*** Loosen **but do not remove** both accumulator body caps (will facilitate removal later). Remove three attaching capscrews from each accumulator body but **do not disturb stud nut.** Remove capscrews extending through front oil pump cover but **do not remove stud nuts** (first type has one capscrew and two stud nuts, later type has two capscrews and one stud nut). Tap lightly on rear of accumulator bodies with fiber hammer to loosen reaction shaft flange, remove assembly and gasket from case leaving input shaft in transmission. Examine gasket for uneven impression or other evidence of oil leaks.

Input Shaft, Clutch, & Low Range Band Removal: ***All parts listed in preceding removal sections must be removed first.*** Pull input shaft and clutch hub front thrustwasher out of transmission (thrustwasher will come out on shaft), then lift out clutch assembly. Use screwdriver to block low band anchor lever (transmissions C-8 & E-8 and earlier), compress the low band with the operating lever (later transmissions), install Band Installing Clip J-2595 across band strut flanges to keep band compressed, release the lever and lift band out of case, lift out band struts (will drop down in case when band removed). Remove the low band anchor lever and operating lever by threading a ¼-20 capscrew in end of each lever shaft and pulling shafts out of case. ***See Overhaul data for clutch disassembly.***

Torque Ball & Universal Joint Removal: ***Does not require removal of any other parts first.*** Remove torque ball rubber boot. Take out attaching bolts in thrust plate, remove thrust plate and gasket, torque ball inner and outer retainers, and paper adjusting shims. Remove speedometer driven gear and sleeve assembly. Lock drive shaft by engaging parking lock pawl (use shift lever to press forward on shift lever shaft while turning universal joint until pawl engages), remove universal joint bolt, lockwasher, and flat washer, pull universal joint using puller J-682A (40, 50), J-859A (70).

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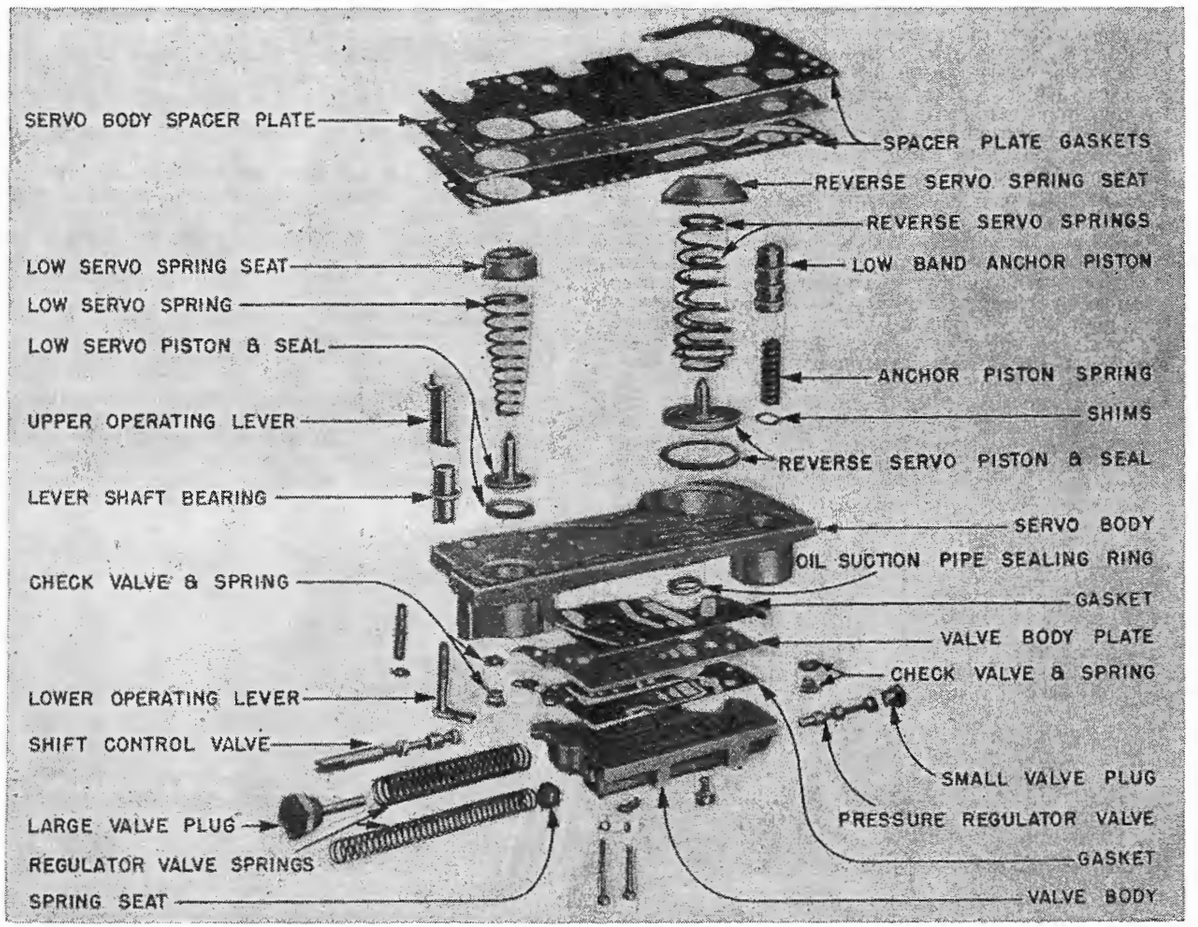

VALVE & SERVO BODY ASSY.
(ANCHOR PISTON NOT USED ON C9, E9, & LATER TRANSMISSIONS)

BUICK DYNAFLOW DRIVE (Cont.)

Rear Bearing Retainer & Parking Lock Ratchet Wheel Removal: ***Torque Ball, Universal Joint, and Oil Pan must be removed first.*** Disconnect valve operating rod from upper operating lever by inserting screwdriver through hole in case and pressing rod away from lever (ball stud on lever engages spring socket in rod). Remove universal joint retaining ring from slot in output shaft (use screwdriver and hammer to free ends of this lock ring). Take out retaining bolts and remove rear bearing retainer and gasket, check gasket for evidence of oil leakage. Take out ratchet wheel outer retaining ring (use snap ring pliers to free ring), slide ratchet wheel off output shaft, remove inner retaining ring. ***See Overhaul data for disassembly of rear bearing retainer.***

Rear Oil Pump and Lubrication Oil Pressure Regulator Valve Removal: ***Rear Bearing Retainer (preceding) must be removed first.*** Take out retaining bolts and remove pump body and gears as an assembly (on first transmissions, separate cover and gasket used). Check gaskets for evidence of oil leakage. Remove pump drive key from shaft recess, remove rubber cushion located under drive key with a pointed tool. If possible, lift off rear pump plate and gasket (if plate sticks, tap plate out **after planetary gear set removed**). Check gasket for evidence of oil leakage. Remove lubrication pressure oil regulator valve seat from rear face of transmission case (use special drag link socket to turn valve seat out), remove valve and spring.

Planetary Gear Set, Reverse Ring Gear, and Reverse Brake Band Removal: ***All parts listed in preceding removal sections must be removed first.*** Pull planetary gear set out through front of transmission case. Lift out reverse ring gear and two planet carrier thrust washers (if these parts did not come out with planetary gear set). If rear oil pump plate and gasket not removed previously (see above), tap out with hammer handle inserted through front of case. Remove reverse band operating lever by threading a ¼"-20 capscrew into tapped hole in anchor shaft and pulling shaft out, then lift out lever. Rotate reverse band toward adjusting hole until anchor accessible, disengage and lift out anchor. Compress reverse band and install Band Installing Clip J-2595 across strut flanges to hold band compressed, lift band out. Remove reverse ring gear thrust washer from case. ***See Overhaul data for disassembly of Planetary Gear Set.***

OVERHAUL

After all Converter and Transmission Major Components removed from transmission case, disassemble and overhaul these units as follows:

Converter Stators & Pump: Disassembly. Rotate primary and secondary stators in opposite directions while slowly pulling them apart (CAUTION—do not allow free-wheeling rollers and springs to fly out). Remove free-wheel race (may remain in either stator), remove roller spacer from secondary stator, remove all free-wheel rollers, springs, and spring cups, remove roller assembling washer from primary stator. Take out secondary pump retaining ring and free-wheel roller spacer, withdraw secondary pump from primary pump (rotate in clockwise direction to free the free-wheel rollers), remove free-wheel rollers, springs, and spring cups, lift out secondary pump thrust washer (see Note) which may be found in the primary pump or on the secondary pump.

►**Secondary Pump Thrustwasher Note**—This thrustwasher used only with first type Secondary Pump, not used with later type pump which has cast hub bearing directly against primary pump hub.

►***CAUTION—This thrustwasher must be used with first type pump but should be DISCARDED WHEN LATER TYPE SECONDARY PUMP INSTALLED AS REPLACEMENT.***

Inspection—Wash all parts in clean solvent and dry with air. Examine all parts for wear, scoring, nicks, or other damage. Replace input shaft pilot bearing if worn or rough. Remove small nicks on free-wheel rollers and race by stoning and polishing with crocus cloth. Remove nicks on pump and stator blades with a fine file.

Reassembly—Install secondary pump thrustwasher over primary pump hub (CAUTION—use this thrustwasher only with first type secondary pump, see Note under Disassembly above), insert free wheel springs and spring cups in secondary pump, install secondary pump over primary pump hub with springs outward (rotate pump clockwise to facilitate installation), compress springs with thin narrow tool and insert all free-wheel rollers. Install roller spacer and retaining ring to hold secondary pump in place. Check installation by rotating secondary pump (should turn freely in clockwise direction but lock in opposite direction). Install free-wheel springs, cups, and race in secondary stator (old race in same direction as before as indicated by wear pattern, new race either end first). Depress springs and cups with thin tool and install **long** rollers, then install roller spacer around race and over rollers. Install free-wheel springs and cups in primary stator, install Primary Stator Assembly Tool J-3081 (40, 50), J-2592 (70) in stator with three tool points between roller recesses, place roller assembly washer flat on tool. Depress springs and cups with thin tool, install **short** rollers (first roller next to one tool leg, next roller diametrically opposite, then alternate rollers until all installed). Remove assembly tool by turning tool until one end can be pushed into roller recess which will free other tool legs without disturbing assembling washer. Install primary stator on secondary stator by placing secondary stator on bench with rollers facing upwards, lower primary stator (rollers downward) squarely on secondary stator while twisting it in counter-clockwise direction.

Valve & Servo Bodies: Disassembly. ***On Trans. A-2999 and earlier, replace Valve & Servo Body with 2nd. type and install later type Anchor Piston also as described in Production Change notes.*** Lift low band anchor piston, spring and shims from servo body (not used on C-9, E-9 and later transmissions). Remove safety nuts and washers from body studs, lift off valve body and gasket, examine gasket for evidence of oil leakage. Remove shift control valve from valve body and rear pump delivery check valve and spring from servo body. Remove large pressure regulator valve plug from valve body (CAUTION—hold plug to prevent it flying off due to heavy spring pressure), remove springs and spring seat. Remove small valve plug and lift out pressure regulator valve. Remove valve body plate and gasket, examine gasket for evidence of oil leakage. Lift out front pump delivery check valve and spring. Take off nut and lockwasher attaching upper and lower valve operating levers in servo body and remove levers. Use wooden block placed across low and reverse servo spring seats to hold them in place with springs compressed while taking out spacer plate attaching screws, carefully relieve spring pressure (CAUTION—use care not to spring spacer plate or allow servo springs to fly out), lift off spacer plate and gasket, examine gasket for evidence of oil leakage. Lift out low and reverse servo spring seats, springs, and pistons. On early transmissions with low band anchor pistons which is retained by spacer plate, remove the piston, springs, and shims at this point. ***NOTE***—On C-9 & E-9 and later transmissions, anchor piston not used and low band anchored to shaft in transmission case.

Inspection—Wash valve and servo bodies and parts with clean solvent, blow out all passages and dry parts with air. Inspect bodies for cracks, damaged gasket surfaces, and scored piston and valve cylinders. Inspect valves and pistons for nicks, scores, scratches, or rounded shoulders (edges must be sharp to keep out foreign material which might cause sticking). Replace worn or damaged piston seals.

►**Piston Seal Installation Caution**—Lip on seal must fit over SMALLER diameter land on piston.

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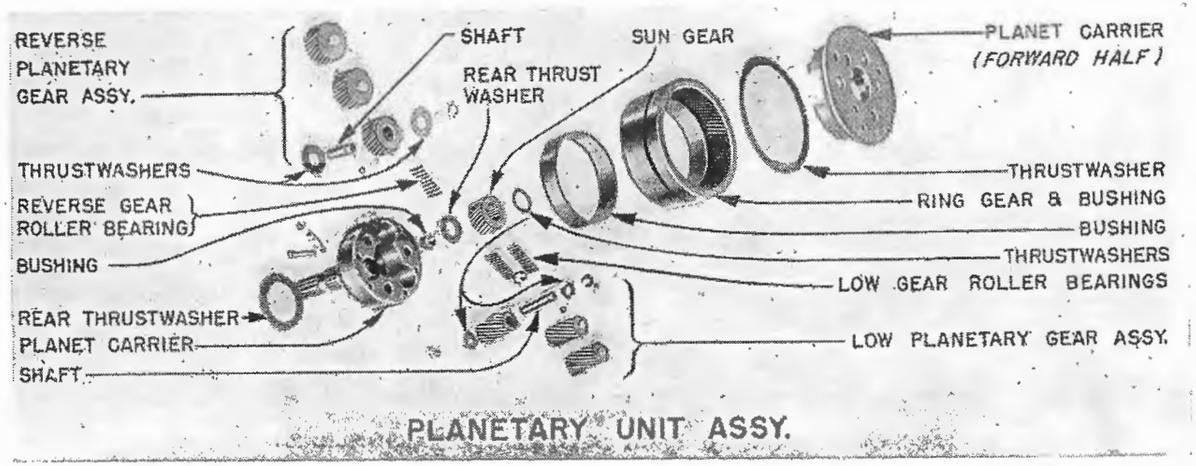


PLANETARY UNIT ASSY.

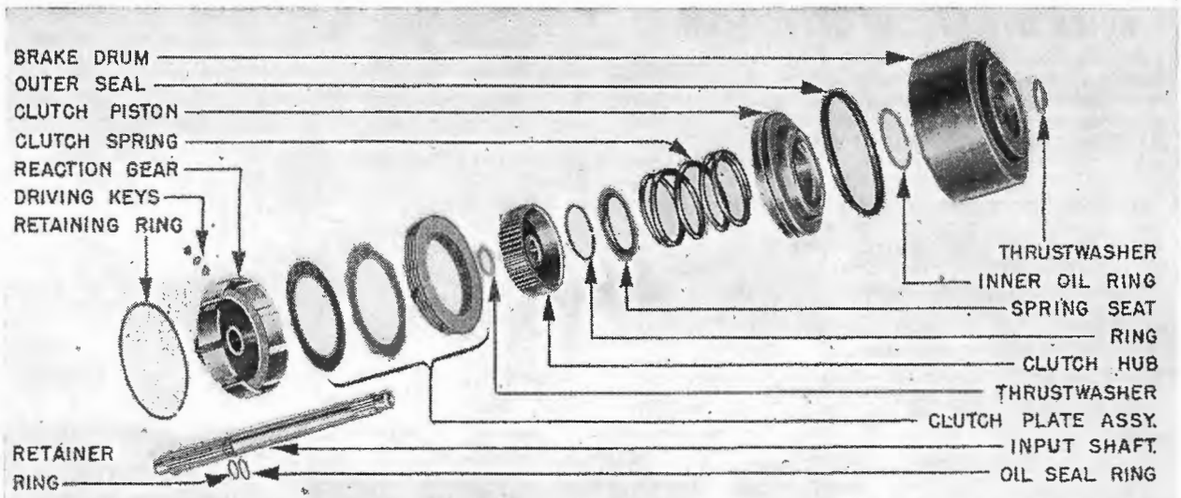
BUICK DYNAFLOW DRIVE (Cont.)

Reassembly—Install low and reverse servo pistons in servo body (CAUTION—use care not to damage seals), check to see that pistons move freely in body. Install piston springs and spring seats (small end of low servo spring in groove in piston, large end of both reverse servo springs in grooves in piston). Place check ball in the reverse servo feed channel. Use new spacer plate gasket, compress servo springs and tighten all spacer plate attaching screws uniformly. Check anchor piston for free movement (on C-8 & E-8 and earlier transmissions only) and if spacer plate or gasket interfere, loosen all spacer plate screws and tap plate to provide uniform clearance around piston, retighten screws uniformly). Check Anchor Piston Height (Trans. C-8 & E-8 and earlier models—see Anchor Piston Height Note below for data). Install both upper and lower operating levers with lower lever pointing to low servo cylinder and upper lever to reverse servo piston spring seat, tighten lever shaft nut to 5-7 ft. lbs. torque. Install front pump delivery check valve spring (large end down), and valve (ridged side up), then install valve body plate using new gasket and making sure that valve seats against plate (must not hang on gasket). Install pressure regulator spring seat, inner and outer springs, and valve plug in valve body, tighten plug to 20-25 ft. lbs. torque. Install pressure regulator valve (see that oil orifice in end land is clear and place this land outward), tighten valve plug to 20-25 ft. lbs. torque. Install shift control valve with slotted end of valve pointing toward large pressure regulator plug. Install rear pump delivery check valve (ridged face inward), and spring (large end upward). Install valve body on servo body using new gasket (CAUTION—see that pump delivery check valve spring below gasket), tighten all stud nuts to 11-15 ft. lbs. torque.

►**Anchor Piston Height Note (C-8 & E-8 & Earlier):** Check anchor piston height with Anchor Piston Gauge J-2657 **and a .010" feeler gauge** (gauge made for first type pistons and is .010" too high). Distance from top face of spacer plate to top edge of top land on piston should be .080-.090" (equal to "Go" and "No Go" legs of gauge with .010" feeler between gauge and piston land). Adjust height by adding or removing shims between spring and piston (if height too great with all shims removed, grind off the end of the spring).

Oil Screen & Oil Pan: Mark first type screen (mounted in oil pan) to insure re-installation in same position. Clean screen and pan thoroughly, check for cracks or holes in screen and for bent pan flanges. When re-installing screen in pan, check oil suction pipe height by placing straightedge (Gauge J-2596 can be used) across pan flanges and measuring from lower edge of straightedge to top of pipe. If this distance not 17/32", adjust by bending screen mounting brackets.

Reaction Shaft Flange & Oil Pump: Disassembly. Remove high and low accumulators and gaskets using care not to drop retaining pin and check ball out of High Accumulator (not used in Low unit) Check gaskets for oil leakage. Check oil pump mounting nuts for tightness (loose nuts may have been causing oil leakage), remove nuts, take out pump body and gears (tap body lightly with soft hammer if necessary). Lift off pump cover and gasket, check gasket for evidence of oil leakage. Remove check ball from clutch feed passage in reaction flange if ball free to fall out (do not remove ball if retained by peened edges of hole).



DIRECT DRIVE CLUTCH ASSY.

Oil Pump Inspection & Repair—Clean pump parts with solvent and dry with air. Check pump gears and mounting faces of body and cover for excessive wear. Check front pump bushing for excessive wear or looseness which will require replacement of pump assembly (NOTE—Check flywheel and primary pump hub run-out and bell housing misalignment if bushing worn or loose). Check front oil pump seal and replace if damaged or any evidence of leakage noted. Drive out old seal, coat outside of new seal with Permatex #3, start seal in place with deep groove in retainer outward, tap seal into place with wood block and mallet. Check following clearances and replace pump parts if excessive:

Pump Gear Side Clearance—Place straightedge across face of pump body and gears. Clearance between face of gears and straightedge should be .001-.0025" (check with feeler gauge).

Pump Gear Clearances—Check pump gears with feeler gauge between gear teeth and crescent while pressing gear away from crescent. Clearance should be .003-.006" (all driven gears), .007-.014" (front pump driving gear), .007-.011" (rear pump driving gear).

Pump Cover Gear Wear—Replace cover if gear bearing area scored or worn to depth of more than .001".

Reaction Shaft Flange Inspection—Clean flange in solvent, blow out all passages and dry with air. Check mounting surface of flange for low spots with straightedge (Gauge J-2596) and feeler gauge, replace if out more than .002". Inspect mating face of transmission case similarly and replace case if it cannot be trued up within .002". Check both surfaces for nicks and burrs, remove these with a mill file. Check bronze bushing on reaction flange rear hub and cast iron sleeve within hub, replace reaction shaft flange if these parts scored or worn excessively. Check oil sealing rings and replace if damaged (rings have interlocked ends and are released by compressing ring and depressing one end while raising the other). Check all studs for tightness, replace if threads damaged or stripped (step studs furnished—can be installed by tapping out hole). When replacing oil pump attaching studs on transmission before No. A-86000 and B-29000, install later type square head bolts (see Production Change notes).

Reassembly—Install pump cover on reaction flange using new gasket (make certain that check ball in clutch feed passage first). Lubricate pump gears and install in pump body with **beveled side of driving gear outward** so that it will be against cover when pump installed (CAUTION—reversal of gear will cause severe damage to transmission). Install oil pump on reaction shaft flange, seating pump body squarely in recess in cover (first type) or engaging locating dowels in dowel holes (second type), use lockwashers under nuts, tighten nuts (or new type bolts) to 5 ft. lbs. torque in correct sequence (see note below), then fully tighten nuts to 25-30 ft. lbs. torque in same sequence, finally tighten cover attaching stud nut to 25-30 ft. lbs. torque.

►**Front Pump Tightening Sequence**—Tighten nuts in following order: Top, Bottom, Right Center, Left Upper Center, Right Lower Center, Left Lower Center, Right Upper Center.

High & Low Accumulators: Disassembly. ***See illustration and Production Change Notes for various types of Accumulator Springs and Caps used.*** Remove retaining pin and check ball from High Accumulator body (not used in Low Accumulator). Remove the pipe plug, cap, gasket, spring and piston from each accumulator body **keeping these parts separated so that same parts will be re-installed in same body.**

Inspection—Clean all parts with solvent, blow out all passages and dry with air. Check parts for excessive wear, scoring, nicks, burrs, and other damage. Remove nicks and burrs from pistons and valves by stoning but **do not round off sharp edges of pistons and valves** (edges must be sharp to keep out foreign material which might cause sticking). Check mounting face of acumulator body for flatness with

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BUICK DYNAFLOW DRIVE (Cont.)

a straightedge (face can be trued up by using emery cloth on a surface plate but all traces of emery must be removed). Replace accumulator assembly if body, or piston worn (these parts not furnished separately). Check piston for wear by placing it in cylinder (all parts clean and dry). Piston should slide freely as body is tilted back and forth.

Reassembly—Lubricate all parts before installation. Install each piston in same cylinder from which removed, install springs (see illustration and Spring Note below), use new gasket on cap and tighten cap finger tight—DO NOT attempt to tighten caps fully at this time (caps will be tightened to 40-50 ft. lbs. torque **after** reaction flange assembly re-installed in transmission).

►**Accumulator Spring Note**—Springs can be identified by free lengths as listed below (early transmissions have single spring only in Low Accumulator).

Low Accumulator Springs

	Free Length	Part No.
Trans. before C-6, D-6, E-6	4 1/16"	1333426
After above Nos. (Inner)	5 3/16"	1339495
(Outer)	3 11/16"	1339496

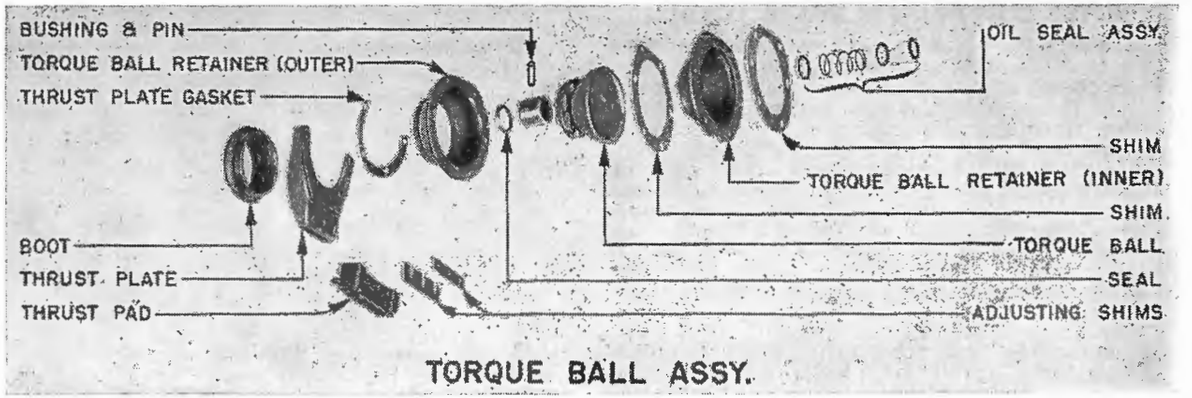
High Accumulator Spring

All Transmissions	4 5/16"	1331461

Multiple Disc Clutch & Input Shaft: Disassembly. Remove retainer ring from reaction gear flange, use pointed tool to remove three flange driving keys. Lift out Low Range Reaction Gear, Thrustwasher, Clutch Hub, and all 10 Clutch Plates. Install Clutch Spring Compressor J-2590 in clutch drum placing slot in compressor ring over ends of spring seat retainer ring, compress spring sufficiently to remove retainer ring, release clutch spring pressure (CAUTION—use care that spring seat does not hang up in retainer ring groove in drum). Remove compressor, lift out spring seat and spring. Tap drum, open end down, on block of wood to dislodge clutch piston (CAUTION—if check ball in piston unseated during this operation, snap ball back in place).

Inspection—Wash parts in solvent and dry with air (CAUTION—use only gasoline or kerosene on clutch bands and plates—do not use chemical degreasers or commercial solvents). Inspect and replace all clutch plates which are worn, scored, burred, or warped (CAUTION—new plates must slide freely on clutch hub—tight plates will prevent full disengagement). Inspect oil seal ring on clutch hub and replace if damaged (ring has interlocked ends and is released by compressing ring and depressing one end while raising the other). Replace clutch piston outer seal if hardened, broken, or with turned lip (install new seal with lip extending over smaller diameter piston land). **See Piston Seal Note below.** Inspect Low Range Band and replace if worn smooth without visible grooves. Inspect oil seal ring and replace if damaged (same type ring with interlocked ends as used on clutch hub). Check to make sure retaining ring in place in shaft groove. See that small bleed hole in piston is open and that check ball is staked in place (CAUTION—ball must be free to move in recess).

►**Piston Seal Note**—When replacing piston seal on transmission below No. A-3000, it will be necessary to **replace piston also** since only later type wider seal furnished for service (seal width increased from .104" to .113" and piston groove increased from .112" to .116").



TORQUE BALL ASSY.

Reassembly—Lubricate piston seal and inner surface of drum with light oil, install piston using extreme care not to distort or turn lip of seal. Top of piston should be approximately even with shoulder in drum when installed. Install clutch spring, use Compressor J-2590 to compress spring, install spring retaining ring in groove in drum, remove compressor. Place reaction gear on bench with flange upward and install all clutch parts in following order: Clutch Hub Thrustwasher, Clutch Hub (open end upward), and all clutch plates (see Clutch Plate Caution below). Bottom clutch plate should be internally splined (faced) type and top clutch plate externally splined (plain steel) type with the two types alternating in the assembly. Install drum and clutch piston assembly over reaction gear and clutch assembly with driving key recesses in drum and gear flange aligned. After drum pressed evenly in place, fully align driving key recesses by tapping reaction gear flange, install three driving keys and flange retainer ring.

Clutch Plate Caution—Externally splined (plain steel) clutch plates are concave or "dished" and **these plates must all be installed with "dished" face in same direction** (either up or down). Check each plate with a straightedge and stack plates with dished faces in the same direction before beginning installation. *NOTE*—Internally splined clutch plates are flat and can be installed in either direction.

►**Clutch Plate Caution (Series 70 Trans. No. G-310 & Later)**—New type clutch plates used (see Production Change Note). Until these type plates furnished for service, it will be **necessary to install entire pack of regular service internally and externally splined clutch plates** if any replacement required.

Rear Bearing Retainer, Universal Joint, & Torque Ball: Disassembly. Disconnect valve operating rod clevis from valve operating cross-shaft inside retainer housing (clevis pin on transmissions before No. C-1 & D-1, snap fastener on later cars), withdraw rod through forward end of housing. Disconnect parking lock operating rod from cross-shaft by unscrewing rod end from lever. Remove cross-shaft bearing using a box wrench (CAUTION—loose fitting socket or end wrench will distort bearing), remove cross-shaft. Remove parking lock pawl shaft by screwing ¼"-20 capscrew into shaft and pulling shaft out. Tap parking lock operating lever toward front of retainer (use long punch), remove operating lever shaft, operating lever, lever and pawl assembly, and apply spring from retainer. Use a socket or box wrench to remove converter pressure valve connector from side of bearing retainer (CAUTION —end wrench will distort connector).

Main Bearing Retainer Inspection—Wash all parts in solvent and dry with air. Check converter pressure valve for nicks, scoring, and wear. Check spring for distortion and special connector for distortion or stripped threads. Check parking brake pawl, pawl locking link, and ratchet wheel for worn teeth, cracks, or other damage preventing positive locking. Check valve operating cross-shaft and bearing for wear, remove and discard rubber seal in bearing. Inspect ouput shaft bushing in retainer for wear scoring, check clearance by inserting output shaft in bushing. Clearance should be .001-.006". Replace bushing with Bushing Remover & Replacer Tool J-2997 (not necessary to ream new bushing).

Universal Joint Inspection—Check for wear and excessive play between spider pins and bushings (should be .002-.004"). Check yokes for wear on shaft splines. Front yoke must be tight fit on output shaft (play will allow "snap" between forward and reverse), rear yoke backlash on propeller shaft should be .0005-.0045". Rear yoke clearance in torque ball bushing should be .004-.006" and bearing surfaces must not be scored.

Torque Ball Inspection—Replace torque ball and retainers if bearing surfaces scored or pitted. Inspect oil seal and replace if worn (use seal which has been soaked in neatsfoot oil, press seal squarely into place until flush with torque ball flange and with feather edge of seal pointing into torque ball. Check universal rear yoke for excessive wear at point where seal bears.

Reassembly—Install converter pressure valve spring, valve (closed end outward), and special connector. Assemble locking pawl and lever assembly, apply spring, and parking lock operating lever & rod using a dummy shaft for this purpose (dummy shaft can be made up of 7/16" round stock, 1½" long, with ⅛" chamfer on one end), place this assembly in position in bearing retainer and install operating shaft through retainer and lever. Install parking lock pawl shaft through bearing retainer and lock

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BUICK DYNAFLOW DRIVE (Cont.)

pawl **with tapped end outward.** Install valve operating cross-shaft and cross-shaft bearing with **new rubber seal** in bearing (grooved side inward). Connect parking lock operating rod to cross-shaft lever (use lockwasher on threaded rod end) but do not connect valve operating rod and lever to cross-shaft until rear bearing retainer being assembled to transmission case.

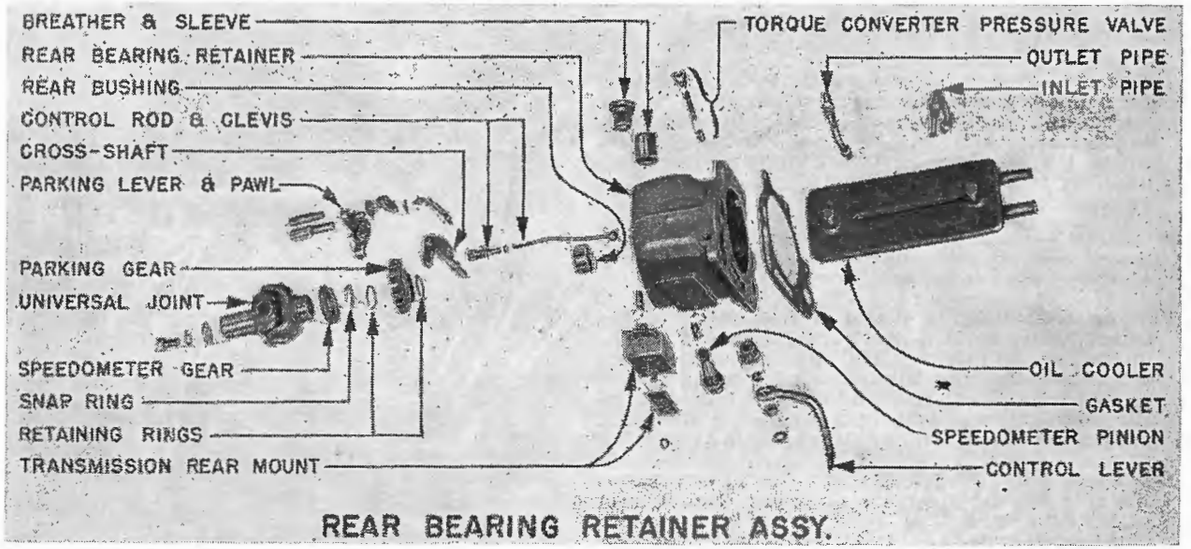
Planetary Gear Set: Disassembly. Remove reverse ring front thrustwasher (not used on later transmissions beginning with No. A-42475 & B-1—see Production Change Notes for interchangeability of first and later type reverse gears). Take out three planet carrier screws and special lockwashers (use 7/32" Allen wrench), separate front and rear halves of planet carrier (hold carrier by output shaft, tap down on flange on front end). Lift out sun gear rear thrustwasher and reverse sun gear. Remove all planet pinion assemblies (three long low pinions, three short reverse pinions) by tapping shaft out of front half of carrier using care not to lose steel ball imbedded in end of each shaft to prevent shaft rotating in carrier. Disassemble pinion assemblies by removing thrustwashers and shafts from pinions and then taking out bearing rollers (long pinions have two sets of rollers separated by spacer, short pinions have one set of rollers).

Inspection: Wash all parts in solvent and dry with air. Inspect planet pinion shaft and rollers, replace if worn. Inspect all gear teeth for wear, remove all nicks and burrs by stoning. Replace bushing in rear end of planet carrier if worn or scored (use Bushing Remover J-3197, Bushing Replacer J-2996—new bushing may be installed either end first and need not be reamed). Inspect reverse band anchor for cracks. If anchor is first two-piece type, rework transmission case and install later forged type anchor (see Production Change notes). Replace reverse band if cracked or the lining worn smooth.

Reassembly—Assemble each planet pinion with its bearing rollers, thrust washers, and shaft (24 rollers in each reverse pinion, 20 rollers at each end of low pinion and separated by a spacer). Make certain that thrustwasher installed at each end of each pinion (lower washer against retaining ring on shaft, upper washer on outer end of shaft). Install planet pinion assemblies in carrier making certain that **steel ball imbedded in lower end of each shaft** (necessary to prevent shafts turning). Install reverse sun gear with bronze thrustwasher on top of gear, align assembly marks on both planet carrier halves when installing upper half (numbers stamped on dividing line during production), make certain that special lockwasher used on each carrier screw, tighten screws evenly to 25-30 ft. lbs. torque. Install reverse ring gear thrustwasher (first transmissions only—see Production Change notes for gears on which thrustwasher **must** be used), install reverse ring gear.

Transmission Case (Cleaning & Inspection): Wash case and blow out all passages. Inspect for cracks, and stripped bolt threads. Check machined surfaces for nicks and burrs and clean these up with a mill file. Check bushing in case for wear by inserting planet carrier in bushing and checking clearance with a feeler gauge. Clearance should be .002-.004". Replace bushing if clearance excessive or if scored.

Bushing Replacement—To remove old bushing, support case with rear end down, drive bushing out with tool J-3175-1 (part of replacer set). To install new bushing, place pilot J-3175-2 (part of replacer set) in rear oil pump recess in case, slip bushing over J-3175-1 and drive bushing into case from front side until bushing is flush with front surface of case wall which supports the bushing. **Bushing must be installed with wide deep ends of oil grooves toward rear of case.**



REAR BEARING RETAINER ASSY.

Flywheel & Primary Pump Run-out and Bell Housing Alignment Check: ***Make this check if front oil pump noisy, bushing and oil seal worn, or if oil leakage noted at Converter or Front Oil Pump Body.***

Flywheel Run-out—Remove all burrs from around drilled holes in face of flywheel, mount dial indicator on flywheel housing with strip of .005" shim stock between dial indicator and face of flywheel (clamp shim stock under a flywheel housing bolt so that it covers bolt holes and provides smooth surface for dial indicator pick-up. Turn flywheel **holding end thrust in one direction.** Run-out should not exceed .008". If excessive run-out cannot be corrected by tapping high side with mallet or by removing flywheel and cleaning up burrs at crankshaft flange mounting holes, install new flywheel and re-check run-out.

Primary Pump Hub Run-out—With converter primary pump and bell housing installed, mount dial indicator on bell housing so that it bears against primary pump hub. If run-out exceeds .012" when flywheel turned, mark flywheel and primary pump, remove and re-install pump at point 180° from first position. If pump run-out still exceeds .012", install new primary pump and recheck run-out. When position found where run-out is less than .012", mark flywheel and pump with **paint and align these marks when transmission is finally re-installed.**

Bell Housing Alignment—Mount dial indicator on oil pump driving lug on rear end of converter primary pump hub (CAUTION—do not clamp indicator on bearing surface) so that it bears against rear face of bell housing at 3¾" radius. Rotate flywheel **holding end thrust in one direction.** Run-out should not exceed .005". Mount dial indicator so as to bear against inner edge of pilot hole in bell housing and repeat test. Run-out should not exceed .004". Correct by installing paper shims of correct thickness between flywheel housing and engine crankcase (use shellac to hold shims in place).

REASSEMBLY

After overhaul of Major Components, make certain that all parts absolutely clean, oil moving parts with 10-W engine oil before installation, use **ALL NEW GASKETS & SEALS.** Tighten all parts evenly to specified torque and in correct sequence (see illustrations). Proceed in reverse order of disassembly directions and note all of following points:

Planetary Gear Set Installation: After reverse ring gear thrustwasher and reverse band installed in case (with Installing Clip J-2595 on band), rotate band 45° toward servo opening, insert anchor and engage hooked end of band, then rotate assembly back into position. Position band operating lever in place with strut shoulder toward inside of case, install anchor shaft **with tapped end outward.** If installation correctly made, adjustment screw will be centered in servo opening (lever has offset end). See that planet carrier front (steel) thrustwasher installed on carrier with three tangs engaging holes in carrier, install rear (bronze) thrustwasher in case with three tangs engaging holes in case, then install planet carrier. If correctly installed, chamfer on output shaft journal will be flush with rear end of transmission case bushing.

Rear Oil Pump & Lubrication Oil Pressure Regulator Valve Installation: Install rear gasket (gasket with LARGER hole—do not confuse with cover gasket) and plate on transmission case with bolt holes aligned, install drive key cushion and key in output shaft, then install driving gear to engage key (old gear should face in same direction as before, new gear with either face in). On first transmissions with

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BUICK DYNAFLOW (Cont.)

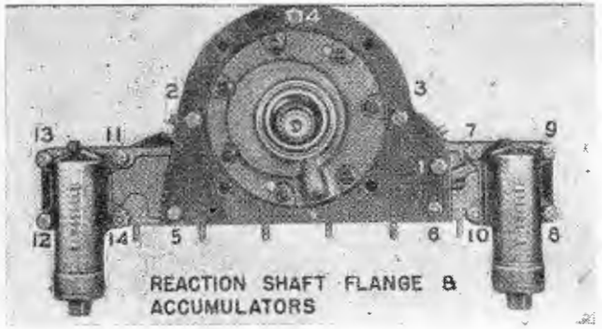
separate cover, use cover gasket (with SMALLER hole) under cover. Tighten attaching bolts to 5 ft. lbs. torque in following sequence: Top, Bottom, Right, Left; then retighten bolts to 25-30 ft.lbs. torque in same sequence. Check pump for free operation by rotating output shaft. Install lubrication oil check valve assembly in case.

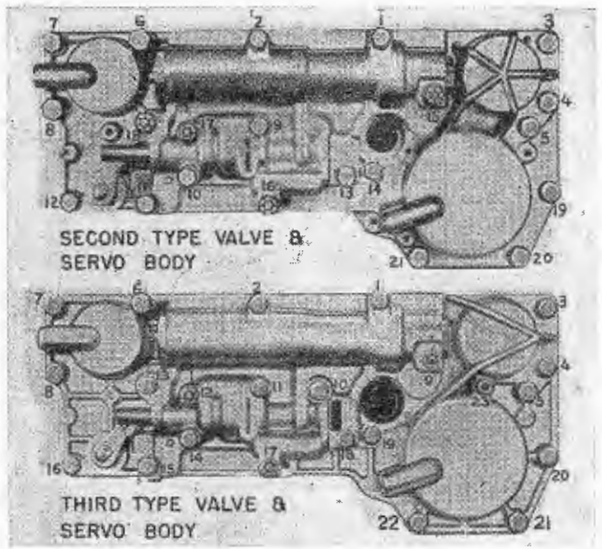
►*CAUTION—On first transmissions with separate pump cover, cover must be centered on body to allow rear bearing retainer to be installed.*

Parking Lock Ratchet Wheel & Rear Bearing Retainer: Make certain that retaining ring installed on each side of ratchet wheel on output shaft, insert valve operating rod through square hole in front face of bearing retainer and connect rod to cross-shaft lever, then install rear bearing retainer and gasket, tighten attaching bolts evenly to 35-40 ft.lbs.

Low Brake Band, Clutch, & Input Shaft Installation: Install low band operating lever and anchor lever with strut shoulders of levers toward inside of case and tapped ends of shaft outward (operating lever on side of case having large servo opening, anchor lever on opposite side). Install low band struts in ends of levers with notched ends together using two wooden blocks (1" x 2" x 3½") to support struts and band while assembling. Install low band with J-2595 band installing clip holding band compressed (CAUTION—used band must be installed in original position with point of heavier wear at anchor end, new band can be installed either way). With struts engaging ends of band (notches on struts must straddle pins on band), apply operating lever and remove clip. Place bronze reaction gear thrust-washer on sun gear, install clutch assembly (use wire hook to lift low band if clutch does not go down fully), place bronze thrustwasher on front face of clutch hub. Install input shaft (make certain that oil seal ring ends properly locked and that retaining ring installed in shaft groove). If shaft does not go down into place, make certain all four thrust-washers are properly centered.

Reaction Shaft Flange, Front Oil Pump, & Accumulator Installation: Install special guide pin (see Guide Pin Note below) in accumulator bolt hole at each end of flange on transmission case. Install new gasket over guide pins so that **all holes in gasket and case aligned** (CAUTION—gasket can be installed incorrectly). Check oil seal rings on reaction shaft flange for correct installation with ends locked, install flange using care not to damage these seal rings. Install low accumulator (on same side as low band operating lever), and high accumulator (opposite side) making certain that **holes in gasket and flange match.** Coat accumulator bolt threads lightly with Permatex #3, install bolts and nuts with lockwashers but **do not tighten,** remove guide pins. Install three special bolts (⅜"-16 x 2") with plain washers in #2, 3, 4 positions (see Tightening Sequence illustration) for assembly purposes (these bolts removed after assembly completed), install regular pump cover bolts, nuts, and lockwashers at positions #1, 5, 6 (CAUTION—Coat #5 bolt threads with Permatex #3). Tighten all bolts and nuts (1-14) to 5 ft.lbs. torque in sequence shown in the illustration, then tighten #1 through #4 to 35-40





BOLT TIGHTENING SEQUENCES

ft.lbs. and all remaining nuts and bolts to 20-25 ft.lbs. torque in the same sequence. Remove the three special bolts (#2, 3, 4). Tighten accumulator body caps to 40-50 ft.lbs. torque. Check flange gasket and trim lower edge flush with bottom face of transmission case if it projects.

►**Guide Pin Note**—These 5/16" guide pins can be made up from 5/16" round stock, 2½" long, with 5/16"-18 thread ½" long on one end and screwdriver slot on opposite end (chamfer this end slightly).

Valve & Servo Body Installation: With transmission inverted on bench, raise reverse band operating lever and insert strut between lever and end of band (CAUTION—rounded ends of strut must be against band and lever). After strut installed, **do not raise lever while installing valve and servo body** (will allow strut to fall into case). Install two 5/16" guide pins (same pins as used for reaction shaft flange—see above) in case to guide each end of servo body, install spacer plate gasket over guide pins. Install valve and servo body on case (hold anchor piston from falling out and move shift control valve and lower operating lever inward to align upper lever with opening in case). Engage control valve pin in slot in operating lever. Install correct length bolts and lockwashers in all mounting holes (see Tightening Sequence illustration for **each type** valve & servo body), remove guide pins. Install operating lever stop (used only on transmissions operating lever stop (used only with first type oil screen). Tighten all attaching bolts and nuts to 5 ft.lbs. torque in **correct sequence for particular type valve & servo body used** (see illustration), then fully tighten all ¼" bolts and nuts to 11-15 ft.lbs. and all 5/16" bolts to 15-20 ft.lbs. torque in same sequence (CAUTION—when tightening nuts and bolts adjacent to shift control valve, operate valve to make sure that it does not bind—if necessary, readjust bolts to lower torque limit to correct binding). On transmissions with second type oil screen, remove bolt #18 and stud nut #9, install cork gasket, oil suction pipe, retaining spring and spring support, tighten this #18 bolt and #9 nut to 11-15 ft. lbs. Connect valve operating rod to upper operating lever by reaching into case with Linkage Hook-up Finger J-2591 and pulling upward on rod to engage ball in socket. Install shift lever on cross-shaft temporarily to check and adjust linkage. Valve linkage must operate freely. Move lever toward front of transmission to engage parking lock. Pawl must fully engage ratchet wheel and pawl lock must be in full contact with pawl in this position. Push shift control valve away from stop pin until all play in linkage is just taken up, check clearance between end of valve and stop pin with feeler gauge. Clearance should be .030-.040" and spring travel at end of shift lever should be 1/8-3/16". Adjust by turning clevis on end of valve operating rod. After adjusting, make certain clevis locknut tightened and that clevis pin secured with cotter pin (first type—snap fastener used on later transmissions).

Oil Pan Installation: If first type oil screen used, check suction pipe fit in servo body (see below). Coat area on transmission case where case cut away under oil pan gasket thinly with Permatex #3. Install 5/16" guide pin at each end (same pins as used for reaction shaft flange—see note above), install new oil pan gasket over guide pins. Install oil pan (use heavy-duty internal tooth lockwashers on bolts and stud nuts), tighten all bolts and nuts evenly to 15-18 ft. lbs. torque.

Oil Screen Suction Pipe Check—***Required for first type oil screen only.*** Install new sealing ring in servo body recess, coat upper edge of suction pipe with red lead, install oil pan with new gasket using two 5/16" guide pins (same pins used for reaction shaft flange installation—see above) in case to guide each end of pan. Install two oil pan bolts and two stud nuts, tighten securely. Remove pan and check pipe contact impression on sealing ring. Pipe must have full 100% contact to prevent air leaks at this point. Adjust by adjusting screen mounting brackets.

►*CAUTION—Do not change oil pipe height setting (17/32" below top edge of pan flange) when making above adjustments.*

Universal Joint Installation: Make certain that joint retaining ring fully seated in groove in output shaft before installing universal joint. If universal cannot

CONTINUED ON NEXT PAGE

BUICK DYNAFLOW (Cont.)

be seated firmly against retaining ring by hand, use Replacer J-865 (40, 50), J-855 (70) to press universal on shaft. Tighten universal joint bolt to 30-35 ft.lbs.

►*CAUTION—Oil passage in bolt must be clear (for universal joint lubrication).*

Torque Ball Installation & Adjustment: *See "Torque Ball Adjustment" in Buick Special Data in Car Model Section for complete data and also note:*

Bell Housing & Torque Converter Assy. Installation:

►*CAUTION—Different converter clearance checking procedure required for transmissions beginning with Nos. F-341 & G-341 (requires reworked gauges and different shimming chart as listed below).*

►**Checking Tool Note**—Converter Clearance Gauges J-3045 (40, 50), J-2596 (70) as designed for early transmissions must be reworked for use on transmissions F-341 & G-341 and later (with redesigned primary pump and cover) by having a cut-out made at each end of the tool immediately inside the stepped ends so that the tool will clear the bulge on the inside of the cover adjacent to the mounting flange face.
Install parts (and check and adjust converter clearance) exactly as follows:

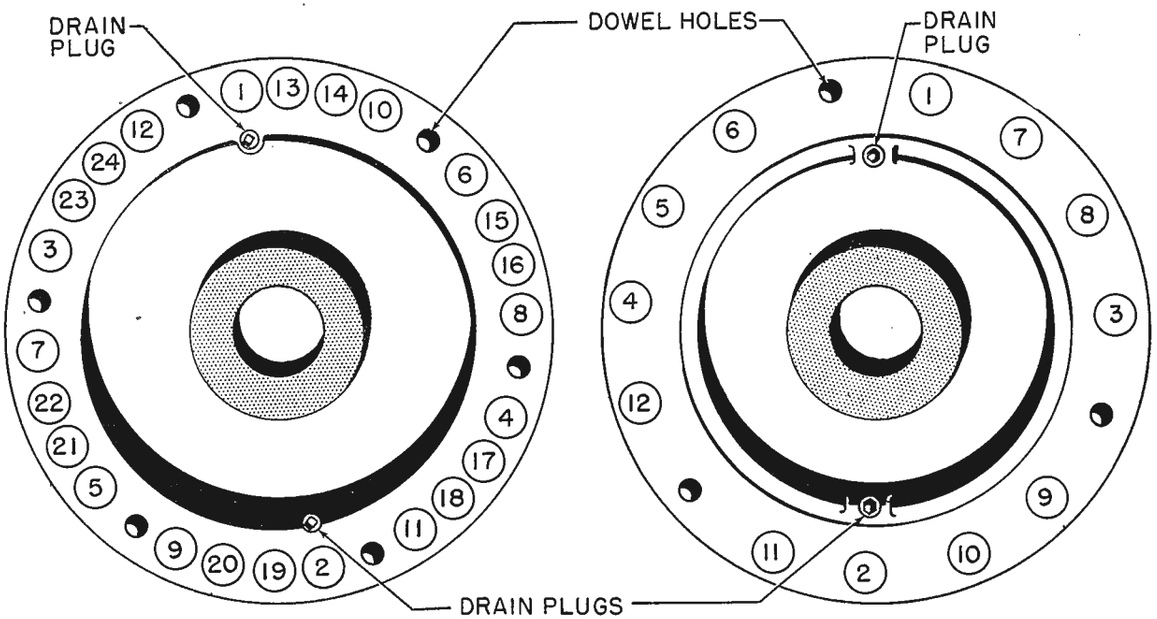
1) See that front oil pump seal ring installed around pump body on pump cover. Install bell housing (use lockwashers on bolts & stud) coating threads of lower right bolt lightly with Permatex #3 (this bolt hole opens into transmission), tighten all bolts evenly to 35-40 ft.lbs. torque.

2) Support primary pump cover firmly on blocks, install bearing plug of Converter Clearance Gauge (see Checking Tool Note above) in pump cover ball bearing, place gauge bar on cover with stepped ends resting on flat surface of cover flange between bolt holes but **do not exert pressure on bar,** carefully measure clearance between gauging step at center of bar and top of plug with a feeler gauge. Rotate gauge bar 90° around pump cover and repeat clearance check. **Average** these two clearances and **make a record of this figure** for use in step (5) below.

3) Place stators and turbine in position in primary pump, place assembly on bench with turbine hub up. Place gauge bar on assembly with stepped ends resting on flat surface of pump flange between bolt holes, measure clearance between gauge step at center of bar and top edge of turbine hub, **make a record of this figure** for use in step (5) below.

4) Install primary and secondary pump assembly on transmission reaction shaft (rock pump to engage pump hub lugs with oil pump driving gear slots), install primary and secondary stator assembly on shaft, install retaining ring in shaft groove.

5) **Add the two clearance figures** obtained in steps (2) and (3) above and note this "total clearance" in the **correct** Converter Clearance Shimming Chart below (CAUTION—different chart required for earlier and later transmissions as noted). Select the correct .018" Shim Washer and .060" Spacer combination as listed for this total clearance and use this in step (6) below.



PRIMARY PUMP COVER

BOLT TIGHTENING SEQUENCES

CONVERTER CLEARANCE SHIMMING CHART

Series 40 & 50

Trans. before No. F-341① "Total Clearance"	Shims Req'd.③ .060"	.018"	Trans. beginning No. F-341② "Total Clearance"	Shims Req'd.③ .060"	.018"
.014" to .031"	0	1	.010" to .027"	0	0
.032" to .049"	0	2	.028" to .045"	0	1
.050" to .055"	0	3	.046" to .063"	0	2
.056" to .073"	1	0	.064" to 069"	0	3
.074" to .091"	1	1	.070" to .087"	1	0
.092" to .109"	1	2	.088" to .105"	1	1
.110" to .115"	1	3	.106" to .123"	1	2
.116" to .133"	2	0	.124" to .129"	1	3
			.130" to .147"	2	0

Series 70

Trans. before No. G-341① "Total Clearance"	Shims Req'd.③ .060"	.018"	Trans. beginning No. G-341② "Total Clearance"	Shims Req'd.③ .060"	.018"
.016" to .033"	0	1	.012" to .029"	0	0
.034" to .051"	0	2	.030" to .047"	0	1
.052" to .057"	0	3	.048" to .065"	0	2
.058" to .075"	1	0	.066" to .071"	0	3
.076" to .093"	1	1	.072" to .089"	1	0
.094" to .111"	1	2	.090" to .107"	1	1
.112" to .117"	1	3	.108" to .125"	1	2
.118" to .135"	2	0	.126" to .131"	1	3
			.132" to .149"	2	0

①—With **FLAT** type Pump Cover Gasket.
②—With "O" RING type Pump Cover Gasket.
③—.060" Spacer & .018" Washer.

6) Install the correct shim washer and spacer combination as selected in 5 (above) on the input shaft.

7) **On transmission before No. F-341 & G-341** (with FLAT type pump cover gasket), install primary pump cover with **new** gasket. Insert pump cover bolts beginning with the two holes directly in line with the drain plugs and **omit the bolt in every fifth hole** clockwise around the cover (see Tightening Sequence diagram). Install bolts from primary pump side with plain washers and safety nuts on cover side but do not tighten bolts until cover has been aligned.

On Transmissions beginning F-341 & G-341 (with "O" RING type pump cover gasket), install primary pump cover with **new** "O" sealing ring, making certain that ring has not been twisted. Insert bolts in following order: With drain plug which is between two bolt holes upward, insert first bolt in hole to right of drain plug, install bolts in clockwise direction around cover **omitting the bolt in every fifth hole** (see Tightening Sequence diagram). Install bolts from primary pump side with plain washers

CONTINUED ON NEXT PAGE

BUICK DYNAFLOW (Cont.)

and safety nuts on cover side but do not tighten bolts until cover has been aligned.

►*CAUTION—All bolts must be same length and have bolt heads of same length. See Primary Pump Cover & Flywheel Bolt Production Change Note.*

8) After cover bolts have been installed, align cover by inserting shank of 11/32" drill through one bolt hole to align all bolt holes, then tighten all bolts to approximately 5 ft. lbs. in correct sequence (see Tightening Sequence diagram for each type pump and cover assembly) **using a wide screwdriver inserted between flat side of bolt head and primary pump to prevent bolt digging into pump,** finally tighten all bolts in same sequence to 30-35 ft. lbs. torque. Install converter drain plugs.

Band Adjustment: Adjust Low and Reverse Bands. *See Band Adjustment.*

Shift Lever Installation: Hold lever forward while tightening nut on cross-shaft to prevent damaging internal linkage.

Oil Cooler Installation: Install oil cooler on right side flange of transmission case, install oil pipes and tighten securely.

Transmission Breather Installation: Make certain that "U" shaped steel baffle is correctly installed in breather body (baffle legs should be aligned with centerline of transmission when breather installed), install breather with tube extending over right rear end of rear bearing retainer, tap breather firmly into opening in bearing retainer.

INSTALLATION IN CAR

After transmission and torque converter completely assembled, install unit in reverse order of removal procedure and note following important points:

Alignment of Parts—See that flywheel, converter primary pump, and converter cover positioned so that paint marks (as made for removal) will be aligned when transmission installed.

►*CAUTION—This alignment necessary to maintain converter assembly balance.*

Bell Housing Mounting Bolt Installation—Install the two bell housing dowel bolts first, then install remaining bolts and tighten evenly to 45-55 ft. lbs. torque **tightening the lower right hand bolt last** (CAUTION—tightening this bolt first may cause misalignment of the bell housing). Install lockwasher and nut on right hand bell housing dowel bolt from under the engine hood after the car has been lowered to the floor (oil pipe spring bracket is also retained by dowel bolt nut).

NOTE—Crankcase ventilator outlet pipe support is attached to lower right bolt. On cars where exhaust pipe hanger attached to lower left bolts, install and tighten regular bolt nuts, then use additional nuts to attach exhaust pipe hanger.

Transmission Support & Thrust Pad Installation & Adjustment—*See ENGINE MOUNTING in Buick Special Data.*

Converter Mounting Bolt Installation—Use correct type bolts and nuts (see Primary Pump Cover & Flywheel Bolt Change) and make certain that balance weights (if used) correctly located under bolt heads, use shank of 11/32" drill to align bolt holes in flywheel and converter, install bolts and tighten evenly to 30-35 ft. lbs. torque.

Final Road Test—After transmission installed and all adjustments made, road test car by driving approximately 20 miles with frequent starts and stops to duplicate heavy traffic conditions. After transmission thoroughly warmed up, check transmission and all oil lines and connections for leaks. If vibration noted due to unbalance of replacement parts, correct this condition as follows:

►**ENGINE & TRANSMISSION VIBRATION CORRECTION:** Remove bell housing cover and bell housing hand hole cover for access to converter primary pump-to-cover bolts, determine location and weight of necessary balance weights as follows:

1) Install one .060" balance weight (medium weight —see table) under heads of two primary pump-to-cover bolts which are immediately to left of one of the converter-to-flywheel bolts, tighten bolts to 25-30 ft. lbs. torque. Check vibration by running engine at critical speed with selector lever in Park "P" position. Stop engine and remove balance weight, retighten bolts to 25-30 ft. lbs. torque.

2) Repeat entire procedure (1 above) with balance weight installed under the two bolts immediately to left of **each of the six converter-to-flywheel bolts** to determine which location of the balance weight produces the least vibration.

3) At the location where least vibration noted (2 above), install balance weight of correct thickness to eliminate all vibration.

Part No.	Balance Weights	Thickness
1337196		.0345"
1337197		.060"
1337198		.120"

►*CAUTION*—On transmissions before Identification No. C-3 & D-3, 1 5/32" long converter-to-flywheel bolts may have to be substituted for shorter 15/16" long converter pump-to-cover bolts to enable thick balance weights to be installed.

4) After balance weights finally installed and cover bolts tightened to correct 25-30 ft. lbs. torque, spot the center of hole in each weight with 5/32" drill, then use No. 32 (.116") drill to drill hole ⅜" deep in pump flange. Install drive screw (No. 145067—⅜" long or No. 450543—½" long depending on weight thickness) in this hole to permanently attach weight to pump flange.

►*IF VIBRATION CAN NOT BE ELIMINATED by above procedure, replace new part which caused the unbalance and repeat balancing procedure.*

Shift Rod Installation—Check and adjust linkage when installing shift rod. See LINKAGE ADJUSTMENT.

Filling Transmission—See LUBRICATION.

Road Testing Car—After installation completed, road test car by driving approximately 20 MPH. with frequent starts and stops (heavy traffic conditions) to thoroughly warm up transmission. Check transmission carefully for oil leaks, recheck oil level.

1939-48 BUICK 60, 70, 80, 90
1951 OLDSMOBILE

BUICK MODELS

Series 60, 70, 80, 90 (1939-42)

Series 70 (1946-48)—See Dynaflow Note

OLDSMOBILE MODELS

Series 88 & 98 (1951)—See Hydra-Matic Note

►**Series 70 (1948) Optl. Dynaflow Transmission**—Dynaflow Drive Transmission is Optl. on 1948 Series 70 and Std. on 1949 and later series. *See "Buick Dynaflow Drive" Transmission.*

Oldsmobile Optl. Hydra-Matic Transmission—*See "Hydra-Matic Transmission" for data on this unit.*

DESCRIPTION: Constant-mesh, synchro-mesh (2nd & High), sliding gear (Low & Reverse), all-helical gear type (low-reverse sliding gear). Main drive gear assembly is mounted on shielded ball bearing at front of transmission case (bearing takes gear thrust). Mainshaft mounted on roller bearing (front), ball bearing (rear) which takes gear thrust. Second speed gear positioned by shoulder on shaft at rear, thrust washer and locking ring at front end. Counter gears mounted on roller bearings (cageless type) on stationary shaft.

Synchronizing Unit:—Consists of two synchronizing drums mounted on the ends of three pin cams which extend through holes in the sliding clutch ring. Synchronizing drum assembly is centered on the clutch sleeve by detent springs which engage the notches in the pin cams. The entire assembly moves as a unit when the clutch sleeve is shifted until the synchronizing drums and cones engage, synchronizing unit then rotates (relative to clutch sleeve) until cam surfaces on clutch ring engage pin cams. Synchronizing drums are driven through this engagement until synchronization is completed.

Shifter Mechanism—New cross-shift mechanism used consisting of vertical shaft in side of transmission case with lever on upper end engaging selector shaft so that movement of the selector lever on the transmission case (small forward lever) shifts the selector shaft sidewise in the transmission to engage low-reverse or second-high rail.

Buick 1940 & Later Synchronizing Cones & Gears: Have 7° angle and marked "S" for use with second speed gear. Service gears are marked '7' and must be used with these cones (do not confuse these gears with types used on previous models).

Countershaft & Reverse Idler Shaft Retainers—Shafts are retained by special grooved lockpin which is driven into hole in case so as to enter hole in shaft. Pin must be driven through into shaft before shafts can be removed and new pin must be used when shafts re-installed.

REMOVAL OF TRANSMISSION: *See "Transmission" on car model page.*

DISASSEMBLY: *Disassemble each model as follows:*

Buick 1939 Disassembly: Remove transmission cover, retainer springs and balls, shifter forks and shafts. Remove torque ball retainer and torque ball at rear of transmission, remove universal joint (use puller). Take out mounting screws and remove rear bearing retainer. Remove mainshaft rear bearing from case and shaft. Pull main shaft assembly (including low

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1939-48 BUICK 60, 70, 80, 90 1951 OLDSMOBILE (Continued)

speed sliding gear, second speed gear, and synchronizing unit) to rear to disengage forward end of shaft from roller bearing in main drive gear, then remove assembly through top of case. Remove main drive gear bearing snap ring (on front end of case), tap main drive gear and bearing assembly back into case and remove through top opening. Remove countershaft lockscrew (at rear end of shaft), drive countershaft out toward rear using special dummy shaft or arbor J-101 (.935" diameter, 7.700" long) and allow this arbor to remain within counter gear cluster until replaced in transmission (arbor will retain loose rollers), remove counter gear cluster through top of case being careful not to lose bronze and steel thrust washers. To remove reverse idler, take out shaft retaining screw, drive out shaft, lift out gear and bronze thrust washers.

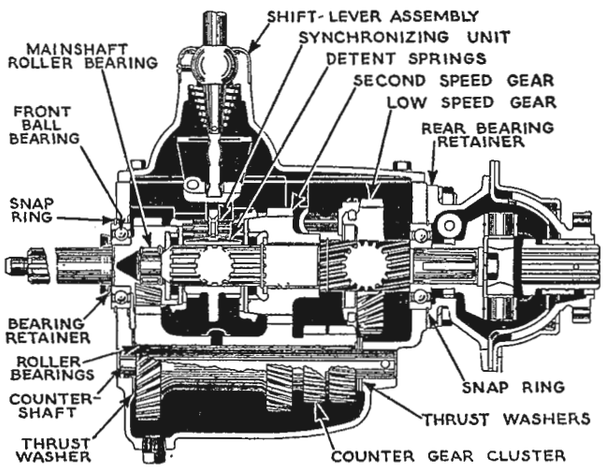
39-60 Note—Shift rails and selector shaft need not be removed to take out transmission mainshaft if they are properly positioned as follows: Shift transmission into high gear, loosen shifter fork on low-and-reverse rail by removing lockscrew, remove rear bearing retainer, pull speedometer gear (press fit on shaft), remove gear spacer and horseshoe shaped rear bearing retainer ring, pull rear bearing, remove mainshaft through top of case.

1939 Selector Shaft Disassembly—Remove both shift rails, take out self-locking setscrews in selector shaft cams, move right cam toward center of case and remove horseshoe lock holding shaft, remove shaft by driving it out through right hand side of case (plug which closes opening will be driven out with shaft). IMPORTANT—Shaft must not be removed from left side which will damage oil seal. Always remove shaft from right and install on left side. Seal plug hole on right side of case

Buick 1940-47 Disassembly: Remove the cover, drive countershaft locking pin in until it is completely within shaft, use service tool J-1001 (dummy shaft) to drive countershaft out through rear of case leaving tool in countergear cluster until it is replaced in case (tool will retain bearing rollers and spacer). Take out mounting screws and remove universal joint ball and cover, remove speedometer drive pinion, take out screw in end of shaft and pull universal joint yoke, then take out mounting screws and remove rear bearing retainer. Loosen lockscrews in both shifting forks, move synchronizer drum assembly to high gear position. Move entire mainshaft assembly back until forward end clears pilot bearing in drive gear, lift shaft up and to left until fork clears collar on synchronizer, move fork to rear in case. Move shaft to right to clear Low-Reverse shifter fork, move fork forward. Remove synchronizer assembly from shaft. Take out second speed gear snap ring, slide second speed gear forward on shaft, take out low speed gear stop ring. Support gears by hand and withdraw mainshaft and bearing through rear of case. Lift out second speed and low speed gears. Remove main drive gear snap ring (on front of case), tap gear through into case and remove through top. Lift out countergear cluster being careful not to lose steel and bronze thrust washers. To remove reverse idler, drive lockpin into shaft, drive shaft out.

Buick 1948 Disassembly: Remove transmission cover and gasket, speedometer drive pinion, thrust plate and gasket, torque ball, retainers and shims from rear bearing retainer (use guide pins to remove torque ball and retainer). Remove retainer bolt and washer, pull universal joint from shaft (use J-859A puller with pressure plug inserted in main shaft and "C" washer in groove in puller body on front side of yoke to take thrust). Remove spacer from mainshaft, remove rear bearing retainer and gasket. Move mainshaft back until bearing clears case, remove bearing snap ring, pull bearing, spacer, and speedometer drive gear from shaft, using puller J-1134. Remove setscrews from shifter yokes, using special tool J-2895. Lift mainshaft assembly (shaft, gears, and synchronizer) out through top of case. Mainshaft assembly can be dismantled on the bench by sliding off synchronizer assembly, removing second speed gear snap ring, and sliding gear off. Remainder of transmission disassembly is same as for previous models (above).

Oldsmobile 1951 Disassembly: Remove transmission cover and gasket, shift lever toggle spring, spring clip and spring extension. Remove speedometer driven gear. Remove rear bearing retainer and gasket. Shift transmission gears to second gear, move mainshaft back until rear bearing clears case, disengage shifter yoke from synchronizer. Lift front end of mainshaft up, slide synchronizer assembly off shaft. Remove snap ring retaining second speed gear on shaft. Line up small wire spacer ring in bottom of snap ring groove with thrust washer key, remove thrust washer and second speed gear. Remove snap ring retaining sliding gear on shaft, then slide gear off shaft as shaft is withdrawn through rear of case. Place transmission shift levers in neutral, remove setscrews retaining shifter yokes and levers on shafts. Slide shifter lever and interlock away from second-and-high yoke shaft, remove interlock retainer from groove in right end of selector shaft. Remove outer shift lever and lockwasher from left end of selector shaft and with transmission shift mechanism in neutral, drive shaft out through right side of transmission case using a soft hammer (welch plug in case will be driven out by shaft) taking care not to allow shifter levers and interlock to drop down in case. Push second-and-high shifter yoke shaft out through front end of transmission case (*CAUTION*—do not allow poppet ball and spring to fly out), lift out shifter yoke, poppet ball, and spring. Remove low-and-reverse shifter yoke shaft similarly through rear end of transmission case. Drive countershaft lock pin in until it is completely within shaft, use Bearing Loader Tool J-1001 to drive shaft out through rear of case (CAUTION—allow tool to remain within gear cluster to retain bearing rollers and thrust-washers). Remove snap ring from main drive gear bearing, tap drive gear and bearing assembly through into case and lift out. Lift out countergear assembly taking care not to lose thrust washers and bearing rollers from within gear cluster (CAUTION—note location of each type thrust washer to insure correct reassembly). Remove nut and lockwasher and take off outer selector lever, remove inner lever and shaft (with spring washer, flat washer, and oil seal) from within case. Drive locking pin completely into reverse idler gear shaft, remove shaft through rear end of case, lift out reverse idler gear and thrust washers.



REASSEMBLY: Reverse disassembly directions above and note following important data:

Retaining Snap Rings—Use all new snap rings and retainers. Before installing snap ring which retains second gear speed thrustwasher, install wire spacer ring, Part No. 1309249, in groove in shaft (this spacer centers the snap ring around the shaft). Use Snap Ring Replacer J-1267 to avoid distorting ring.

Mainshaft & Bearing Assembly:—Rear main bearing should be .0007" tight to .0002" loose on shaft and .0002" tight to .001" loose in case. Bearing is held on shaft by universal joint front companion flange and is retained in case by snap ring in groove in outer race which is clamped between case and retainer. Low and reverse gear backlash on shaft should be .003" maximum.

Synchronizer Assembly:—Cannot be dismantled and should be replaced as a unit. Clutch sleeve clearance on shaft and backlash should be .001-.003". Synchronizer springs are furnished and can be replaced as follows: Remove old springs by prying spring loose from gear pushing it out of the groove, then place new spring over clutch and pull synchronizing coupling up into place over spring.

Main Drive Gear & Bearing:—Bearing is shielded type and should be installed with shielded side in (toward gear teeth). Bearing inner race and oil slinger are retained on shaft by snap ring installed in groove in shaft. Bearing should be .0003" tight to .0007" loose on shaft and .0002" tight to .001" loose in case. Pilot bearing in gear hub is composed of 14 loose rollers which are prevented from moving out by snap ring installed in gear hub.

Countergear Assembly:—Mounted on roller bearings in each end with spacer between bearings. When removing gear cluster, leave dummy shaft or arbor within gear cluster to retain rollers until gears replaced (drive arbor out as countershaft installed). Install roller bearing retaining washer on each end of gear cluster with bronze thrust washer between gears and case (front), bronze washer and steel washer (rear). Use new lockpin to retain countershaft (see Lockpin data below). Countergear bearing clearance should be .0002-.0021" and gear cluster endplay should be .010-.024".

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1939-48 BUICK 60, 70, 80, 90 1951 OLDSMOBILE (Continued)

Reverse Idler Gear Assembly: Install gear cluster with chamfered set of gear teeth to rear of case. Use new lockpin to retain shaft (see Retainer data following).

Countershaft & Reverse Idler Retainers:—With countershaft and reverse idler shaft out of engine, remove locking pins from shaft and discard these pins (pins must not be re-used). After shafts reinstalled in transmission case, line up holes in case and shaft, coat new locking pin with white lead or other sealing compound and drive pin in to the following depth:

Countershaft Lockpin—Flush with surface of case.

Reverse Idler Lockpin—(1940-47 Buick) 5/8" to 3/4", (1948 Buick & Oldsmobile) 1" below surface of boss on case.

Shifter Mechanism:—Before removing selector shaft, remove lever on cross-shift (vertical) shaft to permit lever on upper end of this shaft to disengage from selector shaft as shaft is driven out. Remove lever on left end of selector shaft, take out locking screws in each selector cam, drive shaft out through right side of case (shaft will dislodge sealing plug in hole). This is important to avoid damage to oil seal on lever end of shaft. Inner selector shaft and lever can then be lifted out of case. When replacing this lever, make certain that spring washer, plain washer, and seal are assembled on shaft within case. Inspect condition of selector oil seal (see oil seal data below if seal being replaced). Coat oil seal with Lubriplate, insert shaft through left side of case. Install new welch plug in shaft hole on right side of case (seal plug with white lead or other sealing compound). See that selector shaft slides freely

Selector Shaft Oil Seal—When replacing seal, coat outer surface of seal with white lead or other sealing compound, insert seal with feather edge of seal inward.

IMPORTANT NOTE—Interlock bushing must be installed with large diameter toward transmission case (not toward shifter cam). If reversed, no interlock control of second and high shift rail will result and shift into Low or Reverse may lock gears.

Rear Bearing Retainer (Oldsmobile): Has bronze bushing at rear end which pilots front universal joint yoke hub. Bushing can be replaced as follows:

Bushing Removal—Use tool J-1450-4 to remove old bushing through rear end of housing.

Bushing Installation & Reaming—Use tool J-1450-4 and stop-guide tool J-1450-5 to install new bushing (stop-guide tool will correctly position bushing in retainer). Then ream bushing as follows: Install special reamer pilot in rear end of retainer housing (pilot has two diameters—use diameter which fits tightly in housing), assemble J-1450 reamer and front pilot J-1450-9 in housing, use J-1450-8 clamps to tighten pilot in place, then ream bushing.

Oil Seal & Shield Installation—Line up new seal with bore in rear end of housing, tap lightly on outer edge to start seal into bore, then use driver tool J-1354 to seat seal in housing. Line up shield on seal and tap it into place.

1939 BUICK, OLDSMOBILE, PONTIAC

Buick, Special Series 40 (1939)
Oldsmobile, 6 & 8 All Models (1939)
Pontiac, 6 & 8 All Models (1939)

►**Pontiac 1939 Change for easier 2nd gear shift:** The 1940 type shifter shaft assembly can be installed on these cars (new shaft has tapered section between center and end detent poppet ball grooves in shaft). To make this change, dismantle transmission and install new No. 1312495 Second-and-High Shifter Shaft and new No. 1314658 shaft Poppet Ball Spring.

DESCRIPTION: Constant-mesh, synchro-mesh, all helical gears. Main drive gear integral with clutch shaft and mounted on ball bearing which takes gear thrust. Mainshaft mounted on roller bearing (front), ball bearing (rear) which takes gear thrust. Second speed gear positioned on rear of mainshaft by locking ring at front and thrust washer at rear between gear and bearing. Sliding sleeve, which engages gears, is splined on shaft. Low speed sliding gear is splined on this sleeve at the center and is held stationary when the sleeve is shifted to engage second or high. Counter gear cluster and reverse idler gear mounted on bronze bushings on stationary shaft with thrust washer at each end.

Shifter Mechanism—New type cable and rod actuated shifter shafts for steering column mounted gear shift lever. See Service directions below for disassembling data and separate articles on Buick, Oldsmobile, and Pontiac Transmission controls for adjustment directions.

Rear Bearing Retainer—Rear bearing inner race positioned on shaft by snap ring with spacer between snap ring and speedometer gear which is press fit on shaft. On Oldsmobile (except 6-60) and Pontiac (except Quality 6 39-25), additional Durex bronze bushing located in bearing retainer extension housing. On Buick Model, retainer is flanged to engage front torque tube and mainshaft is splined to engage front propeller shaft.

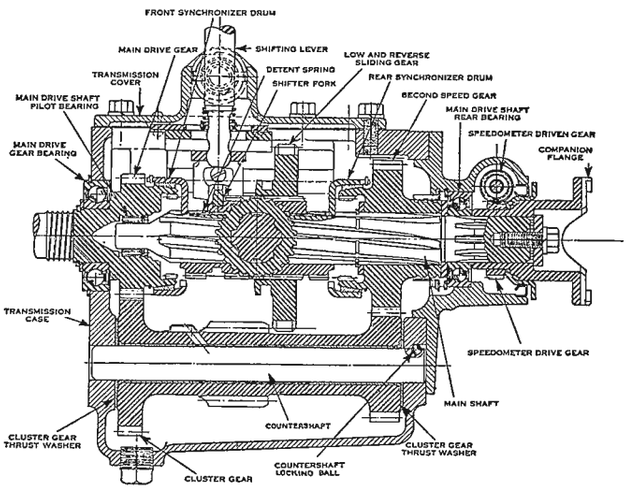
Reverse Idler Lockpin (Buick Only)—New type locking pin used which is driven in case. Pin must be driven completely into shaft to remove gear.

Synchronizing Unit:—Consists of synchronizing cones formed integrally with main drive gear and second speed gear and drums assembled loosely on cones by snap rings. Drums engaged by detent springs assembled in splines on mainshaft (under sliding sleeve) and cams formed on ends of sliding sleeve and are driven by prongs on the drum which engage slots in the sliding sleeve.

REMOVAL OF TRANSMISSION: ***See "Transmission" on car model page.***

DISASSEMBLY: Remove the transmission cover, shift rails (being careful not to lose poppet balls and springs which are under rails, shift forks and selector shaft (use tool KMO-244—Oldsmobile, J-1044—Pontiac, to remove lockscrews in shifter forks and selector shaft cams) being careful not to lose cams when selector shaft withdrawn. **Buick Note—Selector shaft must be driven out through right side of case (with plug which seals hole)—withdrawing shaft from left side of case will damage oil seal. Remove rear bearing retainer screws, withdraw bearing retainer and mainshaft through rear of case as an assembly with the rear bearing and second speed gear, allowing the low speed gear and sliding clutch sleeve to slide off and remain in the transmission case. Lift sliding clutch and low speed gear out through top of case. Push countershaft out of case toward rear being careful not to lose locking ball in groove in shaft and case at rear end. Remove main drive gear bearing snap ring (in bearing outer race on front of case), remove main drive gear through case. Lift out counter gear cluster and thrust washers. To remove reverse idler gear, take out locking screw (Oldsmobile, Pontiac), drive locking pin in so that it is completely within shaft (Buick), remove shaft, lift gear and thrust washers out. On Buick models, remove pin from shaft and use new pin when reassembling (drive pin in so that outer end 5/8-3/4" past flush surface of transmission case.**

Buick Selector Shaft Installation—Install shaft through oil seal on left side of transmission case and seal hole on right side of case (originally closed by plug) with sealing compound.



Mainshaft & Bearing Assembly:—To dismantle, remove sliding sleeve, free 2nd speed gear synchronizing drum snap ring and remove drum. On models with universal joint companion flange bolted on rear end of shaft, remove nut and companion flange. Take out second speed gear snap ring at forward end of gear, remove thrust washer and gear. Take out snap ring in bearing retainer in front of bearing, remove shaft and bearing from retainer by tapping end of shaft on wooden block. When replacing bearing, see that shielded side of bearing is toward front (next to gear) on 1939 cars without oil collector.

Mainshaft Rear Bushing (Oldsmobile 70, 80)—Durex type bronze bushing installed in rear end of rear bearing housing. Bushings cannot be reamed and new bushing should be installed whenever old bushing removed from housing. Use tool J-1060-1 to press old bushing out and driver J-1050 to install new bushing.

Mainshaft Rear Bushing (Pontiac Deluxe 6 & 8)—Durex type installed in rear end rear bearing retainer. Cannot be serviced in the field (replace rear

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1939 BUICK, OLDSMOBILE, PONTIAC (Continued)

bearing retainer if bushing worn—new bushings are line-reamed in production). Oil seal at rear of retainer can be removed by prying out with a screwdriver, use wood block as driver when installing seal.

Buick Specifications—Mainshaft rear bearing should be .0007" tight to .0002" loose on shaft and be .0011" tight to .0005" loose in case (all models). Mainshaft should have no perceptible endplay. Clutch sleeve clearance and backlash on mainshaft should be .001-.003". Low and reverse sliding gear backlash should be .003" max.

Pontiac Specifications—Mainshaft rear bearing should be .0007" tight to .0002" loose on shaft and .0011" tight to .0005" loose in case ('39). Clutch sleeve clearance on shaft and backlash should be .001-.003". Low and reverse gear backlash in splines should be .003".

Synchronizing Unit:—Both synchronizing drums same size, interchangeable, and retained on gear cones by snap ring. Drums can be removed by expanding the ring.

Buick 1939 Note—Synchronizing drum installed on second speed gear must always be **bronze.** Aluminum drums used for high speed gear on some cars.

Second Speed Gear:—Held in place on shaft by steel thrust washer and snap ring at forward end, steel thrust washer (between gear and bearing) at rear.

Buick Specifications—Second speed gear clearance on shaft should be .001-.0026", Endplay .005-.007".

Pontiac Specifications—Second speed gear clearance on shaft should be .0005-.0027", endplay should be .000-.010".

Main Drive Gear & Clutch Shaft Bearing:—Remove high speed synchronizing drum (disengage snap ring), remove bearing retainer snap ring, washer, and bearing. On models with bearing retainer nut, remove snap ring and then back off nut (left hand thread). Where shielded type bearing used, install bearing with shielded side toward gear. Press bearing on shaft using tube against inner race, drill new hole for bearing nut lock ring if old hole does not line up.

Buick Specifications—Drive gear bearing should be .0003" tight to .0007" loose on gear, .0002" tight to .001" loose in case. Shaft endplay should be .013" tight to .002" loose. Pilot bearing for forward end of mainshaft (in drive gear hub) is loose roller type.

Pontiac Specifications—Drive gear bearing clearance should be .0003" tight to .0007" loose on the gear and .0002" tight to .001" loose in case.

Counter Gear Cluster:—When replacing this assembly, see that thrust washers installed at each end. Endplay with washers in place should be .016-.028" and clearance on shaft .0033-.005" (Buick), endplay should be .011-.019" (Pontiac). See that lock ball is in place in end of shaft and that it engages slot in case when shaft installed, use new gasket.

Reverse Idler:—Clearance on shaft should be .0027-.0042" (Buick), .002-.004" (Pontiac). Endplay should be .004-.016" (Buick).

Buick 1939 Note—Shaft locked by new type pin which must be driven completely into shaft before shaft can be removed. Remove pin from shaft before reinstalling shaft in case. Use new pin and drive pin in so that outer end is ⅝-¾" past flush surface of transmission case.

REASSEMBLY: Reverse disassembly procedure.

1940-51 BUICK, OLDSMOBILE, PONTIAC SYNCHRO-MESH

BUICK MODELS
Series 40 & 50 (1940-51)

OLDSMOBILE MODELS
Six, All Models (1940-50)
Eight, All Models (1940-48)

PONTIAC MODELS
Six & Eight, All Models (1940-51)

►**Buick Optl. Dynaflow Drive**—Synchro-mesh transmission (below) is Std. with Dynaflow Drive automatic transmission Optl.
See Hydra-Matic Drive Transmission.

►**Oldsmobile & Pontiac Optl. Hydra-Matic Drive**—Synchro-mesh transmission (below) is Std. with Hydra-Matic Drive (automatic transmission with Fluid Coupling) Optl.
See "Buick Dynaflow Drive" Transmission.

►**Pontiac 1940 Gearshift Lever Stiffness Complaints** To correct stiffness in the lever and difficulty in complaints of stiffness in lever and difficulty in moving lever toward wheel (for cross-shift), dismantle transmission and remove vertical selector lever shaft, clean shaft and hole in transmission case thoroughly and lubricate shaft and hole in case with Lubriplate when shaft re-installed (see Servicing below for dismantling instructions).

DESCRIPTION: Constant-mesh, synchro-mesh (2nd. & High), sliding gear (Low & Reverse), all helical gear type. Same design as used on preceding car models except for the following changes:

Shifter Mechanism—New cross-shift mechanism consisting of a vertical shaft on side of transmission case with inner lever at upper end engaging selector shaft so that movement of selector lever on transmission case (small forward lever) shifts the selector shaft sideways in the transmission to engage the Low-Reverse or Second-High shifter rail.

Countershaft Bearings—Countergear cluster now mounted on roller bearings (loose rollers) at either end with spacer on shaft between bearings. Special service tool (dummy shaft) must be used when removing countershaft to retain bearing rollers.

Synchronizer Cones & Gears (Buick only)—Synchronizing cones have 8° angle and must be used with new gears marked '8' (do not confuse these gears with gears used on previous models). Bronze cones must always be used with Second Speed Gear.

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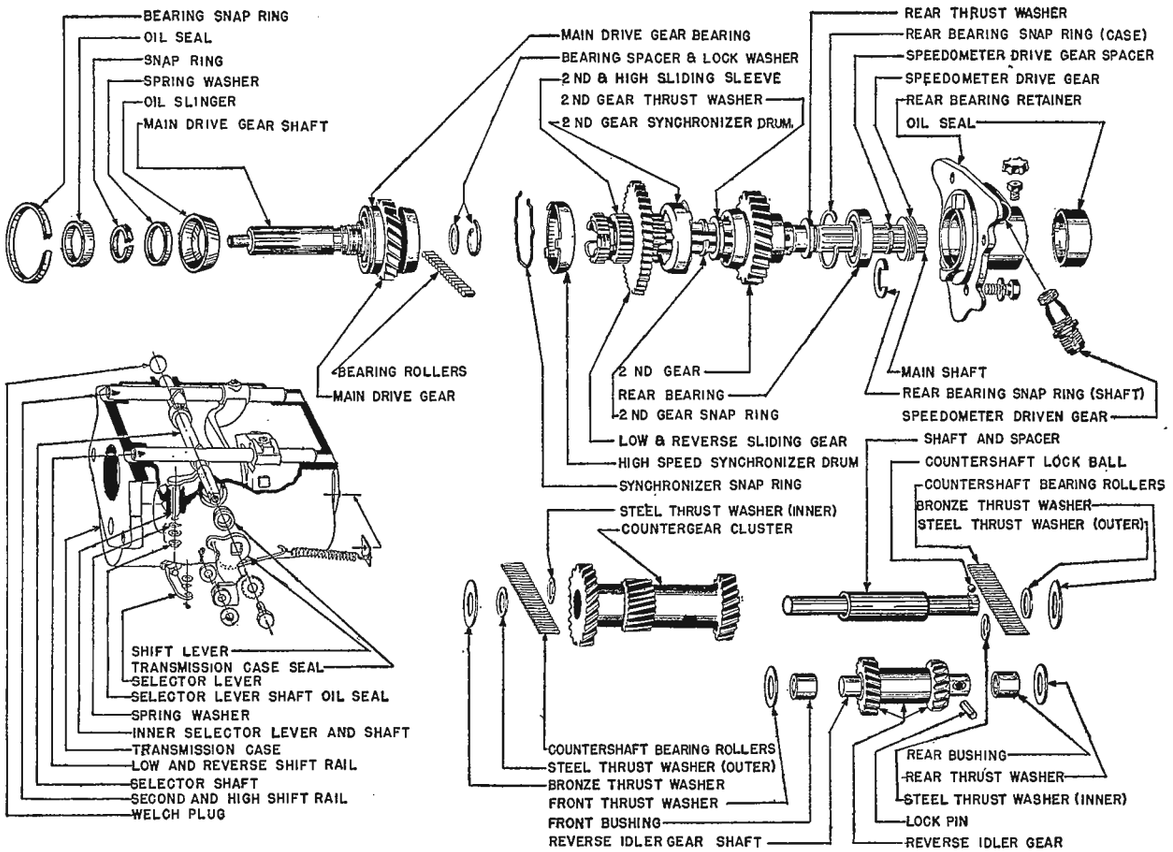

BUICK, OLDSMOBILE, PONTIAC SYNCHRO-MESH TRANSMISSION

BUICK-OLDSMOBILE-PONTIAC 1940-51 (Continued)

REMOVAL OF TRANSMISSION: *See "Transmission" on car model page.*

DISASSEMBLY: Remove transmission cover and speedometer driven gear assembly. Disconnect spring on shifter lever on left side of case. Take out rear bearing retainer screws, set transmission in high gear position (to prevent sliding sleeve and low speed gear from dropping down into case), withdraw bearing retainer, second speed gear, and mainshaft assembly through rear of case. Remove setscrews from shifter forks and selector shaft cams (tool J-2895 or KMO-244), take out screw and remove lever from left end of selector shaft, remove lever from lower end of vertical shaft (necessary to permit inner lever on upper end of shaft to disengage from selector shaft), drive selector shaft out through right side of case (this is important to prevent damage to oil seal on lever end of shaft), remove selector cams from case. Remove shifter rails at front of case (on Buick & Oldsmobile, plug at front end of Second-High rail must be removed—see Note), through rear of case (Pontiac), do not lose the detent balls and springs which are located under rails on all models. Lift out shifter forks, sliding sleeve and low speed gear. Use special tool (arbor or dummy shaft) J-1334 (Buick & Pontiac), J-1449 (Oldsmobile) to drive countershaft out through rear of case, leaving tool within counter gear cluster to retain bearing rollers until shaft is replaced. Remove snap ring on main drive gear bearing (on front of case), tap main drive gear and bearing through into case and lift out. Lift countergear cluster out being careful not to lose thrust washers on either end of cluster or bearing rollers. To remove reverse idler, drive locking pin into shaft, drive shaft out, remove gear.

►**Buick & Oldsmobile Shifter Rail Note**—Forks can be removed without entirely removing shifter rails by pushing rails toward back of case sufficiently to slip forks off (will not disturb poppet balls and springs or second-high rail welch plug).

►**Oldsmobile 1940 Note**—On this model, shaft retained by a setscrew in the case which must be removed before shaft can be driven out.

REASSEMBLY: Reverse disassembly directions above and note following data on servicing of sub-assemblies.

Synchronizing Unit:—No detent springs used. Synchronizer drums are retained on gears by snap rings (remove by releasing snap rings).

Buick Note—Make certain that drum used on second speed gear is Bronze (aluminum drums used on some models for high gear).

Mainshaft & Rear Bearing Assembly: To disassemble parts, remove second speed synchronizing drum by prying retainer over shoulder on gear (leave retainer in drum). Remove snap ring from shaft, using Remover Tool J-1019 (Buick), J-1130 (Oldsmobile & Pontiac), remove thrustwasher and second speed gear. On Buick models, remove retaining bolt and washer on end of shaft and use Puller J-682-A to remove universal joint (install pressure plug in rear end of shaft, insert puller body in universal rear yoke and install "C" washer in puller groove ahead of yoke to take thrust). On all models, remove rear bearing snap ring, remove mainshaft and bearing from retainer or extension housing by tapping rear end of shaft with soft hammer or wooden block. To remove bearing from shaft, press or pull speedometer gear off shaft, remove spacer, use tool J-1041 to remove bearing rear snap ring ("C" type ring used on Oldsmobile and Pontiac only), press or pull bearing off shaft. Install bearing with shielded side forward or toward second speed gear. Bearing should be .0007" tight to .0002" loose on shaft and .0011" tight to .0005" loose in housing.

Oldsmobile Extension Housing (G40, L40 '40; 76, 78, 96, 98 '41-42 & All Later Models): Housing has steel-backed, bronze bushing at rear to support mainshaft. Bushing can be replaced after oil seal removed from housing by using tool J-1450 and new bushing installed with same tool. Bushing must be reamed after installation using reamer which is part of J-1450 tool to provide .0025-.004" clearance on shaft.

►*CAUTION—Tool J-1450 must be used to ream bushing accurately (tool pilots in ends of housing).*

IMPORTANT INSTALLATION NOTE (OLDSMOBILE)—When transmission installed on above models, fill the transmission rear bearing housing assembly with ½ pint transmission lubricant after transmission has been installed in car.

Rear Oil Seal (Oldsmobile)—New oil seal must be installed in rear end of rear bearing retainer whenever oil seal removed. Soak new oil seals in engine oil for 5 minutes, install seal with felt to rear using tool J-1050. NOTE—New type oil seal has shoulder locates it. See that housing vent open.

Pontiac Extension Housing (1949-51): Housing has graphite-bronze bushing (1.159" x 1 5/16" x 1 1/4") at rear end to support mainshaft. This bushing located in housing directly in front of oil seal.

Rear Oil Seal (Pontiac)—Old oil seals can be removed by prying with a screwdriver. Use tool J-1323 to install new oil seals (seal has extension rim which will be damaged if tool not used). Oil the felt of the new oil seal, and coat inner surface of housing and outer rim of seal with Permatex No. 3 or other sealer before installing it in housing.

Main Drive Gear & Bearing:—Bearing can be removed from shaft after lock ring has been removed by tapping end of shaft on wooden block. When installing bearing, see that shielded side is toward gear. Bearing should be .0003" tight to .0007" loose on shaft and .0002" tight to .001" loose in case.

Pilot Bearing (Oldsmobile Models)—Pilot bearing in flywheel consists of special Durex bushing installed with flat end in (no felt used on 1942 models—front wheel bearing lubricant used in reservoir). Bushing is retained by special sheet metal retainer pressed in end of crankshaft. To replace bearing, use puller J-1448 to remove old bushing, clean out all old lubricant, use tool J-1329 to install new bushing (install bushing with flat end in), use adapter J-1329-2 on tool J-1329 to install new retainer, insert ¼ oz. front wheel bearing lubricant in recess in front of bushing.

NOTE—An oil-soaked felt is installed in recess in back of bushing on Oldsmobile 1940-41 cars. Soak felt in #30 SAE. engine oil before installation. This felt not used on later cars.

Pontiac Main Drive Gear Oil Slinger and Oil Seal (1946 On)—An oil slinger and spring washer are installed on main drive gear hub ahead of the bearing (retained by bearing snap ring). Install new felt oil seal (lubricate felt with engine oil) against shoulder on shaft directly forward of oil slinger each time transmission is installed in car.

►*CAUTION*—Do not install oil seal in groove in main drive gear shaft (on 1946-47 cars—seal location changed from this groove). Later gears do not have this groove.

Second Speed Gear: Gear clearance on shaft should be .001-.0026" (Buick), .0005-.0027" (Pontiac 1940-48), .0012-.0028" (Pontiac 1949-51). Gear endplay should be .000-.010" (Buick & Pontiac 1940-48), .0001-.0231" (Pontiac 1949-51). When installing gear, coat thrust washer with lubricant and install against gear, use tool J-1130 to install retaining snap ring.

Countergear Assembly:—If rollers removed from gear cluster, use arbor as assembly tool, make certain that spacer and thrust washers assembled in gear cluster, then install rollers, using grease to retain them in place. Install assembly in case, making certain that small steel thrust washer installed next to bearing rollers and large bronze thrust washer between gear cluster and case at each end, insert countershaft from rear and push arbor out through front of case. See that lock ball in place in rear end of shaft and that ball engages groove in case to prevent shaft from turning. Countergear clearance should be .0005-.0024". Endplay should be .0176-.0296" (Buick), .009-.021" (Pontiac 1940-48), .0176-.0306" (Pontiac 1949-50).

Reverse Idler Gear Assembly:—Remove old lockpin from reverse idler gear shaft and discard pin (use new pin for reassembly). Idler gear bushing clearance on shaft should be .0002-.0042". When installing gear, line up lock pin hole in shaft and case and install NEW lock pin as follows:

Lock Pin Installation—Use new lock pin, coat pin with white lead or other sealing compound, drive pin in until head of pin is correct distance below surface of boss on case:

Buick—(1940-47) 5/8-3/4", (1948 On) 25/32".

Oldsmobile—3/4".

Pontiac—(1940-48) ¾", (1949 on) 25/32".

Shifter Mechanism:—Selector shaft must be removed when transmission is disassembled (see Disassembly directions above). To remove shaft, use KMO-244 or J-2895 tool to remove cam setscrews, remove lever on left end of shaft by taking out retainer screw, remove lever on lower end of cross-shift shaft (necessary to allow inner selector lever on upper end of shaft to disengage from selector shaft). Drive selector shaft out through right side of case (this is important to avoid damage to oil seal on lever end of shaft). With selector shaft out, inner selector lever and shaft can be lifted out. See that this shaft and hole in case are clean, lubricate with Lubriplate when shaft replaced being certain that spring washer, plain washer and oil seal installed on upper end of shaft within case. Install selector shaft through left side of case and install new welch plug to close hole on right side (use white lead or other sealing compound to seal the plug).

►*CAUTION*—When installing lever on selector shaft, hold shaft with wrench to avoid damaging selector cams. Make certain that lockwasher installed on lever retainer screw.

CADILLAC & OLDSMOBILE 8 SYNCHRO-MESH

Cadillac V8, All Series (1939-51)
Cadillac V16, All Series (1939-40)
Oldsmobile 8, Series 88 & 98 (1950)

►CHANGES, CAUTIONS, CORRECTIONS

►**Cadillac & LaSalle 1939 Detent Spring Change to Correct Hard Shifting Complaints:** Springs on 1939 cars were .022" thick and were changed on later cars to new type .018" thick (except 39-90). To correct hard shifting complaints on first cars, install the new .018" thick springs (except 39-90).

►**Cadillac & Oldsmobile Optl. Hydra-Matic Drive Transmission**—Data below applies only to standard synchro-mesh transmission.
See "Hydra-Matic Drive" transmission.

►**Cadillac 1941 Extension Housing Change**—See Extension Housing data for special type used on first Housing data below for special type used on first 1941 cars which must be replaced to allow installation of special speedometer gears if optional ratio rear axles being installed on these cars.

Gearshift Mechanism—Remote control with shift lever mounted on steering column in conjunction with new shifter mechanism on transmission case consisting of separate shift levers and shafts installed in side of transmission case. Special disassembly directions required for this type transmission as given below. Refer to separate Transmission Control article for gearshift adjustment

DESCRIPTION: Constant-mesh, synchro-mesh, all helical gears (low-reverse sliding gear). Main drive gear and shaft mounted on ball bearing in front of case which takes gear thrust. Mainshaft mounted on roller bearing at front end and roller bearing at rear end which takes gear thrust (shaft extension integral with mainshaft with additional ball bearing at rear end of extension housing). Second speed gear positioned on mainshaft by shoulder at rear, thrust washer and snap ring at front. Counter gear cluster mounted on needle bearings on stationary countershaft with thrust washers at each end. Gears are engaged by a sliding clutch sleeve which is splined to the shaft and engages clutch teeth inside the synchronizing cones on the second speed and main drive gears.

Synchronizing Unit. Consists of two synchronizing drums mounted on the ends of three pin cams which extend through cam holes in the center ring of the clutch sleeve. Synchronizing drum assembly is centered on the clutch sleeve by detent springs which engage the notches in the pin cams. The entire assembly moves as a unit when the clutch sleeve is shifted until the synchronizing drums and cones engage, synchronizing unit then rotates (relative to clutch sleeve) until cam surfaces on clutch ring engage pin cams. Drums are driven through this engagement until synchronization is completed.

Interlock Assembly (1939 On)—New type ball seat tube installed in interlock boss in transmission case (spring located within tube, interlock ball in tube at each end). When a gear is engaged, shoulder on shifter shaft quadrant forces tube toward opposite quadrant so that lock ball seated in end of tube and prevented from releasing this shifter shaft.

REMOVAL OF TRANSMISSION: *See "Transmission" on car model page.*

DISASSEMBLY (1939-48): Remove speedometer gear adapter housing and gear assembly. If universal joint flange not removed previously with propeller shaft, slide flange off rear end of extension shaft. Take out extension housing mounting capscrews and remove extension housing. Remove bottom cover from transmission case. Remove countershaft through rear end of case, lift out gear cluster and thrust washers (CAUTION—do not lose bearing rollers and spacer). Remove lockscrews on front of case, pry main drive gear and bearing assembly out through front of case. Slide the clutch sleeve and synchronizer assembly off front end of mainshaft and lift out. Use tool J-1007 to free second speed gear lock ring. Tap mainshaft and bearing assembly out of rear end of case and remove while sliding the second speed gear and low & reverse sliding gear off forward end of shaft (lift these gears out through opening in case). Tap reverse idler gear out through rear of case, lift out reverse idler gear and thrust bearings. Remove shifter levers on outside of case, remove shifter lever shafts from within the case (CAUTION—use care not to lose interlock spring, balls, or tubes).

DISASSEMBLY (1949 ON): Remove the speedometer driven gear and sleeve assembly. Take out extension housing capscrews, remove housing and bushing assembly. Remove transmission lower cover (CAUTION—note location of two longer screws which lock countershaft and reverse idler shaft). Check cluster gear endplay with feeler gauge (for selection of correct thrustwashers when re-installing gears). Push countershaft out through rear of case with tool J-1184 leaving tool in cluster gear to retain bearing roller assembly. Remove cluster gear assembly and thrustwashers from case. Take out lockscrew on front of case, remove bearing lock ring from drive gear bearing outer race. Slide mainshaft and rear bearing out through rear of case as far as possible and tip assembly to one side to provide clearance. Tap drive gear and bearing back into transmission case and remove through opening in case (CAUTION—use care not to damage mainshaft assembly). Slide synchronizer unit off end of mainshaft and remove from case. Remove second speed gear lock ring from mainshaft groove, slide second speed gear, thrustwasher, and low speed gear off shaft while withdrawing mainshaft and rear bearing through rear of case. Lift out second speed gear and low speed gear (turn gear to free it from shifting lever shoe). To remove reverse idler gear, tap shaft out through back of case (or use tool J-1010 to push shaft out), lift out reverse idler gear and thrustwashers. Remove shifter levers from outer driven gear and sleeve assembly. Take out extension ends of shifter shafts, remove shifter lever shafts from within case.

►*CAUTION—Do not lose interlock springs, balls, or tubes when removing shifter shafts.*

REASSEMBLY: Reverse disassembly directions and note following data on sub-assemblies:

Mainshaft Rear Bearing: If bearing being replaced, use tool J-4390 to remove speedometer drive gear from shaft, remove bearing snap ring, remove bearing by jarring end of shaft on wood block or press bearing off in arbor press. Use tool J-4390 to press or tap new bearing against shoulder on shaft, install snap ring, then install speedometer drive gear similarly.

Mainshaft & Second Speed Gear Assembly. Cannot be installed as an assembly (to install, reverse disassembly directions above). See that second speed

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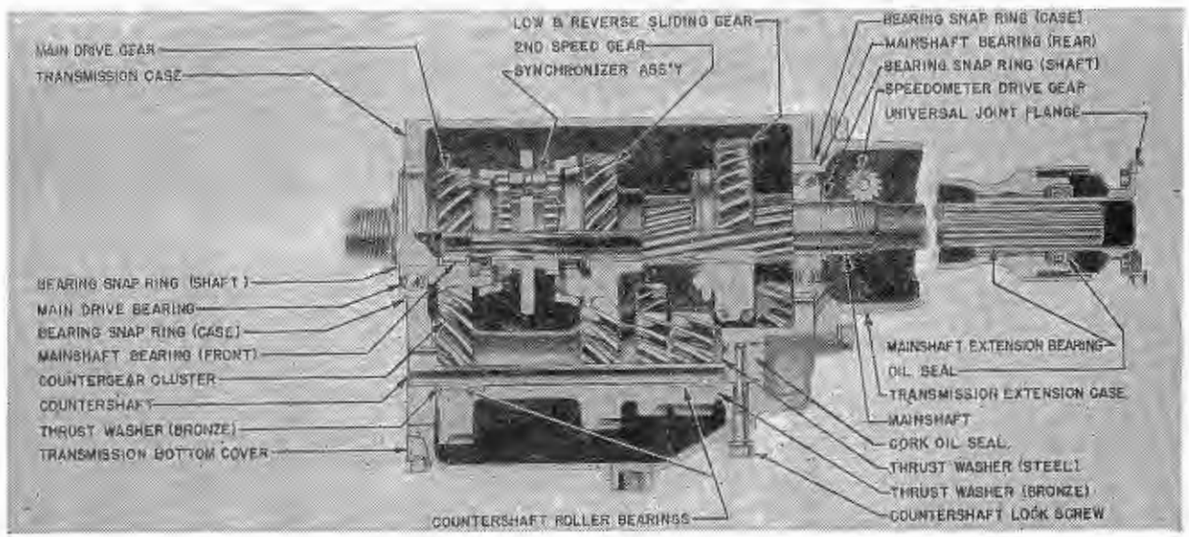

CADILLAC, LA SALLE, OLDSMOBILE 8 SYNCHRO-MESH

CADILLAC & OLDSMOBILE (Continued)

gear thrustwasher installed with key engaged in groove in shaft. Use new lock ring to retain second speed gear (install ring with J-1466A pliers). Low gear backlash on mainshaft splines should be .004-.007" (new), .010" (worn limit). Synchronizer hub backlash on mainshaft splines should be .0005-.001" (new), .003" (worn limit). Second speed gear clearance on mainshaft should be .001-.0015" (new), .00175" (worn limit), and endplay should be .004-.008" (new), .012" (worn limit).

Shifter Shaft Assembly: Install the second & high lever and shaft in neutral position making certain that shoe is properly located. Install interlock ball, tubes, and spring assembly in case with counterbored end of tube toward ball, compress the spring and locking balls with tool J-1168, install low-and-reverse shaft with sector in neutral position making certain that shoe is in place. Install new cork seals on outer ends of shafts (use tool J-1169), tap shifter levers into place on shafts (brace inner ends).

Synchronizing Unit:—Should not be dismantled and cannot be serviced except for removal of detent springs (installed directly below each pin cam and accessible without dismantling unit. To remove detent spring, pry top edge of spring out of gear, push spring out of groove. Install new springs with long end of spring facing long end of gear, pull coupling up in place over springs.

Main Drive Gear & Clutch Shaft Bearing:—Bearing is press fit on shaft. To replace bearing, remove snap ring from shaft groove, jar end of shaft on wood block to remove bearing or press shaft off in arbor press. Press new bearing on shaft (CAUTION—press on inner race only), install snap ring. To remove mainshaft pilot bearing rollers from drive gear recess, remove and discard locking ring (use new locking ring when installing rollers).

Counter Gear Cluster: Needle bearings are loose and will fall out when shaft removed unless a dummy shaft or Tool J-1184 used to retain them. Use this special tool J-1184 to assemble bearings (rollers, spacer, and the retaining washer at each end) before installing counter gear. Leave tool in gear until it is pushed out by countershaft when shaft inserted. Install thrust washer at each end with steel spacer between thrust washer and case at rear. See that locking screw hole in countershaft lines up with cover screw hole so that shaft will be locked in place when cover screws installed and that new cork seal installed in groove near rear end of shaft to prevent oil leaks. Countergear endplay should be .005-.012" (new), .018" (worn limit).

NOTE—If endplay exceeds .018", install special oversize thrust washers.

Reverse Idler Gear:—Clearance on shaft should be .005-.010" (new), .015" (worn limit). When installing shaft, use special tool J-1010 to align front thrust washer (on 1939 and later models, thrust washers are steel-backed, babbitt faced type), see that thrust washers installed at each end of shaft with prongs on washers engaging slots in case, use new cork seal in groove on rear end of shaft to prevent oil leaks, align locking screw hole in shaft and case (shaft locked by cover screw). Endplay should be .005-.010" (new), .015" (worn limit).

Extension Housing & Oil Seal (Cadillac): Install extension housing on transmission case and tighten screws securely. Then install oil seal in rear end of housing using tool J-1942. Extension housing bushings are not furnished separately and housing should be replaced if bushing requires replacing. NOTE—Extension housing used on approximately first 3500 cars in 1941 permits use of speedometer pinion for standard rear axle ratio only and housing must be replaced if optional rear axle installed. Second type housing (with provision for installation of optional axle ratio speedometer drive pinions) only is furnished for service and is marked 'R' on case under speedometer cable opening. *See Cadillac Special Data in Car Model Section.*

Extension Housing & Oil Seal (Oldsmobile): Bronze bushing in housing is furnished separately and can be replaced. Remove old bushing with tool J-1150-4, install new bushing using same tool and adapter J-1150-5 (stop guide which will position bushing correctly). **New bushing must be reamed** using Reamer Tool J-1450 and pilots J-1450-2 (rear) and J-1450-7 (front—this pilot must be tightened in place with clamps J-1450-8).

Oil Seal Replacement—Pry old seal out, start new seal squarely in bore by tapping lightly on outer edge, then drive seal into place with tool J-1354.

OLDSMOBILE 1939 SELF-SHIFTING

ALL MODELS (1939)

SERIAL NUMBER:—First No. 18000. All transmissions with serial numbers above 18000 are new 1939 type NOTE—New type single unit oil pump (described below) used also on 1938 units after No. 14039.

SPECIAL TOWING INSTRUCTIONS: To tow or push cars equipped with automatic transmission, proceed as follows. Move manual shift lever to neutral position, keep ignition key turned off (clutch pedal need not be disengaged). If car will operate only in 1st speed and must be towed, rear wheels must be raised clear or drive shaft disconnected.

DESCRIPTION:—Design same as type used on 1938 cars except as follows:
Steering Column Shift Lever—New design used in conjunction with redesigned forward-and-reverse lever. All control adjustments same as for 1938.

Rear Unit Accumulator—Designed to eliminate noise or jerk when transmission shifts from third back to first gear (high range) with hot oil. Accumulator assembled in rear servo and special one way ball check valve installed in oil control unit valve body. When downshift from third to first occurs, oil in compensator system is trapped by check valve (while oil in clutch system allowed to escape freely) so that rear brake band engages gradually until clutch is disengaged. Oil pressure in compensator system is held to 100 lbs. maximum (exhausts through accumulator bleed slot when pressure exceeds 100 lbs.).

New Single Unit Oil Pump—Mounted in same manner as 1938 type, driven by gear on headset mainshaft (operates whenever rear wheels revolving). NOTE—This oil pump used on 1938 transmissions beginning with Serial No. 14039 and interchangeable with two-unit pump used on earlier models.
Oil Control Unit (Valve Assembly)—New type with check valve for Rear Accumulator control. Interchangeable with 1938 type by removing check valve
Governor—Three stage type driven by oil pump gear (in tandem with oil pump).
Mainshaft Front Pilot Bearing—New needle bearing type (changed from plain bushing).
Clutch Brake Washer—Used on all cars with single unit oil pump to prevent clutch spin. Consists of dished bronze friction washer assembled on forward end of front unit drive gear shaft within main drive gear (clutch shaft gear). See servicing data below for washer installation.

LUBRICATION:—Capacity 3 qts. (refill), 3½ qts. (dry—when pan removed and cleaned). Recommended lubricant (engine oil) for all seasons as follows:

Summer	SAE #30
Winter (Below 45° F.)	SAE #20W
Winter (Below 0° F)	SAE #10W

See preceding article for checking, cleaning, and refilling directions.

ADJUSTMENT & SERVICING:—All adjustments and servicing operations same as for 1938 cars except as noted below. ***See preceding article for data.***

Governor Adjustment:—Governor controls automatic upshift from 1st to 2nd (10 MPH., 1300 RPM) and 3rd to 4th (1350 RPM., 22 MPH. with minimum throttle) at part throttle and should be adjusted so that these shifts occur at the correct speed in the first stage of the governor travel. To adjust (with transmission side cover removed to expose governor), hold inner shaft with screwdriver and turn nut on outer end of governor shaft counter-clockwise until front unit valve just clicks open, then turn nut clockwise until valve just clicks closed, finally turn nut additional ⅞ turn clockwise. This will bring shift at center of governor travel. Replace lockplate and nut and lock securely.

Oil Pump Servicing:—To remove pump, remove Pressure Regulator Valve, remove oil pump to transmission case attaching bolts (two bolts near center of cover hold pump cover on pump body and need not be removed), remove pump. NOTE—Pump is doweled on case and may need to be pried off dowel

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OLDSMOBILE 1939 SELF-SHIFTING (Continued)

pin. With pump free of dowel, do not use force to remove pump which will damage drive gear (use bar or screwdriver to turn front universal joint slightly to line up gears which will allow pump to be pulled out easily).

Oil Pump Disassembly—Remove two pump cover to body screws, lift off cover and gasket. Press oil pump driven gear off shaft (serrated fit on shaft), remove thrust washer and snap ring, invert pump and remove gears and shaft. To disassemble relief valve, remove plug on side of pump cover, remove regulator spring and plunger, take out capscrews mounting regulator valve body on pump, valve body and bronze separator plate.

Oil Pump Assembly—Assemble pressure regulator (tighten mounting screws evenly to prevent distorting valve body) and make certain that regulator valve is free in body after installation. Insert shaft through pump body, assemble snap ring and thrust washer on shaft making certain that snap ring indexed in washer undercut, press driven gear on shaft so that it seats firmly against thrust washer, install pump idler gear on shaft, install plunger, regulator spring and plug in pump cover and make certain that brass sealing gasket in good condition. Use new cover gasket and install pump cover, check gear endplay (should be .001-.003".

NOTE—Cover gaskets available in two thicknesses (.005" thick—has 1 notch in edge, .007" thick—no notch), use .005" gasket first and if shaft does not turn freely, install .007" gasket. If shaft still does not turn freely, it is out of alignment (do not use more than .007" gasket thickness under cover).

Oil Pump Pressure Test—Pump pressure should be tested before dismantling transmission when trouble experienced (such as hunting or slipping particularly in 1st to 3rd shift). To check pump pressure, use 200 lb. gauge connected to plug opening in oil pump cover and operate car as follows: With transmission oil hot, shift transmission into high range and slow car speed down until transmission shifts into 3rd speed. In 3rd gear at car speed of 15 MPH., oil pressure should not be less than 78 lbs. If pressure below this figure, check for oil leaks or weak pressure regulator valve spring (see servicing data below). If pressure is above 78 lbs. after replacing spring but transmission performance is unsatisfactory, clutch plates are worn

Pressure Regulator Valve:—Valve serviced separately (Part No. 1305224) and main and bumper springs available in package sets as follows: No. 1394616 (for Transmissions before Serial No. 18000), 1394617 (Serial No. 18000 up). Bumper (cushion) spring should be installed with tight coil on top (this end coil engages valve stem and spring should be removed from valve only for replacement). NOTE—Wrong spring will cause downshift from 3rd to 1st. to occur at higher than normal speed.

Clutch Brake Washer:—Must be used on all cars with single unit oil pump to prevent excessive clutch spin. Install washer on front unit drive gear shaft (tangs or lugs on washer engage slots in shaft) with dished and pointed face forward toward main drive gear (clutch shaft gear).

Rear Unit Accumulator:—Serviced as an assembly only (Part No. 1396935). Mounted as part of rear servo and removed and installed as an assembly

Transmission Disassembly:—Disassembled in same manner as 1938 type. Ball thrust washer in clutch shaft drive gear is retained by pilot needle bearing and snap ring (Transmission Serial No. 18000 up) and will not drop out as gear removed as on earlier models. Brake washer is used on shaft at rear of clutch shaft drive gear on all units with single unit oil pump (see Clutch Brake Washer data above). Reverse idler gear should be installed with pointed side of teeth toward front of transmission.

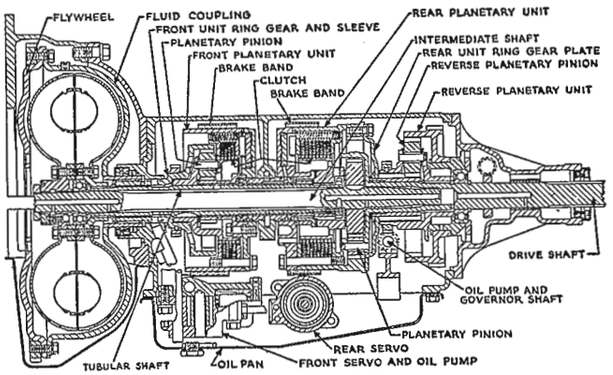
CADILLAC 1941, OLDSMOBILE 1940-41 HYDRA-MATIC DRIVE

OLDSMOBILE 6 & 8, ALL MODELS (1940-41)
CADILLAC, ALL MODELS (1941)

IMPORTANT SERVICE NOTE:—Towing Car—Control lever must be placed in 'N' (neutral) position if car is being towed.

Starting Engine by Pushing or Towing Car—Control lever should be placed in 'N' (neutral) position until car speed of approximately 20 MPH. is reached, control lever should then be moved to 'HI' position and engine will be cranked through gears.

Parking With Transmission in Gear—To park car in gear (for parking on hills), engine should be stopped with control lever in forward driving position (HI or LO), control lever should then be moved to 'R' reverse position. This locks the drive system so that car will not move.



Reverse Shift—To engage reverse, with car completely stopped, control lever should first be moved momentarily to 'LO' position and then quickly and firmly moved to 'R' position.

NOTE:—Hydra-Matic Drive used on all models is similar in design except as noted below (Starter Interlock used on 1941 Oldsmobile models only—not used on 1940 models).

Fluid Coupling—Replaces conventional clutch on Hydra-Matic Drive cars (see illustration).

Starter Interlock—Consists of a bellcrank linked to the starter motor pinion shift lever which 'kicks' the steering column control lever into the 'N' or neutral position when the starter pedal is depressed to start the engine (if control lever has been left in any other position than neutral). This linkage is adjustable (see Adjustment directions below).

Cadillac Type—Cadillac Hydra-Matic Drive is similar in design to Oldsmobile type except for heavier construction and special double reduction or two-unit rear planetary unit (consists of two sets of planetary gears in tandem). This type also has Interlock device which prevents starting of engine unless control lever is in Neutral.

DESCRIPTION:—The Hydra-matic Drive consists of a Fluid Coupling (replacing clutch used with conventional transmission) combined with a self-shifting transmission which differs from the type used on previous Oldsmobile models as follows:

Fluid Coupling:—Unlike other designs in that driver or impeller (rear set of vanes) is not driven directly by the engine crankshaft. The engine drives the flywheel housing (fluid coupling case bolted on flywheel) and the front planetary unit ring gear. The drive is then taken through the planetary gear set and back to the fluid coupling through a tubular shaft, through the fluid coupling, and back to the transmission through the inner intermediate or transmission mainshaft. Fluid coupling is kept filled with oil from transmission case by forward oil pump and does not require attention.

Planetary Units & Servos:—Design changed and new type Servos used to actuate units as follows:

Front Planetary Unit—Planetary unit is similar to design used on previous self-shifting transmission with actuating brake band and hydraulically operated clutch. Front Servo unit (which controls front planetary unit brake band) is new design in which brake band is applied by hydraulic pressure and is released by spring pressure. Servo unit is combined with front oil pump which is built in servo housing and has the oil pressure regulator assembly mounted on the housing also. This front servo is not adjusted in same manner as on previous models (see Adjustment instructions below).

Rear Planetary Unit—This unit is new design and consists of a single planetary gear set. It is controlled by the Rear Servo unit which is similar to previous type except that band is applied by both spring and hydraulic pressure. The usual hydraulically operated disc clutch is used (all clutches have six pistons instead of three as used on former type). Rear Servo is adjusted in same manner as former type (see Adjustment instructions below).

Reverse Planetary Unit—This unit is entirely new and replaces the "Headset' or mechanically engaged reverse gear used on former models. It consists of an additional planetary gear unit in the transmission case in back of the Rear Planetary Unit. This unit does not have the customary brake band and servo unit and is actuated by a toothed pawl in the right side of the transmission case which engages teeth on the rim of the reverse gear planetary ring gear so as to hold the ring gear stationary when the lever on the steering wheel is placed in the 'Reverse' position.

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CADILLAC & OLDSMOBILE 1940-41 HYDRA-MATIC DRIVE (Cont.)

Oil Pumps & Control Valve:—Entirely new design and consist of two separate pumps as follows:

Front Oil Pump:—This pump is built-in front servo housing and is driven by a gear on the front planetary ring gear (drive gear) sleeve. It operates whenever engine is operating and supplies oil for transmission lubrication and for the Fluid Coupling. It also supplies oil for transmission operation (servo and clutch actuation) when car is first started up, this latter function being taken over by rear oil pump as soon as car speed reaches 20 MPH.

Rear Oil Pump:—Mounted as an assembly with the Control Governor and is driven by a gear on the transmission driven shaft (in front of reverse planetary unit). At car speeds above 20 M.P.H this pump develops sufficient pressure to operate planetary gear servos and clutches. At all speeds above this point, front pump provides oil only for transmission lubrication and to keep fluid coupling case filled (fluid coupling has return pipe and control valve through which excess oil is returned to transmission case so as to provide oil circulation for temperature control).

Pressure Regulator Valve—Mounted on front servo housing. Controls oil pressure and delivery from front and rear oil pump as detailed above. See 'Checking Oil Pressure' below for oil pressure checking and servicing data.

Main Oil Control Unit—Mounted on right hand side of transmission case under side cover plate. See Servicing data below for removal and installation

Control Lever on Steering Wheel:—New design lever with four positions—High—Low—Neutral—Reverse. This lever is linked to relay lever and manual shift lever on transmission case by a control rod but does not engage gears as in former designs (no Headset used). Lever case is illuminated by small #51 bulb (see Servicing data below for bulb replacement) and detents are used to locate lever in each position.

Carburetor Throttle Linkage:—Controls speed at which actual gearshifts occur and must be adjusted exactly as detailed below (see Adjustment Section).

OPERATION:—Fluid coupling provides slip at idling speed so that car does not move. When control lever on steering wheel is placed in 'High' or 'Low' position and engine is accelerated, car moves forward and shifts occur automatically as speed increases (in 'low' position, car shifts only from low to second; in 'high' position, car shifts from first to second to third to fourth or direct drive as the speed is increased), the fluid drive transmitting the engine torque with practically no slippage at speeds above idling speed. The speed at which shifts occur is controlled by the Governor with an overriding control by the accelerator linkage by which shifts are delayed or retarded with a wide open throttle so as to provide improved acceleration and power when this is desired. In normal operation the 'Low' range is not used and the lever is moved directly to 'High' position when the car is started up. In this position no further attention is required and car shifts through to direct drive at the proper speed. To reverse the car, the lever is placed in the 'Reverse' position which engages the reverse pawl so that the reverse planetary gear set ring gear is held stationary. Operation of the transmission in each gear ratio is as follows:

First or Low Gear—Brake band of front planetary gear unit is applied by hydraulic pressure and brake band of rear planetary unit is applied by spring and hydraulic pressure. Both planetary unit clutches are released (no oil pressure) and engine drives through both planetary units in tandem providing maximum gear reduction (reverse planetary unit ring gear is released and this unit does not operate).

Second Gear—Front planetary unit brake band is released by hydraulic pressure and clutch is engaged by hydraulic pressure so that this unit is locked and rotates as an assembly. Engine then drives through rear planetary gear unit only.

Third Gear—Engine drives through front planetary gear unit in same manner as for low gear (brake band applied and clutch released) and then drives both the ring gear (directly) and the sun gear (through the fluid coupling) of the rear planetary unit (brake band is released by hydraulic pressure but clutch is also engaged which is unlike low gear operation) so that a gear reduction less than either low or second gear is obtained through the rear planetary unit pinion plate and drive shaft.

Fourth Gear or Direct Drive—Both planetary gear units are locked out (brake bands released, clutches engaged) so that the engine drives straight through the transmission for direct drive to the rear wheels.

Reverse Gear—In reverse gear, the reverse gear planetary ring gear is locked (by reverse pawl engaging teeth on ring gear rim). The engine drives through the front planetary unit in the same manner as for low and then drives both the pinion plate and ring gear of the rear planetary unit (rear unit brake band released by hydraulic pressure). The rear unit ring gear drives the sun gear of the reverse planetary unit and the drive is taken through the reverse unit pinion plate to the transmission drive shaft (shaft is also driven directly by pinion plate of rear planetary unit so that final torque is combination of these two drives).

ADJUSTMENT (OLDSMOBILE):—Linkage should be checked, and adjusted if necessary, whenever it has been disconnected or disturbed by removal of other units, carburetor adjustment, etc. Adjust linkage exactly as follows:

Manual Control Lever Linkage (1940-41):—Take out clevis pin in lower control rod (forward rod) at intermediate lever on lower control relay bracket (on cross-member at left of flywheel housing) and lower control relay rod (rear rod) at shift lever (inner lever) on left side of transmission case. Set control lever on steering wheel in 'R' (reverse) position and make certain that poppet ball engages detent notch. Move intermediate lever so that hole in lever lines up with hole in bracket, insert special gauge No. J-1469 through both holes to hold lever in this position while adjustments are being made. Move manual shift lever on transmission (inner lever on outside of case) toward rear as far as possible (to make certain that lever is in extreme rear position, rotate propeller shaft by hand until pawl is felt to engage and lever is against stop). Adjust lower control relay rod length (loosen locknut and turn clevis on rear end of rod) so that rod can be connected to transmission lever without disturbing lever position, connect rod being certain that waved (anti-rattle) washer is in place and that clevis locknut is tightened. Remove tool J-1469 from intermediate lever, press back on intermediate lever so that rear rod and manual shift lever held in rear position against reverse stop, adjust length of lower control rod (forward rod) by loosening locknut and turning clevis on rear end of rod so that rod can be connected without disturbing position of steering column lever or intermediate lever. Connect rod making certain that waved (anti-rattle) washer is in place and that clevis locknut is tightened. Check control lever in all positions to make certain that it operates freely.

Carburetor Throttle Control Linkage (1940 Models): Determines shifting speeds. Adjust carburetor for idle speed and fast idle throttle opening (see Oldsmobile car model page and Carter WA1 & WDO carburetors in Carburetor Section for data). Then disconnect carburetor throttle rod at carburetor, bell crank to throttle cross-shaft rod at bell crank, cross-shaft to transmission rod at transmission case lever. Install special Oldsmobile setting gauge J-1486 on bell crank, adjust trunnion on throttle rod at throttle lever so that, when rod connected and carburetor throttle valve held closed in slow idle position, rod contacts both legs of gauge. Tighten trunnion locknut, connect rod, remove gauge. Install special setting gauge J-1470 between lever on right end of cross-shaft and toeboard to establish correct clearance (CAUTION—Clearance should be 9/16"—6 cyl. cars, 3/8"—8 cyl. cars, make certain that correct end of gauge marked '6' or '8' used on each model). Press back on cross-shaft lever to make certain that gauge is against toeboard, hold carburetor throttle lever closed in slow idle position, adjust trunnion on bell-crank end of cross-shaft rod so that it enters bell-crank freely, tighten locknut, connect rod, remove gauge. Check cross-shaft stopscrew by rotating throttle cracker lever on left end of cross-shaft to limit of cross-shaft travel with carburetor throttle valve wide open, adjust stopscrew to just contact stop on cross-shaft bracket. Tighten locknut and release cross-shaft. Make certain that carburetor throttle closed in slow idle position, press back on throttle lever on side of transmission case so lever against stop, loosen locknut and adjust clevis on end of cross-shaft to transmission lever rod so that rod can be connected without disturbing position of cross-shaft or transmission lever, tighten locknut and connect rod. Check entire throttle linkage for free operation.

Throttle Control Linkage (1941 Models):—Disconnect throttle rod at lever on left side of transmission case (outer lever). Set carburetor throttle stopscrew for 375 RPM engine speed in neutral (hot or slow idle speed—see Oldsmobile article for carburetor adjusting directions). Remove trunnion nut lock on idler lever at rear end of carburetor throttle rod (right side of cylinder head), adjust length of throttle rod by turning trunnion nut until special gauge J-1469 slips freely through holes in accelerator linkage bellcrank and bracket (on left side of engine), tighten trunnion lock and remove gauge. Move transmission throttle lever (outer lever on left side of transmission case) to extreme rear position against idle stop, and with carburetor in slow or hot idle position, adjust length of transmission throttle rod by loosening locknut and turning clevis on rear end of rod so that rod can be conected without disturbing position of levers, then shorten rod by one additional full turn of the clevis, tighten locknut and connect rod by inserting clevis pin

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CADILLAC & OLDSMOBILE 1940-41 HYDRA-MATIC DRIVE (Cont.)

and installing cotter pin. Adjust rod connecting accelerator pedal idler lever and bellcrank on left side of engine so that clearance between idler lever and bead on toepan is 3/32-5/32" with carburetor in slow or hot idle position. Adjust Throttle Cracker and Fast Idle (see Carburetor adjusting instructions on Oldsmobile car model pages.

Starter Interlock Adjustment:—This adjustment should be made only after manual control has been properly adjusted (see above). Disconnect battery cable at starter motor (to prevent starter cranking engine), place steering column control lever in 'N' or neutral position, fully depress starter pedal and hold pedal in this position while adjustment is being made. Adjust length of rod linking starter pinion shift lever and interlock bellcrank so that clearance between face of bellcrank and lower face of steering column control shaft shift lever is .030-.060". Check operation by placing steering wheel control lever in all other positions than neutral. If control is not returned to neutral 'N' position in each case, recheck adjustment.

ADJUSTMENT (CADILLAC):—Adjust linkage exactly as directed below.

Manual Control Lever Linkage:—Remove clevis pin from lower end of lower control rod (at transmission manual shift lever). Move steering wheel control lever in Reverse position. Move manual shift lever on transmission to rear as far as possible (Reverse position), check this by rotating propeller shaft by hand until reverse anchor is felt to engage. Adjust clevis on lower end of control rod so that clevis pin can just be inserted without disturbing position of rod or lever, connect rod. Check control lever for free operation in all positions.

Throttle Control Linkage:—Make certain that carburetor set for hot or slow idle speed of exactly 375 RPM (use tachometer such as KMO-298 electric type). See that throttle valve completely closed with stopscrew against low step of fast idle cam. Remove cotter pin and anti-rattle spring from upper end of intermediate throttle rod and disconnect throttle rod at transmission lever (lower lever on transmission case). Snap special adjusting tool J-1653 in place on upper end of intermediate throttle rod at relay shaft lever on front of dash. Loosen locknut and turn adjusting nut on carburetor end of throttle-to-relay rod until the adjusting tool contacts both the relay shaft at the distributor support and the projection on the intermediate throttle rod. See that throttle lever on transmission case is moved to rear as far as possible, adjust trunnion on transmission end of throttle rod so that pin can be installed without moving throttle lever from rear position against stop and without disturbing linkage, connect rod. Remove adjusting tool, re-install cotter pin and anti-rattle spring.

SERVO-BAND ADJUSTMENT (ALL MODELS):—Servo-bands should be adjusted at end of first 5000 miles and at 10,000 mile intervals afterward. Oil must be drained and oil pan must be removed.

CAUTION—Front and rear servo bands are adjusted differently and each band must be adjusted exactly as directed below. No band is used on the Reverse planetary unit (pawl on case locks ring gear by engaging teeth on rim of gear).

Front Servo Band—Remove transmission case oil pan and snap-in cover in floor pan over adjusting screw. Loosen adjusting screw locknut, install special adjusting tool J-1459 over capscrew in front unit (insert tool from below through oil pan opening), tighten adjusting screw on top of case until front unit drum just cannot be moved in either direction, then **back off adjusting screw exactly 8 turns**, tighten adjusting screw locknut taking care that adjusting screw does not turn. NOTE—It is extremely important that adjusting screw be backed off exactly 8 turns from point where drum just cannot be turned—mark screw position at this point and count turns carefully as screw is backed off.

Rear Servo Band—Remove transmission case oil pan and snap-in cover in floor pan over adjusting screw. Use servo cam release bar and force rear servo plunger into servo beyond servo gauge. Loosen adjusting screw locknut and turn adjusting screw down to take up all slack in servo band. Install special servo gauge J-1460 on bottom of servo, back off adjusting screw until end of servo plunger is flush with outer edge of gauge (plus or minus 1/32"), tighten adjusting screw locknut. Check adjustment by working servo plunger with cam release bar.

LUBRICATION:—Hydra-matic drive case should be drained and refilled with new Hydra-matic Drive Fluid at intervals of 25000 miles. The servo-bands can be adjusted at same time with oil pan off—see above. Fluid level should be checked at 1000 mile intervals (Cadillac), 2500 miles (Oldsmobile) and fluid added to keep level at 'full' mark as directed below.

NOTE—This 25000 mile oil change interval supersedes earlier specifications.

Checking Fluid Level—Run engine for several minutes, then stop engine and allow car to stand for at least one minute before checking level (this is important because transmission fluid is supplied to the fluid coupling and fluid coupling must be full of oil when checked). Remove sheet metal cover in floor pan over fluid level indicator (right front corner of transmission case), remove indicator to check level. Keep level at 'Full' mark on indicator.

Draining Hydra-matic Drive—Transmission case and fluid coupling are drained separately. Remove plug at front end of oil pan (to drain transmission), on front face of flywheel (to drain fluid coupling).

NOTE—When refilling after draining transmission, add 6 qts. of fluid (Oldsmobile), 8 qts. (Cadillac), run engine for approximately 5 minutes, then add remainder of fluid (see Capacity data below).

Capacity (Cadillac)—11½ qts. when unit has been drained. Use only Cadillac Hydra-Matic Fluid (one type for all-season use).

Capacity (Oldsmobile)—9 qts. (when transmission case and fluid coupling have been drained), 9½ qts. (if oil pan has also been removed for cleaning), 10 qts. (if transmission has been disassembled). Use only Oldsmobile Hydra-Matic Fluid (one type for all-season use). NOTE—For emergency use only, transmission can be operated with good quality SAE. #20W engine oil. Replace oil as soon as possible with genuine Hydra-Matic Fluid.

Oil Pan & Screen—See Servicing directions below for oil pan removal. Clean oil screen when pan removed. CAUTION—When installing pan, make certain that copper washers used on 3 screws on left hand side and 2 screws at rear of case.

CHECKING OIL PRESSURE:—If transmission operation not satisfactory check to make certain that oil pressure sufficient for correct operation as follows:

To Check Oil Pressure—Use special service fixture J-1467 and a reliable 100 lb. oil pressure gauge. Remove the plug on the transmission side cover plate, remove plug from governor sleeve by threading standard ¼" capscrew into plug and removing plug through side cover plate hole. Assemble J-1467 fixture in place in side cover plate and governor housing using extreme care not to cause any bind in governor assembly. Assemble pressure gauge to fixture plugs so that gauge can be read while car being operated. Operate car on road until transmission fluid is hot, see that control lever in high range, allow car speed to drop to 20 MPH and note gauge reading. Oil pressure must not be less than 75 lbs.

Low Oil Pressure Correction—If pressure less than 75 lbs., check for excessive oil leakage in transmission or oil regulator valve assembly, see that oil regulator valve body is tight, check for sticking regulator valve or weak valve spring (substitute new spring and recheck pressure). Inspect for leak in main control valve body or at delivery tube connections. Check oil pumps for worn gears or excessive endplay.

TRANSMISSION REMOVAL (OLDSMOBILE):—Raise car and jack up all four wheels securely approximately 8" above floor. Remove foot accelerator pad, floor mat, center floor pan. Disconnect propeller shaft at rear universal joint, remove by sliding shaft out at splined joint. Remove flywheel housing pan. Drain transmission and flywheel by taking out both drain plugs. Remove outer throttle lever from transmission case, disconnect control rod from manual shift lever. Remove two upper engine mounting bolts, remove master cylinder to brake shaft bracket, disassemble strut from shaft, remove clevis pin from lower control relay rod. Raise engine approximately 1" off mountings with jack just forward of crankcase drain plug (use block of wood on jack). Remove 3 bolts from each side of cross-member at frame side rail, remove cross-member by tipping top toward front of car and moving cross-member forward. Install transmission lifting tool J-1129 in front compartment over floor pan opening (CAUTION—use safety extension legs J-1129-40-1). Place saddle at bottom of transmission, work cables through pan opening and hook both cables onto lifting tool cable snap. Center saddle on transmission pan, hoist transmission just enough to take strain off mounting bolts, remove 5/16" bolts holding fluid flywheel cover on flywheel, remove five ½" bolts holding rear half of bell housing to front half. Lower engine slightly until top of bell housing is flush with top of opening in floor pan, thread two standard transmission bolts into bell housing (on each side just above dowel pins) to force bell housing from dowel pins, then remove these bolts. Remove transmission and rear bell housing as an assembly by moving it toward rear of car and lowering to floor.

TRANSMISSION REMOVAL (CADILLAC):—Raise car and jack up all four wheels securely approximately 8" above floor. Remove floor carpet and pads, front seat cushion, and center floor pan. Disconnect propeller shaft at front universal joint and remove

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CADILLAC & OLDSMOBILE 1940-41 HYDRA-MATIC DRIVE (Cont.)

shaft, remove flywheel housing pan. Drain transmission and fluid flywheel by taking out both drain plugs. Support rear end of engine with jack under oil pan (use block of wood on jack). Disconnect engine rear support at transmission extension, remove cross-member and rear support. Remove throttle lever on side of transmission case, disconnect control rod from shift lever, disconnect speedometer cable. Install transmission hoist J-1616 in front compartment over floor pan opening, screw eyebolt securely into top of transmission, attach hoist cable hook to eyebolt, lift transmission just enough to take strain off mounting bolts. Remove 30 5/16" capscrews holding flywheel cover to flywheel. Lower jack under engine until top of bell housing is just flush with top of floor pan opening. Remove 6 bolts holding bell housing to engine crankcase. Remove transmission by shifting it backward and lowering to floor.

SERVICING (ON CAR): Units listed below can be serviced without removing the transmission.

Servo Units and Front Oil Pump—Drain oil and remove oil pan. Remove main oil line being certain to hold coupling in valve body while this end of line loosened to avoid damage to front connection. Remove oil pressure regulator valve and body. Remove two oil delivery pipes from front cover. Loosen rear servo adjusting screw only. Take out 4 servo to transmission case mounting screws, lift out front and rear servos and front oil pump as a unit. Adjust servos when re-installed.

Main Oil Control Valve and Body Assembly—Remove side cover on transmission case. Loosen four attaching bolts mounting oil control unit on side of case (CAUTION—withdraw bolts only far enough to free unit from case, leave bolts in holes in body to prevent body separating when removed). Slide control unit toward front of transmission to disengage oil pipes from governor unit, lift unit off using extreme care to prevent body separating. Install in same manner, tighten all screws evenly.

Rear Oil Pump and Governor Assembly—Remove main oil control unit (above). Take out attaching bolts and remove reverse linkage and pawl assembly from side of transmission case. Take out mounting bolts and remove oil pump and governor assembly through bottom of case (turn round governor weight toward front of transmission for clearance while unit being withdrawn). Install in same manner.

Steering Column Control Lever Lamp—Lamp bulb in control lever housing is accessible for replacement by taking out 2 screws holding housing and sliding housing around to expose lamp bulb.

Disassembly: Front Servo. To disassemble after removal from transmission, remove oil suction line, take out pump cover attaching bolts, remove pump cover. Remove servo pistons, springs and oil pump gear from housing. When assembling, install servo piston and sleeve in housing, slip retracting spring over piston shaft. Install oil pump idler gear. Install accumulator piston, booster spring, booster spring retainer in servo unit cover, install cover assembly in servo housing, tighten cover bolts. Install suction line making certain that gasket is in good condition. When installing servo in transmission case, see that plunger enters anchor on brake band. Adjust servo after installation.

Rear Servo—To disassemble after removal from transmission, place servo in arbor press and hold squarely in steady position on baseplate so that tension removed from spring retainer. Remove retainer screws, release pressure slowly and guide accumulator body out of servo, remove all parts. When assembling, install booster piston, booster spring, large initial spring, accumulator and piston body in servo body, centering small ring on booster spring so that it enters accumulator body freely. Hold accumulator in place on servo, install inner and outer servo springs and spring retainer. Compress assembly in arbor press and tighten spring retainer screws. Adjust servo after installation in transmission.

Fluid Coupling—To remove fluid coupling members with transmission off car, place manual shift lever in reverse position, loosen mainshaft locknut washer. Use tool KMO.334 to remove locknut retaining driven member (runner) on front end of mainshaft, slide driven member off. Remove drive member (driver) by gripping vanes with pliers at 2 diametrically opposite points and pulling forward while tapping on end of mainshaft with bronze hammer (CAUTION—do not attempt to remove drive member by pushing or pulling on flywheel cover—this will damage oil seal rings).

HYDRAMATIC DRIVE DISASSEMBLY & OVERHAUL: *Procedure similar to 1946 & Later Hydra-Matic Transmissions. See 1946-51 Car Model "Hydra-Matic Drive Overhaul" data beginning on Pg. 2705.*

1942 CADILLAC & OLDSMOBILE HYDRA-MATIC DRIVE

CADILLAC V8, ALL SERIES (1942)
OLDSMOBILE 6 & 8, ALL MODELS (1942)

IMPORTANT NOTE:—Hydra-Matic Drive design is similar to 1941 type but adjustments on 1942 cars should be made as directed below (not same as 1941 in all instances).

CAUTION FOR TOWING CAR—If car being towed on which Hydra-Matic Drive has been damaged or has run out of fluid (drive knocks, slips, or will not drive car), propeller shaft should be disconnected to avoid further damage to transmission by rotating parts when car is moved.

DESCRIPTION:—Hydra-Matic Drive consists of a Fluid Coupling and 4-speed planetary gear type automatic transmission. Design is same as used on 1941 cars except for linkage changes (see Linkage Adjustment).

LUBRICATION:—Check fluid level in transmission case at intervals of 1000 miles (Cadillac), 2500 miles (Oldsmobile), and add fluid to maintain correct level. Change fluid at 25000 mile intervals.

NOTE—This 25000 mile oil change interval supersedes earlier specifications.

Checking Fluid Level—Raise right edge of front compartment rug, carefully clean all dirt and lint from around transmission cover hole, remove small sheet metal cover from top of transmission cover. Operate engine for approximately 30 seconds, stop engine and allow car to stand one minute before checking fluid level (this is important to fill fluid coupling so that actual transmission case fluid level can be ascertained). Remove fluid level indicator plunger and check level. Add fluid to bring level up to "Full" mark on indicator.

Draining & Replacing Fluid—Remove flywheel housing underpan, turn flywheel so that drain plug on front face of flywheel is down, remove plug with 3/16" Allen wrench, drain fluid coupling. Remove plug on side of transmission case and drain case. Re-install both plugs. Insert approximately 8 qts. of fluid (Cadillac), 6 qts. (Oldsmobile), run engine for 3-4 minutes (to circulate fluid and fill fluid coupling), then add additional fluid to bring level up to 'Full' mark on indicator (approximately 3½ qts.).

Capacity & Recommended Fluid—(Cadillac) 11½ qts., (Oldsmobile) 9½ qts. Use only Hydra-Matic Drive Fluid or Automatic Transmission Fluid Type A furnished in container bearing "AQ-ATF" symbol.

ADJUSTMENT (CADILLAC):—Make all adjustments in order and exactly as follows:

Manual Control Lever—Remove clevis pin from lower end of lower control rod (at manual shift lever on transmission case). Move control lever below steering wheel to Reverse position and make certain detent engages. Move manual shift lever on transmission case as far back as possible (Reverse position) and make certain that reverse anchor engages (rotate propeller shaft until anchor engagement is felt). Adjust clevis on rear end of control rod so that clevis pin slips into place freely with shift lever and rod held all the way back, tighten clevis locknut, install pin, check control lever for free operation in all positions.

Throttle Linkage—Adjust carburetor and set idling speed at exactly 375 RPM. (Use Tachometer, tool No. KMO-298) with engine warm so that choke valve wide open and fast idle not operating, check to see that throttle valve closed with stopscrew against low or slow idle step of fast idle cam. Loosen throttle rod adjusting nut at carburetor, insert special .248" dowel pin in relay shaft arm to hold rods in correct position (see illustration), tighten adjusting nuts at carburetor end of carburetor-to-relay rod. Adjust trunnion at throttle valve rod so that pin can be installed freely with throttle lever against its stop, remove dowel pin from relay arm. Check transmission operation. If shifts do not occur in proper ranges, check intermediate throttle rod for bends (see illustration for rod dimensions).

Shift Control Tube & Neutral Switch—If selector lever feels loose, or if rattles occur in shifting mechanism, check shift control tube for excessive endplay and adjust as follows: Remove Neutral Switch from lower end of steering column jacket, loosen clampscrew on lower shift lever, insert .004" feeler between lower face of lever and spring washers, insert small drift or screwdriver in hole in shifting tube and force tube up and lever down, tighten lever clampscrew and remove feeler gauge. Install Neutral Switch and position switch as far as possible toward left side of car with switch connected, tighten mounting bolts just snug (not tight). Connect jumper wire from 'BAT' terminal

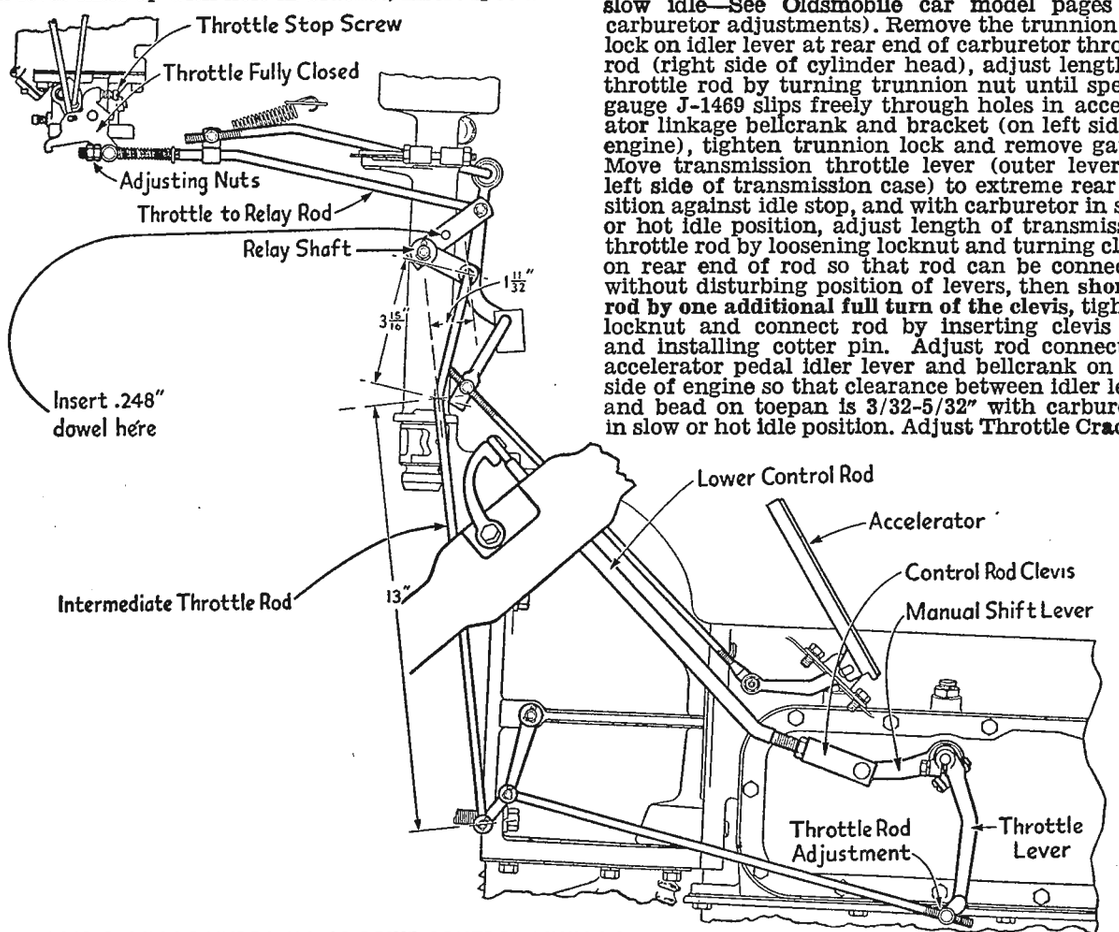
CONTINUED ON NEXT PAGE

CADILLAC & OLDSMOBILE 1942 HYDRA-MATIC DRIVE (Cont.)

of voltage regulator to 'dead' terminal of neutral switch. Set selector lever in neutral, set hand brake, tap neutral switch lightly toward right side of car until starter begins to operate, tighten neutral switch mounting bolts securely and remove jumper wire. Check neutral switch operation to make certain it makes contact with selector lever in neutral but does not make contact with lever in 'Drive' position. Recheck manual control lever adjustment

ADJUSTMENT (OLDSMOBILE): Make all adjustments in order and exactly as follows:

Manual Control Lever Linkage:—Remove clevis pins to disconnect lower control rod (forward rod) at intermediate lever on lower control relay bracket (on cross-member at left of flywheel housing) and lower control relay rod (rear rod) at shift lever (inner lever) on left side of transmission case. Set control lever on steering wheel in 'R' (reverse) position and make certain that poppet ball engages detent notch. Move intermediate lever so that hole in lever lines up with hole in bracket, insert special gauge No. J-1469 through both holes to hold lever in this position while adjustments are being made. Move manual shift lever on transmission (inner lever on outside of case) toward rear as far as possible (to make certain that lever is in extreme rear position, rotate propeller shaft by hand until pawl is felt to engage and lever is against stop). Adjust lower control relay rod length (loosen locknut and turn clevis on rear end of rod) so that rod can be connected to transmission lever without disturbing lever position, connect rod being certain that waved (anti-rattle) washer is in place and that clevis locknut is tightened. Remove tool J-1469 from intermediate lever, press back on intermediate lever so that rear rod and manual shift lever held in rear position against reverse stop, adjust length of lower control rod (forward rod) by loosening locknut and turning clevis on rear end of rod so that rod can be connected without disturbing position of steering column lever or intermediate lever.



1942 CADILLAC HYDRA-MATIC DRIVE CONTROL LINKAGE

Throttle Control Linkage:—Disconnect transmission throttle rod at lever on left side of transmission case (outer lever). Set carburetor throttle stop-screw for 375 RPM engine speed in neutral (hot or slow idle—See Oldsmobile car model pages for carburetor adjustments). Remove the trunnion nut lock on idler lever at rear end of carburetor throttle rod (right side of cylinder head), adjust length of throttle rod by turning trunnion nut until special gauge J-1469 slips freely through holes in accelerator linkage bellcrank and bracket (on left side of engine), tighten trunnion lock and remove gauge. Move transmission throttle lever (outer lever on left side of transmission case) to extreme rear position against idle stop, and with carburetor in slow or hot idle position, adjust length of transmission throttle rod by loosening locknut and turning clevis on rear end of rod so that rod can be connected without disturbing position of levers, then **shorten rod by one additional full turn of the clevis,** tighten locknut and connect rod by inserting clevis pin and installing cotter pin. Adjust rod connecting accelerator pedal idler lever and bellcrank on left side of engine so that clearance between idler lever and bead on toepan is 3/32-5/32" with carburetor in slow or hot idle position. Adjust Throttle Cracker & Fast Idle (see Carburetor on car model pages).

Starter Interlock (Cars with Starter Pedal): With manual control properly adjusted, disconnect battery cable at starter motor, place steering column control lever in neutral 'N' position, fully depress starter pedal and block in this position, adjust interlock rod (linking starter shift lever and interlock lever) so that clearance between other arm on interlock lever and steering column control lever is .030-.060". Check by placing steering column control lever in all other positions than neutral and starting car. Control lever must be moved to neutral when starter pedal is depressed.

Safety Switch (Cars with Starter Pushbutton)—Consists of switch on lower end of steering column control connected in starter solenoid relay circuit which prevents starter operating except when lever is in 'N' (neutral) position. To adjust switch, loosen lockscrew on bracket so that it can be shifted, hold lower end of shift control lever against stop in neutral 'N' position (upper control lever out of neutral detent and slightly to left), shift switch bracket down until vertical switch contact arm is against stop, tighten bracket lockscrew. To check adjustment, move control lever back to neutral detent and check clearance between switch contact arm and stop which should be 1/16".

SERVO BAND ADJUSTMENT:—Front and rear bands are adjusted differently as directed below. No band is used on the Reverse Gear planetary unit.

Rear Servo (All Models)—Install Gauge J-1460 (same as used on 1941 cars) on bottom of rear servo unit so that indicating end of gauge rests on servo plunger. Loosen locknut on servo band adjusting screw on top of case, turn screw until outer end of servo plunger is flush with outer edge of gauge (plus or minus 1/32"), tighten locknut.

Front Servo (Cadillac)—Loosen locknut on front band adjusting screw on top of case and back off adjusting screw. Remove plug in front servo lower cover plate (use Allen wrench), insert tool J-1693 (new 1942 tool), tighten plunger by hand until it is felt to touch servo piston, then tighten plunger 8 full turns additional (6 turns on new bands), tighten front band adjusting screw until knurled washer on tool is just off its seat, tighten adjusting screw locknut securely, remove tool and install plug

Front Servo (Oldsmobile)—Loosen locknut on front band adjusting nut, install tool J-1459 (same as used on 1941 cars) over capscrew of front unit (insert tool from below), tighten adjusting screw to point where front unit drum just cannot be moved in either direction, **back off adjusting screw exactly 7 turns,** tighten locknut.

CHECKING OIL PRESSURE:—If transmission operation not satisfactory check to make certain that oil pressure sufficient for correct operation as follows:

To Check Oil Pressure—Use special service fixture J-1467 and a reliable 100 lb. oil pressure gauge. Remove the plug on the transmission side cover plate, remove plug from governor sleeve by threading standard ¼" capscrew into plug and removing plug through side cover plate hole. Assemble J-1467 fixture in place in side cover plate and governor housing using extreme care not to cause any bind in governor assembly. Assemble pressure gauge to fixture plug so that gauge can be read while car being operated. Operate car on road until transmission fluid is hot, see that control lever in high range,

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CADILLAC & OLDSMOBILE 1942 HYDRA-MATIC DRIVE (Cont.)

allow car speed to drop to 20 MPH and note gauge reading. Oil pressure must not be less than 75 lbs. To make certain that rear pump is operating satisfactorily, drive car at 40-45 MPH. in Fourth Gear, shift to Neutral and turn off ignition allowing car to coast, note speed at which rear band engages (if above 20 MPH., pump capacity is too low.

Low Oil Pressure Correction—If pressure less than 75 lbs., check for excessive oil leakage in transmission or oil regulator valve assembly, see that oil regulator valve body is tight, check for sticking regulator valve or weak valve spring (substitute new spring and recheck pressure). Inspect for leak in main control valve body or at delivery tube connections. Check for worn gears, excessive endplay.

TRANSMISSION REMOVAL (OLDSMOBILE): Raise car and jack up all four wheels securely approximately 8" above floor. Remove foot accelerator pad, floor mat, center floor pan. Disconnect propeller shaft at rear universal joint, remove by sliding shaft out at splined joint. Remove flywheel housing pan. Drain transmission and flywheel by taking out both drain plugs. Remove outer throttle lever from transmission case, disconnect control rod from manual shift lever. Remove two upper engine mounting bolts, remove master cylinder to brake shaft bracket, disassemble strut from shaft, remove clevis pin from lower control relay rod. Raise engine approximately ½" off mountings with jack just forward of crankcase drain plug (use block of wood on jack). Remove 3 bolts from each side of cross-member at frame side rail, remove cross-member by tipping top toward front of car and moving cross-member forward. Install transmission lifting tool J-1502 in front compartment over floor pan opening (see Note below for Model 90). Place saddle at bottom of transmission, work cables through pan opening and hook both cables onto lifting tool cable snap. Center saddle on transmission pan, hoist transmission just enough to take strain off mounting bolts, remove 5/16" bolts holding fluid flywheel cover on flywheel, remove five 7/16" bolts holding rear half of bell housing to front half. Lower engine slightly until top of bell housing is flush with top of opening in floor pan, thread two standard transmission bolts into bell housing (on each side just above dowel pins) to force bell housing from dowel pins, then remove these bolts. Remove transmission and rear bell housing by moving it to rear and downward.

TRANSMISSION REMOVAL (CADILLAC): Raise car and jack up all four wheels securely approximately 8" above floor. Remove floor carpet and pads, front seat cushion, and center floor pan. Disconnect propeller shaft at front and rear universal joints, remove shaft and front universal joint yoke, remove flywheel housing pan. Drain transmission and fluid flywheel by taking out both drain plugs. Support rear end of engine with jack under oil pan (use block of wood on jack). Disconnect engine rear support at transmission extension, remove cross-member and rear support. Remove throttle lever on side of transmission case, disconnect control rod from shift lever, disconnect speedometer cable, remove starter and spark plugs. Install transmission hoist J-1636 in front compartment over floor pan opening, screw eyebolt securely into top of transmission, attach hoist cable hook to eyebolt, lift transmission just enough to take strain off mounting bolts. Remove 30 5/16" capscrews holding flywheel cover to flywheel, marking location of any balancing washers to insure re-installing in same position, push cover to rear to disengage flywheel dowels. Lower jack under engine until top of bell housing is just flush with top of floor pan opening. Remove 6 bolts holding bell housing to engine crankcase. Remove transmission by moving it to rear and downward.

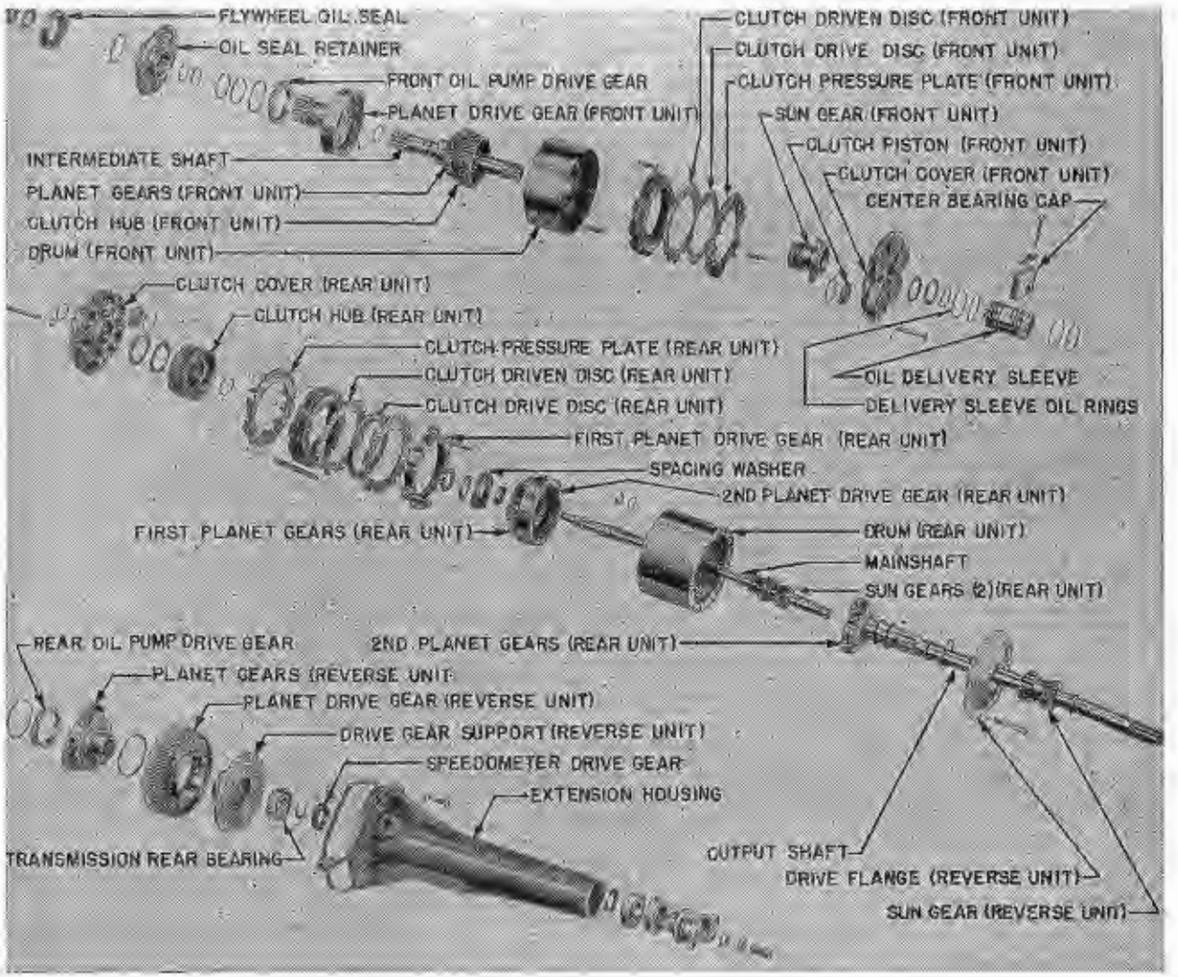
SERVICING:—With transmission removed from car, remove units and disassemble as follows:

Servo Units & Front Oil Pump—Drain oil, remove oil pan, screen, and main oil line taking care to hold oil line front connection in valve body with wrench while loosening line. Remove oil pressure regulator valve, spring, and body. Remove two oil delivery pipes from front cover. On Oldsmobile, take out capscrews holding front cover on transmission case and remove front cover. Loosen rear servo adjusting screw (front adjusting screw on Cadillac), take out four servo-to-transmission screws, remove front and rear servos as a unit.

Main Oil Control Valve Body—Remove side cover on transmission case, take out four oil control valve body attaching screws, slide oil control unit toward front of transmission to disengage oil pipes from governor unit, lift unit off. Install unit in same manner, tightening all mounting screws evenly.

Rear Oil Pump and Governor Assembly—Remove main oil control unit (above). Take out attaching bolts and remove reverse linkage and pawl assembly from side of transmission case. Take out mounting bolts and remove oil pump and governor assembly through bottom of case (turn round governor weight toward front of transmission for clearance while unit being withdrawn). Install in same manner.

HYDRAMATIC DRIVE DISASSEMBLY & OVERHAUL: *Procedure similar to 1946 & Later Hydra-Matic Transmissions. See 1946-51 Car Model "Hydra-Matic Drive Overhaul" data beginning on Pg. 2705.*



1942 CADILLAC & OLDSMOBILE HYDRA-MATIC DRIVE

HYDRA-MATIC DRIVE DRAINING & REFILLING

ALL 1946-51 HYDRA-MATIC CARS

Lubrication Intervals: (All Cars)—**Check Fluid** every 2000 miles. **Drain & Refill** every 25,000 miles.

CAUTION—This 25000 mile interval supersedes earlier specified intervals.

►**Oil Level Indicator Air Cleaner**—Clean the mesh type air cleaner (in dipstick cap) every 10000 miles or twice each year.

Checking Fluid Level: Check only with engine warm and idling at hot or slow idle speed (choke valve open, fast idle inoperative).

1) With transmission oil hot, run engine for at least 2 minutes with selector lever in "N" (to insure fluid coupling being filled so that true oil level reading will be secured).

2) Turn back floor mat and remove cover over dipstick location (right front of transmission). Clean all dirt and lint from around opening and dipstick to prevent this dirt entering transmission when dipstick removed.

3) With engine idling, and selector lever in "N", check fluid level reading on dipstick.

4) Add fluid as required to bring level up to full "F" mark on dipstick. *NOTE*—Approximately 1½ pints required to raise level from "L" to "F".

►***CAUTION—Do not fill above "F" mark on dipstick (may cause foaming when oil is hot).***

Draining & Refilling: Drain oil only when transmission warm (immediately after operation).

1) Remove flywheel housing lower cover (or hand hole cover on Cadillac), turn fluid coupling until drain plug in torus cover points downward, remove plug and drain fluid coupling.

2) Remove drain plug at rear end of transmission oil pan and drain transmission case.

3) **Replace both drain plugs and tighten securely.**

4) Install 8 qts. new Hydra-Matic fluid (7 qts. on Frazer, Kaiser, Nash) through dipstick opening on top of case.

5) Start engine and run it at speed equivalent to 20 MPH. for at least 1½ minutes with selector in "N" (to fill fluid coupling). Return engine to slow idle speed.

6) Check fluid level (see above), add fluid to bring level up to "F" mark on dipstick (approximately 3-4 qts. required).

►***CAUTION—Correct level should be determined by dipstick reading rather than exact amount of fluid added*** and level must always be checked.

Fluid Capacity: Approximately 11 qts. (refill), 12 qts. (after transmission disassembled).

Recommended Fluid: Hydra-Matic Fluid as furnished by car manufacturer or Automatic Transmission Fluid Type "A" as furnished in containers bearing "AQ-ATF" symbol.

►***FLUSHING CAUTION—Flushing of the unit is not required. Use only regular Hydra-Matic fluid for this purpose.***

LINKAGE ADJUSTMENT

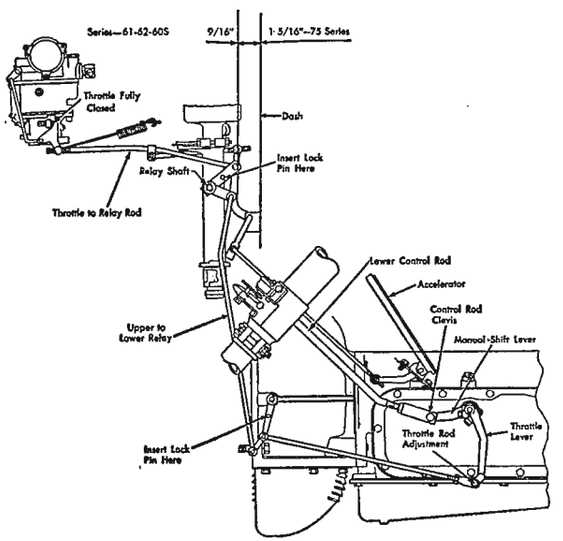
ALL 1946-51 HYDRA-MATIC CARS

►***LINKAGE ADJUSTMENT CAUTION: Adjustments must be made in correct order and exactly as shown below for each car model.***

1946-48 CADILLAC

(1) Manual Control Linkage—Disconnect manual control rod from control lever on transmission case, move control lever to extreme rearward (reverse) position (lever will be held in this position by detent ball). Move Selector Lever on steering column to the Reverse "R" Position. Adjust the clevis on the lower end of control rod until clevis pin can just be inserted freely through clevis and control lever, tighten clevis locknut and install clevis pin.

(2) Throttle Control Rod—Set engine idling speed at 375 Engine RPM. with engine warm (fast idle inoperative). Disconnect throttle rod trunnion at carburetor by removing forward end of retracting spring, install gauge pin in holes in upper relay lever and distributor housing so that lever is locked in position, adjust trunnion on throttle connector rod so that it slides freely into throttle lever without disturbing slow idle position of throttle, install retracting spring and adjust position of spring clip so that center line of spring hole in clip is exactly 5 15/64" from throttle lever trunnion.



1946-48 CADILLAC CONTROL LINKAGE

(3) Throttle Control Lower Relay Lever—With upper relay lever locked by gauge pin inserted through lever into hole in distributor housing, disconnect clevis at throttle lever on transmission case and disconnect lower end of vertical rod connecting upper and lower relay levers. Install second gauge pin through hole in lower relay lever and hole in bell housing so that lever is locked in position, adjust vertical rod by bending rod forward or backward at original bend in rod (use Bending Tool J-2029) until it can be connected to lower relay lever freely (use care to maintain original alignment of rod). Connect vertical rod. With correct adjustment, gauge pin in lower relay lever should be free in lever and housing holes. NOTE—Do not remove gauge pins until following adjustments have been made.

(4) Throttle Lever Position—Install special Throttle Lever Checker (Tool J-2239) on rear face of transmission case. Insert clevis pin in end of throttle lever. Pin should enter hole in checking tool marked "46, 47, 48" freely. Bend lever (up to ½") using Tool J-2029 to secure correct position (replace lever if more than ½" bend required). Check center-to-center distance between upper and lower holes on lever. This must be 4¾".

(5) Throttle Lever Linkage—With gauge pins installed in upper and lower relay levers and with throttle rod disconnected from throttle lever on transmission case, use Spring Scale, Tool J-544, to pull throttle lever against its stop in Reverse (extreme rear) position **using a load of ⅜-½ lb. as** measured by the spring scale. Hold throttle lever in this position, pull lower horizontal rod back to remove all play from lower relay lever, adjust clevis on rod so that pin freely enters holes in clevis and throttle lever, **then screw clevis three complete turns forward on rod,** connect rod, remove gauge pin from lower relay lever.

(6) Upper Relay Lever Position—With upper relay lever locked by gauge pin, disconnect trunnion on horizontal rod connected to upper relay upper lever, adjust trunnion until it will slide freely into relay upper lever when center of hole in lever is exactly 9/16" (Series 60S, 61, 62), 1 5/16" (75, 76) from face of dash (measure from a straightedge placed across pocket in dash—do not measure to bottom of this pocket). Remove gauge pin from relay lever.

(7) Accelerator Pedal Rod—With upper relay lever free (gauge pin removed), disconnect accelerator pedal rod from lower lever of upper relay lever, hold carburetor throttle valve in wide open position and depress accelerator pedal to floor, adjust accelerator pedal rod by turning rod in trunnion until end of rod slips freely into upper relay lower lever, connect rod. CAUTION—Recheck adjustment to make certain that carburetor throttle lever is against its wide open stop when pedal depressed to floor.

Neutral Switch—Mounted on lower end of steering column. Adjust position of switch so that starter operative (switch closed) only when selector lever is in Neutral position. NOTE—When installing switch, make certain that operating pin engages slot in switch lever.

1949-51 CADILLAC

(1) Manual Control Linkage—Disconnect manual control rod from control lever on transmission case. Move control lever to drive position (move lever fully forward, then move lever toward rear until first detent position is reached). Place slecetor lever on steering column against stop in "DR" position. Adjust clevis on transmission end of control rod until clevis pin can just be inserted freely through clevis and lever. Connect control rod.

(2) Throttle Lever Position—Disconnect throttle rod at throttle lever on transmission case. Check lever

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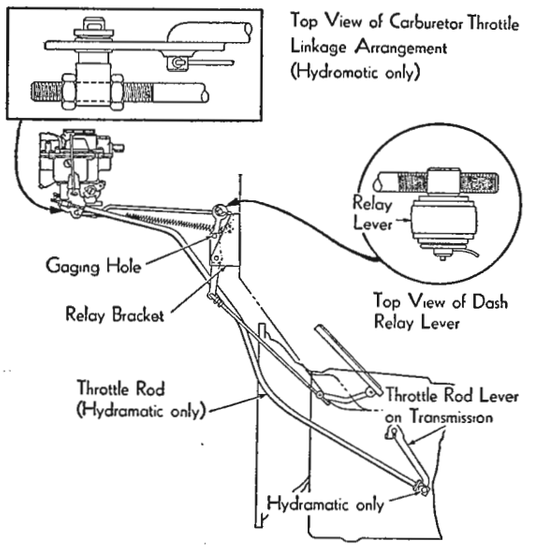
HYDRA-MATIC LINKAGE ADJUSTMENT (Continued)

position by installing checking gauge, Tool J-3065, on rear face of transmission case with long leg of tool extending forward along left side of case. Move throttle lever to extreme rear position. Insert clevis pin through hole in lever and hole in checking gauge. If pin does not enter hole in gauge freely, bend lever as required using bending tool J-2029. Remove gauge and reconnect throttle rod to throttle lever.



1949-51 CADILLAC CONTROL LINKAGE

(3) Throttle Control Linkage—Disconnect carburetor throttle rod at dash relay lever by removing spring clip and freeing trunnion from lever. Install ¼" drill rod through hole in relay lever and hole in bracket to position lever. See that carburetor throttle lever in correct hot or slow idle position (stopscrew against stop and set for correct 375 RPM. idling speed), adjust trunnion on rear end of throttle rod until trunnion enters relay lever freely, connect trunnion and install spring clip. Back off both nuts on throttle rod at carburetor throttle lever, push on end of rod so that transmission throttle lever and valve is against its stop, turn rear nut on throttle rod up against the carburetor throttle lever trunnion, then **back the nut off 3 complete turns (1946-48), 4 turns (1950), 3½ turns (1951)**, finally tighten front nut on rod securely against trunnion. Check to see that linkage moves freely. Remove drill rod from relay lever. Check and adjust accelerator pedal position.

(4) Accelerator Pedal Position—Depress pedal fully and see that it touches floor mat with slight pressure when carburetor throttle valve wide open (NOTE—if floor mat removed, allow ½" clearance between pedal and floor in wide open position). Adjust pedal position, as required, by changing length of pedal to relay lever rod (adjusting trunnion located at pedal end of rod).

(5) Neutral Switch—Adjust position of switch so that starter operative (switch closed) only when selector lever in "N" position.

►*CAUTION*—Do not move switch so far in neutral position that travel of lower lever is limited by switch arm in the reverse position.

1951 FRAZER & KAISER

Throttle Control Linkage:

1) Disconnect rear throttle rod from throttle lever (longer lever) on left side of transmission.

2) Carburetor Rod—Loosen carburetor extension shaft lock bolt in slot in upper bellcrank on left side of cylinder head, install Linkage Adjustment Pin KF-91 through holes in bellcrank and bracket. With engine temperature at 150-160° (choke valve wide open, fast idle inoperative) and transmission warm, set engine idle speed at 425-450 RPM. with selector lever in N. Tighten carburetor extension shaft lock bolt so that shaft is locked to bellcrank. **Do not remove adjustment pin at this time.**

3) Front Throttle Rod—Check alignment of holes in lower bellcrank and bracket on left side of crankcase below starter. If Linkage Adjustment Pin KF-91 can not be inserted freely through both holes, disconnect front throttle rod from lower bellcrank and adjust length of rod so that pin can be inserted after rod connected. Connect rod and install pin. **Do not remove adjustment pins until all adjustments completed.**

4) Transmission Throttle Lever—Tighten clamp bolt on throttle lever on transmission case to 12-15 ft. lbs. torque. Check lever position by installing Throttle Lever Checking Gauge KF-78 flat against machined surface on back of case with gauging leg extending forward along transmission side cover (CAUTION—clean transmission case surface before installing gauge). Move throttle lever to rear position against stop and install clevis pin in hole in lever as gauging point, move gauge upward toward lever. Notch in gauge should align with pin in lever and inner face of lever should just touch outer face of gauge. Bend lever with Bending Tool KF-79 to secure this position. Remove gauge.

5) Rear Throttle Rod—Connect rear rod to throttle lever on transmission (loosen trunnion nuts to align rod and lever) with anti-rattle spring between rod and lever. Adjust trunnion on rod to rear (turn front nut against trunnion) until throttle lever seats lightly against stop in rear position, then **shorten rod by backing off trunnion front nut two full turns,** lock adjustment by turning rear nut up securely against trunnion. Remove Linkage Adjustment Pins from the upper and lower bellcranks.

6) Accelerator Pedal Rod—Hold carburetor throttle valve in wide open position. Adjust accelerator pedal rod (turn adjusting sleeve on rod to rear of upper bellcrank on cylinder head) so that clearance between pedal and floor mat is approximately ¼".

Selector Lever (Manual Control) Linkage:

1) On Kaiser cars, hold selector lever firmly down in "Lo" position and tighten control shaft upper bracket clampscrew securely.
NOTE—Not required on Frazer cars.

2) Back off both locknuts at control rod trunnion (at control shaft lever on steering column on Kaiser, at idler bellcrank lever below starter on Frazer). Tighten shift lever clamp bolt on left side of transmission case to 10-13 ft. lbs. torque.

3) Place selector lever in "Lo" position, move shift lever on transmission to extreme rear position and then move lever forward to **first** detent position (this is Lo). Turn forward locknut finger tight against trunnion, then **lengthen rod by turning locknut one additional full turn,** tighten both locknuts against trunnion securely (CAUTION—do not change trunnion position on rod).

Neutral Safety Switch (Kaiser only):
NOTE—Switch on Frazer is non-adjustable).

1) Place selector lever in "Dr" position. Loosen lockscrew on neutral safety switch bracket (screw hole slotted to permit adjustment), adjust switch position so that starter will not operate when starting button pressed.

2) Place selector lever in "N" position. Check clearance between neutral safety switch arm and stop on switch bracket. Clearance should be 1/16" and starter should operate when starting button is pressed.

3) Tighten lockscrew securely.

1950-51 HUDSON

Throttle Control Linkage:

1) Check engine idle speed and set at 480-520 RPM. with engine at normal operating temperature (fast idle inoperative), transmission warm, and selector lever in neutral "N" position.

2) Carburetor Throttle Rod—Make certain carburetor throttle closed with stopscrew against stop in hot or slow idle position. Adjust length of accelerator cross shaft operating rod (connecting carburetor extension shaft lever on left side of cylinder head to bellcrank on left rear side of engine) by backing off one trunnion nut and tightening opposite nut on forward end of rod until gauge pin J-2544 can be entered freely through hole in bellcrank and hole in cylinder block boss (6 Cyl.) or hole in throttle support assembly (8 Cyl.) at rear end of rod. Tighten both trunnion nuts securely and recheck setting. Remove gauge pin.

3) Transmission Throttle Lever—Disconnect throttle rod at throttle lever (outer longer lever) on side of transmission case. Tighten lever clamp bolt to 10-15 ft. lbs. torque. Check lever position by installing Throttle Lever Checking Fixture J-2195 on back of case with gauging leg extending forward along transmission side cover (CAUTION—clean transmission case surface before installing gauge). Move throttle lever to extreme rear position against its stop. Gauge pin should enter hole in throttle lever freely and inner face of lever should be against larger diameter of gauge rod. Bend lever, as required, to secure this position using bending tool J-3310. Remove gauge and connect rod to lever.

4) Transmission Throttle Rod—Disconnect rod by removing trunnion cotter pin and washer from accelerator pedal link bellcrank on left rear side of cylinder block. Position bellcrank by inserting gauge pin J-2544 through hole in accelerator bellcrank and hole in cylinder block boss (6 Cyl.) or hole in throttle support assembly (8 Cyl.). Move transmission throttle lever to rear position against stop by pressing back on rod. Adjust trunnion position on rod (back off one nut, tighten opposite nut) until trunnion pin freely enters hole in bellcrank. Con-

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HYDRA-MATIC LINKAGE ADJUSTMENT (Continued)

nect trunnion to bellcrank, then **shorten rod by backing off rear nut exactly 1½ turns,** tighten front nut securely. Remove gauge pin from bellcrank.

5) Accelerator Pedal Rod—Back off trunnion nuts on accelerator pedal rod at accelerator pedal link bellcrank on left side of cylinder block. Hold carburetor throttle valve in wide open position, depress accelerator pedal fully against its stop, turn rear nut up against trunnion, **then lengthen rod by turning nut up ¼" further,** tighten front nut against trunnion. This will provide approximately 1/16" clearance between accelerator pedal and its stop.

Manual Control Linkage:

1) Tighten upper and lower control tube brackets on steering column securely. Disconnect transmission shift rod at lower lever on steering column.

2) Position transmission shift lever in "Lo" by pressing backward on shift rod until lever is in extreme rear position against stop and then pulling rod forward until lever reaches **first detent position** (this is "Lo").

3) Place selector lever on steering column in "Lo" position by pulling lever toward reverse as far as possible without lifting the lever.

4) Adjust length of shift rod by turning clevis on forward end of rod until clevis pin hole aligned with hole in steering column lever without disturbing position of either lever, then **increase length of rod by turning clevis one complete turn** off rod, connect rod to lever and tighten clevis locknut. Check all positions of selector lever to make certain that each position indexes properly on dial.

Neutral Safety Switch:

1) Place selector lever in neutral "N" position.

2) Loosen safety switch mounting bracket screw, shift safety switch and bracket (screw hole is slotted to permit this adjustment) until clearance between switch lever and stop on bracket is 1/16", tighten mounting screw.

3) Check operation of switch. Starter should operate when ignition switch turned on and starter button depressed. **Starter should not operate** with selector lever in any other position (check in the "Dr" position).

1949-51 LINCOLN

Throttle Control Linkage:

1) Check and adjust engine idle speed to 375-400 RPM. with engine at normal operating temperature (fast idle inoperative), transmission warm, and selector lever in neutral "N" position. Shut engine off.

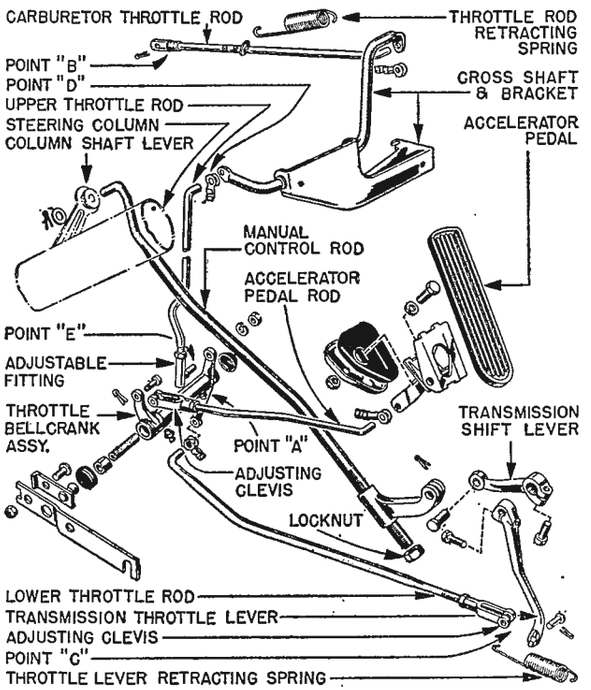
2) Disconnect retracting spring hooked to carburetor throttle rod, disconnect rod at carburetor throttle lever. Disconnect upper throttle rod at bellcrank lever (lower end). Disconnect lower throttle rod at throttle lever on left side of transmission case.

3) **Transmission Throttle Lever**—Check lever position by installing Gauge J-3298 on back of case with gauging leg extending forward along transmission side cover. Move lever to extreme rear position against its stop. Clevis pin in lever hole should align with notch in gauge and inner face of lever should just touch outer face of gauge. Bend lever with tool J-3310 to secure this position.

4) Install Gauge Pin J-2544 through hole in bellcrank lever and bracket (see illustration) to align lever. Leave pin in place while making following adjustments.

5) **Carburetor Throttle Rod**—Connect rod to carburetor throttle lever (adjust ball socket by turning screw in until snug on carburetor lever ball, then back off 1-2 cotter pin holes and install cotter pin). Connect retracting spring from dash to nearest nib on carburetor rod.

6) **Upper Throttle Rod**—With gauge pin inserted in bellcrank lever on left side of engine, hold carburetor throttle lever in closed position with stopscrew on low point of fast idle cam (hot or slow idle position), adjust fitting on lower end of upper throttle rod so that rod can be connected to bellcrank lever without disturbing throttle position. Connect rod.



LINCOLN HYDRA-MATIC CONTROL LINKAGE

7) **Lower Throttle Rod**—With gauge pin inserted in bellcrank lever on left side of engine, connect retracting spring at transmission throttle lever and frame cross-member (spring will hold lever in rear position while making adjustment). Adjust clevis on rear end of lower throttle rod until clevis pin will just enter clevis and hole in throttle lever freely, **then shorten rod by turning clevis 6 turns on the rod.** Connect rod and tighten clevis locknut.

8) **Accelerator Pedal Rod**—With gauge pin inserted in bellcrank lever on left side of engine, adjust clevis on forward end of pedal rod so that tip of accelerator pedal pad is exactly 3⅞" from top of the floor carpet, connect rod and tighten clevis locknut. Remove gauge pin from bellcrank lever.

9) Check entire throttle linkage for free operation without binding. Make certain that carburetor throttle rod returns throttle valves to hot or slow idle position against stop with engine at normal operating temperature.

10) **3-4 Shift Point**—Check shift point by operating car on level road with minimum throttle. **This 3-4 shift must occur at 23 MPH.** Adjust by makjng slight readjustment of lower throttle rod clevis at transmission throttle lever. Increase length of rod to lower the 3-4 shift point, decrease length to raise shift point.

►***CAUTION—Throttle rod clevis must not be turned more than 7 turns (one turn more than standard setting of 6 turns) from point where throttle lever is against its stop.***

Manual Control Linkage:

1) Disconnect manual control rod from shift lever (short lever) on side of transmission case, place shift lever in "Lo" position (move lever to extreme rear position, then move lever forward to **first** detent position which is Lo).

2) Place selector lever in "Lo" against the low range stop.

3) Loosen locknut and adjust clevis on rear end of manual control rod until clevis pin can just be inserted freely through clevis and hole in lever without disturbing the rod or lever positions, **then lengthen rod by turning clevis one complete turn,** connect rod and tighten clevis locknut.

Neutral Safety Switch:

1) Loosen switch bracket mounting screws (on steering column directly below column shaft lever).

2) Place selector lever in "Dr" position. Rotate switch and bracket assembly (mounting screw holes are slotted) so that starter circuit is open. Then move selector lever to "N" position and make certain that starter circuit is closed. Tighten switch mounting screws.

►***CAUTION—Starter circuit must be open in all selector positions except neutral "N".***

1950-51 NASH

►*1951 ADJUSTMENT CAUTION:* A single Throttle Control Rod is used (instead of Upper & Lower rods with connecting bellcrank on left side of crankcase) and **step (4) is not required when adjusting throttle control linkage on 1951 cars.**

Throttle Control Linkage:

1) Disconnect throttle rod (rear rod on 1950 cars) from throttle lever on left side of transmission.

2) Check engine idle speed and set to 375 RPM. with engine warm (fast idle inoperative), transmission warm, and selector lever in neutral "N" position.

3) **Carburetor Throttle Link Rod**—Disconnect link rod at upper bellcrank on left side of cylinder head. Install adjusting pin J-4158 through holes in the upper bellcrank and the mounting bracket. Adjust clevis on bellcrank end of carburetor throttle lever link so that clevis pin enters clevis and bellcrank

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HYDRA-MATIC LINKAGE ADJUSTMENT (Continued)

without moving throttle lever stopscrew away from its stop, tighten locknut and connect rod. Do not remove adjusting pin from bellcrank.

►**1951 Note**—Disregard step (4) on these cars (single throttle rod is adjusted in same manner as Rear Throttle Rod in step (6) below.

4) Front Throttle Rod—With the upper bellcrank locked by adjusting pin, check position of lower bellcrank on left side of crankcase below starter by inserting a second J-4158 adjusting pin through holes in bellcrank and support bracket. If pin does not enter holes freely, disconnect throttle rod at upper bellcrank, install adjusting pin in lower bellcrank, adjust rod length by loosening locknut and turning trunnion end on upper end of rod. Tighten locknut and connect rod. Do not remove adjusting pins until following adjustments have been completed.

5) Transmission Throttle Lever Position—See that clamp bolt on throttle lever on transmission case is tight, place Throttle Lever Checking Gauge J-2545 flat against machined surface on back of case with gauging leg extending forward along transmission side cover. Install clevis pin in hole at outer end of throttle lever, hold lever against stop in extreme rear position. Move gauge upward. Notch on gauge should pass over pin in lever and inner face of lever should just touch outer face of gauge. Bend lever as required using Bending Tool J-3310.

►***CAUTION—Do not twist lever or spring shaft when adjusting.***

6) Rear Throttle Rod—With bellcranks locked by the adjusting pins, hold throttle lever on transmission case in extreme rear position against the stop, adjust trunnion on transmission end of rear throttle rod by backing off one trunnion nut and tightening opposite nut until trunnion pin enters hole in throttle lever freely, then **back off forward trunnion nut two complete turns**, tighten rear nut securely (this will "shorten" rod), connect rod to throttle lever, remove adjusting pins from upper and lower bellcranks.

Starter Switch:

1) Place selector lever in Neutral "N" position. Check alignment of operating plunger (spring-loaded pin) on side of operating lever on steering column and starting switch plunger (must be in line so that switch plunger depressed by operating plunger when selector lever lifted upward in "N" position).

2) Adjust switch to align plunger by loosening switch bracket mounting screws and shifting switch bracket on steering column (holes are slotted to permit this adjustment).

Manual Control (Selector Lever) Linkage:

1) Place steering wheel selector lever in "Lo" position and see that operating lever on steering column is against low range stop (right side) of notch in starter switch bracket.

2) Disconnect control rod at shift lever on left side of transmission case.

3) Move transmission shift lever to "L" position (place lever in extreme rear "R" position, then move lever forward until next detent position is reached), adjust clevis on transmission end of control rod until clevis pin enters hole in lever freely, then **lengthen rod by turning clevis off one complete turn**, tighten locknut and connect rod.

1946-48 OLDSMOBILE 6 & 8

Manual Control—Disconnect lower control relay rod at lever on side of transmission case and lower control rod at intermediate lever on cross-member bracket (remove clevis pins and spring washers, loosen clevis locknuts). Move manual control lever on transmission to reverse position (all the way back against stop—rotate propeller shaft by hand until anchor engages and lever is against stop). Position intermediate lever so that gaging hole lines up with hole in bracket, insert locking pin (Tool J-1469) through both holes to lock lever in position. Adjust clevis on lower control relay rod so that rod can be connected without disturbing position of transmission lever, connect rod (CAUTION—use spring washer on clevis end to prevent rattles), remove locking pin from intermediate lever. Move manual lever on transmission to "LO RANGE" position (move lever all the way forward to "Neutral", then move lever back to second detent position). Place Selector lever against stop which prevents shifting into reverse (without raising lever) by pulling down on lower control rod until stop is felt. Adjust clevis on lower end of control rod so that clevis pin can be inserted without disturbing position of selector lever or intermediate lever, then **lengthen rod by turning clevis one full turn**, connect rod to intermediate lever (CAUTION—use spring washer on clevis end to prevent rattles).

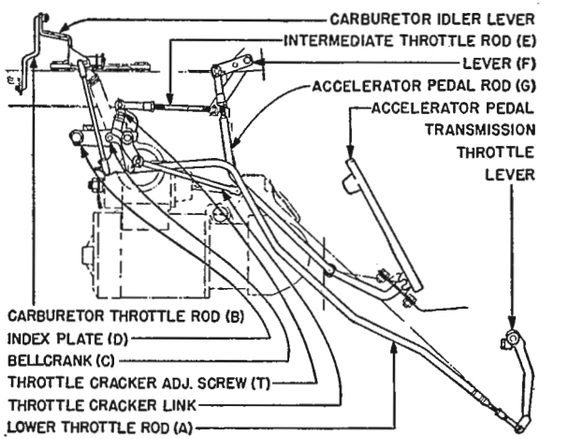
Throttle Control (1946 & Early 1947)—Adjust with engine idling speed properly set at 375 RPM (slow idle speed) and with transmission in Neutral. Remove small spring lock from trunnion on idler lever (on cylinder head above oil filler cap), adjust length of carburetor rod by turning trunnion adjusting nut until locking pin (Tool J-1469) slips freely through holes in bell-crank (on side of engine block below trunnion) and indexing plate with carburetor throttle lever in slow-idle position, tighten trunnion locknut and position adjusting nut so that trunnion spring lock can be replaced. CAUTION—If tightening trunnion locknut changes alignment of gaging holes (recheck alignment with Tool J-1469), loosen locknut and lengthen rod one-half turn, tighten locknut and recheck alignment. Make sure carburetor rod moves freely in idle and full-throttle positions. Install trunnion spring lock.

Throttle Control (Late 1947 & 1948)—Adjust with idling speed properly set at 375 RPM. (slow idle speed with engine warm and selector lever in Neutral). Disconnect throttle control rod at auxiliary bellcrank on cylinder head (6 cyl. cars), at cross-shaft (8 cyl. cars), adjust rod by bending the rod until locking pin (Tool J-1469) slips freely through holes in bellcrank and indexing plate (on side of engine) with rod connected and carburettor throttle closed. Check to see that carburetor rod moves freely throughout travel from idle to full throttle position.

Throttle Lever Position—Position of hole in end of throttle lever on transmission case may change (if valve body, inner throttle lever and shaft assembly, or outer lever replaced) and should be checked. Install Gauge J-2195 (against machined surface on back of case with gauging rod extending forward to throttle lever), disconnect rod at throttle lever on transmission case. Tip of gauge rod should enter hole in end of throttle lever freely. If lever position incorrect, remove lever and bend, as required, for correct position.

Throttle Lever Control Linkage—Disconnect the rod at throttle lever on side of transmission case, move throttle lever all the way back against stop, make certain that carburetor throttle in slow-idle position and adjust clevis on rod so that it can be connected to throttle lever on transmission without disturbing position of lever and linkage, then **shorten rod by turning clevis one full turn**, connect rod to lever. Adjust accelerator pedal rod so that idler lever under toeboard (to which pedal rod connected) will have **3/32-5/32"** clearance between lever and rib in body toe pan. CAUTION—This clearance necessary to allow carburetor to return to slow idle position.

Throttle Cracker Adjustment (6 Cyl.)—Must be correctly set for starting. .0625" to .0851" (1/16") clearance between throttle stopscrew and highest step of fast idle cam with starting pedal fully depressed (starter pinion fully meshed). Adjust by loosening locknut and turning adjusting screw on accelerator bellcrank (screw contacts lug on lever linked to starter pinion shift lever).



1949 OLDSMOBILE 6 CONTROL LINKAGE

Throttle Cracker Adjustment (8 Cyl.)—Set for correct throttle opening for starting. To adjust, disconnect starter cable at starter switch (for foot operated starters), disconnect coil lead to distributor (for solenoid operated starters), depress starter pedal or pushbutton to full down position (engine will be turning over on solenoid starter cars) to fully mesh starter pinion, loosen locknut and turn adjusting screw on accelerator bell-crank (screw contacts lug on lever linked to starter pinion shift lever) so that clearance between throttle stopscrew and highest step of fast idle cam is .105-.125" (⅛").

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HYDRA-MATIC LINKAGE ADJUSTMENT (Continued)

Fourth-to-Third Throttle Downshift—Should be checked whenever linkage adjusted to insure proper operation and prevent damage to linkage. To adjust with engine stopped, pull transmission throttle rod all the way forward until throttle lever on transmission is against stop, hold in this position and bend stop lip on indexing plate (at bell-crank on side of engine) for clearance of 1/16-3/32" between lip and stop on bell-crank.

Safety Switch Adjustment—Clearance between switch and stop should be 1/16-3/32" between lever and stop with selector lever in "Neutral" position. To adjust, loosen switch bracket locking screw, adjust switch (bracket is slotted). NOTE—With correct adjustment starter operative only when selector lever placed in Neutral "N" position.

1949-50 OLDSMOBILE 6

(1) Manual Control Linkage—Same as for 8 Cyl. models (following).

(2) Throttle Control Linkage—See that carburetor set for correct hot or slow idle speed of exactly 350 RPM. with selector lever in "DR" position. Use safety lock tool J-4396 installed on accelerator pedal to prevent accidentally racing engine when warming up engine and transmission prior to setting idle speed. Then adjust linkage in following order:

Transmission Throttle Lever—Disconnect lower throttle rod from lever on side of transmission case. Install checking tool J-2195 on machined surface on rear face of transmission case with gauging rod extending forward toward lever. Hold throttle lever back against stop. If small end of tool does not enter hole in lever freely in this position, bend lever as required using tool J-2029. Do not connect throttle rod to lever at this point.

Carburetor Throttle Rod (B)—Disconnect rod (B) at carburetor throttle valve lever. Align bellcrank (C) with index plate (D) by inserting Gauge BT-25 through holes in lever and plate. Hold carburetor throttle lever in slow idle position, bend rod (B) using tool GA-38 so that it can be connected without disturbing lever positions. Connect rod. Gauge BT-25 should now slip in and out of holes in lever and index plate freely. Remove gauge.

Lower Throttle Rod (A)—See that carburetor in slow idle position (throttle lever against stop), hold transmission throttle lever fully back against its stop, adjust length of rod (A) by loosening locknut and turning clevis until clevis pin enters hole in lever freely, then **shorten rod by one full turn of the clevis,** tighten locknut and connect rod.

1949 Intermediate Throttle Rod (E)—Disconnect accelerator spring, disconnect rod (E) by removing clevis pin at forward end. Insert Gauge BT-25 through hole in lever (F) and hole in bracket. Adjust clevis on forward end of rod (E) so that gauge BT-25 will enter holes in lever and bracket freely with rod connected. Connect rod and remove gauge.

1950 Intermediate Throttle Rod (E)—Disconnect rod (E) from bellcrank lever by taking out cotter pin at forward end, install special "U" gauge on accelerator pedal rod to prevent pedal bottoming on grommet retainer on floor (make gauge up from piece of 3/8" flat stock). Pull rod (E) forward until accelerator pedal pad rests firmly on gauge (floor mat must be away from pedal), hold carburetor throttle wide open, adjust rod by turning it in or out of clevis on rear end until it can be just entered in bellcrank, connect rod, tighten clevis locknut, remove gauge.

1949 Accelerator Pedal Rod (G)—***This rod not adjustable on 1950 cars.*** First disconnect accelerator pedal rod (G) by removing clevis pin at lever (F). Hold carburetor throttle lever in wide open throttle position, push down lightly on rod (G) so that pedal stop touches floor mat (CAUTION—floor mat must be flat against floor cover). Adjust clevis on end of rod (G) so that clevis pin enters hole in lever (F) freely, then **shorten clevis by six full turns,** connect rod. This will provide approximately ¼" clearance between pedal stop and floor mat when carburetor throttle in wide open position.

(3) Throttle Cracker Linkage—Disconnect coil to distributor lead (to prevent starting engine), press starter button to fully engage starter drive (solenoid pinion shift). With starter fully engaged, loosen locknut and turn adjusting screw (T) on lever on side of engine for clearance of .062-.085" between carburetor throttle stopscrew and high step of fast idle cam (cam turned to cold or fast idle position).

(4) Bellcrank & Index Plate Clearance—Bend stop lug on index plate (D) so that clearance between lug and lip on bellcrank (C) is 1/32-1/16" with bellcrank in full open position as limited by transmission throttle lever.

(5) Starter Safety Switch Adjustment—Same as for 8 cyl. models (following).

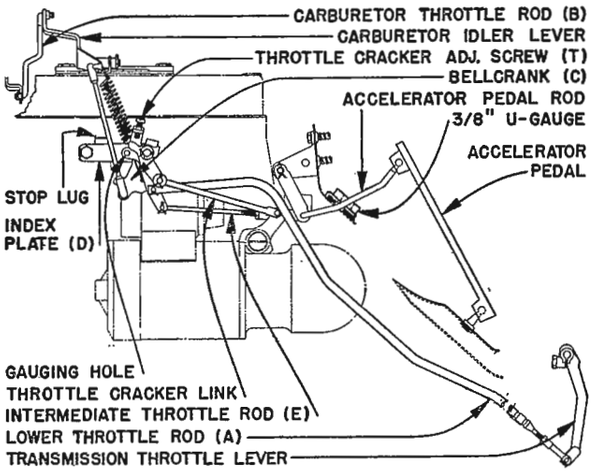
1949-51 ODSMOBILE 8

(1) Manual Control Linkage—Loosen clevis locknut at rear end of lower control rod (from steering column to intermediate lever on frame cross-member). On 1949 cars, loosen clevis locknut at rear end of lower control relay rod (from intermediate lever to transmission control lever) and disconnect rods at intermediate lever and transmission. Adjust Lower Control Relay Rod on 1949 cars only ***(CAUTION—this rod not adjustable on 1950-51 cars).***

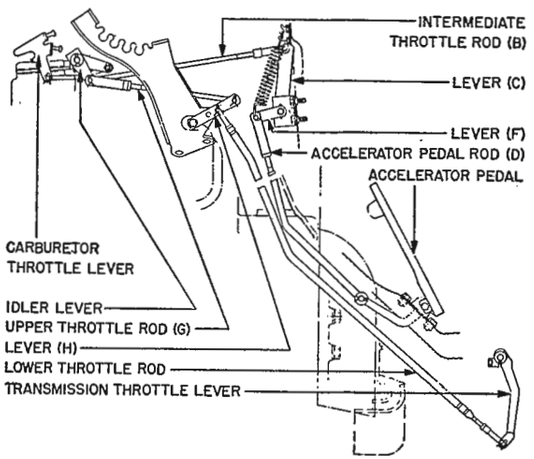
Lower Control Relay Rod (1949 Cars). ***This rod not adjustable on 1950-51 cars.*** Move the transmission control lever all the way back into Reverse position (rotate propeller shaft by hand until reverse anchor engages and lever is against stop). Position intermediate lever on cross-member so that gauging hole in lever lines up with hole in bracket, insert Gauge BT-25 through both holes to maintain lever position. Adjust clevis on rear end of relay rod so that rod can be connected without disturbing position of levers. Connect rod and remove gauge from intermediate lever.

Lower Control Rod—Place transmission control lever in "LO" position (move lever all the way forward to Neutral, then move lever back to the second detent "LO" position). Place steering column selector lever at end of Lo range against stop which prevents movement into Reverse without raising lever (pull down on lower control rod until stop is felt). Adjust clevis on lower end of lower control rod until pin can just be slipped freely through clevis and intermediate lever without disturbing lever positions, **then lengthen rod by turning clevis one full turn (1949-50), two full turns (1951),** tighten locknut and connect rod.

(2) Throttle Control Linkage—See that carburetor set for correct hot or slow idle speed of exactly 350 RPM. with selector lever in "DR" position. Use safety lock tool J-4396 installed on accelerator pedal to prevent accidentally racing engine when warming up engine and transmission prior to setting idle speed. Then adjust linkage in following order:



1950 OLDSMOBILE 6 CONTROL LINKAGE



1949-51 OLDSMOBILE 8 CONTROL LINKAGE

Transmission Throttle Lever—Disconnect lower throttle rod from lever on side of transmission case. Install checking tool J-2195 on machined surface on rear face of transmission case with gauging rod extending forward toward lever. Hold throttle lever back against stop. If small end of tool does not enter hole in lever freely in this position, bend lever as required using tool J-2029. Do not connect rod to lever at this point.

Upper Throttle Rod (G)—Disconnect rod (G) from lever (H). Insert gauge BT-25 through three holes in cross shaft assembly. Adjust rod (G) in

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HYDRA-MATIC LINKAGE ADJUSTMENT (Continued)

or out of clevis at forward end until rod can be connected without moving carburetor throttle lever from its hot or slow idle position. Tighten clevis locknut, connect rod, remove gauge from lever.

►***CAUTION—If clevis at forward end of rod (G) disconnected, this clevis must be installed with open side facing away from engine.***

Lower Throttle Rod—See that carburetor is in slow idle position (throttle lever against stop), hold transmission lever fully back against its stop, adjust length of the rod by loosening locknut and turning clevis until clevis pin enters hole in lever freely, then **shorten rod by one full turn of the clevis,** tighten locknut and connect rod.

Intermediate Throttle Rod (B)—Disconnect rod at lever (C) on dash. See that carburetor throttle lever in hot or slow idle position (throttle lever against stop), adjust clevis on rod so that distance from rear face of lever (C) to bottom of depression in dash is 5/16-3/8" (88), 7/32-9/32" (98), tighten clevis locknut and connect rod.

1949 Accelerator Pedal Rod (E)—Unhook accelerator spring, disconnect rod (E) at lever (F) by sliding clevis off lever pin. Hold accelerator pedal down lightly against floor mat but do not push down on rod (CAUTION—floor mat must be flat on floor). Adjust clevis on upper end of rod (E) until it just slides freely on lever pin, then **shorten clevis by six full turns,** connect rod, install spring. This will provide approximately ¼" clearance between pedal stop and floor mat when carburetor throttle in wide open position.

►***CAUTION—Clevis on upper end of rod (E) must be installed with open side facing toward engine.***

1950 88 Accelerator Pedal Rod (E)—This model has idler lever on dash and additional short adjustable rod between this lever and lever (C). Install special "U" gauge on accelerator pedal rod to prevent pedal bottoming on grommet retainer on floor (make gauge up from piece of ⅜" flat stock). Disconnect this short rod from lever (C), depress accelerator pedal until it bottoms on gauge (floor mat must be away from pedal), hold carburetor throttle wide open, adjust clevis on upper end of rod until it can just be connected to pin on lever (C), tighten clevis locknut, connect rod, remove gauge.

►***CAUTION—Clevis on upper end of rod must be installed with open face toward engine.***

1951 88 Accelerator Pedal Rod (E)—Same design as 1950 88 but adjusted differently: Disconnect short rod from lever (C), depress accelerator pedal until clearance between face of rod boss on underside of pedal and floor mat is ¼" (CAUTION—floor mat must be in place), hold carburetor throttle valve in wide open position, adjust clevis on upper end of short rod so that it just slides over pin on bracket, tighten clevis locknut and connect rod.

►***CAUTION—Clevis on upper end of rod must be installed with open face AWAY from engine.***

1950-51 98 Accelerator Pedal Rod (E)—See illustration. Disconnect accelerator pedal rod (D) from lever on dash. Depress accelerator pedal until clearance between tip of pedal and floor mat is ¼" (CAUTION—floor mat must be in place), hold carburetor throttle valve in wide open position, adjust clevis on upper end of rod (D) until it slides over pin in bracket, tighten clevis locknut and connect rod.

►***CAUTION—Clevis on upper end of rod must be installed with open face AWAY from engine.***

►**Throttle Cracker Note**—No throttle cracker (as used on 6 cyl. cars) is used. When starting cold engine, first opening of throttle allows fast idle cam to rotate so that special starting step of cam holds throttle open for starting. When starting hot engine, open throttle approximately 1/3 by depressing accelerator pedal.

(3) **Starter Safety Switch Adjustment**—Loosen switch bracket locking screw just enough so that slotted bracket can be moved. Place selector lever on steering wheel in "N" neutral position. Adjust switch by moving bracket so that clearance between lever and stop is 1/16-1/32", tighten bracket screw.

1948 PONTIAC

1. Carburetor Throttle Rod—Disconnect control rod at throttle lever (outer lever) on side of transmission case. Check to make certain that engine idle speed correctly set at 365-385 RPM. hot or slow idle (with engine at 150-160°F., transmission warm, selector lever in Neutral). Disconnect carburetor throttle rod from throttle control intermediate lever (6 cyl.) or from lever on cross-shaft (8 cyl.) on cylinder head. Install Adjusting Pin J-2544 through holes in lever and bracket to position lever. Adjust trunnion on carburetor rod so that trunnion pin will just enter hole in lever without moving carburetor throttle lever stopscrew from against its stop. Tighten trunnion locknut, connect rod. Do not remove Adjusting Pin until following adjustments made:

►***CAUTION—On 6 Cyl. cars, position carburetor throttle rod upward away from ignition wires before tightening locknut.***

2. Throttle Control Rear Rod (Acelerator Pedal Intermediate Rod)—With adjusting pin J-2544 installed in lever on cylinder head (1. above), check position of accelerator pedal lever on dash. If second Adjusting Pin J-2544 cannot be inserted freely through holes in levers and bracket, disconnect rod at throttle control idler lever (on side of engine), adjust trunnion on rod until adjusting pin can be inserted freely with rod connected, tighten locknut and connect rod. Leave this adjusting pin in the ped al lever while following adjustments made:

3. Transmission Throttle Lever Front Rod—With Adjusting Pins in place in lever on cylinder head and in accelerator pedal lever on dash (1. & 2. above), check position of transmission throttle idler lever on lower edge of crankcase under starter. If third Adjusting Pin J-2544 cannot be inserted freely through holes in lever and bracket, disconnect rod at cylinder head lever, adjust rod length by turning upper end fitting until adjusting pin can be inserted freely with rod connected, tighten end fitting locknut. Remove all three adjusting pins.

4. Transmission Throttle Lever Position—See that clamp bolt in transmission lever (outer lever on side of case) is securely tightened. Check position of lever by installing Throttle Lever Checking Gauge J-2545 flat against rear surface of transmission case with edge of gauge against side cover. With clevis pin installed in lever, hold lever in rear position against stop, move gauge upward. Notch in gauge should pass over pin in lever and inside face of lever should just touch outer face of gauge. Bend lever, as required, using tool J-2807, to secure this position. Recheck lever position.

►***CAUTION—Use extreme care not to twist lever or spring shaft when bending lever for correct position. Check rod alignment with lever for free action without binding.***

5. Transmission Throttle Lever Rod—Hold transmission throttle lever in extreme rear position against stop (see 4. above), adjust clevis on rear end of throttle rod so that clevis pin can just be inserted freely through clevis and hole in lever, then **shorten rod by turning clevis up one full turn,** tighten clevis locknut and connect rod.

6. Manual (Shift Control) Linkage—Hold selector lever down firmly in "Lo" position, tighten control shaft upper bracket clampscrew securely. Move selector lever to Reverse "R" position. Loosen locknuts on trunnion at forward end of forward control rod (at lower end of selector lever shaft), tighten control shaft lower bracket securely. Disconnect rear rod at shift lever (inner lever) on transmission case, tighten shift lever clampscrew securely. Install Adjusting Pin J-2544 through holes in lower control relay lever (to which lower end of forward rod connected) and bracket to lock lever. Move transmission shift lever to extreme rear (Reverse) position (NOTE—rotate propeller shaft by hand to insure reverse engagement). Adjust clevis at lever end of rear rod so that rod can be connected to shift lever without disturbing lever position, connect rod. Remove adjusting pin from relay lever. Move transmission shift lever to "Lo" position (move lever forward until next (Lo) detent is felt to engage). Move selector lever to "Lo" position against stop which prevents further lever movement into reverse (without raising lever). Turn lower locknut on forward control rod (under control shaft lever trunnion) up until it contacts trunnion, then **turn locknut up one additional turn.** Tighten upper locknut securely against trunnion.

7. Throttle Cracker Adjustment—Important for satisfactory starting operation. *See "Accelerator Linkage Adjustment" under CARBURETOR on each car model page for complete instructions.*

8. Starter Interlock Adjustment—Must be adjusted so that depressing starter pedal to start engine (with Hydra-Matic selector lever in any other position than Neutral), will move selector lever to Neutral "N" position. To adjust, disconnect battery cable at starter (to prevent starter operating while adjusting), tighten neutralizer lever attaching bolts on starter shift lever. Depress starter pedal fully. Adjust length of interlock rod by turning locknuts at trunnion on lower end of neutralizer lever so that selector lever indicator is in exact neutral "N" position, then **lengthen rod by turning trunnion nuts one additional full turn.** Lock trunnion nuts securely. Check operation by placing selector lever in various positions and noting action when starter pedal depressed fully.

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HYDRA-MATIC LINKAGE ADJUSTMENT (Continued)

1949 PONTIAC

(1) Carburetor Throttle Rod—Disconnect control rod at throttle lever (outer lever) on side of transmission case. Check engine idle speed and set for 365-385 RPM. hot or slow idle speed with engine temperature at 150-165°F., transmission warm and selector lever in neutral "N". Loosen checknuts at trunnion on carburetor throttle rod at throttle control intermediate lever (6 cyl.), cross-shaft lever (8 cyl.) on cylinder head, install adjusting pin J-2544 through holes in lever and bracket on left side of cylinder head. Tighten trunnion checknuts being careful not to move carburetor throttle stopscrew away from its stop. Do not remove adjusting pin.

►***CAUTION—On 6 cyl. cars, position carburetor throttle rod upward and away from ignition cables.***

(2) Transmission Throttle Front Rod—Check adjustment by inserting second adjusting pin J-2544 through holes in transmission throttle idler lever and bracket (on left side of crankcase **below** starter). If pin does not enter both holes freely, adjust rod length by disconnecting rod at upper (cylinder head lever) end of rod and screwing end fitting in or out Connect rod but do not remove adjusting pins.

(3) Throttle Control (Accelerator Pedal) Rear Rod—Loosen front checknut at trunnion on forward end of rod (at idler lever on left side of crankcase **above** starter), tighten rear checknut until accelerator pedal rocker lever lug just contacts lever bracket on dash, then **back off rear checknut three full turns,** tighten front checknut so that trunnion is locked on rod. Remove adjusting pins from intermediate lever on cylinder head and idler lever on left side.

(4) Transmission Throttle Lever Position—See that clamp bolt on transmission throttle lever securely tightened, check position of lever by installing Checking Gauge J-2545 flat on machined rear face of transmission case with edge of gauge against side cover. Install trunnion pin in lever, hold lever in extreme rear position. Move gauge upward. Notch in gauge should pass over pin in lever and inside face of lever should just touch outer face of gauge. If not, bend lever with tool J-2807, and recheck lever

(5) Transmission Throttle Rear Rod—Hold transmission throttle lever in rear position against stop, adjust trunnion position on rod by backing off one checknut and tightening opposite nut until trunnion pin enters hole in lever freely, then **shorten rod one full turn** (back off front nut, tighten rear nut one turn), connect rod.

(6) Manual Control Linkage—Hold selector lever under steering wheel down in "LO" position firmly, tighten control shaft upper bracket clampscrew securely. Back off both trunnion checknuts at forward end of manual control rod (at steering column control shaft lever), place manual control lever on transmission case in "LO" (move lever forward from extreme rear to second position where detent is felt to engage). With both levers held in "LO" position, tighten rear (lower) nut against trunnion finger tight, then **lengthen rod by turning nut up one additional turn,** tighten forward checknut against trunnion securely.

(7) Starter Neutralizer Switch—Place selector lever in "DR" position. Loosen switch bracket clampscrew (on steering column at lower end of selector shaft), shift switch and bracket (screw hole is slotted) until starter does not operate when starter button depressed. Move selector lever to "N" position. Check to see that switch arm does not touch stop on switch bracket, and that starter operates when starter button depressed. Tighten bracket clampscrew.

►**Neutralizer Switch Replacement (first cars)**—On cars before Serial No. P6RH-1063 (6 Cyl.), P8RH-1384 (8 Cyl.), if backing light terminal posts pushed into switch case and interfering with operation of switch arm, install new No. 1997846 switch which has posts staked to prevent this occurrence.

1950-51 PONTIAC

(1) Carburetor Throttle Rod—Disconnect throttle rod at throttle lever (outer lever) on left side of transmission case. Check and adjust engine idle speed to 365-385 RPM. hot or slow idle with engine at 150-160°F., transmission warm, and selector lever in Neutral "N". Install adjusting pin through holes in carburetor intermediate lever on left side of cylinder head and lever bracket. Adjust nuts at trunnion on carburetor throttle rod (back off one nut, tighten opposite nut) until adjusting pin is free with carburetor throttle lever stopscrew against its stop. Tighten trunnion nuts but **do not remove adjusting pin.**

(2) Transmission Throttle Front Rod—Check adjustment by inserting second J-2544 adjusting pin through holes in idler lever (left side of crankcase **below** starter) and lever bracket. If pin does not enter both holes freely, adjust length of transmission throttle front rod at trunnion on upper end of this rod (back off one nut, tighten opposite nut), then tighten both nuts securely, remove both adjusting pins (intermediate lever and idler lever).

(3) Accelerator Pedal Rod—Loosen front locknut on pedal rod at throttle control idler lever on left side of engine, depress accelerator pedal until carburetor throttle is just wide open, check clearance between lower face of accelerator pedal and floor mat. If clearance not ¼" at closest point, adjust pedal by turning rear nut at trunnion on forward end of rod in or out as required, then tighten front nut securely.

(4) Transmission Throttle Lever Position—With rear rod disconnected at transmission case throttle lever, check tightness of lever clamp bolt (12-15 ft. lbs. torque), check lever position by installing Checking Gauge J-2545 flat against machined rear face of transmission case with edge of gauge against side cover flange. Install trunnion pin in lever, hold lever in extreme rear position, move gauge upward, align gauge with trunnion pin. Inside face of throttle control lever should just touch outer side face of gauge and pin in lever should enter slot in gauge freely. Adjust by bending lever with tool J-2807.

(5) Transmission Throttle Rear Rod—After checking and adjusting transmission throttle lever, connect rear rod trunnion at lever, loosen rear locknut on trunnion, adjust rod length by turning front locknut toward trunnion until throttle lever is just back against its stop, then **shorten rod by backing off front nut one turn,** tighten rear nut securely.

(6) Manual Control Linkage—Hold selector lever under steering wheel down in "LO" position firmly, tighten control shaft upper bracket clampscrew securely. Back off both trunnion checknuts at forward end of manual control rod (at steering column control shaft lever), place manual control lever on transmission case in "LO" (move lever forward from extreme rear to second position where detent is felt to engage). With both levers held in "LO" position, tighten rear (lower) nut against trunnion finger tight, then **lengthen rod by turning nut up one additional turn,** tighten forward checknut against trunnion securely.

(7) Starter Neutralizer Switch—Place selector lever in "DR" position. Loosen switch bracket clampscrew (on steering column at lower end of selector shaft), shift switch and bracket (screw hole is slotted) until starter does not operate when starter button depressed. Move selector lever to "N" position. Check to see that switch arm does not touch stop on switch bracket, and that starter operates when starter button depressed. Tighten bracket clampscrew.

HYDRA-MATIC BAND ADJUSTMENT

ALL 1946-51 HYDRA-MATIC CARS

►***BAND ADJUSTMENT CAUTION: Do not attempt to adjust bands EXTERNALLY (without removing oil pan) unless Adjusting Tool J-2681 (or Kaiser-Frazer No. KF-96) and accurate Tachometer are used. Otherwise remove oil pan and use special servo gauges.***

ADJUSTMENT—EXTERNALLY using Adjusting Tool J-2681 (or Kaiser-Frazer KF-96) and Tachometer:

1) Block front wheels securely and set hand brake firmly to prevent car moving while adjusting.

2) Remove front floor mat and adjusting hole cover over adjusting screws on left side of transmission.

3) Run engine until temperature is normal and engine idles at hot or slow idle speed of 375-400 RPM.

4) Connect and adjust tachometer for accurate recording of engine speed.

5) Place selector lever in "DR" position.

6) Adjust carburetor throttle stopscrew so that engine idles at exactly 700 RPM. Then adjust bands:

Front Band (After steps 1 through 6):

7F Install the adjusting tool on front band adjusting screw, loosen adjusting screw locknut (turn long handle while holding short handle stationary).

8F) Loosen band adjusting screw (turn short handle) until engine speed increases to 900-1000 RPM. (800-900 RPM. on Hudson—this will make it unnecessary to back adjusting screw all the way out).

►***NOTE***—If no increase in engine speed noted when adjusting screw loosened, band has probably been slipping in service. Remove oil pan and inspect band and drum. With pan off, adjust bands as directed in ADJUSTMENT—WITH PAN OFF below and disregard following steps.

9F) Tighten band adjusting screw slowly until engine speed drops to 700 RPM., loosen adjusting screw until engine speed increases, then tighten adjusting screw until engine speed again drops to exactly 700 RPM., watch tachometer for 30 seconds to note any increase in engine speed. If increase noted,

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HYDRA-MATIC BAND ADJUSTMENT (Continued)

tighten adjusting screw 1/10 turn. Repeat this procedure until engine speed remains at 700 RPM. for at least 30 seconds,

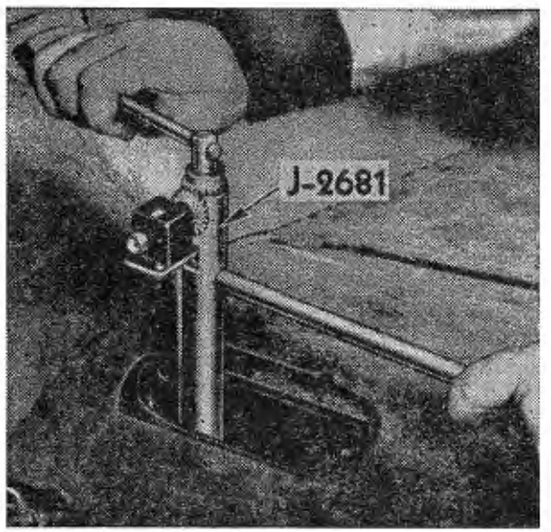
10F) Set counter on adjusting tool to 00. Hold locknut stationary, **tighten adjusting screw exactly 5½ turns (see Oldsmobile Note below) so that tool counter reads 5.5,** hold adjusting screw from turning and tighten locknut securely.

OLDSMOBILE WHIRLAWAY NOTE—On cars where transmission has been modified to start in 1st gear, band should be adjusted to 6½ turns tight rather than 5½ turns as above.

Rear Band (After steps 1 through 6):

7R) Install the adjusting tool on rear band adjusting screw, loosen adjusting screw locknut (turn long handle while holding short handle stationary).

8R) Loosen band adjusting screw (turn short handle) until engine speed increases to 900-1000 RPM. (800-900 RPM. on Hudson—this will make it unnecessary to back adjusting screw all the way out).



HYDRA-MATIC BAND ADJUSTING TOOL J-2681

NOTE—If no increase in engine speed noted when adjusting screw loosened, band has probably been slipping in service. Remove oil pan and inspect band and drum. With pan off, adjust bands as directed in ADJUSTMENT—WITH PAN OFF below and disregard following steps.

9R) Tighten band adjusting screw slowly until engine speed drops to 700 RPM., loosen adjusting screw until engine speed increases, then tighten adjusting screw until engine speed again drops to exactly 700 RPM., watch tachometer for 30 seconds to note any increase in engine speed. If increase noted, tighten adjusting screw 1/10 turn. Repeat this procedure until engine speed remains at 700 RPM. for at least 30 seconds.

10R) Place selector lever in "N" position.

11R) Set counter on adjusting tool to 00. Hold locknut stationary, **tighten band adjusting screw exactly 2 turns until tool counter reads 2.0.**

12R) Place selector lever in "DR" position. Hold band adjusting screw from turning, tighten locknut securely.

After Front & Rear Bands Adjusted.

Reset engine idle speed as follows:

Car Model	Idle Speed	Selector Lever
Cadillac	375 RPM.	"Dr"
Frazer & Kaiser	425-450 RPM.	"N"
Hudson	480-520 RPM.	"N"
Lincoln, Nash	375 RPM.	"N"
Oldsmobile (exc. Whirlaway)	375 RPM.	"Dr"
Oldsmobile (Whirlaway) ①	350 RPM.	"Dr"
Pontiac	365-385 RPM.	"N"

①—When Whirlaway transmissions modified to start in 1st gear, set idle speed at 375 RPM. in "Dr".

ADJUSTMENT—WITH OIL PAN OFF Using Servo Gauges J-1693 & J-5071 (Kaiser-Frazer KF-92 & KF-77): Drain transmission case by removing plug at rear of oil pan, remove pan, remove front compartment floor mat and floor hole cover over band adjusting screws. Adjust each band:

Front Band (Gauge J-1693 or Kaiser-Frazer KF-92):

1) Loosen locknut and back off front band adjusting screw approximately 5 turns. Make certain that band is centered on drum.

2) Remove pipe plug from bottom of front servo.

3) Loosen hexagonal headed adjusting screw on gauge by hand until approximately ⅛" of adjusting screw threads are exposed above gauge body. Screw gauge into pipe plug hole in front servo **by hand**

4) Tighten hexagonal adjusting screw on gauge by hand until gauge stem is felt to just touch piston in servo, then continue to tighten adjusting screw with a wrench **exactly 6 full turns** (see Oldsmobile Note below) from point where stem first contacted piston.

OLDSMOBILE WHIRLAWAY NOTE—On cars where transmission has been modified to start in 1st gear, band should be adjusted to 5 turns tight rather than 6 turns as above.

5) Tighten front band adjusting screw until knurled washer on gauge (at upper end of hexagonal adjusting screw) is just free to turn. Hold band adjusting screw from turning and securely tighten adjusting screw locknut.

6) Loosen gauge adjusting screw **at least six turns,** remove gauge from servo. Install pipe plug in servo and tighten securely.

Rear Band (Gauge J-5071 or Kaiser-Frazer KF-77):

1) Place the gauge on the finished surface of the Accumulator body with leg of gauge resting on rear servo stem.

2) Loosen locknut and back off rear band adjusting screw until face of actuating lever (which contacts servo stem) is well away from the face of the gauge.

3) Tighten band adjusting screw until face of band actuating lever just contacts gauge.

►***CAUTION—If adjusting screw turned too far when making this adjustment, back screw off SEVERAL TURNS and repeat adjustment.***

4) Hold band adjusting screw from turning and tighten adjusting screw locknut securely. Remove gauge.

HYDRA-MATIC TESTING
ALL 1946-51 HYDRA-MATIC CARS

For test and repair purposes, the first basic types of Hydramatic Transmissions are identified below.

Hydra-Matic Types

1—Not Modulated Pressure. Mechanical Reverse.
2—Modulated Pressure. Mechanical Reverse.
3—Not Modulated Pressure. Hydraulic Reverse.
4—Modulated Pressure. Hydraulic Reverse.
5—"WHIRLAWAY" Either Type 2 or Type 4).

WHIRLAWAY TRANSMISSION NOTE—This transmission is basically the same as other Hydra-Matic Transmissions except for arrangement of shifts in "Dr" Range ("Lo" Range—1 & 2, "Dr" Range—1, 2, 3). *CAUTION*—Some Whirlaway Transmissions may be found which have been modified to start in 1st gear in "Dr" Range.

MODULATED PRESSURE: Main line or throttle pressure is regulated by the pressure regulator valve, depending on throttle pressure. This throttle pressure acts upon a throttle valve pressure plug house within pressure regulator. Inner end of plug bears against pressure regulator which controls main line pressure, adding force to the pressure regulator spring thus adding to main line pressure. (See illustrations).

HYDRAULIC REVERSE: Consists of a cone clutch arrangement within the reverse unit and allows for "Rocking" the car without danger of clashing gears. Transmisisons with hydraulic reverse can be identified by trying to shift into reverse with the car moving forward. Gears will clash and resistance will be apparent on cars without hydraulic reverse.

►***CAUTION—Before performing any Hydramatic tests check fluid level in transmission and bring up to "FULL" mark on indicator, using recommended fluid only. Check engine idle and set at recommended speed.***

ROAD TEST: If possible, choose a route that includes a hilly section to test for open throttle upshift, slippage and throttle downshift points, and a level section for upshift point tests. Refer to Hydramatic Shift Point table for correct shift speeds.

STALL TEST: This test can be made to determine engine performance, transmission band slippage or damaged torus member. Engine speed must remain between test limits for normal engine and transmission operation (See Table below.) Bring engine to normal operating temperature and connect electric tachometer. Place selector lever in "Dr" position, set hand and foot brakes securely and depress accelerator pedal to floor. ***(CAUTION—Extreme care must be used in making this test. NEVER HOLD THROTTLE OPEN MORE THAN ONE MINUTE. If engine speed EXCEEDS maximum limit by more than 200 RPM, close throttle immediately).***

STALL TEST LIMITS

Car	Minimum RPM	Maximum RPM
Cadillac	1500	1700
Hudson	1450	1650
Kaiser-Frazer	1450	1650
Lincoln	1350	1600
Nash	1450	1650
Oldsmobile "6"	1500	1600
Oldsmobile "8"	1700	1800
Pontiac	1400	1600

Engines operating within test limits indicate transmission and engine are normal.

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HYDRA-MATIC TESTING (Cont.)

If engine speed is BELOW MINIMUM limit, engine needs tune-up. (NOTE—Low engine RPM will result if torus members are damaged and are locked together). If engine speed goes ABOVE MAXIMUM limit, bands are slipping, fluid level low, or torus check valve or front pump relief valve sticking or missing. Before adjusting bands make valve check (below).

Checking Valves—Set hand brake and run engine for 1½ minutes, then with engine idling check fluid level (Selector lever in "N" position), see that fluid is at "FULL" mark on indicator. Shut off engine and wait ten minutes. Re-check fluid level with engine off. If the fluid level has not raised more than ½", torus check valve and front pump relief valve are operating satisfactorily. Test shift points (See Hydramatic Shift Points).

MAIN OIL PRESSURE (Cars WITHOUT Modulated Pressure): Remove front floor mat and hole cover plate over band adjusting screw. Remove plug from transmission case (between band adjusting screws), using 7/16" six point socket. Install Pressure Gauge (Kent-Moore No. J-2540). With transmission oil warm, start engine and run at 1000 R.P.M. Oil pressure should be 75 to 90 lbs. Apply both hand and foot brakes and move selector lever from "N" to "Dr", "Lo" and "R". Oil pressure should remain equal at all positions.

►*NOTE*—Rear Oil Pump may be checked separately by driving the car at 30 to 40 M.P.H. in Third speed in "Dr" range. Move selector lever to "N" and turn the ignition key off. Pressure on gauge should not be less than 55 lbs.

MAIN OIL PRESSURE (Cars WITH Modulated Pressure, except Oldsmobile "Whirlaway" Tranmission).

Zero Throttle Pressure—At 30 M.P.H. in fourth speed, with Zero Throttle, oil line pressure should be 55 to 72 lbs. (Cadillac 60-72 lbs..)

Full Throttle Pressure—Full throttle pressure in fourth speed at 30 M.P.H. (full throttle without going thru detent) should be between 75 and 105 lbs. (Cadillac 20 to 35 lbs. higher than zero throttle pressure test reading). Use brake to hold car at 30 M.P.H.

►*NOTE*—Rear oil Pump may be checked in the same manner as cars without Modulated Pressure.

Oldsmobile "Whirlaway" Transmission Cars: Place selector lever in "Dr" and set engine idle speed at exactly 350 RPM. Pressure should not be less than 35 lbs.

Line Pressure Modulation Test (Oldsmobile)—With selector lever in "Dr" and car traveling at 30 M.P.H. in third gear, pressure on gauge should not be less than 60 lbs., and should increase at least 20 lbs., as throttle position is changed from zero to full throttle.

REVERSE PRESSURE (Cars WITH Hydraulic Reverse): Install pressure gauge (see Main Oil Pressure above). Make sure Pressure Regulation is normal in forward speeds, then note pressure in "Dr" and "Lo" with engine idling at normal speed. Move lever to "R". Pressure should be as high or higher than in "Dr" or "Lo". Apply brakes and accelerate engine to half throttle. The pressure should gradually increase to 125 lbs., minimum. If the pressure does not check satisfactorily, a leak in the reverse oil system or a poorly operated pressure regulator is indicated.

HYDRA-MATIC SHIFT POINTS IN M.P.H.
(Selector Lever as Indicated)

CADILLAC 60S, 61, 62

UPSHIFTS:		1-2	2-3	3-4
Minimum Throttle	("Dr")	5-7	11-14	16-20
Full Throttle	("Dr")	9-15	26-35	59-67
Minimum Throttle	("Lo")	7-14		
Full Throttle	("Lo")	21-27		
DOWNSHIFTS:		**4-3**	**3-2**	**2-1**
Closed Throttle ①	("Dr")	17-13		
Full Throttle	("Dr")	20-17	13-10	9-5
Closed Throttle	("Lo")			10-8
Full Throttle	("Lo")			15-11
Forced	("Dr")	62-13		

①3-1 Closed Throttle Downshift, 9-3 M.P.H.
Lockout—4-2 Shift, 49-39 M.P.H.

CADILLAC 75, 85, 86

UPSHIFTS:		1-2	2-3	3-4
Minimum Throttle	("Dr")	5-6	10-13	15-19
Full Throttle	("Dr")	9-14	25-33	55-63
Minimum Throttle	("Lo")	7-13		
Full Throttle	("Lo")	20-25		
DOWNSHIFTS:		**4-3**	**3-2**	**2-1**
Closed Throttle ①	("Dr")	16-12		
Full Throttle	("Dr")	19-16	12-10	9-5
Closed Throttle	("Lo")			10-8
Full Throttle	("Lo")			14-10
Forced	("Dr")	58-12		

①3-1 Closed Throttle Downshift, 9-3 M.P.H.
Lockout—4-2 Shift, 47-37 M.P.H.

HUDSON

UPSHIFTS:		1-2	2-3	3-4
Minimum Throttle	("Dr")	4-8	10-14	15-20
Full Throttle	("Dr")	10-15	27-35	58-66
Full Throttle	("Lo")	22-27		
DOWNSHIFTS:		**4-3**	**3-2**	**2-1**
Closed Throttle	("Dr")	15-11	8-5	5-3
Full Throttle	("Dr")	19-16	14-10	10-5
Forced Throttle	("Dr")	60-15		
Closed Throttle	("Lo")			9-5
Full Throttle	("Lo")			14-10

Lockout—4-2 Shift, 48-38 M.P.H.

FRAZER & KAISER

UPSHIFTS:		1-2	2-3	3-4
Minimum Throttle	("Dr")	4-8	10-14	15-20
Full Throttle	("Dr")	14-18	27-35	58-66
Full Throttle	("Lo")	22-27		
DOWNSHIFTS:		**4-3**	**3-2**	**2-1**
Closed Throttle	("Dr")	15-11	8-3	3-1
Full Throttle	("Dr")	19-16	13-10	9-5
Forced Throttle	("Dr")	60-15		
Closed Throttle	("Lo")			9-5
Full Throttle	("Lo")			14-10

Lockout—4-2 Shift, 48-39 M.P.H.

LINCOLN

UPSHIFTS:		1-2	2-3	3-4
Minimum Throttle	("Dr")	5-7	11-17	19-25
Full Throttle	("Dr")	10-18	26-35	62-67
Full Throttle	("Lo")	24-28		
Light Throttle	("Lo")	9-14		
DOWNSHIFTS:		**4-3**	**3-2**	**2-1**
Closed Throttle ①	("Dr")	17-13		
Full Throttle	("Dr")	20-17	13-10	9-5
Forced Throttle	("Dr")	62-19		
Closed Throttle	("Lo")			10-8
Full Throttle	("Lo")			15-11

①3-1 Closed Throttle Downshift, 9-3 M.P.H.
Lockout—4-2 Shift, 47-37 M.P.H.

NASH

UPSHIFTS:		1-2	2-3	3-4
Minimum Throttle	("Dr")	4-8	10-14	15-20
Full Throttle	("Dr")	14-18	27-35	58-66
Minimum Throttle	("Lo")	14-17		
Full Throttle	("Lo")	22-27		
DOWNSHIFTS:		**4-3**	**3-2**	**2-1**
Closed Throttle ①	("Dr")	15-11		
Full Throttle	("Dr")	19-16	13-10	9-5
Forced Throttle	("Dr")	60-15		
Closed Throttle	("Lo")			9-5
Full Throttle	("Lo")			14-10

①—3-1 Closed Throttle Downshift, 7-2 M.P.H.
Lockout—4-2 Shift, 48-39 M.P.H.

OLDSMOBILE ALL SERIES (1946-49), 76 (Early 1950)

UPSHIFTS:	1-2	2-3	3-4
"Dr" ① exc. 88	5-15	10-30	22-68
"Dr" ① 88 only	5-15	10-34	25-76
"Lo" ① exc. 88	17-30		
"Lo" ① 88 only	19-34		
DOWNSHIFTS:	**4-3**	**3-2**	**2-1**
Closed Throttle ②	15-12		
Full Throttle	③	12-10	8-6
Closed Throttle			6-3
Full Throttle			12-10
Forced	63-13		

①Dependent on throttle pressure.
②3-1 Closed Throttle Downshift, 4-2 M.P.H.
③—19-17 MPH. (exc. 88), 21-19 MPH. (88 only).
Lockout—4-2 Shift, 40-44 MPH. (exc. 88), 45-50 (88).

OLDSMOBILE 98 (1950-51) & 76 (Late 1950)

UPSHIFTS:	1-2	2-3
"Dr" ①	10-30	22-68
"Lo" ①	13-23	
DOWNSHIFT:	**3-2**	**2-1**
Closed Throttle	15-12	10-2
Full Throttle	19-17	12-10
Closed Throttle		6-3
Full Throttle		12-10
Forced	58-13	

①Dependent on throttle pressure.
Lockout—3 ("Dr"), 2 ("Lo"), 40-44 M.P.H.

OLDSMOBILE 88 (1950-51)

UPSHIFTS:	1-2	2-3
"Dr" ①	10-32	25-72
"Lo" ①	13-23	
DOWNSHIFT:	**3-2**	**2-1**
Closed Throttle	15-12	10-2
Full Throttle	21-19	12-10
Closed Throttle		6-3
Full Throttle		12-10
Forced	60-13	

①Dependent on throttle pressure.
Lockout—3 ("Dr"), 2 "Lo") 43-48 M.P.H.

PONTIAC

UPSHIFTS:		1-2	2-3	3-4
Minimum Throttle	("Dr")	4-8	9-13	14-18
Full Throttle	("Dr")	9-14	25-35	60-75
Minimum Throttle	("Lo")	16-21		
Full Throttle	("Lo")	19-24		
DOWNSHIFTS:		**4-3**	**3-2**	**2-1**
Closed Throttle	("Dr")	14-10		
Full Throttle	("Dr")	18-14	12-9	8-4
Closed Throttle	("Lo")			6-3
Full Throttle	("Lo")			14-10
Forced	("Dr")	60-15		

Lockout—4-2 Shift, 48-40 M.P.H.

HYDRA-MATIC TROUBLE SHOOTING & DIAGNOSIS

ALL 1946-51 HYDRA-MATIC CARS

►*NOTE—75% of all troubles can be corrected by external adjustments and oil level. Over 80% of the remainder of troubles can be corrected with transmission in the car. See "HYDRA-MATIC OVERHAUL" following.*

LIGHT THROTTLE SHIFT POINTS HIGH: (With Full Throttle Shift points normal)—Throttle linkage adjusted incorrectly. Adjust throttle linkage and check for worn or loose control rods.

FULL THROTTLE SHIFT POINTS: (Either too high or too low or do not occur)—Governor valves not operating properly, leakage at governor assembly, broken oil rings or missing governor balancing plug. Governor ring lands might be worn. Correct by freeing valves, check for warped surfaces. Replace parts as necessary.

NO THROTTLE DOWNSHIFT IN "Dr" RANGE: (From 4 th to 3rd (3rd to 2nd Oldsmobile) above 20 M.P.H.)—Insufficient accelerator travel due to interference of throttle linkage or at floor carpet. Throttle controls improperly adjusted or lever bent or loose on shaft. Spring lock in downshift valve may be missing.

TRANSMISSION DOES NOT RESPOND TO SHIFT LEVER POSITION: Pin which picks up manual valve in valve body is not operating in groove in manual valve. To check, shift selector lever into reverse. If severe clashing results or if lever goes into reverse but car locks up and fails to move backwards, pickup pin is not operating manual valve. Remove side cover and engage pin.

TRANSMISSION FAILS TO DRIVE CAR: Usually caused by failure of one or both bands to be applied. Check for low oil pressure. Front or rear band adjustment incorrect. Manual valve mispositioned, or sticking torus check valve. See Oil Pressure Tests.

ERRATIC RESPONSE TO SHIFT LEVER: Inner manual control valve lever loose on shaft. Replace lever assembly.

ERRATIC TRANSMISSION OPERATION (Slipping and jerking during Light Throttle acceleration): May be caused by improper governor operation due to ring land on governor having been worn off by ring. To check for this condition, first make certain Linkage Adjustment and Band Adjustment are correct, warm up transmission thoroughly, check performance on light to medium acceleration for following conditions: (1) First shift point occurs at approximately 5 MPH. and there is considerable slippage above this point, (2) Shift into high occurs at higher than normal speed, (3) Car jerks when starting after stopping in reverse. If above conditions noted, remove and inspect the governor for worn ring land. *See Hydra-Matic Overhaul data.*

SHIFT LEVER STICKS IN REVERSE OR PARK POSITION (When parked on steep hill): Caused by rough surface on face of tooth on parking pawl engaging reverse internal gear. Replace parking pawl with new part having smooth surface (no tool marks). Pawl cannot be reworked (special shape and case-hardened).

HUNTING: Adjust throttle linkage, check valve assembly and clean thoroughly and reface.

HAS SECOND AND FOURTH SPEED ONLY: (1st & 3rd speed Oldsmobile)—Clean and reface valve assembly. Check front unit for possible locking.

ALL SHIFTS ROUGH: Adjust throttle linkage and servo bands. Clean and reface valve assembly. Check transmission passages for leaks. Check oil pressure.

TWO-THREE SHIFT ROUGH: *(1-2 shift Oldsmobile Whirlaway)*—Follow instructions under ALL SHIFTS ROUGH and also check front and rear servos.

NO FOUR-THREE DOWNSHIFT: *(3-2 Oldsmobile Whirlaway)*—Adjust throttle linkage. Inspect, clean and reface control valve assembly.

SLIPS AFTER FOUR-THREE DOWNSHIFT: *(3-2 Oldsmobile Whirlaway)*—Check front servo.

WILL NOT SHIFT, STAYS IN SAME GEAR: Check valve assembly and governor. Front or rear units not operating properly. Check for possible locking.

SHIFTS ABOVE SECOND SPEED (IN LOW RANGE): Adjust manual linkage. Check control valve assembly and governor.

SLIPS IN VARIOUS SPEEDS: Check fluid level and oil pressure. Adjust servo bands, clean control valve

SLIPS OUT OF REVERSE: (Except cars with hydraulic type reverse). Overhaul reverse anchor.

LOCKS UP ON REVERSE COAST: Check oil pressure. Clean and reface control valve assembly. Rear servo not operating properly.

CREEPS FORWARD WHEN IN "R" POSITION: Rear unit not operating correctly. Excessive drag in rear clutch.

CLASHES WHEN PROPERLY SHIFTED TO "R": Engine idle speed too fast. Control valve plugged or dirty. Reverse anchor not operating correctly.

NO DRIVE WHEN ENGINE IS FIRST STARTED: Check fluid coupling and front pump. Test oil pressure.

CREEPS EXCESSIVELY IN "Dr": Engine idle speed too high.

CAR WILL NOT BACK UP: (Unless throttle is opened excessively)—Rear band not released due to low oil pressure caused by leakage or compensator valve auxiliary plug pin missing.

BANDS APPLIED VIOLENTLY, ENGINE SPEEDS UP: Low oil pressure or level. Pressure regulating valve sticking. Front pump may not be operating properly or there is a bad oil leak in the system. Check oil pressure and oil level. Free up pressure regulator valve or install new valve.

SEVERE "CLUNK" ON 3-2 DOWNSHIFT AT HIGH SPEED WITH CLOSED THROTTLE: *(2-1 downshift Oldsmobile Whirlaway)*—Rear check valve is not operating properly. Check valve may be broken. Stuck or broken ring in accumulator piston. Rear clutch piston may also be binding on its pilot.

SELECTOR LEVER RATTLES (Caused by loosening of lever or breaking of Retainer Spring): To correct, check retainer nut and tighten if found loose. If nut tight and lever is loose and rattles, check for broken retainer spring or missing anti-rattle spring and spring stop. Install special retaining spring which has ⅛" slot to allow installation on lever and make certain that spring does not hang up on threads during installation of lever.

TRANSMISSION RATTLES (Oldsmobile Whirlaway Transmissions): "Tip In" Rattles (noted when car idling with selector lever in "Dr" or just as accelerator pedal is depressed) or "Float" Rattles (noted when car creeping at 2-3 MPH. on level road with selector lever in "Dr"—noise will be accentuated by rough engine). If tuning up engine does not eliminate this complaint, transmission can be modified to start in first gear in Drive Range. ***See "Oil Control Valve Assembly" Note under Assembly of Units in Hydra-Matic Overhaul data in this section.***

CAUTION—See Linkage Adjustment and Band Adjustment data for special settings when above modification made.

CARS WITH HYDRAULIC REVERSE

CLICKING OR RATCHETING NOISE: (With selector lever in Reverse and car moving forward 2 to 4 M.P.H.).—This condition is due to parking pawl trying to engage reverse internal gear. This condition is usually the result of a sharp drop in line pressure. Check as follows:

1) Check line pressure in reverse (see Testing). If pressure too low, check reverse clutch apply oil pipe and reverse booster apply oil pipe for leaks, inner and outer cone clutch piston seals for leakage, valve body sealing surfaces for flatness (check on surface plate), and leakage between extension housing and transmission case.

2) Check engine idle speed and tune engine (rough engine may cause this condition).

3) Reverse check valve located in detent plunger housing should be firmly attached to retainer by rivet, opposite end should extend ¼" above face of retainer in free position, .062" hole should line up with hole in detent plunger spacer. Valve face should be flat against spacer when installed. Replace assembly if necessary.

4) Parking block piston return spring stop seat should be ½" to 17/32" from face of bracket. The parking blocker spring should never be altered. If distorted, it should be replaced.

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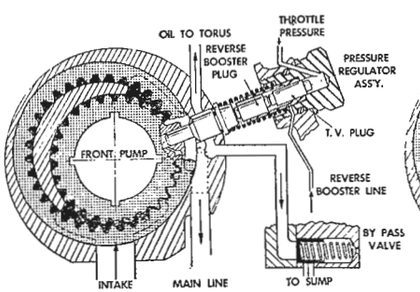

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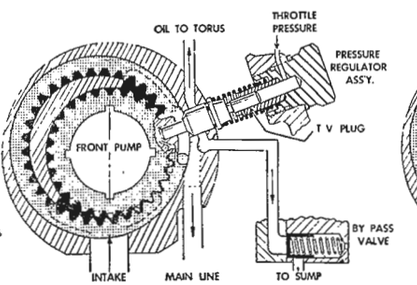

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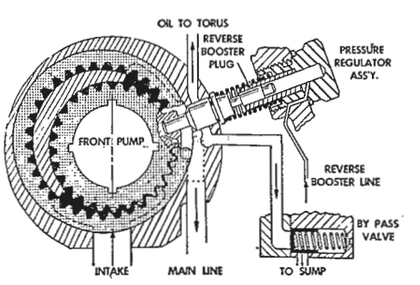

NOT MODULATED PRESSURE & HYDRAULIC REVERSE

HYDRA-MATIC PRESSURE REGULATOR VALVE ASSEMBLY

HYDRA-MATIC TROUBLE SHOOTING & DIAGNOSIS (Cont.)

►*NOTE*—A second type spring stop and a new spring are now being used. The stop has a fixed setting and is mounted under both bracket bolts. The new spring has a free length of 1".

NO DRIVE IN REVERSE: This condition will occur if front servo exhaust body spacer is installed in reverse. Under this condition oil pressure does not increase when selector lever is placed in Reverse position. Pressure will increase to 150-170 lbs. when transmission shifts from 1 to 2.

SLIPPING IN REVERSE ONLY: Check for Low Oil Pressure in Reverse, Inoperative Front Servo Exhaust Valve, Key missing or defective in stationary cone, Stationary Cone or Cone Clutch Piston worn excessively, Front Servo & Band operation not operating properly, Valve Body Assembly dirty (sticking valves or oil leaks), Stationary cone distorted by handling when disassembled.

SELECTOR LEVER WILL NOT GO INTO REVERSE: Check for: Governor G-1 weight stuck wide open or broken governor ring (separating main line pressure from G-1 pressure to reverse blocker piston), Governor ring groove or gap clearances incorrect, Governor sleeve defective, Parking Pawl Crank bent, Detent Plunger in inner control lever stuck, Reverse Blocker Piston sticking or piston spring weak or broken.

EXCESSIVE SQUAWK IN REVERSE (May occur when selector lever out of Reverse if reverse unit not fully disengaged): Check for low oil pressure and galling of stationary cone and cone clutch piston. If reverse not fully disengaged also check for: Check Valve in detent plunger retainer in valve body plugged, Reverse Clutch Spring inoperative or weak, High spot or galling of stationary cone and cone clutch piston, cone clutch piston release springs defective or weak, Rear Bearing Dowels too high.

LOW OIL PRESSURE, SLIPPAGE, DELAYED AND ERRATIC UPSHIFTS: These conditions will exist when one or the other of the two ¼" cup shaped plugs are missing from the parking bracket. (CAUTION—These plugs are not service parts and should never be removed). If plugs are loose or missing, replace assembly.

REVERSE CONE ENGAGES WHEN IN DRIVE: This condition can occur when there is excessive leakage into the reverse apply circuit. Check for leakage as follows:

1) Check front servo exhaust valve for proper fit in exhaust body. Clearance should be .002".

2) Inspect detent retainer spacer and valve body surfaces that contact spacer. Replace control valve if necessary.

3) Check Throttle Valve plug in Pressure Regulator for excessive clearance. If greater than .002" replace Regulator plug assembly.

4) Neoprene seal on Pressure Regulator Plug defective. Use extreme caution when installing plug not to damage seal (remove all sharp corners or burrs in transmission case with round hone, place small amount of grease on seal before installing assembly, DO NOT use wrench to start pressure regulator plug in housing).

HYDRA-MATIC REMOVAL & INSTALLATION

ALL 1946-51 HYDRA-MATIC CARS

1946-51 CADILLAC

Removal: Support car with all wheels approximately 12" above floor. Remove floor carpet & pads, front seat cushion, and center floor pan. Disconnect propeller shaft at rear universal joint, remove shaft and front universal joint and yoke, remove flywheel housing pan. Drain transmission and fluid flywheel by taking out both drain plugs. Support rear end of engine with jack under oil pan (use block of wood on jack or use special Engine Support Stand Tool. Install Transmission Hoist, Tool J-1636B, in front compartment over floor pan opening, screw eyebolt securely into top of transmission, attach hoist cable hook to eyebolt, lift transmission just enough to take strain off rear support. Disconnect rear support at transmission extension housing, remove the bracket cross-member carrying the support. Remove throttle rod and manual shift rod from levers on the transmission case, remove both levers and the lower relay lever from flywheel housing. Disconnect speedometer cable at rear of transmission. Remove spark plugs and starter from engine. Remove 30 capscrews holding fluid coupling cover to flywheel, push cover toward rear of car to disengage flywheel dowels (CAUTION—Do not pry cover away from flywheel). Lower the jack under the engine until top of bell housing is flush with top of opening in floor pan. Remove the bolts holding bell housing to engine crankcase. Remove transmission and bell housing as a unit by moving it to the rear and lowering it to the floor.

Installation: Make certain that face of flywheel and torus cover are clean and free from all nicks or burrs, install NEW gasket on face of flywheel (use grease to retain gasket—do not use shellac or sealing compounds). Raise transmission in place carefully, make certain that mainshaft enters pilot bearing and that dowels in crankcase enter holes in housing squarely, align flywheel and torus cover so that large dowel pin and large dowel hole (marked by yellow paint) are at top and small dowel pin and small hole at the bottom. Install four flywheel housing-to-crankcase screws and tighten evenly to 45-50 ft. lbs. Install one torus cover screw adjacent to each dowel pin and tighten these screws just snug, install two more cover screws (90° from first two screws) and tighten these just snug (CAUTION—this procedure necessary to insure evenly applied pressure which will prevent leaks). Install all remaining torus cover screws, tighten all screws evenly to 20-25 ft. lbs. torque. Check torus cover drain plug tightness before installing flywheel lower cover. Raise engine approximately 1" (use jack and wooden block under oil pan), install engine rear support bracket, lower engine, connect support. Install and connect propeller shaft, speedometer cable, starter, spark plugs, transmission throttle lever and manual control lever. Fill transmission with Hydra-Matic fluid and adjust linkage. ***See separate instructions.***

1951 FRAZER & KAISER

Removal: Raise car and support it on stands. Drain transmission case (remove oil pan drain plug). Disconnect speedometer cable and housing at rear bearing retainer, rear throttle rod and manual control rods at levers on transmission case. Disconnect propeller shaft at center bearing (Frazer), rear universal joint yoke (Kaiser), remove shaft by sliding front universal yoke out of transmission case. Install Support Fixture KF-104 under rear of engine and turn up support studs to remove engine weight from cross-member (CAUTION—do not raise engine more than enough to take weight off cross-member). Disconnect hand brake cable from bracket on cross-member, free engine from support cushions, remove cross-member with engine support cushions attached. Take off flywheel lower cover, drain fluid coupling by removing drain plug in torus cover. Remove throttle lever (Long lever) from transmission case. Mark torus cover and flywheel to insure reassembly in same position (CAUTION—necessary to maintain balance), remove all torus cover-to-flywheel attaching bolts. Lower engine slightly so that upper housing attaching bolts are accessible. Use transmission support jack (KF-106) under transmission to support transmission weight and remove strain from mounting bolts, remove all housing mounting bolts. Thread one 9/16"-12 bolt into housing bolt hole directly above dowel pin on each side of housing, turn up bolts evenly until dowel pins are freed from front housing, then remove these bolts. Move transmission straight back until it is free, then lower it carefully (CAUTION—turn flywheel so that end of mainshaft passes between two bolts), remove transmission from beneath car.

Installation: See that face of flywheel and torus cover mounting flange are clean and free from nicks or burrs, install NEW gasket on face of flywheel (use grease to retain gasket—do not use shellac or sealing compounds). Turn flywheel so that one dowel pin approximately 4" below edge of front flywheel housing. Carefully raise transmission in place and guide mainshaft pilot into pilot bearing in crankshaft. Align torus cover and flywheel marks (made at removal), push transmission forward until dowels in flywheel rear housing enter holes in front housing. Install attaching bolts and lockwashers in rear flywheel housing and tighten securely. Install all (30) torus cover-to-flywheel bolts and tighten finger tight (CAUTION—these are special alloy steel bolts), tighten these bolts in following order to insure even pressure and prevent leaks:

(1) Tighten one bolt adjacent to each dowel to 12-15 ft. lbs. torque.

(2) Tighten two bolts located 90° from dowels (evenly spaced between first two bolts) to 12-15 ft. lbs. torque.

(3) Tighten all bolts in rotation to 20-25 ft. lbs.

(4) Retighten all bolts in rotation to 30-35 ft. lbs.

Check tightness of torus cover and transmission oil pan drain plugs, install flywheel housing lower cover. Install engine support cross-member and connect engine support cushions. Install and connect transmission throttle lever, connect manual control rod. Connect speedometer cable and hand brake cable. Fill transmission with Hydra-Matic fluid and adjust linkage. ***See separate instructions.***

1950-51 HUDSON

Removal: Disconnect battery ground cable first.

1) Disconnect starter cable and remove starter.

2) Take out bolt attaching breather pipe to valve

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HYDRA-MATIC REMOVAL & INSTALLATION (Cont.)

chamber cover and bracket-to-flywheel housing bolt, remove breather pipe.
3) Turn back floor mat to expose two upper floor opening covers and remove covers for access to top flywheel housing-to-engine bolts, remove these two bolts.
4) Raise car and support securely on jack stands.
5) Disconnect propeller shaft at rear universal joint and at front universal joint (CAUTION—tape journal bearing cups to universal journal to avoid losing bearings). Take out center bolt attaching center bearing support and slide propeller shaft to rear to provide clearance at transmission.
6) Disconnect speedometer cable at transmission rear bearing retainer. Disconnect rear throttle rod and manual control rod from levers on side of transmission case.
7) Remove left hand engine side rear stone guard by taking out 4 self-tapping screws.
8) Disconnect return spring at hand brake cable lever and cable clevis at pull rod slide link, remove cable retainer clip at engine support cross-member, pull cable forward and through the cross-member.
9) Take out two bolts attaching each engine rear support insulator to cross-member. Install transmission support jack under transmission case (hydraulic hoist with transmission cradle), raise transmission just enough to remove weight from cross-member. Disconnect and remove cross-member (4 screws on bottom and 3 on top at each end).
10) Install Engine Holding Fixture J-4651 to support engine weight (holes provided in frame side rail just below steering housing support and in same location on opposite side for engagement of support hooks), adjust support hooks so that front end of engine clears center tie rod by approximately ½" and weight of engine is supported by fixture.
11) Remove flywheel housing lower dust cover, drain fluid coupling by removing drain plug in torus cover.
12) With engine supported by fixture and transmission supported by jack, remove all torus cover attaching screws, remove flywheel housing lower right hand bolt (use ⅝" universal socket and 14" extension) leaving the bolt in the hole, remove lower left hand bolt (use 9/16" universal socket and 14" extension).
13) Pull transmission straight back until transmission shaft pilot clears pilot bushing in flywheel, then lower transmission carefully (CAUTION—use care that shaft does not strike flywheel bolts).

Installation: Reverse the removal procedure above and note the following important points:
Torus Cover & Flywheel Gasket—Make certain face of flywheel and torus cover mounting flange are clean and free from nicks and burrs. Use petrolatum to hold NEW gasket on face of flywheel (DO NOT use shellac or sealing compounds).
Flywheel Housing Bolts—Tighten all four bolts evenly to 40-50 ft. lbs. torque.
Torus Cover Bolts—After all bolts have been installed, tighten bolts in following order to insure even pressure and to prevent leaks:
(1) Tighten one bolt adjacent to each dowel pin to 12-15 ft. lbs. torque.
(2) Tighten two bolts located 90° from dowel pins (equally spaced between first two bolts) to 12-15 ft. lbs. torque.
(3) Tighten all bolts in rotation to 20-25 ft. lbs.
(4) Retighten all bolts in rotation to 26-31 ft. lbs.
Engine Support Cross-member—Install and tighten bolts in engine rear support insulators first, then install screws mounting cross-member on frame.
Filling Transmission with Fluid—*See REFILLING.*
Transmission Linkage—Connect throttle and manual control rods and adjust linkage. ***See separate instructions.***

1949-51 LINCOLN

Removal: Support car securely with all four wheels approximately 8" off floor.
2) Remove front seat and front floor carpet, disconnect throttle rod at accelerator pedal, remove front floor pan cover.
3) Disconnect propeller shaft at rear universal joint, remove propeller shaft and universal joint from transmission spline shaft.
4) Remove flywheel housing pan and engine plate. Drain transmission case (drain plug at rear of pan) and fluid coupling (drain plug in torus cover).
5) Disconnect rear motor mount from frame cross-member and remove the bottom half of the rubber mount.
6) Place jack under rear end of engine oil pan with wooden block on jack to prevent damage to pan, raise engine sufficiently to install engine support.
7) Remove detachable cross-member from frame X-member. Lower jack under engine until engine rests on support.
8) Install transmission lifting hoist over floor pan opening in front compartment (adjust legs of hoist to fit car and attach cables to floor pan to prevent tipping of hoist). Screw eyebolt securely in tapped hole in top of transmission case, attach cable hook, take up slack in cable so that weight of transmission and fluid coupling taken off engine support.
9) Disconnect manual control rod and lower throttle rod at levers on side of transmission case, remove throttle lever (longer lever) to prevent damaging lever during removal of transmission. Disconnect speedometer cable at rear of transmission.
10) Remove spark plugs from engine. Disconnect and remove starter motor.
11) Take out 30 5/16" capscrews mounting torus cover on flywheel, push cover toward rear of car to disengage locating dowel pins.
►***CAUTION—Do not pry cover away from flywheel (will damage gasket surface on cover and flywheel).***
12) Take out 6 bolts mounting flywheel housing on engine.
13) Remove transmission and flywheel housing as an assembly by moving unit toward rear of car until flywheel housing dowels and main shaft are disengaged, then lower assembly (tilt front end down and move it forward to free transmission bearing extension from frame cross-member) and remove from beneath car.

Installation: Make certain that face of flywheel and torus cover mounting flange are clean and free of all nicks and burrs.
1) Install NEW gasket on face of flywheel using grease to retain gasket (DO NOT use shellac or sealing compounds).
2) Raise transmission in place carefully, make certain that mainshaft enters pilot bearing and that dowels in engine enter holes in housing squarely, align flywheel and torus cover so that large dowel pin and large dowel hole are at the top.
3) Install six flywheel housing-to-engine bolts and tighten evenly to 45-50 ft. lbs. torque.
4) Install one torus cover screw adjacent to each dowel pin in flywheel and tighten these screws just snug, then install two more screws (at 90° from first two) and tighten these just snug (CAUTION—this procedure necessary to insure evenly applied pressure which will prevent leaks). Install remaining torus cover screws, tighten all screws evenly to 20-25 ft. lbs. torque.
5) Check torus cover drain plug tightness, install flywheel housing pan and engine plate.
6) Raise engine approximately 1" (use jack and wooden block under oil pan), install frame cross-member, lower engine into place, install engine mount.
7) Install and connect propeller shaft, speedometer cable, starter, spark plugs, transmission throttle lever. Connect manual control lever rod.
8) Fill transmission with Hydra-Matic fluid and adjust linkage. ***See separate instructions.***

1950-51 NASH

Removal: Raise car and support securely on stands (support rear of car at body side sills and place hydraulic jack under rear axle assembly).
2) Drain transmission case and fluid coupling (remove flywheel lower cover for access to drain plug.
3) Remove accelerator pedal and front compartment floor mat, take out screws in floor hole cover and remove cover.
4) Disconnect hand brake cable at adjusting yoke, disconnect speedometer cable and housing at transmission adapter, disconnect rear throttle rod and manual control rod at levers on left side of transmission case, remove rear brake hydraulic hose bracket from floor pan to prevent damage to lines.
5) Disconnect torque tube from rear bearing retainer by taking out flange mounting bolts, disconnect propeller shaft by sliding universal joint yoke to rear and free of transmission driveshaft, move torque tube out of the way.
6) Place jack under rear end of engine oil pan (use block of wood on jack to prevent damage to pan), or use special Engine Support Fixture J-4179 installed under engine to support engine so that all weight removed from rear engine support cross-member.
►***CAUTION—Do not raise engine more than necessary to remove engine support cross-member.***
7) Remove rear engine support cross-member (take out bolts in rear bearing retainer so that rubber cushion removed as unit with cross-member).
8) Loosen clamp bolt and remove throttle control lever (longer lever) from left side of transmission
9) Remove 30 capscrews and lockwashers mounting torus cover on rear face of flywheel.
10) Lower engine slightly so that upper housing attaching bolts accessible through floor pan opening. Install special transmission holding tool J-2808 on hydraulic jack (CAUTION—tool must be securely fastened to jack pad), place jack under transmission with tool securely engaging transmission case oil pan, lift transmission just enough to remove weight from mounting bolts in flywheel housing.

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HYDRA-MATIC REMOVAL & INSTALLATION (Cont.)

11) Remove attaching bolts, nuts, and lockwashers holding rear flywheel housing on front housing, take out upper rear stud on each side, use two 9/16" USS bolts to disengage dowels (screw one bolt evenly into each of above stud holes until dowels are free of front housing, then remove bolts).

12) Move transmission to rear until it is free, then lower assembly (CAUTION—turn flywheel so that end of mainshaft passes between two of the flywheel-to-crankshaft bolts), remove transmission from beneath car.

Installation: Reverse the removal procedure above and note the following important points:

Torus Cover & Flywheel Gasket—Make certain that face of flywheel and mounting flange on torus cover are clean and free from all nicks and burrs. Install NEW gasket on face of flywheel (use petrolatum to hold gasket—DO NOT use Shellac or sealers).

Transmission Alignment—Turn flywheel so that one dowel pin is approximately 4" below lower edge of front housing (so that mainshaft will pass between two crankshaft bolts) and turn torus cover so that dowel pin hole is in corresponding position. Lift transmission into place carefully, guide mainshaft pilot into pilot bushing and push transmission forward so that dowels in rear flywheel housing enter holes in front housing squarely.

Flywheel Housing Bolts—Install all rear flywheel housing-to-front housing bolts and stud nuts and tighten evenly and securely (NOTE—Rear engine mountings must be installed on lower studs before nuts are tightened).

Torus Cover Bolts—Install all bolts and tighten finger tight, then tighten these bolts in following order to insure even pressure and avoid leaks:

(1) Tighten one bolt adjacent to each dowel pin to 12-15 ft. lbs. torque.

(2) Tighten two bolts located 90° from dowel pins (equally spaced between first two) to 12-15 ft. lbs.

(3) Tighten all bolts in rotation to 20-25 ft. lbs.

(4) Retighten all bolts in rotation to 30-35 ft. lbs.

Filling Transmission with Fluid—*See REFILLING.*

Transmission Linkage—Connect manual control rod. Install throttle lever and connect rear throttle rod. Adjust linkage. *See separate instructions.*

1946-48 OLDSMOBILE

Removal: Support car with all four wheels approximately 8" above floor. Remove foot accelerator pad, floor mat, center floor pan. Disconnect speedometer cable. Disconnect propeller shaft at rear universal joint, remove by sliding shaft out at splined joint. Remove flywheel housing pan. Drain transmission and flywheel by taking out both drain plugs. Remove outer throttle lever from transmission case, disconnect control rod from manual shift lever. Remove two upper rear engine mounting bolts, remove master cylinder to brake shaft bracket, disassemble strut from shaft, remove clevis pin from lower control relay rod. Raise engine approximately ½" off mountings with jack just forward of crankcase drain plug (use block of wood on jack). Remove 3 bolts from each side of cross-member at frame side rail, remove cross-member by tipping top toward front of car and moving cross-member forward. Install transmission lifting tool J-1502 in front compartment over floor pan opening. Thread special eye-bolt, Tool No. J-1636SA-5, in tapped hole in top of transmisssion case and attach cable hook to eye-bolt. Lift transmission just enough to take strain off mounting bolts, remove 30 bolts holding fluid flywheel cover on flywheel, remove five bolts holding rear half of bell housing to front half. Lower engine slightly until top of bell housing is flush with top of opening in floor pan, thread two standard transmission bolts into bell housing (on each side just above dowel pins) to force bell housing from dowel pins, then remove these bolts. Remove transmission and rear bell housing by moving it to rear and downward.

CAUTION—Do not allow end of mainshaft to strike crankshaft bolts (turn flywheel so that shaft passes down between two bolts).

Installation: Reverse the removal procedure above and note the following important points:

Torus Cover & Flywheel Gasket—Make certain face of flywheel and torus cover mounting flange are clean and free from nicks and burrs. Use vaseline to hold NEW gasket in place on face of flywheel (DO NOT use shellac or sealing compounds).

Torus Cover Alignment & Tightening—Align torus cover over dowel pins in flywheel(just start the flywheel capscrews by hand to align torus cover (CAUTION—these capscrews are special type). AFTER rear bell housing mounting bolts have been tightened, tighten all torus cover screws evenly to 30 ft.lbs. torque.

Filling Transmission with Fluid—*See REFILLING.*

Transmission Linkage—Install throttle lever and rod, connect manual control rod., Adjust linkage. *See Linkage Adjustment.*

1949 OLDSMOBILE

Removal: *CAUTION—Rocket engine requires different removal procedure as follows:* Disconnect accelerator pedal rod at bellcrank, remove floor mat and center floor pan. Remove upper transmission to bell housing capscrews. Raise car approximately 8" off floor and securely support all four wheels. Drain fluid coupling and transmission case. On 8 cyl. cars, remove engine side pans, disconnect starter wiring, remove starter, remove lower flywheel housing (necessary to remove exhaust pipe bracket and crankcase ventilator bracket from housing first). Install Rear Engine Support, Tool No. BT-28, to support rear end of engine. Remove engine mount to cross-member bolts (left side). capscrews (right side), and two capscrews attaching engine mount to flywheel housing (right side only). Remove bolts attaching intermediate lever bracket to cross-member, and bolts attaching cross-member to frame (3 bolts on each side). Lift engine approximately ½" and remove cross-member (CAUTION—do not lift engine more than necessary to remove cross-member). Then remove transmission in same manner as on previous Oldsmobile models.

Installation: Reverse the removal procedure above and note the following important points:

Torus Cover & Flywheel Gasket—Make certain face of flywheel and torus cover mounting flange are clean and free from nicks and burrs. Use vaseline to hold NEW gasket in place on face of flywheel (DO NOT use shellac or sealing compounds).

Torus Cover Alignment & Tightening—When installing transmission align torus cover over dowel pins in flywheel *(CAUTION*—On 8 Cyl. cars, one dowel is larger than standard and torus cover must be turned to align the larger dowel with the larger dowel pin hole). After transmission rear bell housing attaching bolts tightened, install torus cover capscrews and tighten snugly, then tighten all screws to 30 ft.lbs. torque.

Filling Transmission with Fluid—*See REFILLING.*

Transmission Linkage—Install throttle lever and rod, connect manual control rod., Adjust linkage: *See Linkage Adjustment.*

1950-51 OLDSMOBILE

Removal: Use twin-post hoist to raise car, or support car securely on jack stands.

1) Remove transmission oil pan plug and drain transmission case.

2) On 8 Cyl. cars only, disconnect engine side pans at rear and drop these down for access to starter, disconnect starter wiring and remove starter.

3) On 8 Cyl. cars only, free exhaust pipe bracket and crankcase ventilator bracket from lower flywheel housing and remove housing. Remove flywheel housing pan.

4) Drain fluid coupling by removing drain plug from torus cover.

5) Disconnect propeller shaft at rear universal joint, pull shaft to rear to disengage forward end from transmission.

6) Disconnect speedometer cable at transmission case. Free intermediate lever bracket from frame cross-member by taking out two bolts.

7) Install special transmission lift (hydraulic jack and transmission cradle) under transmission and raise transmission and engine just enough to remove weight from engine support cross-member.

8) Free engine mounts from cross-member by taking out two bolts (left side), two capscrews (right side). Take out three cross-member to frame bolts at each side. Lift engine approximately ½" and remove cross-member (CAUTION—do not lift engine more than necessary to remove cross-member). Then lower engine just enough (approx. 1½") for access to upper rear bellhousing-to-front bellhousingcapscrews (CAUTION—do not lower engine more than 1½" unless upper radiator hose and exhaust pipe-to-manifold connections are loosened).

9) Disconnect manual control rod and throttle rod from levers on side of transmission case, remove throttle lever to prevent damaging lever during transmission removal.

10) Remove all torus cover-to-flywheel capscrews

11) Install Rear Engine Support BT-28 to support engine when transmission taken out. Remove rear bell housing-to-front bellhousing capscrews.

12) Move transmission to rear and lower it to the floor. CAUTION—Turn flywheel so that end of mainshaft passes between two flywheel bolts.

Installation: Reverse the removal procedure above and note the following important points:

Torus Cover & Flywheel Gasket—Make certain face of flywheel and torus cover mounting flange are clean and free from nicks and burrs. Use vaseline to hold NEW gasket in place on face of flywheel (DO NOT use shellac or sealing compounds).

Torus Cover Alignment & Tightening—On 6 Cyl. cars, engage paint-marked dowel pin in flywheel with dowel pin hole in cover which is also paint-

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HYDRA-MATIC OVERHAUL

ALL 1946-51 HYDRA-MATIC CARS

DISASSEMBLY OF TRANSMISSION

Torus, Torus Cover, Bell Housing. Move manual control lever on side of transmission toward rear to reverse position and remove oil level indicator from case. Straighten main shaft nut lock plate (using a chisel and light hammer) and remove the main shaft nut. Slide driven torus member off transmission shaft *(CAUTION:*—If torus member sticks, tap end of mainshaft with rawhide hammer while pulling torus on hub). Remove driving torus snap ring and driving torus assembly. Torus cover member plate can then be removed.

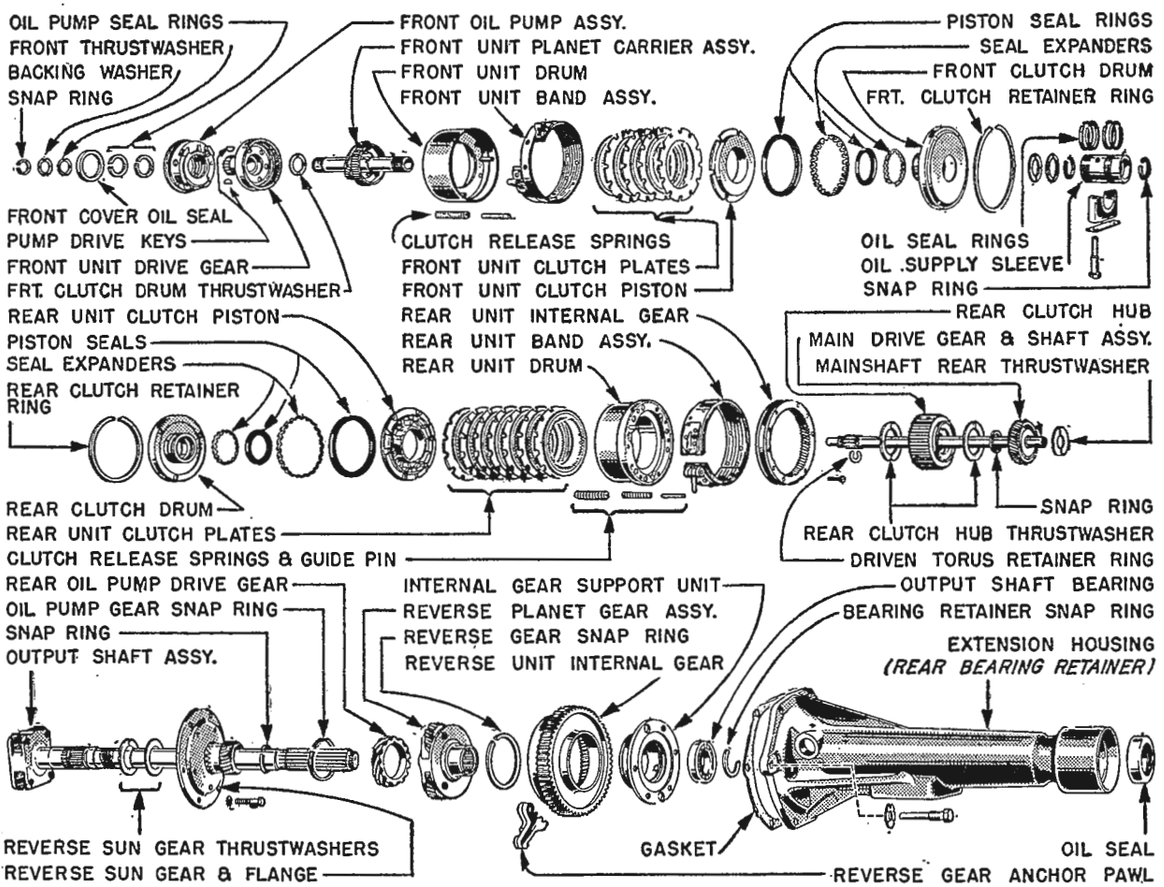
►*CAUTION:* Do not attempt to remove torus cover and driving torus by pulling and pushing on torus cover in a rough manner as this will possibly result in a broken oil seal ring. Instead, work hub of torus cover back thru oil seals gently, and then pull torus cover forward with a quick jerk.

Take out the four capscrews and lock washers holding the flywheel housing to front of transmission case. Remove flywheel housing and gaskets. Take out the ⅛" oil pressure line plug from transmission case, and place transmission into holding device.

Manual Lever, Oil Pan and Side Cover. Loosen lock screw holding manual lever to shaft and remove lever. Drive out open type driven torus retainer ring from main shaft using Tool J-1458, being careful main shaft is not damaged. Remove all capscrews from oil pan and side cover and remove oil pan and side cover from transmission. Lift oil pump screen from rear pump intake pipe. Straighten two front intake pipe bolt locks and loosen the two capscrews while lifting slightly on the pipe to avoid dropping capscrews into transmission case. Remove intake pipe from case.

Parking Brake Bracket and Control Valve (Cars with Hydraulic Type Reverse): Back off front and rear band adjusting screws at least 5 turns and remove parking brake pawl support bolt from rear of case and position anchor down in case as far as possible (Pawl can not be removed at this time). Remove pressure regulator reverse oil pipe (Do not bend pipe). Loosen two bolts holding parking brake bracket assembly to transmission case and place detent control lever in "L" position. Unhook parking brake release spring from pin assembly and inside oil pipe. Remove four bolts holding control valve assembly to transmission case and work control valve assembly toward front of case to remove governor pipes and reverse clutch pipe. Remove bolts from brake bracket assembly and remove piston release spring and stop. Carefully remove sleeve from governor to avoid damage to oil rings. Remove parking pawls from case.

Servos and Rear Oil Pump (Cars with Hydraulic Type Reverse). Remove front and rear servo attaching bolts and rear oil pump attaching bolts. Separate front and rear servo at oil transfer pipe by moving rear servo toward rear of transmission, then remove servo and rear pump discharge pipe. Remove front pump delivery pipe by pulling straight up from front pump. Position governor so that large round end is toward front of transmission and position one reverse drive flange attaching bolt up. Remove rear pump and governor by moving toward control valve assembly side of transmission base.



HYDRA-MATIC FRONT UNIT, REAR UNIT, & REVERSE DRIVE ASSY. (WITHOUT HYDRAULIC REVERSE)

Servos and Control Units. Hold rear pump discharge pipe brass fitting in front servo and loosen pipe nut. (Do not remove pipe from coupling). Loosen front and rear band adjusting lock nuts, then loosen adjusting screws approximately five turns each. Remove front and rear servo attaching screws and take both servos out as a unit. **NOTE:**—As servos are lifted from the case, the rear pump discharge pipe will rotate in the coupling and fall free without bending the pipe. (The pipe is connected in the same manner when installing the servos to the transmission case). Remove the rear pump discharge pipe from the pump, then remove the front delivery pipe.

Main Oil, Control Valve Body. *NOTE:*—Governor runout may be checked at this point before removal of oil control body. (See "Governor Runout Check" instructions). Position manual control detent lever so steel ball is in the "LO" range detent position, then remove four valve body mounting screws. Remove control body by sliding forward along transmission case. Oil delivery pipes from valve body to governor sleeve may come off with valve body. If they do not come off with valve body, they should be pulled out of governor sleeve at this time.

Reverse Shifter Bracket Assembly. Remove mounting bolts and take off the reverse shifter bracket, being careful not to lose the shims, spring or roller.

Rear Oil Pump and Governor Assembly. Remove the two screws holding the rear oil pump and governor to transmission case. Rear oil pump and governor can be removed as an assembly by positioning one reverse drive flange attaching screw up. Governor must be rotated so that the large round governor weight is toward the front of the transmission while removing the assembly. Take the assembly from the case by moving it toward control valve assembly side of the case and raising rear of pump to clear case.

Pressure Regulator Assembly. Remove pressure regulator plug, spring and valve from side of transmission case, holding it under pressure during removal as it is under spring tension.

Front Oil Pump and Front Unit Drive Gear. Remove

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HYDRA-MATIC OVERHAUL (Cont.)

snap ring holding front unit drive gear on front end of intermediate shaft and remove steel and bronze thrustwashers from shaft. (**NOTE:**—These washers have a smaller diameter than similar washers used in the transmission and should be kept separate). Remove front pump retaining screws and copper washers from its counterbore. Snap ring pliers can be used for this. Front pump, gasket and front unit drive gear will now come off as an assembly. Remove bronze thrustwasher in front of planet carrier.

Check End Clearance of Main Shaft. Install main shaft End Play Guide J-2587 over main shaft and front planet carrier and set up dial indicator on transmission case using Tool J-1465. Insert screwdriver between front clutch drum and center bearing cap, holding front planet unit forward. The screwdriver should be placed at an angle to prevent damage to oil delivery sleeve. Move shaft back and forth. End Clearance should be .004" to .005". Be sure to get just the float in the shaft. Do not force hard enough to compress clutch release springs. (NOTE:—Record amount of end clearance so the proper size washer can be installed when transmission is reassembled). Remove indicator and special tools.

Reverse Gear Assembly and Main Shaft (Cars without Hydraulic Type Reverse): Loosen rear bearing retainer to reverse internal gear support attaching bolts. This aids in the disassembly after removal of rear bearing retainer from transmission case. Remove reverse drive flange attaching bolts and straighten reverse anchor support bolt lock. Then remove the reverse anchor support bolt and reverse anchor. Remove rear bearing attaching bolts and remove reverse assembly from transmission case. If assembly sticks, tap front end of main shaft with soft hammer.

►***CAUTION:*** The selective washer may stick to the main shaft or it may remain in the counterbore of the output shaft. Be sure to remove this washer when reverse assembly is removed.

Reverse Assembly and Main Shaft (Cars with Hydraulic Type Reverse): Remove rear bearing retainer oil seal and take out six center gear and drive flange attaching bolts. (Drive flange can be held from turning by bracing screw driver under drive flange bolt head). Install Tool J-2173 between center bearing cap and rear clutch drum to prevent drum from moving forward. Remove five bolts attaching rear bearing retainer to transmission case and carefully remove reverse assembly from transmission case. (If shaft sticks, tap on front end of drive shaft with rawhide hammer. ***CAUTION***—The selective washer may stick to the main shaft or it may remain in the counter bore of the output shaft. Be sure to remove this washer when reverse assembly is removed. Remove stationary cone lock key).

Front and Rear Units. Install rear hub holding Tool J-2174 to rear unit drum, using a reverse drive flange attaching screw. Bend back edges of lock plate under two center bearing cap mounting screws, remove screws and bearing cap. Lift both front and rear planetary assemblies, with bands, from transmission case.

OVERHAUL OF UNITS

OVERHAUL: Transmission Units.

Front Servo Unit, Disassembly. Separate front and rear servos from oil delivery pipes, then remove two capscrews holding front band release band to servo body, and remove front band release cylinder. Booster spring, retracting spring retainer and retracting spring can now be removed. Take front band release piston from cylinder and remove servo piston from servo body.

►***CAUTION:*** Piston assembly must not be disassembled at it is furnished as a complete unit.

Remove pipe plug and lock wire holding 4 to 3 valve in place, and take valve from servo body.

Rear Servo Unit, Disassembly. Place rear servo in press and bring ram down to rest on spring retainer. Remove two retainer screws and lockwashers holding spring retainer to servo body. Release press slowly until servo springs are released, then remove servo from press. Take out servo spring retainer, accumulator spring, compensator piston and two compensator springs. Remove accumulator body and piston assembly from servo body. Rest the accumulator body on a vise with copper jaws and tap accumulator piston thru spring and accumulator body. Booster spring and booster piston can be taken from body.

►***NOTE:*** To replace a broken or leaking check valve in the accumulator, drive out the rivet holding check valve in place and remove check valve and plunger. Clean body and passages and install plunger. Install check valve, inserting the notch in the valve under the shoulder at the small end of the plunger. Insert new rivet thru valve and into body. Peen the rivet.

►***NOTE:*** Small bleed hole in valve must be over hole in body.

Oil Control Valve Body, Disassembly. ***(CAUTION:***—Manual lever detent ball is under tension and may become lost unless care is taken to remove detent spring and steel ball). Move manual control lever slowly past reverse position while holding fingers around casting to catch spring and ball. Remove seal and two springs from manual control shaft.

►***CAUTION:*** Extreme care must be taken in handling the main control valve assembly. Never grip the casting in a vise or use force in removing or installing valves or plugs. It is suggested the valve body be laid flat on a clean paper for disassembling. Remove the two screws holding inner and outer valve body castings together. Separate castings and remove separator plate. Remove three screws holding governor pipe end casting to valve body and take off the pipe end casting and separator. Remove cover plate from regulator plug casting. Take out the three screws holding regulator plug end cast-

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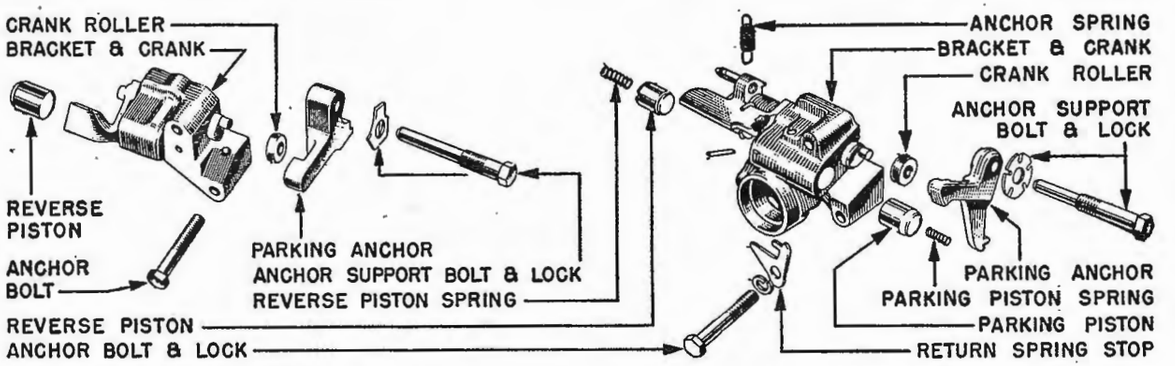
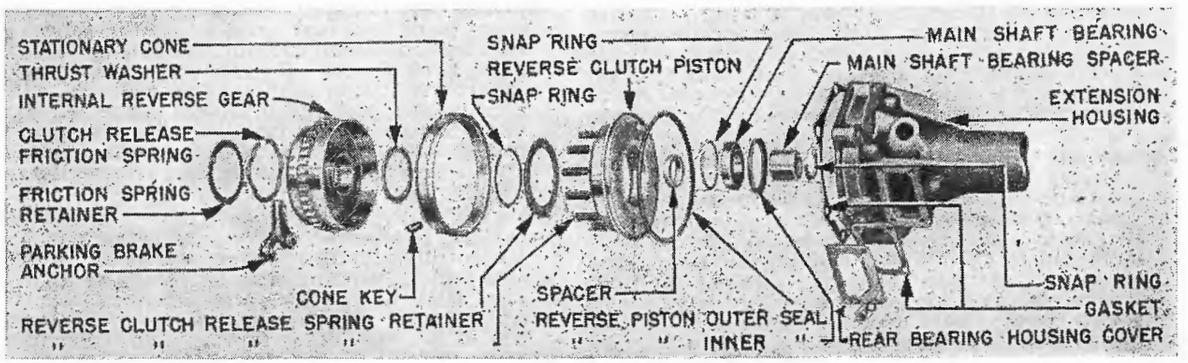


REVERSE BLOCKER ASSEMBLY



HYDRAULIC TYPE REVERSE ASSEMBLY

HYDRA-MATIC OVERHAUL (Cont.)

ing to inner casting and remove end casting. Hold regulator casting and inner valve body together while removing screws to avoid springs jumping out of place. Remove 1st and 2nd regulator plug spring, 2nd to 3rd shifter valve spring and 3rd to 4th shifter valve spring. Remove the three shifter valves. Valves should be free to move from body by pushing on opposite ends against governor plugs with fingers. Remove three governor plugs. Take off detent ball and spring retainer and remove steel plate over compensator valve and throttle detent plug in outer body. Remove compensator valve, spring, and detent plug from outer valve body. Double transition valve will now slide out. Remove "T" valve, throttle valve spring and throttle valve. Remove the spring holding compensator valve auxiliary plug in place. Compensator valve can now be removed by inserting a ⅛" punch into hole in plug and using another punch to push valve from body.

►*CAUTION:* Since this plug is short, be careful not to let it drop from punch and become lodged in valve body.

Rear Oil Pump and Governor Assembly, Disassembly. Remove plug from governor oil delivery sleeve and pull sleeve off governor body. Mark edge of governor body and edge of governor drive flange so they may be reinstalled in the same position. Remove governor body from drive flange and remove oil seal rings from governor body, being very careful not to damage rings while they are being removed.

►*CAUTION:* Do not attempt to remove the governor weights.

Remove two screws retaining small governor plunger and bushing, and take out small governor plunger stop. Pull governor plunger and bushing assembly from body. Remove the four bolts holding rear pump cover to pump body and take off cover, internal tooth oil pump can then be removed.

Front Oil Pump Unit Drive Gear, Disassembly. Remove front pump from front unit drive gear; tap gear with composition hammer if necessary. Hold front pump assembly with Tool J-2184-1. (*CAUTION:*—No attempt should ever be made to hold pump body by inserting bar into the intake bore or pressure regulator piston bore.) Remove two 1" long and one ⅝" long screws and copper washers from front pump cover, using an offset screwdriver. Remove one 1⅜" screw and copper washer from rear of pump. Take front pump cover from body. (*CAUTION:*—Tap lightly with a soft hammer at dowel area but ***DO NOT PRY WITH A SCREWDRIVER AS THIS WILL DAMAGE THE LAPPED SURFACE.)*** Use care not to drop gears out of gear pocket when cover is removed. Remove by-pass valve and spring from pump body and take out both internal and external pump gears. Remove oil seal from pump cover and take two oil seal rings from front cover.

CAUTION:—Mark top face of driven gear (outer) with Prussian Blue for identification when reassembling.

Reverse Gear and Main Shaft Disassembly (Cars without Hydraulic Type Reverse): Remove the speedometer driven gear and sleeve assembly from rear bearing retainer. Take out the five internal gear support bolts and copper washers. Lift up rear bearing and remove by tapping end of output shaft with soft hammer. Remove open type snap ring from back of output shaft ball bearing. Lift gear, support and output shaft as an assembly and bump end of output shaft on block of wood. This will allow weight of internal gear and support to bump speedometer drive gear off end of output shaft. Remove reverse internal gear support snap ring and internal gear. With a soft hammer tap the ball bearing from internal gear support.

(*CAUTION:*—Keep snap ring spread to avoid damage to splines.) Lift reverse center gear and flange assembly from output shaft.

►*CAUTION:*—Do not disassemble the reverse center gear and drive flange assembly as this is serviced as a complete unit.

Remove steel and bronze thrustwashers from output shaft and remove bearing retainer seal.

Reverse Gear and Main Shaft Disassembly (Cars with Hydraulic Reverse): Remove stationary cone lock key and speedometer driven gear and sleeve assembly from rear bearing retainer. Remove snap ring on output shaft inside of rear bearing retainer at ball bearing. (This snap ring is smaller than other snap rings used in transmission). With output shaft standing on carrier end, remove bearing retainer from output shaft (It may be necessary to tap output shaft with soft hammer while holding rear bearing retainer to separate units). Remove reverse internal gear and stationary cone from rear bearing retainer by compressing stationary cone by hand. Remove snap ring locating ball bearing in rear bearing retainer. (Install new snap ring when assembling). Remove ball bearing from retainer and with Tool J-4670, compress reverse cone clutch release coil springs and remove large snap ring. Take out spring retainer and coil springs (6). Pull reverse piston straight out (do not attempt to turn piston as it is located by four dowel pins). Remove outer oil seal from reverse piston and inner oil seal from hub of rear bearing retainer and take large thrust washer from reverse intenal gear. By using large snap ring pliers, expand stationary cone and remove from internal gear, then remove clutch release flat spring and retainer. Remove snap ring holding planet carrier to output shaft and remove carrier, now remove the remaining snap ring and remove sun gear and drive flange assembly from output shaft.

Rear Unit and Front Unit from Intermediate Shaft. Remove both bands and place intermediate shaft with front and rear planet assemblies into holding fixture J-2190. Remove rear clutch hub snap ring lift rear unit and rear clutch hub as an assembly from intermediate shaft. Remove rear clutch hub front snap ring from intermediate shaft and take off oil delivery sleeve. Remove snap ring back of front unit center gear. (*CAUTION:*—Hold snap ring open to avoid damaging bearing surface on shaft.) Front unit can now be taken from shaft. Remove steel and bronze thrustwashers from drum back of front unit center gear. (NOTE: These washers are similar to those used ahead of the front unit and should not become mixed.)

Front Unit, Disassembly. Place front unit in press and apply enough pressure to allow the snap ring to be removed. Take assembly from press and separate the drums by tapping front face of center gear with soft hammer. (*CAUTION:* Use care not to lose springs.) Remove annular piston from clutch drum by bumping front face of center gear on soft wood block. Take out the six inner and six outer clutch release springs. Remove three composition and three steel clutch plates.

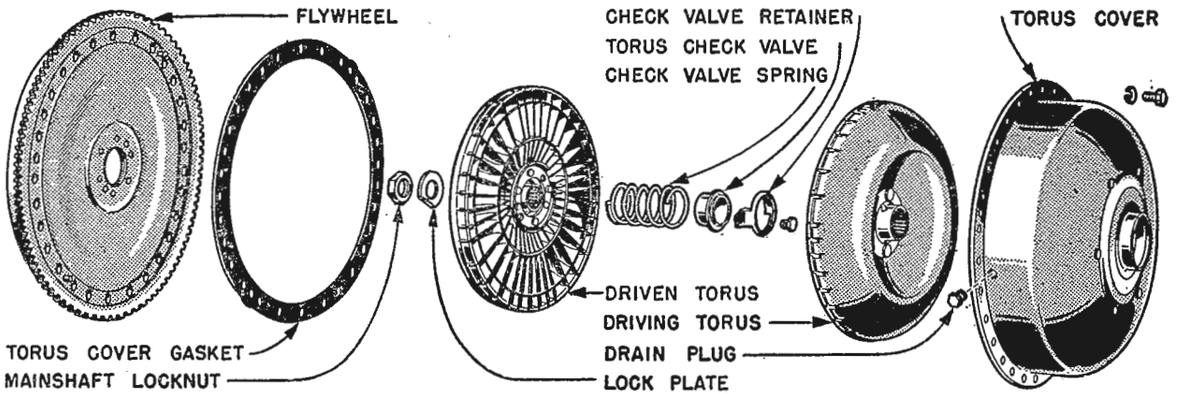
NOTE: Lincoln and Oldsmobile 8, use four composition and four steel clutch plates.

With a blunt edge screwdriver, remove rubber seal and brass liner from annular piston and clutch drum piston.

Rear Unit, Disassembly. Remove rear clutch hub Tool J-2174, and take clutch hub and front thrustwasher from drum. Place rear unit in press and remove drum retainer snap ring. Remove the assembly from press and separate the drums by tapping lightly on rear thrust face of drum with block of wood and light hammer. Tap clutch drum on block of wood and remove annular piston. Remove six inner and six outer clutch release springs with guide pins. (NOTE: Front and rear clutch release springs are interchangeable, but guide pins are used only in rear unit.) Remove six composition and six steel clutch plates.

NOTE: Lincoln and Oldsmobile 8, use seven composition and seven steel clutch plates.

Remove two filister head cap screws that retain rear unit internal gear to drum and remove internal gear by tapping lightly with a soft hammer. Remove seals and brass liner from piston.



HYDRA-MATIC TORUS ASSEMBLY

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HYDRA-MATIC OVERHAUL (Cont.)

ASSEMBLY OF UNITS

ASSEMBLY: Before assembly of transmission and the component units is attempted, a thorough inspection should be made of each part. It is very important to distinguish between parts that are simply "worn in" and those worn to the extent they effect the operation of the unit. Only worn, broken or damaged parts should be replaced.

Clean the transmission case with cleaning fluid and blow out all holes and passages. Inspect case for cracks and stripped threads. Inspect oil delivery sleeve for scored bearing surfaces. Insert a wire through both oil delivery sleeve holes to check for open passages into the opening between oil seal and ring grooves. Check rings for freedom in grooves and for damage. Install oil delivery sleeve with dowel holes toward case and tighten cap with dowel on one of the two holes. Apply oil on each side of the bearing cap. Apply air pressure to two clutch holes in side of case. If movement of oil on delivery sleeve is observed, leakage is indicated. Attempt correction by installing a new oil delivery sleeve. If new sleeve leaks, dress bearing cap down with fine emery cloth on surface plate until sleeve does not leak. Remove bearing cap and oil delivery sleeve and inspect adjusting screws (band anchor stop) and threads in case.

Pressure Regulator Valve. Inspect pressure regulator valve, spring and gasket for damage. Valve must have free fit in front pump body and end coils of spring must fit freely over valve.

►**Modulated Pressure Regulator Assembly.** Overhaul of this unit is the same as for previous models. A modulated oil line valve has been added to this assembly, fitting into the plug, which is now sealed with a neoprene gasket. **Do not use this type regulator valve on earlier models.**

Front Unit Assembly: Inspect both bands for burned or worn lining and check steel bands for distortion or cracks, inspect strut on rear band for alignment and free pivoting. The rear band is furnished with strut attached. Inspect anchor ends of front band for broken welds or worn sockets.

CAUTION: Do not pry either band open or distort band in any manner as they are surface ground at the factory for drum fit.

Place intermediate shaft assembly in holding fixture J-2187 with clutch hub up. Place front unit drum over hub to rest on pinion gears with drive pin up. Install clutch into front drum, alternating plates, beginning with a composition (drive) plate and finish with a steel (driven) plate. Assemble the driven plates with square notches over the drive pins. (*NOTE:* Apply Hydra-Matic oil to face of each plate surface as assembled.) Install inner and outer clutch release springs thru plates into holes in drum unit. Now take the clutch drum and install new inner brass expander into ring groove in clutch drum, with expanding ring down. While holding brass expander in position, work new inner piston rubber seal into ring groove with lip down, over brass expander. (*CAUTION:* Work expander well back into position under seal so brass edges are not exposed.) Place new large rubber seal over front piston beyond seal groove. Install new large brass expander in piston, work seal well into groove. Install piston into clutch drum resting on large outer seal. Align square notches in piston with holes in drum. While applying pressure slightly to piston, guide seal into bore with flat side of blunt screwdriver. Install front clutch drum and piston assembly over intermediate shaft into front drum assembly. (*CAUTION:* Be sure clutch release springs enter into recesses of clutch piston.) Lift front unit assembly off intermediate shaft, place in press and press clutch drum below snap ring groove. Install clutch drum snap ring, positioning gap of snap ring between two snap ring holes. (*CAUTION:* Snap ring must be well seated into groove to prevent interferance with ledge on drum.) Release assembly from press and tap face of sun gear with a soft hammer so the clutch drum will seat against the snap ring. Remove intermediate shaft from holding fixture and insert hub into drive plates and drum by rolling drum on bench while pressing firmly into position. Place assembly into holding fixture and install bronze, then steel thrustwasher over intermediate shaft. NOTE: Locating lug on steel washer must fit over flat portion of shaft. Install snap ring.

►*CAUTION:* If flakes of facing material can be removed by scratching the surface with thumbnail, the plate should be replaced. Discoloration is not an indication of failure.

►**FRONT & REAR UNIT SERVICING CAUTION: (1946-48 CADILLAC & OLDSMOBILE):** First 6-Driving Pin Type Brake Drums and Clutch Drums (Cover) superseded by new 3-Driving Pin type (On Oldsmobile, both types used in mixed production on late 1947 & early 1948 cars—3-pin type used exclusively beginning with Transmission Serial No. 0-221729). These types **interchangeable as complete assemblies only** except that steel clutch plates still furnished with six slots for interchangeability.

►***CAUTION—Always use 6-pin parts or 3-pin parts together in assemblies as follows:***

Front & Rear Unit Part Nos.

Cadillac & Oldsmobile No.:	Brake Drum	Cover
Front Unit (6-Pin Type)	8608178	8607338
Front Unit (3-Pin Type)	8611446	8611456
Rear Unit (6-Pin Type)	8608790	8608773
Rear Unit (3-Pin Type)	8611445	8611455

►**INSTALLATION OF 1948 ALUMINUM ANNULAR CLUTCH PISTONS TO REPLACE CAST IRON TYPE ON EARLIER OLDSMOBILE MODELS:** Cast aluminum annular pistons as used in production on 1948 cars beginning with Transmission Serial No. 08-8000, furnished for replacement use on 1948 and earlier cars (cast iron type pistons discontinued) as follows:

Front Clutch Annular Piston.....Part No. 8611261
Rear Clutch Annular Piston.....Part No. 8611258

►*ALUMINUM CLUTCH PISTON INSTALLATION CAUTION*—Additional steel clutch plate must be used and installed **next to the aluminum piston** to provide friction. In the event that a cast iron piston

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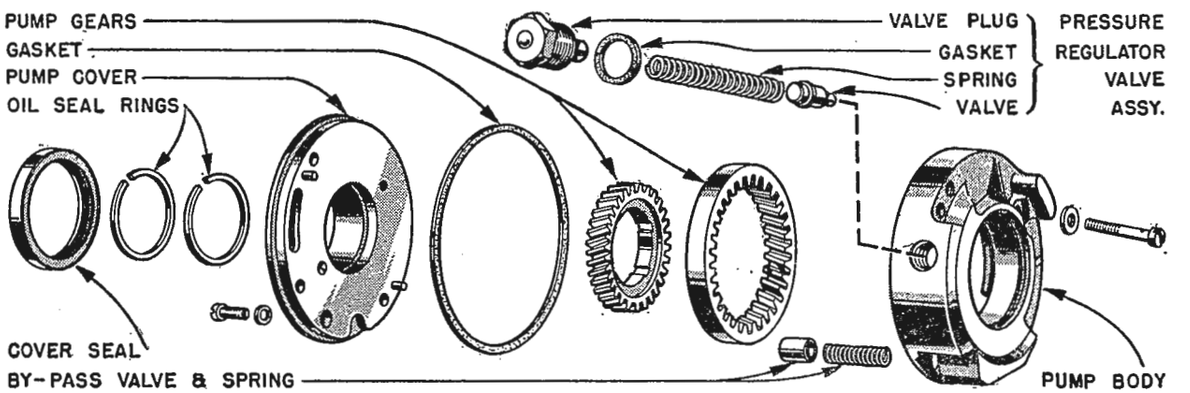
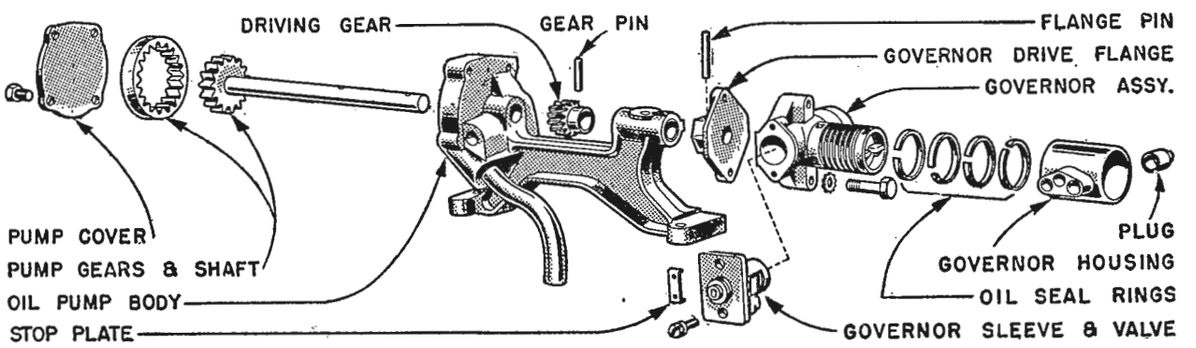


HYDRA-MATIC FRONT OIL PUMP & PRESSURE REGULATOR VALVE



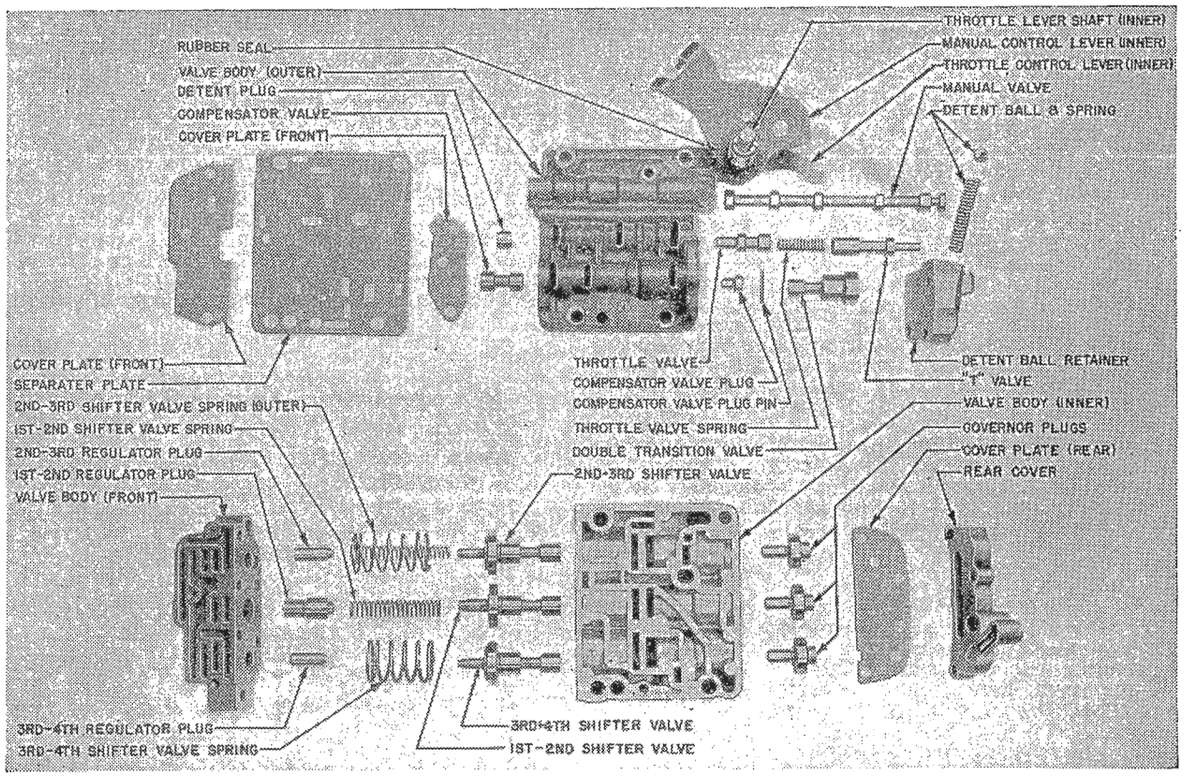
HYDRA-MATIC REAR OIL PUMP & GOVERNOR

HYDRA-MATIC OVERHAUL (Cont.)

from stock is used to replace an aluminum piston, this first steel plate should be removed and discarded so that plate next to cast iron piston is composition type.

Rear Unit, Assembly. Place rear unit drum, less internal gear, on the bench with drive pin up and install the drive and driven plates into drum beginning with a composition (drive) and finish with a steel (driven) plate. Assemble driven plate with square notches over drive pins. (NOTE: Apply Hydra-Matic oil to face of each plate as assembled.) Position new inner rubber seal on clutch drum above groove. Install new small brass expander into ring groove of clutch drum with expander ring down. While holding the brass expander in position, work the rubber seal into ring groove with lip down over brass expander. (*CAUTION:*—Work brass expander well back into position under seal so brass edges are not exposed.) Place new large rubber seal over rear piston beyond ring groove and install new large brass expander in piston with lips up. While holding expander in position, work rubber seal with lip well up into groove. Place piston into clutch drum resting on outer rubber seal. Align square notches in piston with holes in drum. While applying slight hand pressure to piston, guide seal into bore with a blunt screwdriver. Install rear clutch drum and piston assembly over drive pins into drum unit. Install clutch drum snap ring, positioning gap of ring between two drive pin holes. (NOTE: With a wooden block and hammer, tap clutch drum until clutch seats against snap ring.) Install inner and outer clutch release springs and guide pins. Assemble rear unit inernal gear to rear drum, locating on dowel, and install and tighten two filister head screws. Install front bronze thrustwasher into deep counterbore in rear clutch hub and retain with grease. Install rear hub and thrustwasher into clutch drive plates. Rotate hub and drum on bench to mesh splines with teeth of plates. Install rear clutch hub holding Tool J-2174 on rear drum to hold hub in place. Install oil delivery sleeve over intermediate shaft with long bearing up. Compress exposed oil delivery sleeve rings with ring compressor J-1537 and tap oil delivery sleeve into bore of front clutch drum with soft hammer. Install rear clutch hub front snap ring into second groove on intermediate shaft, and install snap ring.

Reverse Unit Reassembly (Cars without Hydraulic Reverse): Install the steel then the bronze thrust washer into thrust washer retainer on reverse sun gear and flange assembly. Retain in place with grease. Install output shaft into reverse sun gear and drive flange assembly, seating shaft firmly against washers, then holding shaft firmly against washers, stand shaft on pinion end. Install sun gear snap ring. Place reverse planet carrier over output shaft with bronze oil pump gear down, meshing pinion with sun gear. Assemble reverse internal gear on gear support and install large snap ring. Place internal gear and support over output shaft meshing internal teeth with pinions. Place ball bearing over output shaft and tap into counterbore of internal gear support. Install open type snap ring in groove of output shaft behind inner race of ball bearing. Install a new bearing retainer seal. Slide rear bearing over output shaft and line up attaching bolt holes in retainer with bolt holes in internal gear support. Tap housing in place with a soft hammer. Dip threads of five attaching bolts, and copper washers in Permatex No. 3. Install bolts and tighten finger tight. Final tightening is done with retainer in case.



HYDRA-MATIC DRIVE CONTROL VALVE ASSY. (FIRST TYPE)

Reverse Unit Reassembly (Cars with Hydraulic Type Reverse): Hold reverse center gear in left hand with drive flange up; install the steel thrust washer, and then the bronze thrust washer in drive flange recess. Still holding reverse center gear in left hand, insert output shaft end through drive flange and center gear until carrier bottoms on the two thrust washers. Hold drive flange and center gear tightly against the carrier to keep thrust washers from moving and set assembly on the bench with carrier end down. (*CAUTION*—Do not pick up this assembly until completely assembled to prevent washers from slipping out of place). Install reverse planet carrier over output shaft with bronze drive gear down, meshing pinions with the sun gear. (Be certain unit is bottomed against reverse planet carrier snap ring). Install snap ring on output shaft to position planet carrier. Install reverse clutch release flat spring and spring retainer on internal gear side of reverse internal gear. Make certain spring is in recess. If retainer tips are misaligned, preventing centering, use new retainer. Install reverse stationary cone on reverse internal gear cone, using large snap ring pliers to spread stationary cone. (*CAUTION*—Do not spread cone more than necessary.) Install large bronze thrust washer over collar of internal gear. Install outer seal on cone piston with seal lip toward flat side of piston, and work well into groove. Install inner seal with lip down and work well into groove. Install reverse cone piston in rear bearing retainer (using Tool J-4752) so it rests on the four dowel pins. Turn the reverse cone piston until the four dowel pins are aligned with holes in piston and carefully push piston into retainer. (*CAUTION*—Use extreme care when installing, to prevent damage to seal). To make certain piston is fully seated, lay a straight edge across face of piston and measure from straight edge to face of rear bearing retainer. The measurement should be 3/8" to 13/32". Install the six clutch coil springs and spring retainer. Compress springs with Tool J-4670 and install large snap ring, holding retainer in place, and remove tool. Install ball type bearing in rear bearing retainer, making sure bearing is fully and squarely seated. Install new large special type snap ring in rear bearing retainer, locating ball bearing. Install internal gear and stationary cone into rear bearing retainer, compressing cone by hand (Position keyway of stationary cone so it will line up with keyway in case when installed.) With output shaft standing on carrier end, place rear bearing retainer over ouptput shaft and mesh carrier gears with internal gear.

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HYDRA-MATIC OVERHAUL (Cont.)

(*CAUTION*—Use care to prevent damage to bushing and ball bearing in rear bearing retainer. Install snap ring on output shaft, locking rear bearing retainer to output shaft (This snap ring is smaller than other snap rings used in transmission). Install speedometer gear in rear bearing retainer and install retainer gasket. Install stationary cone to case lock key, holding in place with petrolatum until installing in case.

Front Pump Assembly. Inspect pump drive and driven gears for damaged teeth or scored end surfaces. Inspect pump body for scored gear pockets and check all passages for obstruction. Be sure small drilled hole at end of pressure regulator valve bore is open. Inspect bushing in body for wear or scores. Slight wear of the bushing in the front pump body is permissable as long as the wear is not sufficient to effect the operation of the transmission. If excessive wear is present on one side of the pump bushing, a careful check should be made of the torus cover runout at the hub which must not exceed .005" total dial indicator reading. Inspect pump cover for scored surfaces, loose dowels, or obstructed passages. Check oil seals for damage and freedom in grooves, and inspect front drive gear for scored surfaces, worn bushings, or damaged teeth. Relief valve must be free in bore and free length of spring must be 1-25/64".

CAUTION: If any of the following parts are damaged, it will be necessary to replace the complete pump assembly. Pump gears, body, cover, or front drive gear bushing in pump body.

If necessary, install new oil seal rings in pump cover.

CAUTION: Check new ring gap in torus cover before installing rings in pump cover. (Gap .001" to .007".) New seal in pump cover must be installed with step side up. Drive seal into place with Tool J-2170. Apply sealing compound around edge of cover and seal. Using Permatex No. 3. Lubricate both pump gears with Hydra-Matic fluid and install both gears in gear pockets of body. (Be sure Prussian Blue side of driven gear is up.) Install the relief valve spring, and relief valve into pump body. Press down on valve and insert feeler stock in slot to hold valve down. Install pump body, locating over dowels. Apply sealing compound under heads of screws. Install screws and new copper washers. Hold pump with Tool J-2184-1 and tighten screws to 12-15 lbs. ft. torque. Remove feeler stock from relief valve. Turn pump assembly over and install screw using a new copper washer. Torque to 12-15 lbs. ft. Assemble the front pump over front drive gear, aligning keys to keyway.

Governor and Rear Pump, Assembly. Inspect pump gears for damaged teeth and check cover and gear pockets in body for scores. Inspect ring lands and rings for freedom in grooves. If lands are damaged or worn thin replace the complete governor assembly. Inspect both G-1 (round shaped) and G-2 (square shaped) governor valves for free movement. Both plungers should have a free movement of from .118" to .148". Inspect oil delivery sleeve for ring scores and governor plug for freedom in its bore. Install pump driven gear (inner) and shaft with (inner) drive gear in pump body, sliding (outer) driven gear on shaft. Install pump cover. Install governor drive flange on pump shaft. Line up holes in gear and drive flange within pump shaft and install new pins. Peen ends of pins using Tool J-2183-1 and S-2183-2. (*CAUTION:* Height of peened end of pins must not exceed .070".) Install G-2 governor plunger and bushing assembly in governor body, with slot in bushing for governor plunger stop, up. Install and tighten G-2 governor plunger and bushing assembly attaching screws and lock washers. While holding G-2 plunger in, install the plunger stop with the two small holes up. (*CAUTION:* Be sure stop does not extend above surface of governor body.) If needed, install governor oil seal rings on governor body. Check ring gap in oil delivery sleeve (Gap .001" to .007"). Install oil delivery sleeve with chamfer next to governor body; use care not to damage rings while compressing them into oil delivery sleeve. Position governor assembly on drive flange, lining up locating marks. Install governor body to flange bolts and lockwashers. Tighten to 6 to 8 lbs. ft. torque. Install governor sleeve plug.

►**Oldsmobile 8, and Late 6 Cyl. (1950)** Equipped with larger front oil pump and is not interchangeable with older models.

►**PONTIAC 1948 TRANSMISSION REAR OIL PUMP CHANGE:** New "crescent" type rear oil pump, No. 8611366, used in part production on late 1948 cars

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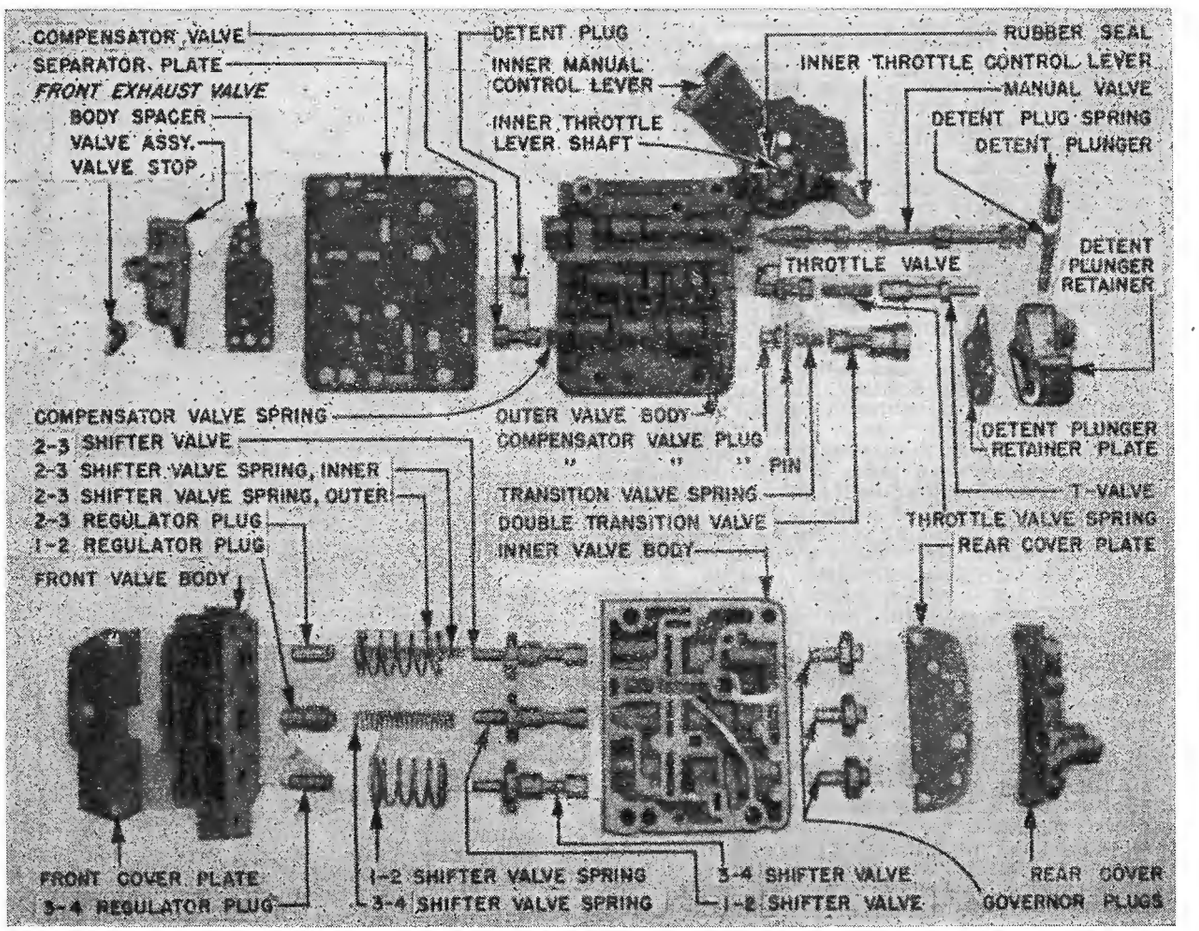

HYDRA-MATIC DRIVE CONTROL VALVE ASSY. (LATER TYPE)

HYDRA-MATIC OVERHAUL (Cont.)

and supersedes previous gear type oil pump, No. 8607647. **Pumps interchangeable as an assembly.**

►***NOTE—Use gear type pump No. 8607647 as service replacement for both the gear type pump and for the crescent type pump No. 8611366.***

Front Servo, Assembly. Inspect all parts for scores, broken rings, freedom of ring in grooves and dirt in passages. Inspect servo springs for distortion of collapsed coils. Booster spring length 61/64", retracting spring length 1-33/64". Install and tighten brass fitting into servo body. Install 4 to 3 valve into bore of body and align slot with hole for valve retainer and install retainer. Install screw plug over 4 to 3 valve and install dowel pin if removed from servo body. Install servo piston into body and align slot in sleeve over dowel pin. Install front band release piston into cylinder, using care when compressing ring. Place booster spring over front band release piston and place retracting spring retainer over piston stem on booster spring. Place retracting spring over piston stem. Place band release cylinder assembly on servo body. Cylinder should seat squarely on body before bolts are installed. Insert and tighten attaching bolts and lockwashers.

►**Modulated Front Servo Assembly.** Apply piston increased in size, and ball check replaced with a flat valve. **Do not use on earlier models.**

Rear Servo, Assembly. Inspect actuating lever for free operation and worn socket. Check servo body, pistons, and accumulator body for scores. Clean all passages. Be sure check valve is not broken and the check valve plunger is free. Inspect all servo springs for damage or collapsed coils. Free length of springs in the rear servo are: Rear servo spring, 4¼". Compensator Piston Inner spring, 3-25/32". Compensator Outer spring 3-15/32". Accumulator apply spring, 1-15/64". Booster spring, 1-19/32". Install accumulator piston in accumulator body, using care not to damage piston ring. Install accumulator apply spring over stem with small tapered end seating against shoulder. Install booster spring in booster piston. Make sure spring fits snuggly in recess in bottom of booster piston. Install booster piston in accumulator body. Install accumulator assembly in servo body using care not to break the booster piston ring. Place two compensator springs in bore of accumulator piston and install compensator piston over springs. Place servo spring and retainer with attaching bolts and lock washers in position and place complete assembly into press. Slowly compress springs while tightening mounting screws. (*CAUTION:* Use extreme care to avoid breaking oil seal rings on compensator piston.) Test operation of servo by applying air pressure in the rear band release passage.

►**Modulated Rear Servo Assembly.** New "Quick Dump" feature eliminates long pause shifting to reverse. **Do not use on earlier models.**

Driven Torus Check Valve, Assembly. Position torus check valve spring over hub of driven torus member and place check valve over hub. Place check valve retainer over valve and press assembly against torus hub and tighten in place with attaching bolts. Bend ends of retainer against flats of bolts. Press down on valve to check for free movement.

Oil Control Valve: ***CAUTION—See Oldsmobile Whirlaway Transmission Note (at end) for modtifications which may have been made in control valve to permit the transmission to start in first gear with selector lever in "Dr".***

Assembly—Clean valves and bodies thoroughly with gasoline and inspect carefully to see they are not damaged and are free from burrs. Burrs can be removed by using fine crocus cloth. (*CAUTION:*—This type of valve has sharp edges to prevent dirt from wedging between valve and body. Therefore, when removing burrs, do not round off corners and edges.) Check all moving parts of valve for free movement in their bores and operating positions.

►*NOTE:*—The manual control valve is the only valve furnished separately. If it becomes necessary to replace one of the other valves or one of the bodys, a complete front or rear valve body assembly may be replaced. The spacer plate between the inner and outer body assemblies is also furnished separately. Check the fit of the throttle valve inside lever and shaft in hub of the inside manual control lever on the outer valve body. If the shaft binds in the hub or is excessively worn, or if the oil seal is missing or damaged, repairs are necessary. Proceed as follows: Drive out throttle valve shaft pin. Replace the throttle valve inside lever and shaft and oil seal. To assemble control valve, carefully assemble compensator auxiliary plug into the outer valve body, using a punch to hold plug. Install plug pin. Install throttle valve, throttle valve spring, "T" valve and detent plug. Install compensator valve and spring and double transition valve. Check for freeness. Install outer valve body front plate on outer valve body being sure the inner throttle lever is inside of stop, and install screws holding retainer to valve body. Install the manual control lever. To do this: Rotate inside manual control lever counterclockwise past the reverse position. Insert manual valve detent spring in bore of detent ball retainer. Insert detent ball over spring. Push ball and spring into bore with fingers while rotating manual control lever clockwise into "LO" position. Install manual shaft seal inner washer with small inside diameter over manual control shaft, dish up. Install manual shaft seal outer washer with large inside diameter over manual control shaft, dish down. Install the rubber manual shaft seal over the shaft with lip extending into the inside diameter of outer washer. *(See Control Valve Assembly Illustration.)* Install regulator plugs 1-2, 2-3, and 3-4 in front valve body and check for freeness. Install the three governor plugs in inner valve body. Install shifter valves 1-2, 2-3 and 3-4 in inner valve body and check for freeness. Install inner valve body plate and valve body rear cover on body. Install 1-2 regulator plug spring in valve body. 2-3 valve spring, 2-3 regulator plug spring and 3-4 valve spring can be installed. Lay front valve body and inner valve body on clean surface, line up regulator springs in inner body with regulator plugs in front body. Compress springs with front body and install attaching screws. Position front body plate on front body and install screws. Be sure plate does not extend over face of inner body. Position the valve body spacer plate on the inner body, position outer body on spacer plate and insert the four valve body to transmission case attaching bolts through valve bodies and spacer plate to hold spacer plate in position while tightening the inner and outer valve body attaching screws.

►*CAUTION:*—Make sure all assembly screws are tight in valve body by double checking.

►**Modulated Oil Control Valve Assembly.** Identified by **three** attaching bolts instead of **two.**

CAUTION—Previous type oil control valve assemblies must not be used on modulated pressure transmissions.

►***OLDSMOBILE WHIRLAWAY TRANSMISSION NOTE***—Some transmissions have been modified to permit car starting in first gear with selector lever in "Dr" position: (1) 1-2 Governor Plug Spring removed and discarded (accessible by removing governor plug end casting from valve body). (2) Special Bushing No. 562189 inserted in oil orifice behind

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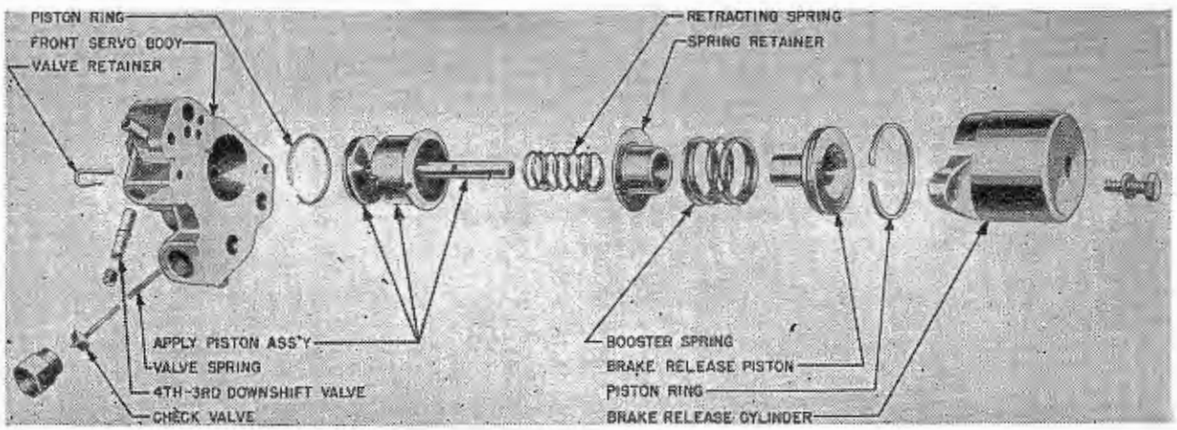


HYDRA-MATIC DRIVE FRONT SERVO

HYDRA-MATIC OVERHAUL (Cont.)

1-2 shifter valve to reduce diameter of orifice to .078" (bushing should be driven into hole with punch and light hammer so that top is flush with casting). See Linkage Adjustment and Band Adjustment for special settings used when these modifications made.

REASSEMBLY OF TRANSMISSION (INSTALLATION OF UNITS)

INSTALLATION OF UNITS IN TRANSMISSION CASE.

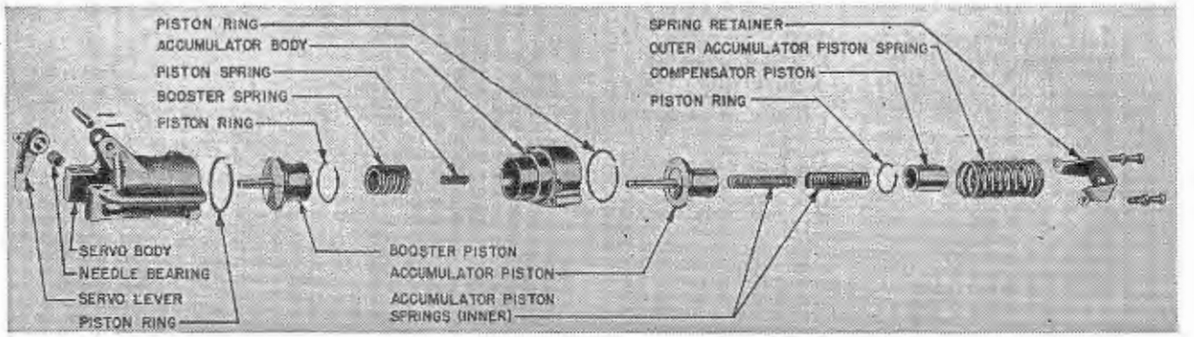
Front and Rear Units. Remove front and rear units from holding stand and position front band over front unit drum so short anchor end will be positioned to fit over adjusting screw when units are placed in case. Install suitable spring or wire to hold front band on front drum. Install front and rear units in case by lowering front end of intermediate shaft into case first. Remove spring and position anchor end of band over adjusting screw. Position center bearing cap over oil delivery sleeve. Lightly tap bearing cap in place. Install a new center bearing cap lock plate under attaching bolts and tighten to 40-50 lbs. ft. torque. Bend lock plate up around bolts, using large pliers. (*CAUTION:* Do not use screwdriver to pry corners of lockplate up, as this may damage lapped edge of transmission case.) Install screwdriver between center bearing cap and rear clutch drum to keep drum from moving forward. Remove rear clutch hub holding tool from drum. Position rear clutch hub rear thrustwasher in the counterbore of rear hub and retain with grease. Install correct size washer in counterbore of output shaft and retain in place with grease. (NOTE: If main shaft did not have correct end clearance prior to disassembly, select proper washer to bring end clearance within limits of .004-.015".) Selective washers are furnished in the following six sizes:

Mark	Size	Mark	Size
1	.055-.059	4	.079-.083
2	.063-.067	5	.087-.091
3	.071-.075	6	.095-.099

Install a new rear bearing retainer to transmission case gasket on retainer, align holes and retain in place with grease. Install main shaft in output shaft and position reverse assembly into rear end of transmission case so mounting bolt holes aligned.

►*NOTE:* Revolve output shaft to facilitate meshing planet gears with rear unit internal gears.

Position reverse anchor in transmission case and install reverse anchor support bolt and lock. Do not tighten bolt. Start rear bearing retainer to case attaching bolts and lockwashers. Align holes in reverse flange and rear durm and install reverse drive flange bolts and lockwashers. After two bolts are entered finger tight, remove screwdriver. Tighten bolts to 10-13 lbs. ft. torque. (*CAUTION:* Tighten the six bolts evenly without distorting flange.) Push rear bearing retainer against case, then tighten mounting bolts and rear anchor support bolts evenly to 28-33 lbs. ft. torque. Turn up anchor support bolt locks. Tighten rear bearing retainer to reverse internal gear support bolts to 28-33 lbs. ft. torque. Test for freeness by turning mainshaft, output shaft and front and rear drum units.



HYDRA-MATIC DRIVE REAR SERVO

Front Pump and Front Drive Gear. Position bronze thrustwasher over intermediate shaft and place pump cover gasket over front pump cover. Install front pump and front drive gear assembly over intermediate shaft. Align locating counterbore in pump cover with counterbore in case. Install pump locating washer in counterbore and install pump attaching bolts (with flat copper washer) finger tight. (NOTE: These bolts will be tightened after front servo is installed.) Install the bronze, then the steel thrustwasher over intermediate shaft against front end of front drive gear. Install snap ring holding thrustwashers in place. Install open type snap ring in groove on main shaft.

Governor and Rear Pump Assembly (Cars with Hydraulic Type Reverse): Before installing the rear pump, make certain the pump to case mating surface is free of nicks and burrs, and that attaching bolt holes in the case have a good chamfer. Position large round governor weight to front of transmission and locate one reverse drive flange attaching bolt up, to provide clearance for pump and governor assembly to slide into case.

Governor and Rear Pump. Position the large round governor weight to the front of transmission and locate one reverse flange attaching bolt up, to provide clearance for pump and governor assembly to slide into transmission case. Slide the pump and governor assembly into position in case and install and tighten attaching bolts and lockwashers to 15-18 lbs. ft. torque.

Oil Control Valve. Install three oil delivery pipes into holes in governor oil delivery sleeve and pull oil delivery sleeve out ⅛". With inside manual lever in "LO" position, push control valve assembly onto oil delivery pipes. Lower control valve assembly into position and push delivery sleeve in to bring control valve assembly against case. Install attaching bolts and lockwashers and tighten to 6-8 lbs. ft. torque. (NOTE:—Be sure governor oil delivery sleeve plug is in place.)

Check Governor Runout. Mount dial indicator on side of transmission case so that point of indicator rests against governor oil delivery sleeve. Rotate main shaft several revolutions and note runout of sleeve as measured on indicator. Total runout should not exceed .005". If within this limit, check no further. If runout exceeds .005", mark position of governor body on drive flange. Remove control valve assembly and remove bolts holding governor body to drive flange. Rotate main shaft and note runout of drive flange as measured on dial indicator. This should not exceed .002". If runout exceeds this limit, replace governor drive flange, gear set, or complete rear pump assembly. If runout of flange is less than .002", rotate governor body 180° from original position and reinstall governor body on flange. Recheck for runout, and if limit is still exceeded, replace governor and sleeve.

Reverse Shifter Bracket Installation (Cars without Hydraulic Reverse): Position retracting spring & roller on bracket assembly and assemble bracket and shims to transmission case. Tighten bolts to 15-18 lbs. ft. torque. Check backlash between reverse internal gear and anchor as follows: Install reverse gear backlash gauge J-2650 and dial indicator. Place inside manual lever in reverse position and hold reverse anchor against bolt with screwdriver to remove float. Rock reverse gear with Gauge and take reading on dial indicator. Remove or install shims between reverse bracket and transmission case to obtain correct backlash of .016" to .049". To increase backlash add shims.

►**Reverse Shifter Bracket and Blocker Piston.** Retracting spring eliminated. Blocker piston now a steel stamping. Assembly can be used on earlier models.

Front & Rear Servo Installation (Cars without Hydraulic Reverse): Install front pump discharge pipe in front pump body and insert plain end of rear pump discharge pipe into hole in rear pump. Position front servo with piston stem in socket on end of front band, place servo on front pump discharge pipe, enter rear pump discharge pipe into brass fitting in servo. Lower servo on case. Enter front servo attaching bolts and lockwashers. Do not enter more than 2 or 3 turns. Place rear servo in position engaging rear band strut with actuating lever while entering oil transfer pipe from front servo. Enter rear servo attaching bolts, then tighten all four servo

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HYDRA-MATIC OVERHAUL (Cont.)

bolts to 23-28 lbs. ft. torque. Tighten coupling end of rear pump discharge pipe in front servo. Install front pump intake pipe to front pump, using a new gasket and attaching bolt locks. Tighten bolts to 10-12 lbs. ft. torque and bend locks up against flat of bolts. Tighten front pump attaching bolts, with copper washers to 10-13 lbs. ft. torque. (NOTE:—Cover should protrude .003" to .015" out of case. If cover protrudes less than .003" add a pump cover gasket to allow cover to protrude within limits.

Front and Rear Servos (Cars with Hydraulic Reverse): Install front pump delivery pipe in front pump body and position front servo with piston stem in slot on end of front band; place serve on front pump delivery pipe and push servo into position against case. Enter front servo attaching bolts and lock washers about three threads. Enter rear pump discharge pipe into passage in front servo and rear pump. Place rear servo in position, engaging rear band strut with actuating lever while entering oil transfer pipe from front servo. Enter rear servo attaching bolts and tighten. Install rear pump bolts and tighten. Check governor runout (see below). Install front pump intake pipe to front pump, using a new gasket and attaching bolt locks. Tighten attaching front pump intake pipe bolts and secure locks by bending up against bolt heads. Tighten to front pump attaching bolts. **NOTE**—Cover should protrude .003" to .015" out of case. If less than .003", add a pump cover gasket.

Parking Brake Bracket and Control Valve (Cars with Hydraulic Type Reverse): Remove parking brake pawl support bolt from case (this bolt was previously installed to insure alignment of threads). Install pawl into position in case, but let pawl slide down as far as possible. DO NOT INSTALL PARKING BRAKE PAWL SUPPORT BOLT. Install three oil delivery pipes into parking brake bracket assembly, then place chamfered side of oil delivery sleeve over end of the governor and press gently on, guiding rings into the oil delivery sleeve. Install blocker piston spring, piston release spring stop and start bracket to case bolts into case. Install roller on pawl crank, raise pawl to position and install support bolt and lock plate. Tighten bolt and bend lock plate over flat of bolt. Install pawl return spring over inside oil delivery pipe and hook other end over parking brake lever pin. Install reverse clutch pipe with "L" end in rear of transmission case, then install control valve assembly over three oil delivery pipes and reverse clutch pipe and start bolts. Press valve body and bracket assembly against case and tighten the bolts evenly. Torque to 6-8 ft.lbs. With the rear pump bolts and parking bracket bolts loose, install governor to sleeve aligning tool J-4731 over governor. Turn rear pump to several positions and rotate the tool in each position to be certain no bind exists. Shift the rear pump or parking bracket slightly if necessary to relieve bind. Tighten the rear pump and parking bracket bolts to 15-18 ft. lbs. Install pressure regulator reverse oil pipe.

Adjust Front Band. Remove the pipe plug from front servo. Loosen adjusting screw of Gauge J-1693, until ⅛" of threads are exposed above gauge body. Install gauge, tightening by **hand only.** Tighten the gauge adjusting screw with fingers until the stem of the gauge is felt to **just** touch piston in front servo. (NOTE:—While tightening screw, be sure band is lined up over drum.) Tighten adjusting screw on gauge, six complete turns from the point where it was felt by hand that stem **just** touched piston. Tighten front band adjusting screw until knurled washer on top of adjusting gauge is just free to turn. Hold band adjusting screw and tighten band adjusting screw lock nut securely to 40-50 lbs. ft. torque. Loosen gauge adjusting screw at least six full turns, remove gauge, install pipe plug.

Adjust Rear Band. With rear band centered on drum, tighten band adjusting screw until actuating lever contacts face of Gauge J-5071. (***CAUTION:*** Do not go beyond adjustment. If adjusting screw is accidentally turned beyond adjustment, loosen two or three turns and repeat adjustment.) Hold band adjusting screw and tighten lock nut to 40-50 lbs. ft. torque.

Pressure Regulator and Pressure Line Plug. Place a new gasket over pressure regulator plug. With regulator valve and guide assembled into spring, locate valve on seat in front pump. Apply pressure on regulator plug and tighten in transmission case to 40-50 lbs. ft. torque. Apply sealing compound (Permatex No. 3) to threads of oil pressure line pipe plug and install plug between band adjusting screws.

Side Cover and Outer Manual Lever. Place a new gasket on side cover and retain in place with grease. Position side cover over manual shaft. Install attaching bolts with copper washers finger tight. Shift cover to centralize manual shaft in hole and tighten bolts to 10-12 lbs. ft. torque. (NOTE:—Throttle lever (outer) was removed from shaft at the time the transmission was removed from the car. Reinstall on shaft after transmission is installed in car (will prevent bending lever).

Transmission Oil Screen and Pan. Slide oil screen over front pump intake pipe and position over rear pump intake pipe. Install oil pan on transmission case, using a new gasket, and tighten attaching bolts to 10-13 lbs. ft. torque. Install new drain plug screw gasket and tighten plug to 35-45 lbs. ft. torque.

Flywheel housing, Torus Cover and Members. Position transmission case to flywheel housing gasket against face of transmission. Position flywheel housing on front of transmission and install attaching bolts and lockwashers. Tighten to 80-90 lbs. ft. torque. Apply light film of Lubriplate to seal surface on torus cover and install torus on splines of front drive gear. Push on cover evenly, without rocking, to prevent damage to oil seal rings. Install drive torus on intermediate shaft and install snap ring. Install driven torus on main shaft against open snap ring. Move manual lever into reverse position and install new main shaft lockplate with ear over flat on torus hub. Install main shaft nut and tighten to 15-20 lbs. ft. torque. Bend lockplate up against nut. Install oil level indicator.

INSTALLATION IN CAR

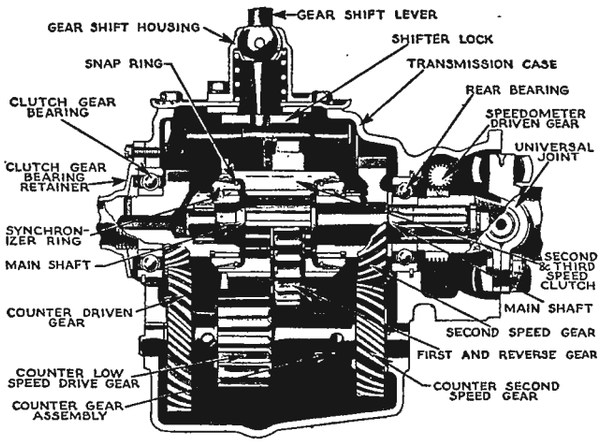
See REMOVAL & INSTALLATION data (beginning on Page 2701 in this section).

CHEVROLET 1939 THREE-SPEED

Pass. Cars & Half-Ton Models (1939)

►**1939 Trucks Low Gear Disengagement Complaints (when Replacement Cover Plate Assembly installed).** May be caused by incorrect assembly of cover plate (shifter interlock guide plate installed upside down). *See Chevrolet Special Data in Car Model Section for identification of these faulty covers.*

►**1939-40 Special Bearing Retainer:** A malleable iron Clutch Gear Bearing Retainer (front bearing) #604227 is available and can be installed on 1938-39 Passenger cars and 1938-39-40 Trucks (½, ¾, ¾ Ton Special) with three speed transmission for severe service. This retainer will prevent lubricant loss due to cracked bearing retainers.



DESCRIPTION: Constant-mesh, synchro-mesh type with helical gears (second speed), sliding spur gear (low and reverse).

Synchronizing Unit:—Bronze synchronizing cones are staked in ends of sliding clutch with synchronizing rings assembled loosely within them (held by locking rings on inner ends within clutch). Synchronizing rings have prongs which engage slots on gears (between banks of clutch teeth) and revolve with gears. When clutch shifted to engage gears, ring moves toward gear until prongs strike energizing spring (in groove in gear hub) and spring resistance then engages ring with cone to effect synchronization, cone prongs then slide over spring and enter narrow wedge slots and sliding clutch engages clutch teeth on gear.

REMOVAL OF TRANSMISSION: *See "Transmission" on car model page.*

DISASSEMBLY: Remove the gear shift lever and housing (back screws off evenly to relieve shift lever spring tension), transmission cover, interlock. Drive shifter shafts out toward front (front end of shafts .003" larger), remove shifter yokes, lock balls and springs. Remove universal joint capscrew and washer, slide joint off shaft. Remove drive gear bearing retainer screws on front of case, take off retainer. Mark main drive gear, second speed gear, and both synchronizing rings to insure reassembly in same relative positions. Use special puller, J-937, to remove clutch shaft and main drive gear bear-

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CHEVROLET 1939 3-SPEED (Cont.)

ing, take out 14 loose rollers (mainshaft front bearing). Use special tool, J-938, installed on back of transmission case and push mainshaft out toward front (IMPORTANT—front synchronizer ring must be turned so that lugs line up with slots in splines on mainshaft to avoid damage to lugs and splines), remove mainshaft from front end. Engage second speed gear and clutch sleeve, remove clutch sleeve assembly, low and reverse gear, second speed gear from case as a unit, remove second speed gear thrust washer. Expand rear bearing lock ring into case (use tool J-935), tap bearing out toward front (bearing must be removed before countershaft can be removed). Drive countershaft out toward front. To remove reverse idler, drive idler shaft lockpin into shaft (pin shorter than shaft diameter), drive out expansion plug at rear of case, remove idler shaft through this hole.

Main Drive Gear & Clutch Shaft Bearing:—Bearing retaining nut and oil-slinger are single unit with left hand thread and are staked in hole in shaft. Use special press-plate J-936 to press bearing on or off shaft. Bearing retainer mounting holes on front of case spaced irregularly to insure assembly in correct position (to align oil return holes).
NOTE—Special Malleable Iron Clutch Gear Bearing Retainer, No. 604227, available for installation on all 1938-39 Three-Speed Transmissions for severe service (will prevent lubricant loss due to cracked retainers).

Clutch Sleeve & Synchronizing Rings:—To disassemble rings, turn ring until ends of ring retainer is visible through slot in sleeve, insert special pliers J-932 in slot, expand retainer to free ring, pull ring out. See that synchronizing cones are tight in sleeve (replace clutch sleeve and cone assembly if cones loose or worn). Check rings to see that they do not rock in cones.

Energizing Springs:—Use new spring whenever spring is removed. When installing springs, do not expand more than necessary to clear clutch teeth. Install springs with offset end between fourth and fifth teeth (see Note) of any bank of the clutch teeth (offset prevents spring rotation).
IMPORTANT NOTE—Two types of synchronizer furnished which are interchangeable but must be installed differently as follows:

No. 590846—Gap is 3/32-7/32". Install in groove with offset locking end between 2nd and 3rd teeth of any one of the three banks of teeth.

No. 591288—Gap is 5/16-7/16". Install in groove with offset locking end between 4th and 5th teeth of any one of the three banks of teeth.

Counter Gear Cluster:—Bushings staked in place and diamond-bored after installation. Not sold separately. Clearance on shaft .002-.004". When installing countershaft, see that thrust washers are in place at each end of counter gear cluster and that flat on forward end of shaft is horizontal and on top (flat engages clutch housing to prevent shaft turning, transmission cannot be installed unless flat properly located).

Reverse Idler Gear:—Remove old lockpin from shaft before installing, line up holes in case and shaft, use new lockpin and drive pin in so that head is approximately 1/16" beyond surface of case, peen hole to prevent pin coming out. Pin must be tight in hole to prevent oil leaks.

1940-51 CHEVROLET 3-SPEED

Pass. Cars & Sedan Delivery (1940-51)①
Half-Ton & ¾ Ton Trucks (1940-51)
One-Ton Truck Models (1940-47)
①—*Powerglide Optl. on 1950-51 Pass. Cars.*

►CHANGES, CAUTIONS, CORRECTIONS

►**1940 Pass. Car High Gear Disengagement Complaints**—To correct complaints of transmission disengaging in High Gear position, check the following points first: Check Vacuum Cylinder Valve Setting and install No. 3655072 Valve Friction Spring on valve rod (see Chevrolet Transmission Control article for data), check run-out of transmission pilot face on clutch housing and shim between clutch housing and transmission if run-out exceeds .008". If this does not correct complaint, install following parts (furnished in Unit Package No. 605021): Main Shaft, 2nd. & 3rd. Speed Clutch & Synchronizer Assembly, Clutch Gear. New main shaft and clutch are 1941 type with 6 splines (instead of 18) and have ground lands.

►**1940-47 Truck Low Gear Disengagement Complaints (when Replacement Cover Plate assembly installed).** May be caused by incorrect assembly of cover plate (shifter interlock guide plate installed upside down). *See Chevrolet Special Data in Car Model Section for identification of these faulty covers.*

►**Serviceable Interlock Lever and Shaft**—On late 1940 (and all later models), shifter interlock lever is clamped on shaft by ¼x28x¾" bolt and can be removed so that these parts can be serviced separately (complete cover must be replaced on first type with welded shaft and lever).

►**Truck Countergear Assembly Note**—Countergear is mounted on roller bearings and this type countergear only is furnished for service on all models.

►**Truck Rear Bearing Support (1948 On):** Universal joint front yoke supported in bearing support assembly secured to rear end of transmission case by a square head pipe plug. Speedometer drive gear mounted on forward end of universal spacer (ahead of universal yoke) with a spacer installed ahead of gear (between front side of gear and rear side of mainshaft ball-bearing).

DESCRIPTION: Constant-mesh, synchro-mesh (2nd & High), sliding gear (Low & Reverse), all helical gear type. Design changed from type used on 1940 models as follows: Shifter interlock lever clamped on shaft by clamp bolt instead of being welded (parts can be serviced separately), mainshaft now has 6 splines instead of 18 and lands between splines ground for more accurate centering of 2nd. and high clutch (see 1940 Special Service Note above), shifter yokes are 'granodized', Reverse Idler Gear bushings staked in place to prevent loosening in service, and speedometer drive gear now mounted on universal joint spacer (instead of on yoke).

Passenger Car Shifter Mechanism—Have special type Shifter Mechanism mounted in side cover on transmission case (no top cover used). All service replacement gears are Carburized type (same as used in Truck transmissions).

Truck Shifter Mechanism (1940-47): Have conventional shift lever mounted on top cover. All gears are Carburized type (carburized gears furnished for passenger car transmission service also).

Truck Steering Column Gearshift (1948 On): Mechanical gearshift with shifter levers (directly engaging gears) mounted in cover on side of transmission case. Gear selection shifter gates located in housing mounted at lower end of steering column

Transmission Extension (all models)—All transmissions have extension on rear end so 4 speed transmission can be installed without difficulty on truck models. NOTE—When installing 4 speed transmission on ½ Ton Models, new brake master cylinder must be installed. Special speedometer gear adapter and new speedometer gears must be installed on all models.

REMOVAL OF TRANSMISSION: *See "Transmission" on car model page.*

DISASSEMBLY: On all Pass. Cars and trucks (1948 & later), remove screws and take off cover on side of case (see Shifter data). On earlier trucks, take out screws and remove gear shift lever and transmission cover assembly (turn screws out evenly to relieve spring pressure), remove shifter shafts and forks (see Shifter servicing data below). On all models, remove universal joint capscrew and washer, slide joint off shaft. Remove drive gear bearing retainer screws on front of case, take off retainer. Mark main drive gear, second speed gear, and both synchronizing rings to insure reassembly in same relative positions. Use special puller, J-937, to remove main drive gear and drive gear bearing, take out 14 loose rollers (mainshaft front bearing). Use special tool, J-938, installed on back of transmission case and push mainshaft out toward front (IMPORTANT—front synchronizer ring must be turned so that lugs line up with slots in splines on mainshaft to avoid damage to lugs and splines), remove mainshaft from front end. Engage second speed gear and clutch sleeve, remove clutch sleeve assembly, low and reverse gear, second speed gear thrustwasher. Remove rear bearing support assembly, remove speedometer drive gear and gear spacer from shaft. Expand rear bearing lock ring into case (use tool J-3185), tap bearing out toward front (bearing must be removed before countershaft can be removed). Drive countershaft out toward front. To remove reverse idler, drive idler shaft lockpin into shaft (pin shorter than shaft diameter), drive out expansion plug at rear of case, remove idler shaft through this hole.

REASSEMBLY: Reverse disassembly directions (above) and note following data on servicing of all sub-assemblies.

Main Drive Gear & Clutch Shaft Bearing: Bearing retaining nut and oil slinger are single unit with a left hand thread and are staked in hole in shaft. Clamp shaft in vise, remove nut with wrench J-933. Use special press-plate J-936 to press bearing on or off shaft. Bearing retainer mounting holes on front of case spaced irregularly to insure assembly in correct position (to align oil return holes).
NOTE—Special Malleable Iron Clutch Gear Bearing Retainer, No. 604932, available for installation on all 1940 and later 3-speed transmissions for severe service (will prevent lubricant loss due to cracked retainers).

Clutch Sleeve & Synchronizing Rings:—To disassemble rings, turn ring until ends of ring retainer is visible through slot in sleeve, insert special pliers

CONTINUED ON NEXT PAGE

1940-51 CHEVROLET 3-SPEED (Cont.)

J-932 in slot, expand retainer to free ring, pull ring out. See that synchronizing cones are tight in sleeve (replace clutch sleeve and cone assembly if cones loose or worn). Check rings to see that they do not rock in cones.

Energizing Springs:—Use new spring whenever spring is removed. When installing springs, do not expand more than necessary to clear clutch teeth. Install springs with offset end between third and fourth teeth of any bank of the clutch teeth (offset prevents spring rotation).

IMPORTANT NOTE—Two types of synchronizer springs—No. 590846 and No. 591288 (new type)—were furnished for all 1937-42 transmissions (new No. 591288 only now furnished). These springs interchangeable but must be installed differently as follows:

No. 590846—Gap is 3/32-7/32". Install in groove with offset locking end between 2nd and 3rd teeth of any one of the three banks of teeth.

No. 591288—Gap is 5/16-7/16". Install in groove with offset locking end between 4th and 5th teeth of any one of the three banks of teeth.

Mainshaft & Rear Bearing:—To install bearing, first install bearing lock ring in case, expand lock ring with tool J-3185, tap bearing outer race with soft steel drift until it is halfway in case, release snap ring, continue to tap bearing until lock ring engages slot in bearing race. Lubricate second speed area of mainshaft, install shaft with lugs on front synchronizer aligned with slots in mainshaft spline (to avoid damage to lugs and splines), use replacing tool J-938 to pull shaft into place. Second speed gear endplay should be .010" with shaft installed.

Rear Bearing Support (Truck 1948 On): Support and bushing furnished as an assembly to maintain the transmission alignment. Replacement of bushing requires replacement of complete Support as follows: Split universal joint, take out transmission support to frame bolts, push front end of propeller shaft up out of the way. Remove universal capscrew and take off yoke. Remove Support Pipe Plug from case and pull Support out through rear of case with hook puller. When installing Support, align pipe plug hole in support with tapped hole in case.

Speedometer Gear (Truck 1948 On): Replacement of this gear requires removal of Rear Bearing Support (as given above). With the Support off, Speedometer Drive Gear and Sleeve can be removed after removing Speedometer Driving Gear from case.

►***CAUTION—Speedometer Drive Gear Spacer installed*** ahead of speedometer drive gear on these trucks.

Counter Gear Cluster:—Bushings staked in place and clearance on shaft is .002-.004". When installing countershaft, see that thrust washers are in place at each end of counter gear cluster and that flat on forward end of shaft is horizontal and on top (flat engages clutch housing to prevent shaft turning, transmission cannot be installed unless flat properly located).

Countergear Cluster Bushing Installation—Rear bushing must not close up rear holes in countergear cluster (hole opening must be 3/32" minimum—bushing must project partly over hole to permit staking it in place). These openings necessary to permit oil circulation around shaft for lubrication. When bushings installed, stake bushings in place by expanding bushings into the front and rear holes in countergear cluster. Check rear bushing and if hole opening is not 3/32" minimum, drill 1/8" hole in bushing at each rear hole (drill at front edge of countergear cluster hole to avoid disturbing bushing stakings).

NOTE—Front holes in countergear cluster provided merely for staking bushing and will ordinarily be closed by the bushing when it is installed. These holes are not necessary for lubricant circulation.

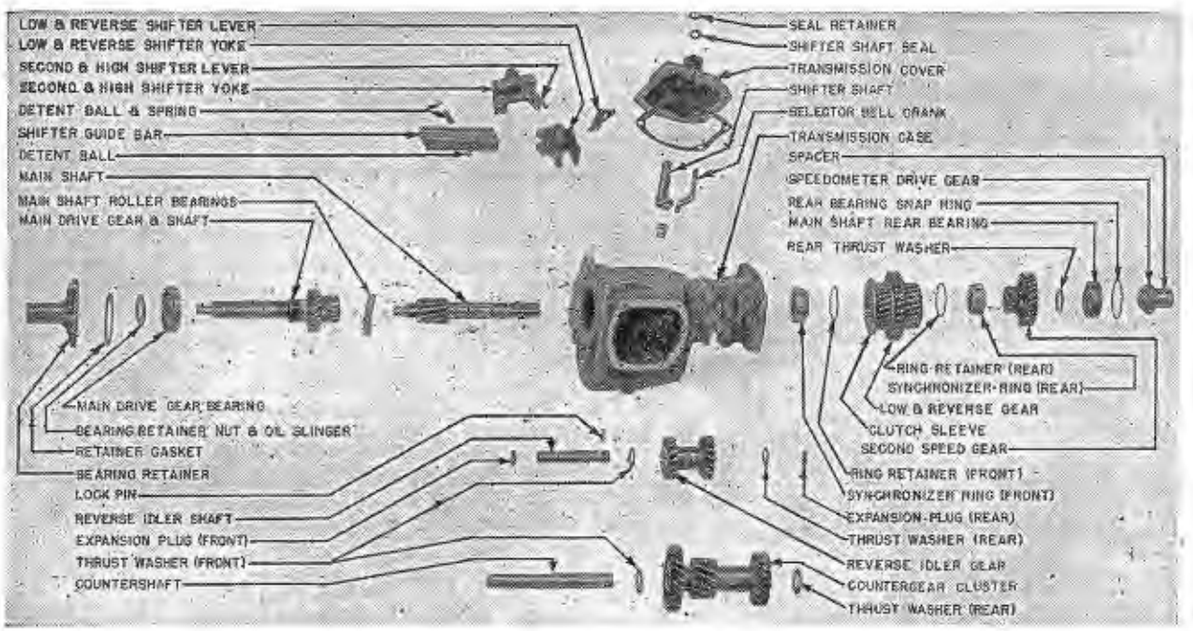
Roller Bearing Type—Used on trucks and furnished as service replacement on Passenger cars (Carburized Gear type). To install bearing rollers, install shaft in countergear cluster, coat roller recess with cup grease, install 25 rollers in each end, remove countershaft and install gear cluster in transmission case. Install forward thrust washer between gears and case (lubricate washer), feed assembly tool T-1617 in from front end (tapered end first), lubricate countershaft and install at front end and pushing assembly tool out at rear end (lubricate rear thrust washer and install in case before assembly tool reaches this point). See that flat on forward end of shaft is horizontal and flush with case (not more than 1/64" below face).

Reverse Idler Gear:—Remove old lockpin from shaft before installing, line up holes in case and shaft, use new lockpin and drive pin in so that head is approximately 1/16" beyond surface of case, peen hole to prevent pin coming out. Pin must be tight in hole to prevent oil leaks. Install new expansion plug in shaft hole in rear of case.

Shifter Mechanism (1940-48 Pass. Cars): Consists of two shifter forks on "I" beam type guide bolted on inner face of transmission side cover. Forks are operated by toggle lever in cover and one fork is locked by cross-shift lever while the other fork is being moved to engage gears (cross-shift lever has short arc between slots in gears).

Disassembly—With cover off transmission case, remove two bolts holding guide bar and shifter fork assembly on cover, remove assembly, lift shifter yoke lever, anti-rattle spring, and operating shaft out. Slide shifter forks off guide bar being careful not to lose shift lock balls and spring (in hole in guide bar under forks). Wash all parts in gasoline.

Reassembly—Install long shifter fork on guide bar with fork end toward nearest mounting screw hole, line up lock ball recess in fork with hole in guide bar, install one lock ball and spring in hole, start opposite shifter fork on guide bar, assemble other lock ball on spring, use flat tool to compress spring and slide fork into position over lock ball. Check operating shaft cork seal and retainer, replace if worn. Install operating shaft in cover, assemble anti-rattle spring and shifter yoke lever on bell crank end of operating lever, move selector (cross-shift) bell crank over center of shifter yoke lever. Press on outer end of operating shaft so that shifter yoke lever held firmly against selector lever bell crank, make certain that both shifter forks in neutral position on guide bar, then assemble guide bar and shifter fork assembly on cover with low-reverse shifter fork toward bottom (narrow side) of cover. Make certain that selector lever bell crank engages slots in shifter forks and that pins in forks engage slots in end of shifter yoke lever. Bolt guide bar to cover. CAUTION—Low-reverse sliding gear and clutch sleeve must be in neutral position when



CHEVROLET 3-SPEED TRANSMISSION

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1940-51 CHEVROLET 3-SPEED (Cont.)

shifter mechanism installed on transmission case. See Chevrolet Vacuum Power Transmission Control for gearshift lever adjustment on the car.

Shifter Mechanism (1940-47 Trucks): Shafts must be removed from front end of case (.003" larger diameter at this end) and can be driven out with a soft steel drift. Shafts are locked in place by two long cover screws which engage holes in shafts (see that holes in case and shafts line up when installed).

Shifter Mechanism (1948 & Later Trucks, 1949 & Later Pass. Cars): In transmission cover. Requires removal of cover as follows: Drain transmission, take out shift lever lock bolts, and pull lever off each shifter shaft. Remove cover from transmission. Take out shifter interlock retainer nuts and locks, remove shifter interlock retainer, then remove shifter shaft and fork assemblies, shaft seals, poppets and springs, or interlock from cover.

Cover Installation—Hump on side of First and Reverse Shifter Fork must be toward rear of transmission. Install cover (using new cover gasket) with gears and shifter forks in neutral. Install shift lever on each shifter shaft and tighten lock bolts.

Universal Joint Ball Adjustment: Should be checked each time propeller shaft disconnected (before transmission reinstalled). Remove ball housing from torque tube, clean ball with cleaning solvent, check for roughness and clean up with emery cloth, see that torque tube is clean. Install new torque ball outer retainer seal and packing. Assemble ball housing on back of transmission using four new shims for a trial fit, tighten attaching capscrews securely. Check adjustment by moving rear end of ball housing. If adjustment correct, torque tube ball should be snug fit but should move with hand pressure. If ball housing cannot be moved, add shims under ball retainer flange, if ball housing moves very freely, remove shims at this point until correct adjustment secured.

CHEVROLET TRUCK 4-SPEED (SPUR GEAR)

1½ &2 Ton Truck Models (1939-47)
Cab-Over-Engine Truck Models (1939 to 1947)

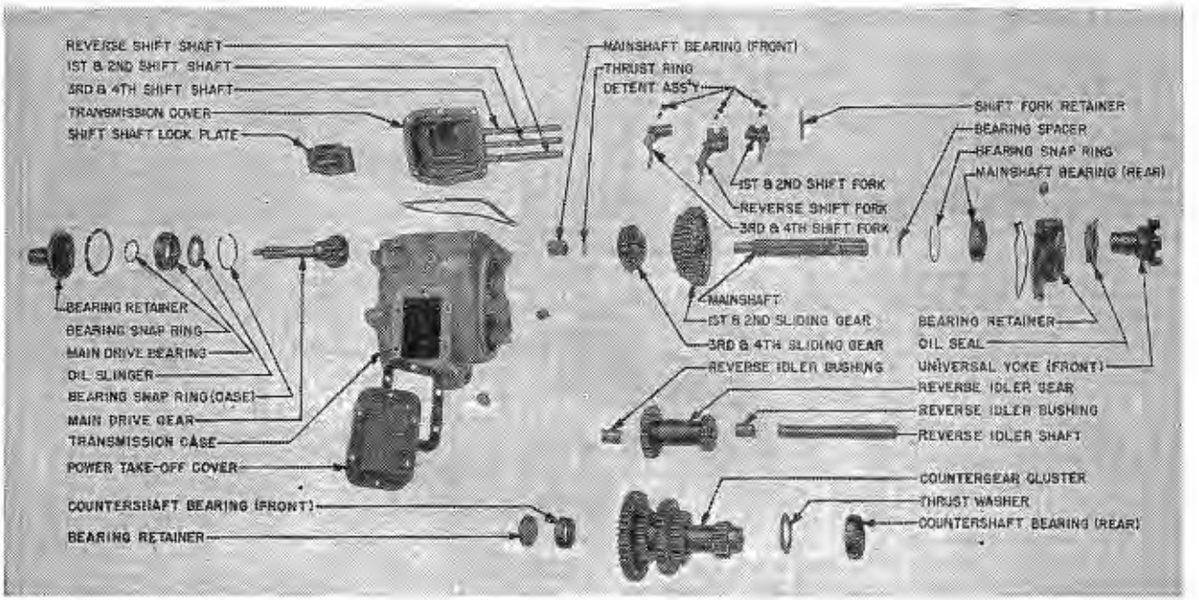
►CHANGES & CORRECTIONS

►**Optl. Equipment Note**—This transmission is Optl. on ½ & ¾ Ton trucks. Requires special speedometer gear adapter and speedometer gears (all models), new brake main cylinder (½ Ton).

►**Main Drive Gear & Bearing Retainer Change to correct lubricant leakage along drive gear shaft to Clutch.** To correct complaints of lubricant seepage along main drive gear shaft, new type main drive gear and new type bearing retainer (serviced as a unit, Part No. 3847311) are available as follows:

Main Drive Gear—Has oil return threads machined on shoulder on shaft and 3/16" oil return hole connecting oil return threads with main shaft pilot bearing cavity. A second oil hole 1/8" in diameter is drilled into the main shaft pilot bearing cavity just forward of the gear teeth. This hole causes a vacuum in the cavity which tends to draw in any lubricant caught in the oil return threads.

Bearing Retainer—Retainer for use with new main drive gear (above) does not have oil return threads on inner diameter as found on previous type retainer. NOTE—This new type retainer furnished separately under Part No. 591605.



CHEVROLET TRUCK 4-SPEED SPUR GEAR TRANSMISSION

►**1941 Truck Low and Reverse Gear Ratio Change:** Gear ratio of Low Gear changed from 7.226 to 7.06 to 1, and ratio of Reverse Gear changed from 7.148 to 6.98 to 1 in production (first type same ratio as 1940 and previous transmissions). These new gear ratios used on transmissions beginning with Transmission Serial No. 7108902 (number stamped on left side of case at rear just below cover). New gears in first transmissions (Serial No. 7108902 to 7114663) not marked but can be identified by transmission serial number and fact that low-reverse sliding gear has 42 teeth. Beginning with Serial No. 7114664, gears marked for identification as follows:

Countershaft & Low Speed Gear—Two grooves in shaft at point between low and second speed gears.

Reverse Idler Gear—Two similar grooves on shaft between gears.

Low, Second, Reverse Sliding Gear Assembly—Not marked but may be distinguished by larger low & reverse gear with 42 teeth (first type had 43). CAUTION—Both types of gears furnished for service and care must be taken to install correct type in each transmission.

DESCRIPTION: Four speed, spur gear. Clutch shaft and main drive gear mounted on ball bearing at front end of transmission case. Mainshaft mounted on roller bearing at front, ball bearing at rear. Countershaft mounted on roller bearing at each end. Reverse idler gears mounted on bronze bushing on stationary shaft.

1941-47 Type—All models have Hotchkiss Drive and open propeller shaft and transmission has new type universal joint yoke and oil seal. Disregard universal joint ball housing data and refer to new Universal Joint Yoke & Oil Seal data below when servicing these 1941-42 transmissions.

REMOVAL OF TRANSMISSION: *See "Transmission" on car model page.*

DISASSEMBLY ('36-40): Remove transmission cover shifter shaft and fork assemblies. Lock transmission by engaging two gears at once, remove speedometer pinion, remove capscrew at rear end of shaft holding universal joint yoke on shaft, pull yoke. Take out universal joint ball retainer mounting screws, remove retainer. Take out mounting screws in main drive gear bearing retainer on front of case, drive out main drive gear and bearing toward front (use soft steel drift to avoid damage to gear teeth). Remove mainshaft front bearing, drive mainshaft and rear bearing out through rear of case, slipping off sliding gears and removing these through top of case. Drive out reverse idler gear shaft toward rear, lift out gears. Drive counter gear to rear until rear bearing clears case, remove bearing and retainer, remove counter gear assembly. Remove front bearing and plug type retainer from case by tapping on outer race.

DISASSEMBLY (1941-47): Remove gearshift lever using K-353 remover tool, engaging tool lugs in gearshift lever retainer slot and turning tool counter-clockwise to disengage retainer, lift lever out (see Cab-Over-Engine Note below). Remove transmission cover assembly. Lock transmission mainshaft by engaging two gears at once, remove speedometer driven gear, remove universal joint retaining screw on rear end of mainshaft, pull universal joint on ½ & ¾ Ton Models (on 1½ Ton model, take out bearing retainer screws and remove universal joint yoke and bearing retainer as an assembly—necessary because speedometer pinion installed on front end of yoke will not permit yoke to be pulled out through oil seal). Remove screws in main drive gear bearing retainer on front end of case, remove retainer, tap drive gear and bearing out through front of case (use soft steel drift to avoid damage to gear teeth). Remove mainshaft

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CHEVROLET TRUCK 4-SPEED SPUR GEAR (Cont.)

pilot bearing from front end of shaft, drive mainshaft and bearing out through rear end of case slipping the sliding gears off the shaft and removing these gears through top of case. Drive reverse gear idler shaft out through rear of case, remove idler gear. Drive counter gear assembly to rear until rear bearing and retainer clear rear of case, remove bearing and retainer, remove countergear through top of case. Drive out front bearing and retainer by tapping around bearing outer race.
NOTE—See Cab-over-Engine Gearshift Removal in Chevrolet Shop Notes in Car Model Section.

REASSEMBLY: Reverse disassembly directions and note following data on sub-assemblies:

Main Drive Gear & Mainshaft Bearings:—Bearings are press fit on shafts and should be removed and installed in an arbor press (remove snap ring from gear hub in front of bearing before pressing bearing off drive gear). When reassembling transmission, see that snap rings are in place in each end of case to retain bearings.

Countergear Assembly:—Low speed gear is integral with shaft, other gears are keyed on shaft with spacers to position each gear. If gears removed from shaft, assemble gears and spacers in this order: Second Speed Gear (chamfered side toward low speed gear), ¼" Spacer, Third Speed Gear (chamfered side away from second speed gear), ⅞" Spacer, Reverse Gear (chamfered side toward third speed gear—chamfered sides of these two gears face each other), 5/32" Spacer, Counter Drive Gear. The round keys should be used to keep keyways lined up while pressing gears on shaft. After gears installed, drive keys down 1/32" below flush with gear, prick-punch keys and remove all burrs.

Countergear Endplay—When installing countergear, check clearance between rear thrust washer and shoulder on gear. Endplay should be .015-.045". If clearance greater than .045", install shims between front bearing and retainer.

Reverse Idler Gear & Bushings:—Use special tool J-1662 to remove old bushings and install new bushings in idler gear. Ream new bushings with KMO-349 Reamer to provide minimum shaft clearance of .002" (bushing size .877-.878").

Shifter Mechanism:—To disassemble, remove two screws and remove shifter shaft lock plate. Turn shifter shafts ½ turn to lift lock balls out of notches in shaft, push shafts out of cover and shifter forks being careful not to lose lock balls and springs in shifter forks. When reassembling cover, install shafts in this order: Reverse Speed, Low Speed, High Speed Shaft. Install lock ball and spring in fork, use special tool to force ball down on spring, turn tool ½ turn to hold ball in place while shaft is being installed.

Rear Oil Seal (1½ Ton):—To remove universal joint yoke from rear bearing retainer, remove oil seal by pressing on front surface inside bearing retainer, press speedometer drive gear off hub of yoke, slip oil seal off. Soak new oil seal in engine oil, install seal in same manner using care to line up bolt holes in seal bolting flange with holes in retainer. Install speedometer drive gear with chamfered face of gear toward front end of yoke.

CHEVROLET TRUCK 4-SPEED HELICAL GEAR (SYNCHRO-MESH)

1, 1½, 2 Ton Truck Models (1948-51)

►CHANGES, CAUTIONS, CORRECTIONS

INSTALLATION ON ½ & ¾ TON TRUCKS: When this transmission installed on these models (Optl. Equipment), regular Rear Bearing Retainer (No. 591701) must be replaced by No. 591679 Rear Bearing Retainer.

►**GEAR DISENGAGEMENT (1ST, 2ND, REVERSE) & HIGH GEAR NOISE (15-40 MPH):** May be caused by excessive clearance between splines of First & Reverse Sliding Gear and mainshaft. Check clearance when this trouble experienced, or when new parts installed, as follows: Disassemble transmission, re-install universal joint yoke on rear end of mainshaft and tighten attaching bolt. Clamp yoke in vise with shaft vertical. Slide gear on shaft splines, shifting gear on shaft to obtain best possible fit, position gear in approximate first-speed position on shaft (CAUTION—see that energizing lugs are not touching mainshaft), place a supporting block of wood under one side of gear. Mount dial indicator so that it contacts upper edge of gear at shifter yoke groove on opposite (unsupported) side of gear. Hold supported side of gear tightly against block, lift gear at point under dial indicator so that total play or rocking motion of gear indicated. This play or movement must not exceed .017". If gear fit satisfactory, mark matching splines on gear and shaft to insure installation in this position. *See also Mainshaft & Sliding Gear Production Change below.*

►**MAINSHAFT & SLIDING GEAR PRODUCTION CHANGE:** Beginning Transmission No. SM-73563, new type mainshaft and sliding gear used with "skip-tooth" splines (alternate teeth on gear shorter and bear on wide splines on shaft) to provide closer fit. **Parts must be installed as a unit as follows:**
Mainshaft ..... No. 3692608
First-&-Reverse Sliding Gear ..... No. 3692598

►**SHIFTER HEAD & YOKE PRODUCTION CHANGE:** Beginning Transmission No. RC-53869, mating tongues and grooves in Reverse Shifter Head and First-&-Second Shifter Yoke were removed and new type parts used as follows:
Reverse Shifter Head ..... No. 591905
First-&-Second Shifter Yoke ..... No. 591906
INTERCHANGEABILITY OF PARTS—New type yoke can be used in earlier transmissions with first type shifter head. If new type shifter head installed, **new type yoke must also be used.**

►**LOCKING IN 3RD OR 4TH GEAR (Transmission before Serial No. SC-103207):** Caused by overshift condition permitting clutch keys to cock and ride up on bronze synchronizer cone. Correct by installing new design 3rd. & 4th. Speed Clutch Hub and Clutch Keys as listed below. On these parts, key slots in hub are machined at outer edges to provide shoulders to retain keys and prevent endwise cocking. Keys used with this hub do not have hump at sides and new square section retainer spring is also used. **Install all new type parts as an assembly as follows:**
Clutch Hub ..... No. 591912
Clutch Key (3 used) ..... No. 591913
Clutch Key Retainer Spring (2 used) ..... No. 591914
NOTE—Started in prod. with Trans. No. SC-103207.

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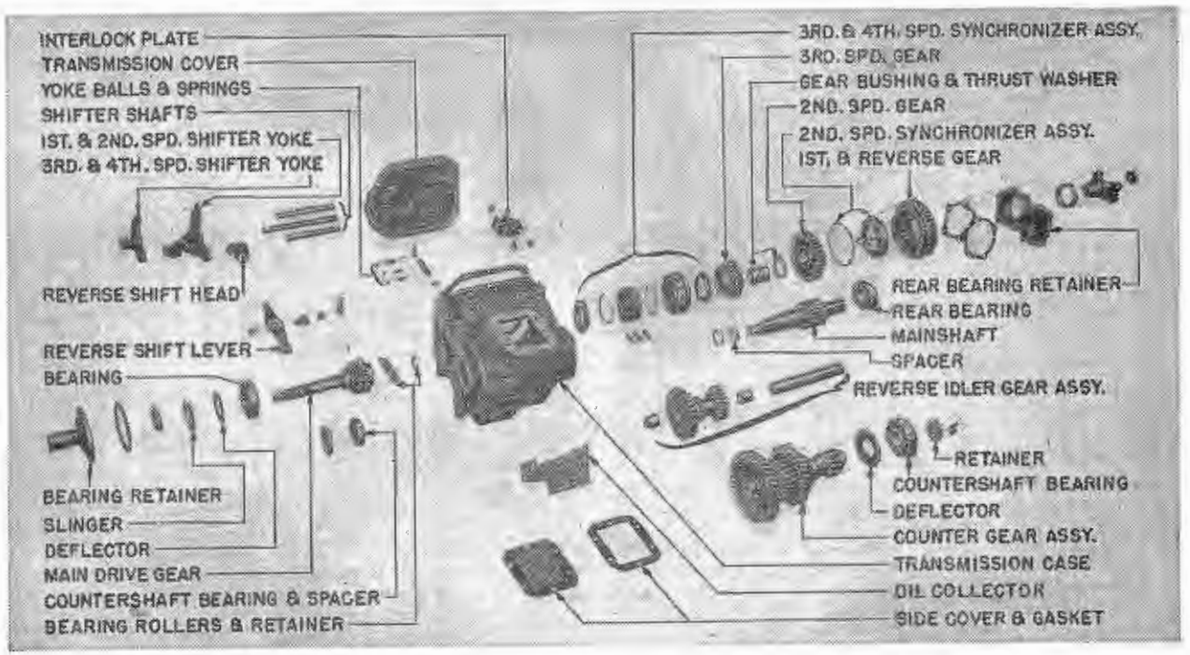


CHEVROLET TRUCK 4-SPEED SYNCHRO-MESH TRANSMISSION

CHEVROLET TRUCK 4-SPEED HELICAL GEAR (Cont.)

DESCRIPTION: Four speed type with helical constant-mesh, synchro-mesh gears (2nd, 3rd, 4th), sliding spur gears (1st & Reverse). Sliding 1st speed gear serves as the clutch member for engaging the 2nd speed gear. Mainshaft is mounted on pilot roller bearing (front), ball bearing (rear). Countergear cluster shaft mounted on roller bearing (front), ball bearing (rear).

Synchronizer (2nd Speed)—Consists of a loose synchronizer ring retained in 1st speed gear synchronizer cone by a locking ring. Synchronizer ring has two lugs which engage slots in 2nd speed gear. Lugs have wedge angles on end which engage energizing springs on web of 2nd speed gear and provide friction between synchronizer ring and cone to synchronize gears when engaging the 2nd speed gear.

Synchronizer (3rd & 4th Speed)—Conventional "wire bound strut blocking type" synchronizer. Consists of inner and outer clutch sleeves with loose synchronizer ring at each end. Rings are actuated by three struts or keys in slots in clutch hub (struts held in engagement with detent in clutch hub by two wire springs). Keys engage slots in rings and provide friction between ring and cone in gear hub when clutch sleeve shifted to engage 3rd or 4th speed gear.

REMOVAL OF TRANSMISSION: *See "Transmission" on car model page.*

TRANSMISSION DISASSEMBLY: Remove transmission cover assembly (with complete gearshift mechanism) by lifting straight up off case. Take out Reverse Shifter Lever (remove nut, screw bolt out of case, remove lever, bolt spacer, and large flat washer). Remove clutch gear bearing retainer on front end of case, remove clutch gear using J-2669 Remover (CAUTION—index cutout section of clutch gear with countershaft driven gear for clearance). Remove synchronizer ring and roller bearing spacer from end of mainshaft. Remove speedometer pinion from rear bearing retainer. Lock mainshaft by shifting into two gears at once, remove universal flange retaining screw, lockwasher, plain washer, and flange. Take out retaining screws and remove rear bearing retainer. Install J-2667 Remover on rear end of mainshaft and pull shaft to the rear until rear bearing is free of case, use J-1619 Remover to remove bearing from shaft, then remove shaft and gear assembly through top of case (tilt forward end of shaft up, move 1st speed gear as far forward on shaft as possible). Drive reverse gear shaft locking pin through into the shaft (use small punch), then drive shaft out toward rear of case, lift reverse idler gear out of case. To remove countershaft, drive punch through front bearing spacer and pry spacer out. Use brass drift on forward end of countershaft and drive shaft to rear until rear bearing is free of case. Take out rear bearing retainer screws, lift off lock plate and retainer, use TR-278-R (Differential Side Bearing Puller) to remove bearing and oil deflector from shaft. Raise front end of countershaft and remove assembly through top of case. Remove chip collector from bottom of case. Disassemble all sub-assemblies as follows:

Main Drive Gear (Clutch Gear) & Shaft: Lift out mainshaft pilot bearing rollers and roller retainer from recess in shaft. Mount shaft in vise, use special spanner wrench J-2670 to remove retaining nut, remove oil slinger and oil deflector. To remove bearing, use J-2228 press plate mounted in holder to press gear and shaft out of bearing. Install bearing with J-1453 press plate. CAUTION—Make certain oil deflector centered around retainer nut and stake nut after it has been securely tightened.

Mainshaft Assembly: To disassemble, remove retainer ring from pilot end of mainshaft, support assembly on 1st speed sliding gear in arbor press, press shaft out of gear cluster. Remove synchronizer key springs from synchronizer hub, remove outer sleeve from hub (CAUTION—do not lose the 3 keys). Remove synchronizer ring from 3rd speed gear, lift off gear, 2nd speed gear thrust washer, and 2nd speed gear. Remove synchronizing ring retainer from 1st speed gear, remove synchronizing ring. Wash all parts in cleaning solvent and inspect as follows before reassembling:

Synchronizer—Outer sleeve should slide freely on hub but hub should be snug fit on shaft splines. Synchronizer rings and cones must not be scored, excessively worn, or damaged.

3rd Speed Gear—Gear should be running fit on bushing and bushing must be press fit on shaft. Thrust surfaces must not be scored or worn excessively.

2nd Speed Gear & Thrustwasher—Washer and gear must not be scored or worn excessively on thrust surfaces. Replace synchronizer springs if broken or loose (use special rivets). Replace gear if bushing worn excessively. Inspect synchronizing ring for wear and scoring.

1st Speed Gear—Gear must be sliding fit on mainshaft splines. Synchronizer cone in gear must not be scored or worn excessively.

Countershaft Assembly: Gears can be removed from shaft by removing lockring on forward end and pressing shaft out in an arbor press. Install gears on shaft as follows: 2nd Speed Gear (radius end toward rear or low speed gear end), 3rd Speed Gear (may be installed either way), Revere Gear (chamfered end of teeth forward or toward driven gear), Spacer, Driven Gear. Use new Countershaft Drive Pins when installing gears, after all gears in place, drive pins 1/32" past flush with shoulder on driven gear hub. Select lock ring of correct thickness and install on shaft to retain gears.

Countershaft Front Bearing—Press fit in case. To remove bearing for replacement, drive old bearing through into case using J-994 Differential Side Bearing Replacer. Drive new bearing in using same tool until it is flush with inner face of case.

Reverse Idler Gears: Replace bushings if worn. Remove old bushings with tool J-1614 (Pitman Shaft Bushing Remover). Press new bushings in (using same tool) until flush with ends of gear. Stake bushings in place with tool J-2680. (CAUTION—bushings are split type and may creep in service if not properly staked). Line ream bushings using J-2668 Reamer.

TRANSMISSION REASSEMBLY: Assemble in reverse order of disassembly directions given above and note the following points:

Mainshaft Assembly: Install 1st speed gear on shaft with 2nd speed synchronizer forward (synchronizer ring must be held in gear hub by retainer ring), install 2nd speed gear with synchronizer springs toward synchronizer ring and prongs aligned with slots in gear hub, install thrust washer. Press 3rd speed gear bushing on shaft until it bottoms on thrustwasher. Check 2nd speed gear endplay which must be .012" plus or minus .003". Install synchronizer assembly (see data below), pressing clutch hub on shaft until it bottoms against shoulder on shaft. Check 3rd speed gear endplay which must be .012" plus or minus .002". Select lockring of correct thickness and install on forward end of shaft to retain assemblies. NOTE—This lockring furnished in four thicknesses and marked for identification as follows: .083",.087"—Red, .091"—Blue, .095"—Yellow.

Synchronizer Assembly—Install outer sleeve on hub with taper on sleeve toward long shoulder on hub, slip three synchronizer keys in slots, install spring on each side of hub to hold keys out against sleeve (CAUTION—Both springs must be installed in same relative position so that even tension applied on keys). When installing assembly on mainshaft, long shoulder on hub should be out toward pilot end of shaft and synchronizer keys must index with slots in synchronizer rings.

Reverse Idler Shaft & Lockpin: Drive shaft in from rear, aligning lockpin hole in shaft with hole in case. Install lockpin to retain shaft.

Main Drive Gear Bearing Retainer: When installing gear, align cutout portion of clutch gear teeth for clearance with countershaft driven gear. Use new gasket under bearing retainer, use Permatex or other sealing compound on retainer screw threads and tighten these screws to 15-18 ft.lbs.

Mainshaft Rear Bearing Retainer: Use new gasket. Coat retainer screw threads with Permatex or other sealing compound, tighten these screws to 20-25 ft.lbs.

Reverse Shifter Lever: Lever bolt has sleeve which acts as shoulder for lever to pivot on and must be installed as follows: Place reverse shifter lever in position, thread bolt with sleeve and flat washer through lever and into case from inside. Tighten bolt to 25-30 ft.lbs. in case, then install bolt nut and tighten nut to 60-65 ft.lbs.

GEARSHIFT LEVER & COVER ASSY.: Gearshift lever assembly and transmission cover can be removed without removing transmission from chassis as follows:

Gearshift Lever Removal: See Cab-Over-Engine Note below. On all models, slide open side of K-353 Gearshift Lever Remover & Replacer over the lever and engage lugs on tool in open slot of retainer. Press down on tool and rotate it to left to disengage lugs on retainer, lift lever out of cover. Install lever by reversing this procedure.

Cab-Over-Engine Truck Note—For access to lever, disconnect gearshift lever from top of engine cover, lower cloth boot wire and raise boot above transmission tower, remove nut from stub gearshift lever, raise gearshift lever link assembly from top of lever. Then remove gearshift lever assembly using tool K-353 (above).

Transmission Cover Removal (Except C-O-E): Remove accelerator pedal, floor mat, and cover from body floor. On forward control models, remove front floor pan. Remove gearshift lever (see above). Take out capscrews and remove transmission cover.

CHEVROLET POWERGLIDE

Deluxe Pass. Car Models (1950-51)

►CHANGES, CAUTIONS, CORRECTIONS

►**STARTING ENGINE BY PUSHING CAR:** Pushing recommended rather than towing car. Place selector lever in Neutral "N" position. When car reaches speed of approximately 15 MPH., move lever to "L" position to crank engine, then move lever to "N" position to warm up engine.

Wet or Icy Road Caution—Push car until speed of 20 MPH. reached, then place lever in "D" position to crank engine (do not use "L" position).

►**TRANSMISSION LOCKING OR SLIPPING OUT OF PARK "P" POSITION:** Correct as follows:

Locking in "P" Position—May be caused by slight depression at top of cam ramp on parking pawl which makes disengagement of cam roller difficult. Correct by disassembling transmission and replacing parking pawl. See Disassembly data.

Slipping out of "P" Position—May be caused by weak apply spring on parking lock lever shaft which allows detent pin to ride out of detent in parking lock pawl. Correct by disassembling transmission and replacing Parking Lock Lever Shaft & Apply Spring Assembly. See Disassembly data.

►**UNIVERSAL JOINT & PROPELLER SHAFT BUSHING LUBRICATION CAUTION ON POWERGLIDE CARS:** These parts lubricated from transmission output shaft through drilled passage in special universal joint retaining bolt No. 3690869 (bolt drilled completely through and has special flat head nail in hole to keep oil passage open). If universal or bushing lubrication trouble experienced, make certain that drilled bolt used and that nail is free in oil passage (1/32-1/16" clearance between head of nail and head of bolt).

CAUTION—Plain bolt used for transmission run-in at factory must be replaced by this special drilled bolt when transmission installed in car.

►**TRANSMISSION CASE PIPE PLUG CHANGE (To eliminate leakage and for easy removal in the field):** All square-head and slotted-head plugs in transmission case have been replaced by special hex-head **dry seal** plug No. 444613 (same type as used for fuel tank drain plug).

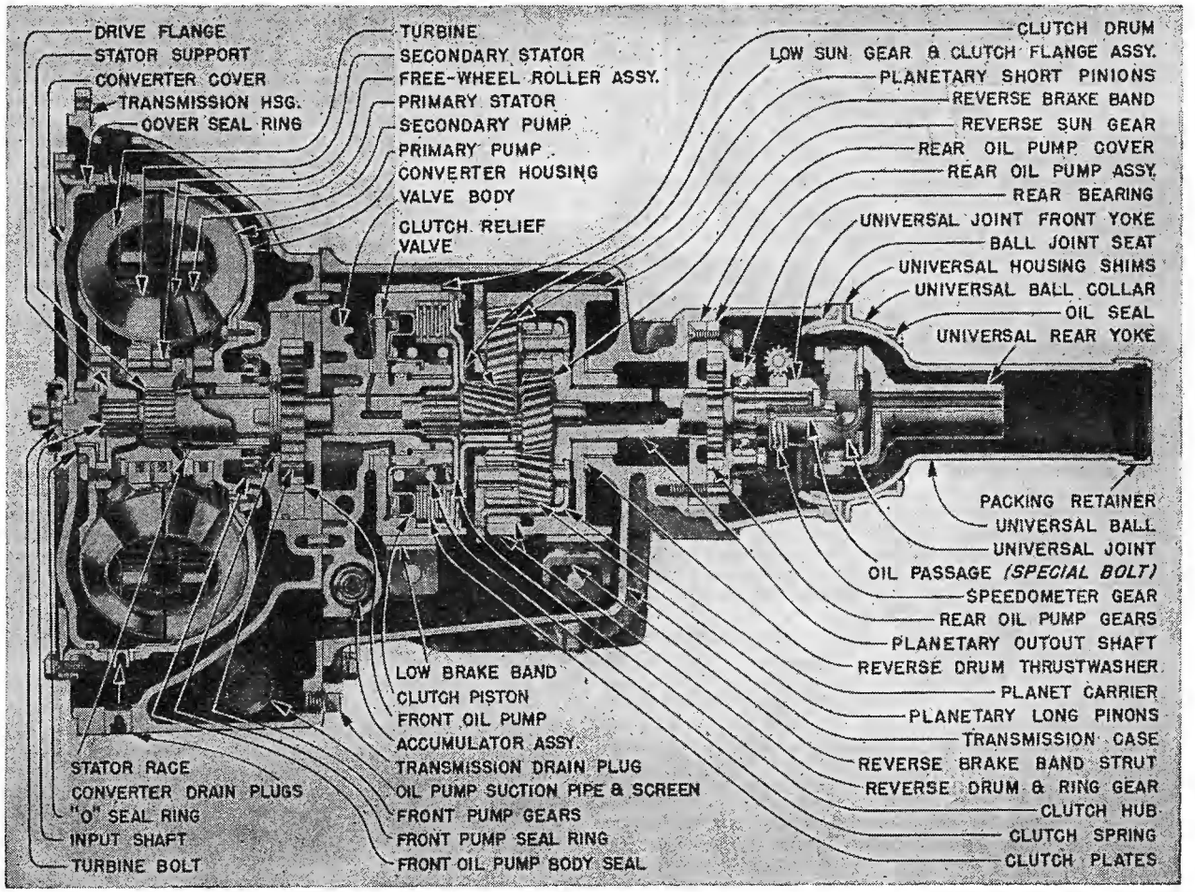
►**CONVERTER OIL LEAK (INTO TRANSMISSION HOUSING) CORRECTION:** Correct by replacing primary pump "O" ring seal. See Turbine Disassembly for data.

CAUTION—Primary pump and pump hub balanced as an assembly and must be marked first and reassembled to these marks to maintain balance.

►**POWERGLIDE OIL COOLER CAUTION:** Whenever broken parts or other foreign material found in transmission oil, or if transmission temperatures excessive, check oil cooler and lines for clogged passages. Replace cooler if circulation restricted.

►**PUMP CHECK VALVE CHANGE:** New valve assembly with changed contour of tab ends which cover pump inlet ports now used to insure proper installation of valve in body. This valve interchangeable with first type.

CAUTION—When installing check valve, see that tab end of valve does not extend beyond face of valve body (turn valve over and re-install, or grind edge of tab off slightly to prevent interference with valve body gasket).



POWERGLIDE TRANSMISSION ASSEMBLY

►**REPLACEMENT LOW SERVO PISTON CAUTION:** Stamped metal piston, Part No. 3689820, furnished for replacement differs from regular cast iron production piston (cast iron piston has thicker head and requires larger piston return spring) and **special Piston Return Spring, Part No. 3689840, must be used with this stamped metal replacement piston.** Springs can be identified as follows:

Cast iron piston Return Spring——I.D. 59/64" and length of 5 coils.

Stamped metal piston Return Spring—I.D. 11/16" and length of 6 2/3 coils.

CAUTION—Piston return spring must be replaced with correct type when replacement piston installed to replace cast iron piston.

►**CLUTCH ASSY. PRODUCTION CHANGE (Beginning Trans. No. JT-232315-D-23-D):** Redesigned clutch with cast iron piston used in transmissions after this number to prevent possibility of partial clutch engagement due to centrifugal force under certain conditions. This clutch has relief valve located in piston (instead of cylinder) and **individual parts are not interchangeable with first type clutch parts.**

►**REPLACEMENT LOW & REVERSE BAND CAUTION:** New 1951 type Low & Reverse Band (heavier construction at slots on anchor end) furnished for replacement use on 1950-51 transmissions and **new 1951 Low & Reverse Band Link and Low & Reverse Band Strut must be installed when new Low & Reverse band installed in 1950 transmissions.**

	1950 Prod. Part	①1950 Repl. Part
Band Assembly	3689821	3694493
Band Strut	3689827	3694491
Band Link	3689814	3694492

①—Same part as used in 1951 production.

CAUTION—All three parts above must be installed as a unit in 1950 transmissions.

►**TRANSMISSION GASKET CAUTION:** Gasket Kit 3695236 should be stored flat in warm dry place to insure gaskets fitting properly when installed. This is important for Servo Cover Gasket No. 3692966 and Valve Body Gasket No. 3693098 (cut from dry stock).

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CHEVROLET POWERGLIDE (Cont.)

DESCRIPTION

Powerglide transmission is an automatic type and consists of a Torque Converter and a Planetary gear unit providing automatic operation in the Drive range, and additional Low, Reverse, Neutral, and Parking positions controlled by the operator.

Torque Converter: This assembly mounted in a housing which replaces the flywheel used on cars with conventional transmission and consists of the units listed below. Torque converter operation is entirely automatic and unit operates as a torque converter (for starting and low speed operation) or as a fluid coupling (at higher car speeds). The change from one type of operation to the other, and also the operational phases of each unit as described below, are governed entirely by the car operating conditions and do not occur at any set car speed.

Primary Pump (Driving Member): Mounted directly on engine crankshaft (bolted within turbine cover) and rotates at engine speed to transmit engine power to the turbine through the oil.

Turbine (Driven Member): In converter housing directly ahead of primary pump and driven by oil flow from the pump. Turbine hub is splined on input shaft through which power is transmitted into the planetary gear unit (for Low and Reverse operation), or directly through to the propeller shaft (for Drive Range operation).

Primary & Secondary Stators: Two similar units consisting of sets of curved vanes located between inner ends of turbine and secondary pump vanes. Each stator is mounted on a free-wheeling unit on a stationary stator support. Stators are locked or held stationary when unit is operating as a torque converter and act to redirect the oil flow from the turbine to the secondary pump thus supplying the torque multiplication. When the turbine speed becomes equal to the pump speed, stators rotate freely with the other members (rotation permitted by free-wheel units) without torque multiplication and the converter operates as a simple fluid coupling.

Secondary Pump: Consists of a set of curved vanes mounted on a free-wheel unit on the primary pump hub just ahead of the inner end of the primary pump vanes (between pump and primary stator). Secondary pump overruns the primary pump when unit operating as a torque converter but is locked to the primary pump and operates with it to provide greater capacity when operating as fluid coupling.

Planetary Transmission: Consists of a double planetary gear set, controlling bands, servo mechanisms, and disc clutch located in transmission case.

Planetary Sun Gears: Two separate gears, Front (Low) Sun Gear and Rear (Reverse) Sun Gear are mounted in tandem within the planetary unit. Front sun gear is part of the clutch flange assembly (locked to input shaft when clutch engaged) and meshes with the short planetary pinions. Rear sun gear is splined on rear end of input shaft (acts as driving gear for Low & Reverse) and meshes with the long planetary pinions.

Planetary Pinions: Assembly consists of three short (Reverse) pinions and three long (Low) pinions mounted alternately in the Planet Carrier and all meshing together. The short Reverse Pinions mesh with the front Low Sun Gear and with the Reverse Ring Gear (internal gear controlled by the reverse brake band). The long Low Range Pinions mesh with the rear Reverse Sun Gear.

Multiple Disc Clutch & Low Range Drum: This assembly mounted on input shaft ahead of planetary pinion assembly. Clutch hub (inner member) is splined on input shaft and rotates with the shaft. Clutch drum (outer member) is locked to the front Low Sun Gear. Clutch is engaged by a hydraulic piston within the clutch drum and locks the Low Sun Gear to the input shaft. Clutch is disengaged by a spring and allows the sun gear to revolve freely (except when sun gear held stationary by application of the Low Brake Band). A relief valve is located in front face of clutch drum (first type), clutch piston (later type), to insure complete drainage of oil from clutch cylinder when clutch is disengaged.

Low Range Brake Band & Servo Mechanism: Band holds front sun gear stationary when it is applied on the clutch drum by the Low Servo which consists of a hydraulic piston linked to one end of the band by a strut. The opposite end of the band is held stationary by a strut and anchor which has an adjusting screw for band adjustment.

Reverse Brake Band & Servo Mechanism: Band holds the Reverse Ring Gear stationary when it is applied on the reverse drum (integral with the gear) by the Reverse Servo which consists of a hydraulic piston linked to the band by a lever-and-link mechanism. One end of the band is held stationary by a strut and anchor which has an adjusting screw for band adjustment.

Oil Pumps: Two pumps used to supply oil pressure for hydraulic controls, oil supply for torque converter and transmission lubrication.

Front Pump—Internal-external gear type mounted between the transmission and torque converter and driven directly by the converter primary pump through a tongue-and-slot coupling. This pump has relatively large capacity and begins to operate as soon as the engine started, supplying oil to the torque converter and for transmission lubrication. It also supplies oil pressure for hydraulic control for idling, low speed, and reverse.

Rear Pump—Internal-external gear type mounted in rear end of transmission case and driven by the output shaft. Pump operates whenever rear wheels are turning and supplies oil pressure for transmission operation when pushing car to start engine. At car speeds above 15 MPH., rear pump normally supplies all oil pressure for transmission operation and front pump idles (pressure regulator valve bypasses front pump output by connecting output line to pump suction line).

Hydraulic Controls: Consist of manual and automatic Control Valves, Accumulator, and Vacuum & Hydraulic Modulator.

Manual Valve—Linked to transmission selector lever on steering column and controls oil pressure supply to servo mechanisms, multiple disc clutch, and modulator as required for operation in each range (Park, N, D, L, R depending on selector lever position).

Pressure Regulator Valve—Spring-loaded type with extended stem contacting modulator lever. Valve has following functions: 1) Controls maximum pressure of both oil pumps (and allows front pump to by-pass when rear oil pump takes over), 2) Controls oil pressure requirements for transmission operation (modulator acting on this valve "boosts" oil pressure as required for Low & Reverse Band application), 3) Supplies oil to Converter and prevents oil draining out of converter case when engine not running.

Vacuum & Hydraulic Modulator—Vacuum modulator consists of a spring-loaded, diaphragm type vacuum unit mounted on the transmission case with the vacuum chamber connected to the engine intake manifold. Diaphragm is connected to a lever bearing on the pressure regulator valve stem so that diaphragm movement tends to modify the action of the regulator valve springs in accordance with load requirements which affect engine vacuum.

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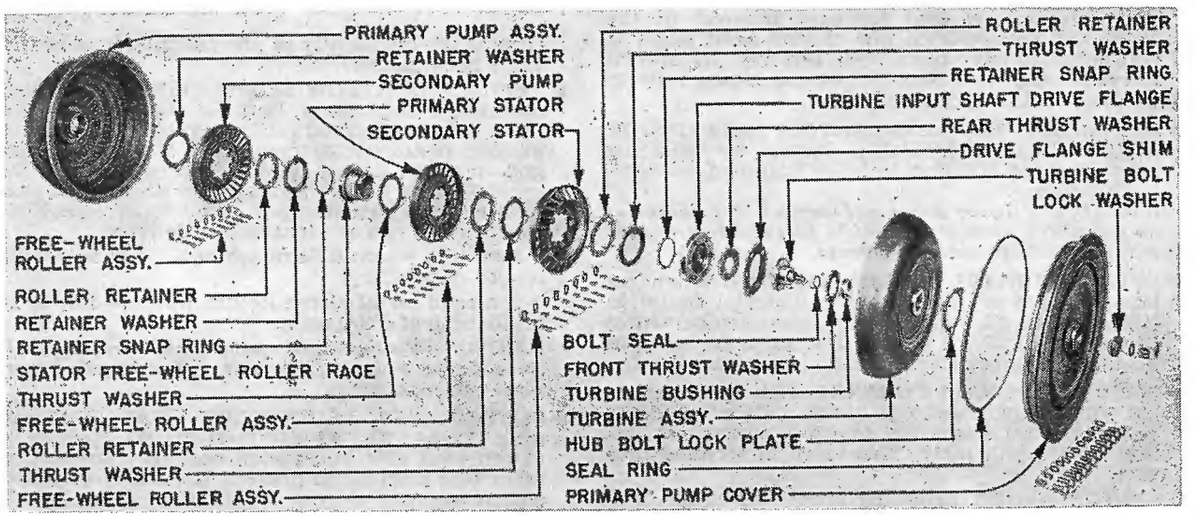


TORQUE CONVERTER

CHEVROLET POWERGLIDE (Cont.)

With light loads and high vacuum, no pressure is exerted on the valve stem and valve is controlled entirely by the valve springs. With increase in load and decrease in manifold vacuum, modulator lever exerts pressure on the valve stem and assists the valve springs which has the effect of increasing hydraulic pressures within the transmission. Hydraulic modulator is built-in the vacuum modulator diaphragm plunger (hydraulic plunger and body assembly). Oil pressure expands this plunger and body assembly and increases modulator pressure when selector lever placed in Low or Reverse position (manual valve directs oil pressure to hydraulic modulator).

Accumulator—Consists of a surge chamber in the hydraulic line between the manual valve and the hydraulic modulator. Accumulator cushions the band application when shifting into Low or Reverse.

Pump Check Valve—This valve controls oil delivery from each pump and prevents oil from the operating pump bleeding back through the pump that is not operating (cuts off rear pump at low speed and when operating in reverse).

By-Pass & Lubrication Check Valve—By-pass valve controls oil flow from converter to oil cooler. With oil temperature below 240°F., by-pass valve remains open so that oil goes directly to transmission lubrication system (through lubrication check valve) without passing through oil cooler. When oil temperature reaches 240°F., by-pass valve closes and oil flows through oil cooler and then returns to the lubrication check valve for use in the transmission lubrication system.

Parking Mechanism: Consists of a pawl controlled by the transmission selector lever which engages gear teeth cut on edge of planet carrier and locks the planet carrier to the transmission case when selector lever placed in Park position.

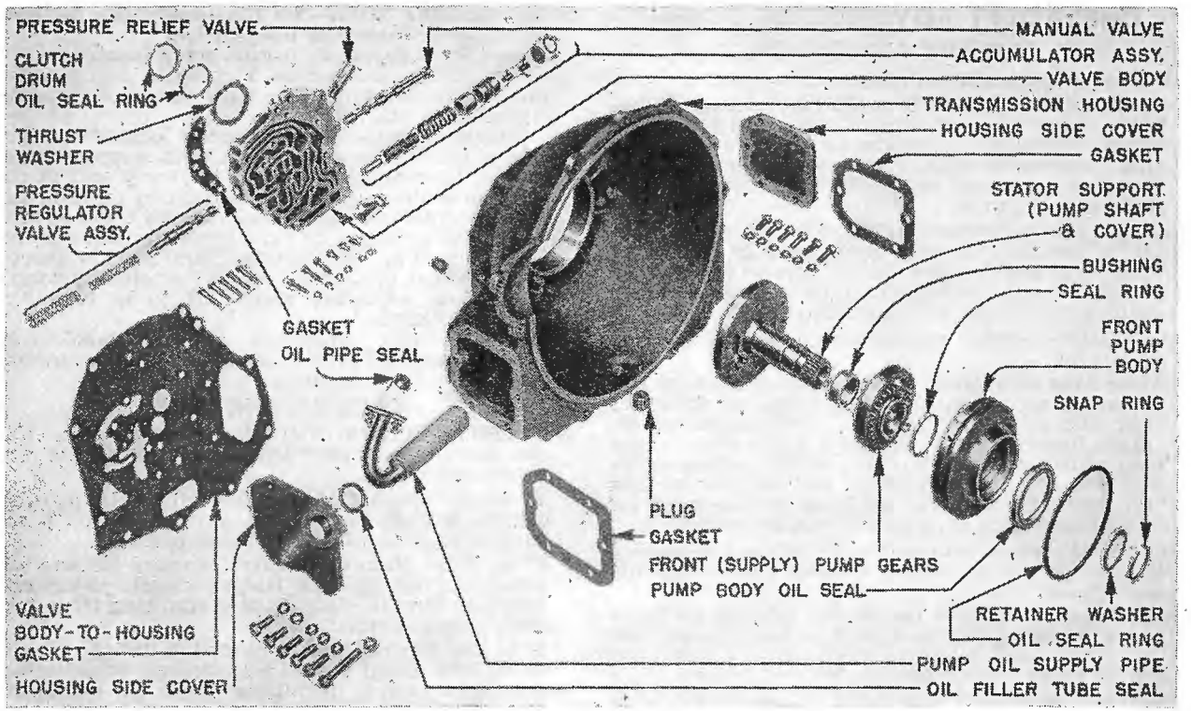
OPERATION

Powerglide Torque Converter automatically provides a torque multiplication ranging from 2.2-1 (maximum for starting and acceleration) to 1-1 (normal driving range with torque converter acting as a fluid coupling). This torque multiplication is supplemented by the planetary gears when selector lever placed in Low or Reverse range (gears provide 1.82-1 reduction). Transmission operation in each range is as follows:

Neutral "N" Position—Multiple disc clutch, Low Brake Band, and Reverse Brake Band are all released so that gears are free to spin. Drive is not transmitted through transmission and this "N" position can be used to start and warm up engine with car standing still.

Low Range "L" Position—Multiple Disc Clutch is released and Low Brake Band is applied so that the front sun gear is held stationary. Power is transmitted through the reverse sun gear to the planetary pinions which "walk" around the stationary sun gear. This results in a 1.82-1 gear reduction between the input and output shafts.

Drive Range "D" Position—Multiple Disc Clutch is engaged and both brake bands are released. In this position both of the sun gears are locked to the input shaft so that the entire planetary gear system is locked and revolves as a unit. Power is then transmitted straight through from input shaft to output shaft with no gear reduction.



TURBINE HOUSING, FRONT OIL PUMP, & VALVE BODY ASSEMBLY

Reverse Range "R" Position—Multiple Disc Clutch and Low Brake band are released, Reverse Brake Band is applied. Power is transmitted through the Reverse Sun Gear to the planetary pinions which "walk" around the stationary Reverse Ring Gear. This results in reverse rotation and a 1.82-1 gear reduction between the input and output shafts.

Parking "Park" Position—Parking pawl engages gear teeth cut on edge of planet carrier and locks carrier to transmission case. Planet carrier is integral with output shaft so that shaft and rear wheels are held stationary.

CAUTION—Park position of selector lever should never be engaged when car is in motion.

LUBRICATION

The transmission oil level should be checked at 1000 mile intervals and oil should be changed at 25000 mile intervals (supersedes original period of 15000 miles).

Recommended Oil—Use only Automatic Transmission Oil Type "A" (in sealed containers with "AQ-ATF" number).

Capacity—Approximately 9 qts.

Checking Oil Level—Check only with transmission warm and engine idling with selector lever in "N" position (NOTE—this procedure supersedes original recommendation that selector lever be placed in "D" drive position). Check with dipstick located on right side in engine compartment. Add fluid only when level falls to "ADD ONE QUART" mark on dipstick, fill only to "FULL" mark on stick.

►***CAUTION—High fluid level (above FULL mark) will cause foaming and loss of fluid.***

►**Low Oil Level**—May be caused by external leaks or leak at universal joint seal allowing fluid to leak back into rear axle (can be checked by noting if rear axle lubricant level too high). Correct by replacing universal joint seal.

Draining & Refilling—Warm up transmission. Drain transmission by removing drain plug in rear face of transmission housing under case. On first cars with converter lubrication check valve, fold back floor mat, remove toe pan plate, turn engine over until one converter drain plug is at top, remove this plug (later cars have only one drain plug). Then drain converter by taking out plug on bottom of housing, turning converter until drain plug visible through hole, and removing drain plug. Clean dirt away from filler tube housing cover on right side of transmission, remove this side cover, remove oil suction screen and seal and clean thoroughly in cleaning solvent. Replace screen and side cover using **new pipe seal and gasket.** Replace all drain plugs. Install 3 qts. new fluid through filler tube (Oil Filler Tube and Funnel J-4264 will facilitate filling, since this assembly vented and transmission case is not). Start engine and allow it to idle with selector lever in N (Neutral), add additional 6 qts. fluid. Allow engine to idle for several moments. Check oil level (see above), make certain that oil level is up to "FULL" mark on dipstick.

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CHEVROLET POWERGLIDE (Cont.)

LINKAGE ADJUSTMENT

LINKAGE ADJUSTMENT: Adjust as follows:

Control Lever Clearance: 3/32-1/8" clearance between lower edge of control lever and top upper support cover. To adjust, remove screws attaching upper support to mast jacket, screw support up or down, as necessary, until clearance correct, re-install support screws.

Control Lever Position: 1 1/2" ± 5/16" between upper face of control lever knob and lower face of steering wheel with selector lever in "R" reverse position. To adjust, loosen lower support clamp bolts, move lower support up or down, tighten clamp bolts.

►*CAUTION—Dowel in support must be located in slot in mast jacket.*

Reverse Stop Clearance: 3/64" clearance between Reverse Stop on control shaft lower support and lower lever with selector lever in "R" reverse position. To adjust, loosen control rod swivel, make certain that manual control valve lever on left side of transmission is in top detent position, and selector lever in "R" position, move selector lever as necessary for correct clearance, then tighten control rod swivel.

►*CAUTION—Short connector rod (bellcrank-to-parking lock lever) must be correctly installed with arrow pointing UP.*

Neutral Safety Switch: Located on bracket on lower end of lower support assembly on steering column. To adjust, loosen two switch assembly mounting screws. Place selector lever in neutral, make certain that switch clip is over flats on end of shifter shaft. Insert locating pin through holes in switch mounting bracket and locating plate. Tighten switch mounting screws, remove locating pin.

BAND ADJUSTMENT

BAND ADJUSTMENT: Not ordinarily required in service. Use adjusting tool J-4277 (combination screwdriver and locknut wrench) to adjust bands.

►*REASSEMBLY NOTE—See Reassembly data for band setting when assembling transmission.*

Low Servo Band—Adjusting screw located on **left** side of transmission case. Tighten adjusting screw until band is tight, then **back screw off 3 turns,** tighten locknut.

Reverse Band—Adjusting screw located on **right** side of case **under servo cover.** With servo cover removed, turn adjusting screw in slowly and **at the same time** check endplay in linkage by pushing and pulling on servo return spring directly below adjusting screw. Continue to turn screw in until endplay is just taken up (at this point band must be free on drum so that drum can be easily rotated by hand), then **back adjusting screw off ⅛-¼ turn** and tighten locknut.

►*CAUTION—Above procedure supersedes previous instructions and will provide sensitive adjustment without possibility of false settings.*

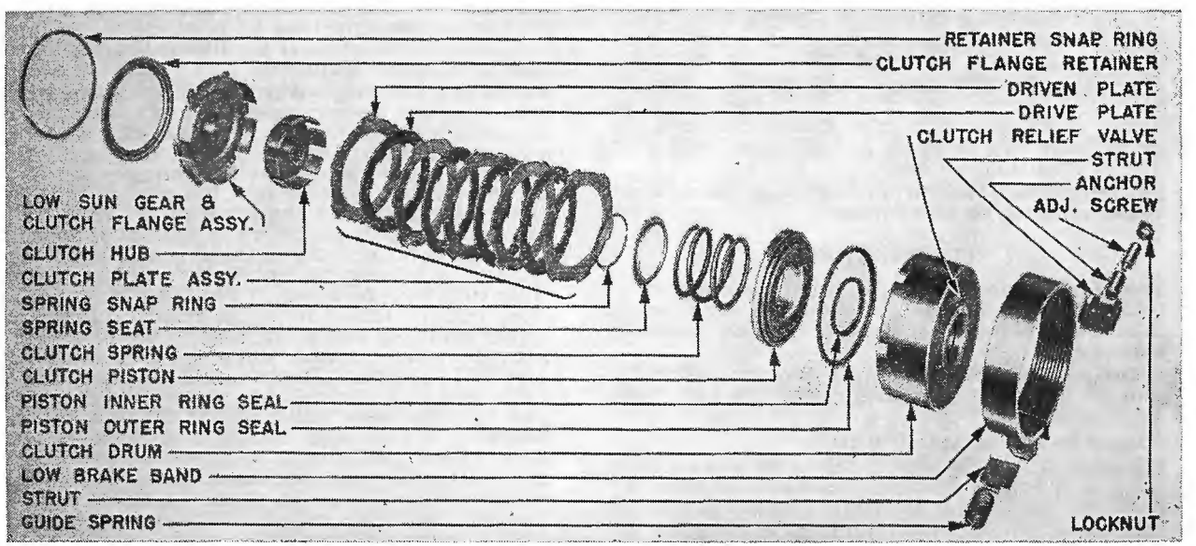
TROUBLE SHOOTING

EXCESSIVE SLIPPAGE (High engine speed in relation to car speed, poor acceleration, or engine runs away on turns).

1) In all Speed Ranges—Low oil level. Incorrect control linkage adjustment. Air leak in oil pump suction pipe. Low front oil pump pressure.

2) In Drive Range—Incorrect control linkage adjustment. Damaged or leaking clutch piston seal (worn or burned clutch plates resulting from partially engaged clutch).

3) In Low Range—Incorrect control linkage adjustment. Low Band out of adjustment. Sticking accumulator valve, modulator lever, or modulator valve. Damaged or worn Low Servo Piston Ring resulting in poor band application or excessive oil leakage into clutch apply circuit causing partial clutch application and possibly burned clutch plates (check by connecting pressure gauges to Low Servo Apply and to High Clutch test points—there should be no pressure indicated at High Clutch point with selector lever in "L").



MULTIPLE DISC CLUTCH & LOW BAND ASSEMBLY

CAR CREEPS (Forward or Backward).

1) With Control Lever in Neutral—Incorrect control linkage adjustment. Clutch piston vent valve stuck closed. Clutch plates sticking or incorrectly assembled (not "stacked" in correct order).

2) Creeps forward with Control Lever in Reverse or backward with Lever in Low—Incorrect control linkage adjustment.

CAR WILL NOT MOVE (Rear Wheels may be locked or free).

1) With Control Lever in any range (rear wheels free). If this occurs at other times than after reversing car, see causes listed under EXCESSIVE SLIPPAGE above. If this occurs only after reversing car (indicating loss of front pump pressure) check: Rear pump air leakage into front pump suction line (causing front pump to lose its prime). Rear pump gasket leakage. Front pump clearance excessive.

2) With Control Lever in any range (rear wheels locked). Parking pawl lock engaged. Broken parts in transmission. Parking brake applied.

3) With Control Lever in Drive Range (rear wheels free). If engine runs away and transmission is hot, check for: Low radiator water level, clogged oil cooler, sticking thermostatic valve, or dragging Low Range Band (causing over-expansion of clutch parts due to excessive heat).

SHIFTS ARE ROUGH.

1) Low-to-Drive Shift (car in motion). Incorrect Low Band adjustment. Clutch plates worn or binding. Modulator control lever or piston sticking (will cause excessive pressures). Accumulator dump valve orifice plugged.

If engine speeds up during this shift—Check for incorrect low band adjustment and worn or binding clutch plates.

2) Drive-to-Low Shift. Incorrect Low Band adjustment. Accumulator piston stuck closed. Modulator control lever or piston stuck (will cause excessive pressure).

3) Neutral-to-Reverse. Incorrect reverse band adjustment. Accumulator piston stuck closed. Modulator control lever or piston stuck (will cause excessive pressure).

CHATTERS WHEN STARTING.

1) In Low Range. Incorrect Low Band adjustment. Worn or rough band, scored drum. Clutch not disengaging properly due to distorted or binding plates, sticking clutch piston, sticking piston vent valve, or damaged or worn Low Servo Piston Ring allowing oil leakage into clutch apply circuit and causing partial clutch application (see tests for Excessive Slippage in Low Range above).

2) In Drive Range. Incorrect Low Band or Reverse Band adjustment. Bands worn or rough, drums scored.

3) In Reverse Range. Incorrect Reverse Band adjustment. Worn or rough band, scored drum. Reverse ring gear and drum bushing worn or damaged.

REVERSE OPERATION JERKY OR DRAGGING.

1) Clutch plates are incorrectly assembled (not "stacked" properly) or sticking. Clutch piston vent valve stuck closed.

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CHEVROLET POWERGLIDE (Cont.)

REVERSE CAN NOT BE ENGAGED WITH ENGINE RUNNING: If reverse can only be engaged when engine not running, check for accumulator snap ring being out of place (allowing accumulator valve and body to be forced against clamp nut on parking lock lever shaft and apply spring assembly, blocking shift into reverse). *NOTE*—Above condition will not prevent shift into Low Range).

DRIVE-TO-LOW OR LOW-TO-DRIVE SHIFT DIFFICULT: May be caused by improperly drilled high clutch feed orifice in valve body resulting in slow clutch application in Drive Range and slow clutch release when shifting from Drive to Low (restricted orifice will cause slow oil flow). Check by connecting pressure gauges to Low Servo Apply and to High Clutch (low servo release side) and noting pressures as follows:

1) Move selector from Neutral to Drive with engine idling. If pressure builds up much more rapidly on Low Servo Apply gauge than on High Clutch gauge, a restriction in the passage (undersized orifice) is indicated.

2) Move selector from Drive to Low. If pressure in High Clutch gauge drops slowly, oil drainage from clutch is restricted. NOTE—This will result in slow Low Band application and clutch drag (may cause burned clutch plates).

HIGH CLUTCH PLATES BURNED OR CLUTCH FAIL

►***CAUTION—When High Clutch failure noted, following tests should be made before transmission removed, and transmission should also be carefully examined after removal and disassembly.***

1) Connect pressure gauges to Low Servo Apply, High Clutch (low servo release side), and to Reverse Servo points. Operate engine to supply oil pressure.

2) Place selector lever in Drive position and note pressure build-up in High Clutch gauge. Slow build-up indicates restriction in high clutch apply orifice resulting in clutch slippage and burned plates.

3) Place selector lever in Low position. High Clutch gauge should not show any pressure. Pressure at this point indicates leakage past Low Servo Piston Ring resulting in partial clutch application and burned clutch plates.

4) Place selector lever in Reverse position. High Clutch gauge should not show any pressure. Pressure at this point indicates leakage between the converter "out" and low servo "release" channels in valve body or damaged Housing-to-Valve Body gasket. This condition will cause partial clutch application and burned clutch plates.

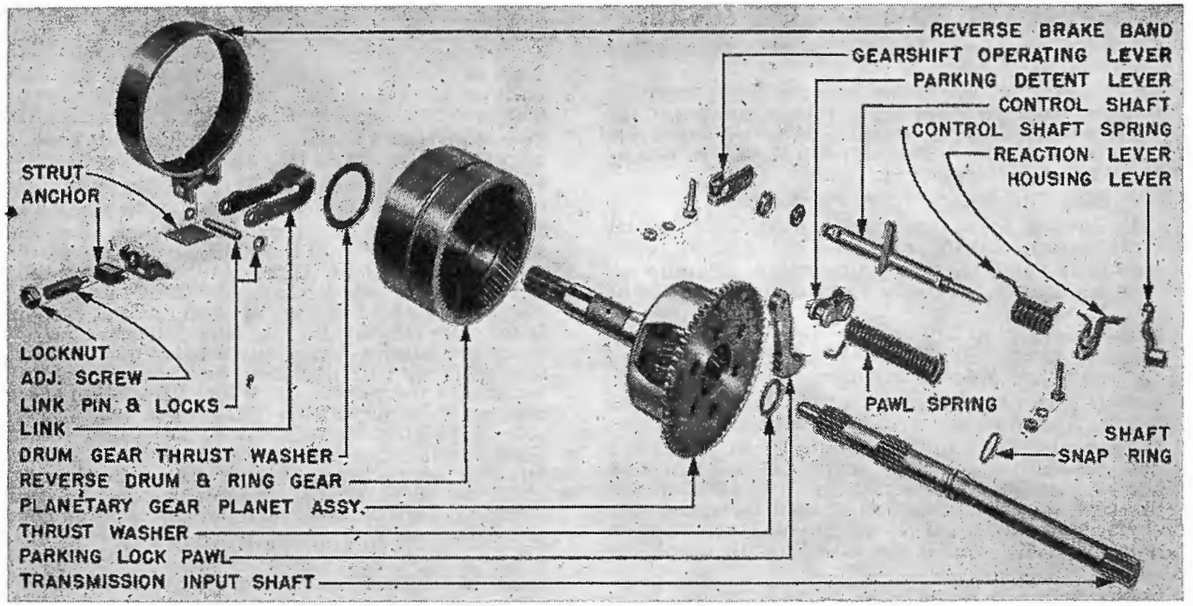
NOISE IN TRANSMISSION.

1) Buzzing Noise (All Ranges). Low oil level. Pump gear interference with crescent in pump. Pump check valve not seating.

2) Ringing Noise in Converter. Low oil level. Air leak in pump suction line (pipe not seated properly) resulting in low oil level in converter. Pressure regulator valve stuck (closing converter inlet port). Leakage in oil line between front pump and regulator valve.

3) Clicking Noise. Incorrect manual linkage adjustment (causing interference between parking lock pawl and gear).

4) Whining Noise. Transmission gear teeth worn. Pump gear clearance excessive or pump gear bushings worn.



PLANET CARRIER ASSEMBLY, REVERSE BAND & PARKING LOCK MECHANISM

FUEL CONSUMPTION EXCESSIVE.

1) Transmission Causes. Converter stator or secondary pump free-wheeling cams and roller incorrectly assembled. Converter secondary pump locked to primary pump hub. Clutch piston vent valve stuck open.

TRANSMISSION OIL BEING FORCED OUT OF FILLER PIPE: Caused by aeration and foaming of the oil due to one or more of the following:

NOTE—This condition may also cause Loss of Power and Lower Stall Speed (due to converter turbulence and lower pressures in control circuits).

1) Oil level too high allowing planet carrier to revolve in oil and aerate it. Correct by lowering oil level to correct point (see LUBRICATION) and driving car for 5 miles to work out air bubbles.

2) Oil suction pipe split, seal damaged, bore for suction pipe in housing too deep, or suction pipe retainer ears bent (preventing proper compression of the seal) resulting in air leaks in oil suction line.

3) Sand hole in suction bore of transmission case or housing or in suction cavity in valve body resulting in air leaks in oil suction line.

TESTING

►***TESTING CAUTION***—Transmission oil level must be checked and corrected (see LUBRICATION) and ***transmission must be warmed up before tests made.***

Warming Up Transmission: Transmission must be warmed up by road driving or in the shop exactly as follows before checking for oil leaks or trouble.

Road Warm Up—Drive car for approximately 5 **miles with frequent starts and stops to approximate heavy-traffic conditions.**

Shop Warm-Up—Set hand brake tight to hold car, place selector lever in "D" range, start engine and run for 15 minutes at 750 RPM. At end of 15 minutes, transmission will be warmed up sufficiently for testing regardless of initial temperature.

►***CAUTION—Recheck oil level after warm-up and before making following tests.***

►***NOTE—Above supersedes original procedures for shop warm-up of transmission.***

Stall Test: Connect tachometer to engine, apply brakes to lock rear wheels. Test as follows:

►***CAUTION—Do not test longer than 10 seconds in each range and allow at least 2 minutes between tests to prevent overheating of converter oil.***

Place selector lever in each range in turn as noted below. Depress accelerator and run engine speed up until maximum speed reached in each range. Maximum stall speed should be between 1560 RPM. and 1610 RPM. and should be almost identical in each range. If engine speed not within this range, following trouble is indicated:

Engine Speed Low (During Stall Test)—If several hundred RPM., less than minimum stall speed, secondary pump may be frozen on its hub or stators may not be "locking up" for converter operation.

Engine Speed varies or exceeds maximum (During Stall Test)—May be caused by insufficient oil pressure (see test below) or slippage in following units:

Slippage in "D" Range—Multiple disc clutch.
Slippage in "L" Range—Low Band.
Slippage in "R" Range—Reverse Band.

Pressure Tests: Support rear end of car on jack stands so that rear wheels will be free to turn during tests. Connect pressure gauges at the following points and make the tests listed below (special test gauge assembly of four gauges on a mounting plate recom-

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CHEVROLET POWERGLIDE (Cont.)

mended to allow complete testing without changing gauge connections):

1) Low Servo Apply (at plug on lower front of servo cover on right side of transmission. ***CAUTION—do not confuse this plug with Modulator Lever Pivot Pin Retaining Plug which is slightly to rear of this Low Servo Apply Plug.***

2) High Clutch (Low Servo release side).

3) Reverse Servo (at reverse servo apply outlet plug on bottom of transmission case at right rear).

4) Rear Pump (at rear pump outlet plug on rear of transmission case to right of universal joint ball housing).

Drive Range Tests—Check and adjust engine idling speed to 430-450 RPM. Place selector lever in Drive "D" range and proceed as follows:

1) Note pressure with engine idling (see Gauge Note below). This pressure should be 40-45 lbs.

2) Increase speed to approximately 30 MPH. and note pressure. Then load engine several times by applying brakes while maintaining 30 MPH. speed. Pressure should rise each time load increased (see Gauge Note below). If no rise noted, check vacuum lines for leaks and if no leaks found, check for defective Vacuum Modulator.

►**Gauge Note**—In above tests, check pressures indicated on both Low Servo Apply gauge and High Clutch (low servo release side). Pressures shown on both gauges should be approximately the same with selector lever in "D" position.

4) Apply brakes and accelerate engine to normal stall speed (1560-1610 RPM.). Check pressure which should be 75-100 lbs. If pressure within these limits, but engine speed exceeds 1610 RPM., high clutch slippage is indicated. If pressure below 75 lbs. with engine at full throttle and brakes locked, check for: Oil Suction Screen plugged, Oil Suction Line leaking air, Pressure Regulator Valve stuck, Clutch Piston Seals or Clutch Drum Oil Seal Rings leaking, Valve Body-to-Case Gasket leaking or leaks between valve body and housing, Front Pump clearances excessive.

Low Range Tests—Place selector lever in Low "L" range and proceed as follows:

1) Note pressure on Low Servo Apply gauge with engine idling. This pressure should be 125-150 lbs.

2) Apply brakes and accelerate engine to normal stall speed (1560-1610 RPM.). Pressure reading should be 160-200 lbs. If pressure within these limits but engine speed exceeds 1610 RPM., adjust Low Band (see Band Adjustment) and recheck pressure. If pressure is below 160 lbs., check Hydraulic Modulator (see below). If pressure is below 125 lbs. and is the same at both the Low Servo Apply and the Modulator test points, check for: Oil Suction Screen plugged, Low Servo Ring damaged or broken, Pressure Regulator Valve stuck, Valve Body-to-Case Gasket leaking or leakage between valve body and housing, Servo Cover leaking, Front Pump clearances excessive, Modulator Control Lever or Piston stuck, leakage between modulator and servo cover.

Hydraulic Modulator Testing—Connect pressure gauge at modulator test point (plug at top of modulator housing). Repeat low range idling test (1 above). If pressure is zero or very low, check for defective accumulator. If pressure is below 125 lbs. but the same as shown on Low Servo Apply gauge, see 2 (above) for possible troubles.

Reverse Range Test—Place selector lever in Reverse "R" position and proceed as follows:

1) Note pressure on Reverse Servo gauge with engine idling. This pressure should be 125-150 lbs.

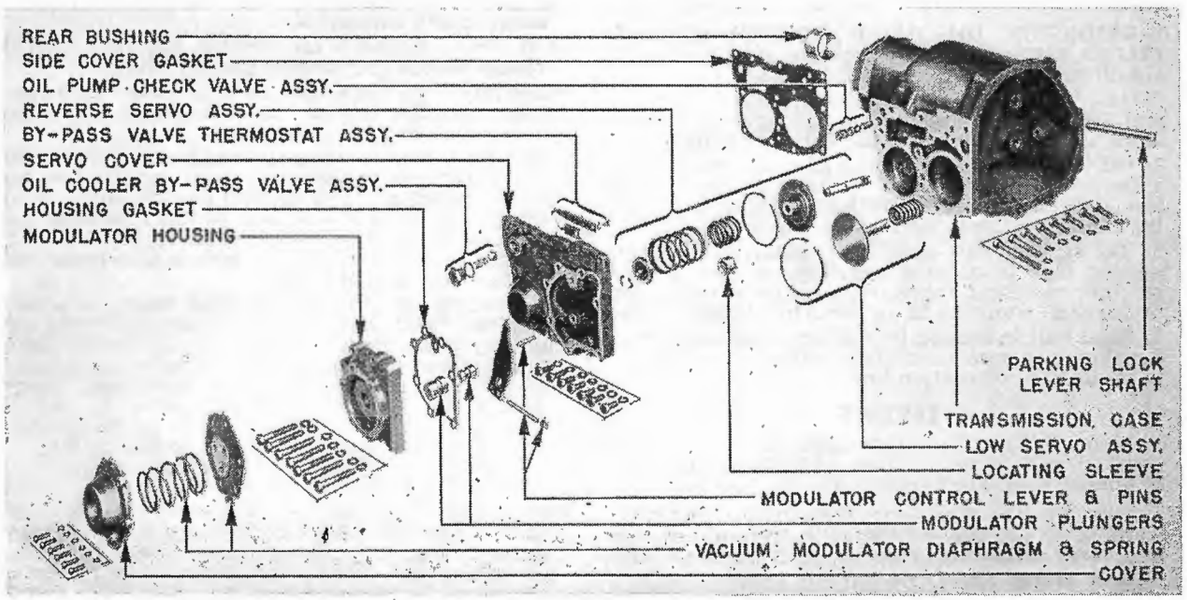
2) Apply brakes and accelerate engine to normal stall speed (1560-1610 RPM.). Pressure reading should be 160-200 lbs. If pressure within these limits but engine speed exceeds 1610 RPM., adjust Reverse Band (requires removal of transmission—see Band Adjustment). If pressure is below 160 lbs., check for: Oil Suction Screen plugged, Reverse Servo Piston Ring damaged or broken, Pressure Regulator Valve stuck, Valve Body-to-Case Gasket leaking or leakage between valve body and housing, Front Pump clearances excessive, Modulator Control Lever or Piston stuck, leakage between modulator and servo cover.

Rear Pump Tests—Place selector lever in Drive "D" range and release parking brake so that rear wheels are free to turn. Then proceed as follows:

1) Accelerate engine to 30 MPH. speed (as registered on speedometer), note pressure on Rear Pump gauge. This pressure should be 50-75 lbs.

2) Move selector lever to Low "L" range and again check pressure at 30 MPH. speed. This pressure should be 140-180 lbs.

3) If pressures low in (1) and (2), check for: Leaks at Servo Cover, Valve Body-to-Case Gasket, or between valve body and housing. Check for excessive rear pump clearances.



TRANSMISSION CASE, SERVO COVER, & MODULATOR ASSEMBLY

REMOVAL FROM CAR

Transmission & Torque Converter are removed as an assembly:

1) Raise car and support securely on jack stands. Remove floor mat and transmission cover plate, remove toe pan plate.

2) Take out three top turbine housing attaching bolts (through toe pan hole).

3) Disconnect speedometer cable at transmission and hand brake rod from cross-shaft. Drop cross-shaft, brake cables, and spring.

4) Free universal joint collar by taking out cap screws on back of transmission case, slide ball and collar back on shaft. Support propeller shaft with jack, take out front universal trunnion bearing cap screws, split universal, lower front end of propeller shaft.

5) Take out two upper right transmission-to-converter housing bolts, install lift sling (J-4262) and attach cable of J-4279 hoist positioned in front compartment. Attach lift chain (part of hoist assembly) to two top universal joint collar screws at rear of transmission.

6) Drain transmission and turbine (see Draining instructions). Disconnect transmission oil cooler lines and vacuum line.

7) Take out two lower turbine housing attaching bolts. Remove flywheel cover and flywheel underpan extension.

8) Remove all spark plugs. Disconnect exhaust pipe at manifold, disconnect muffler support. Tie exhaust pipe and muffler to left frame side member out of the way.

9) Disconnect both short and long shift rods at transmission levers, tie long shift rod up out of the way. Remove bell crank lever and stud from transmission case.

10) Remove all six flywheel-to-converter bolts working through housing opening on left side (use tool

CONTINUED ON NEXT PAGE

CHEVROLET POWERGLIDE (Cont.)

J-4281 to turn engine crankshaft and align each bolt with housing opening for access).

11) Clean all dirt from around filler tube and dipstick fitting on transmission side cover, remove housing bolt holding filler tube, remove filler tube and dip stick.

►***CAUTION—Cover the filler tube opening with masking tape or plug with rubber stopper to keep out dirt.***

12) Support engine with jack under oil pan. Remove transmission-to-rear support bolts, remove the transmission support.

13) Take out all remaining turbine housing bolts (lift or lower engine, as necessary, for access to bolts).

14) Move transmission straight back to clear flywheel pilot from flywheel.

►***CAUTION—Use extreme care not to damage flywheel pilot.***

15) Lower transmission slightly, lift rear end as far as possible and secure by hooking lift chain in notch on back of hoist. Use pry bar between transmission and right side of floor opening to clear servo cover bolts. Repeat this process (lowering front end of transmission and lifting rear end) until lubrication by-pass valve plug clears floor opening.

16) Lower transmission and remove from beneath car.

►***CAUTION—Transmission must not be allowed to strike against flywheel.***

DISASSEMBLY—TRANSMISSION

►**DISASSEMBLY & REASSEMBLY CAUTION:** ***CLEANLINESS IS EXTREMELY IMPORTANT when opening up transmission. Thoroughly CLEAN exterior of case first, CLEAN each part as removed with cleaning solvent or gasoline and dry with air—do not use wiping cloths which will leave lint on parts. Store all parts in clean storage bins.***

DISASSEMBLY OF TRANSMISSION (Into Major Units): With transmission on bench (fixture J-3361 recommended for holding transmission), remove all units from transmission case as follows:

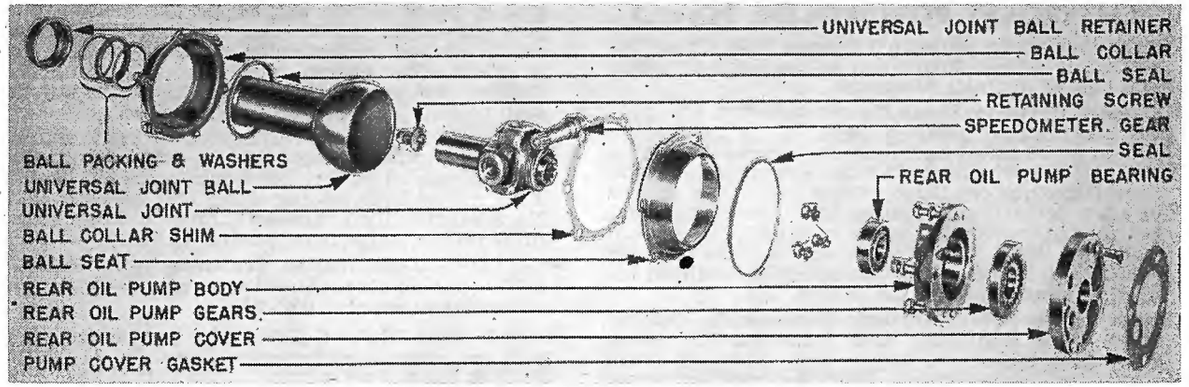
1) Take out right side cover attaching bolts, remove side cover and oil suction screen.

2) Install locking strap on turbine to hold unit stationary (install bolt in one flywheel attaching hole to hold strap). Remove all turbine cover bolts. Thread three 10/32x2" T-screws (part of J-3387 Pilot Stud Set) into three tapped holes in turbine cover to loosen cover, remove cover and turbine assembly. Remove primary and secondary stators as a unit, test for slippage of free-wheel clutches by rotating units by hand (should rotate freely in one direction but lock when turned in opposite direction). Check secondary pump free-wheeling clutch for slippage in same manner as stators. Take out converter retaining ring and washer. Slide primary pump from stator support and examine pump hub for bearing surface damage.

3) Take out Modulator assembly attaching bolts on right side of case, lift Modulator assembly off.

►***CAUTION—Use care that hydraulic plunger and body do not fall out of modulator when it is removed.***

4) Loosen all servo cover bolts slightly and break servo cover loose if it sticks to case (reverse servo spring and pressure regulator spring bear against cover) **using care not to allow cover to tip** which may damage or break tip of pressure regulator valve. Use guide bolts to maintain cover alignment or turn all cover bolts out evenly while exerting pressure on cover, then lift cover and gasket straight off until cover clears tip of pressure regulator valve. Remove reverse servo spring and pressure regulator springs, lift regulator valve out.



REAR OIL PUMP, UNIVERSAL JOINT, & JOINT BALL

►***CAUTION—Handle valve carefully to prevent damage and store it by itself to avoid nicking or scratching of the polished surfaces.***

5) Loosen low band adjusting screw locknut and tighten adjusting screw until low band grips clutch assembly to hold it in place. Take out transmission-to-turbine housing bolts, separate turbine housing from transmission.

6) Remove manual valve from valve body on rear of turbine housing, remove manual valve lever, remove bronze thrustwasher from valve body delivery sleeve. Take out bolts attaching valve body to turbine housing and also pump-to-valve body bolts, remove valve body and gasket.

►***CAUTION—Handle manual valve carefully to prevent damage and store it by itself to avoid nicking or scratching of the polished surfaces.***

7) Remove front pump from turbine housing using J-4263 pump driver tool.

8) Loosen low servo band adjusting screw to free clutch assembly, lift input shaft and clutch assembly out of transmission case.

9) Back off low servo band adjusting screw until band is free, lift out servo band and strut assembly, remove low servo piston and release spring.

10) Take out universal joint retainer bolt on rear end of output shaft, remove lockwasher and plain washer, slide universal joint yoke off shaft. Use soft hammer to tap output shaft forward, remove planet carrier assembly from transmission. Lift out reverse brake drum.

11) Loosen reverse servo band locknut, back off adjusting screw until band is free, remove reverse servo band and servo piston.

12) Take out rear pump attaching screws, remove rear pump assembly and gasket.

13) Use parking lock pawl spring tool J-3383 to rotate spring and unhook end from case. Remove spring and parking lock pawl, lever shaft and apply spring assembly.

14) Remove all lubrication check valve parts: sleeve, ball seat, ball, spring.

►***For disassembly of all above units, see OVERHAUL data***

OVERHAUL

►**"O" RING SEAL CAUTION:** ***These seals must be discarded when removed and a new seal installed exactly as directed below.*** "O" ring rubber seals are special design and are installed with side clearance in ring groove so that oil pressure on seal deforms the rubber and extrudes a portion of the rubber into the clearance space between the mating parts to provide a positive seal against loss of oil pressure. Seals **must not be re-used.**

"O" Ring Seal Installation—Make certain that parts are clean and that burrs and sharp edges are removed. Seal must be free of any twists (place ring on flat surface and allow it to assume natural position) and **must not be twisted during installation.** Engage one side of ring in groove, pull other side straight back until it can be fitted in groove without twisting. Work ring against trailing edge of groove (last side to enter when parts assembled) using flat tool entered between ring and leading edge of groove to move ring without twisting. Lubricate "O" ring and parts with transmission oil.

Converter Primary Pump: Disassembly. Remove stator race thrust snap ring (use snap ring pliers KMO-410), remove thrustwasher. Rotate secondary pump clockwise to release free-wheel clutch, withdraw secondary pump. Remove free-wheel cam roller and spring retainer, remove cam rollers, spring retainers, springs, and thrustwasher.

Inspection—Wash all parts in cleaning solvent and dry with air. Inspect cam rollers and inner and outer primary pump hubs for scoring or galling. Check roller springs for distortion, spring retainers for wear or damage, pump vanes for looseness.

Reassembly—Install free-wheel cam roller and spring retainer with prongs to rear. Assemble rollers, spring retainers, and springs in cam pockets with spring retainer curvature fitting curvature of unit, then install cam thrustwasher (CAUTION—hold retainer on opposite side to prevent its being pushed out of position). Use loading tool J-3362 to install

CONTINUED ON NEXT PAGE

CHEVROLET POWERGLIDE (Cont.)

secondary pump on primary pump hub. Check installation (should turn freely in clockwise direction and lock in opposite direction).

►**Primary Pump-to-Pump Hub Installation Caution:** On units where pump is tight fit on hub, pump should be installed as follows to prevent dislodging "O" seal ring which would cause serious leakage and out-of-balance condition: Place pump hub on bed of arbor press, check position of "O" seal ring, place primary pump in position on hub, use piece of thin wall pipe (3¼" I.D., 4" long, and square on both ends) to press pump on hub carefully. Tighten retaining screws to 4½ ft. lbs. torque.

Primary & Secondary Stators: Disassembly. Remove stator race snap ring and thrustwasher, rotate secondary stator clockwise and withdraw from stator race, then remove stator race similarly from primary stator (CAUTION—use care not to lose cam rollers and springs). Remove cam roller and spring retainer from stators, remove cam rollers, springs, and spring retainers.

Inspection—Wash all parts in solvent and dry with air. Check cam rollers and stator hub for galling or scoring, check roller springs and retainers for distortion or damage. Check stators for loose or damaged vanes.

Reassembly—Install cam rollers and spring retainer in secondary stator (this retainer has LONG tabs), then install cam rollers, springs, and spring retainers with retainer curvature corresponding to hub curvature. Install cam thrustwasher. Repeat this entire procedure for primary stator. Place loading tool J-3362 on stator race, slide primary stator over tool and onto race with thrustwasher down, **rotating stator clockwise during installation** to prevent pushing cam rollers out of position; install secondary stator, with thrustwasher down, following same procedure. Install bronze thrustwasher and snap ring. Check assembly by rotating stators. Both stators should turn freely on race in clockwise direction but lock in opposite direction.

Converter Turbine: Disassembly. Remove "O" seal ring from cover. Remove turbine bolt nut and washers, lift cover off bolt. Bend down lockplate ears and remove three turbine hub capscrews. Lift out turbine hub and bolt, remove bolt and thrustwashers from hub. Remove "O" seal ring from bolt.

Inspection—Discard seal rings, wash all parts in solvent and dry with air. Check bolt, hub and thrustwasher for scoring or wear. Check turbine for loose or damaged vanes. Check turbine hub bushing for excessive wear and replace bushing as follows:

Turbine Hub Bushing Replacement—Precision type bushing, No. 3689929, furnished for service. Press old bushing out of turbine hub with tool J-4375, use same tool set to install new bushing. Support turbine on special collar of tool set (has three locating pins to center turbine) on arbor press with turbine vanes downward, place new bushing on small end of driver and press bushing in place in turbine hub. New bushing need not be reamed.

Reassembly—Install new "O" seal on turbine bolt (see "O" ring installation note). Install thick thrustwasher (next to turbine—lugs engage holes in turbine), turbine bolt, thin thrustwasher, and turbine hub (with three dowels engaging holes in turbine) in this order. Install new lockplate and three turbine hub capscrews, tighten screws securely and lock in place. Check and adjust turbine bolt endplay (see data below). Install turbine cover, assemble slotted washer (nibs engaging locating hole in pilot), flat washer, and nut on turbine bolt. Tighten nut securely and lock with cotter key. Install new "O" seal ring on turbine cover.

Turbine Bolt Endplay Adjustment—Check endplay with dial indicator mounted on end of bolt after bolt assembled in turbine. Endplay should be .002-.016". Adjust by installing shims (No. 3691922—.014", No. 3691923—.019") between turbine and input shaft drive flange, as required, for this endplay.

►***CAUTION—Transmissions beginning No. HT-19226-B24 do not use above shims but endplay limits for these transmissions are also .002-.016".***

Multiple Disc Clutch: ***CAUTION—New design clutch with cast piston used beginning Trans. No. JT-232315-D-23-D.*** Both types serviced alike except that parts not interchangeable and relief valve on later type located in piston (ball seating in relief hole and retained by staking of the piston metal around the hole) instead of being located in clutch drum.

Disassembly—After converter removed, remove clutch flange retainer ring and retainer, low sun gear and clutch flange assembly, clutch hub, and all clutch plates. Place clutch drum in arbor press (CAUTION—use care not to damage pressure relief valve on end of drum), use tool J-3364 to compress clutch spring, remove clutch spring snap ring (use KMO-410 snap ring pliers), release spring pressure, remove spring seat and spring. Remove clutch piston by rapping drum face down on wood block. Remove piston outer seal ring from piston and inner seal ring from clutch drum hub.

Inspection—Wash all parts in solvent and dry with air. Inspect drum brake band surface for excessive scoring or burring, and drum bushing for scoring or wear. Examine clutch hub and clutch flange for galling (see Note below for installation of special thrustwasher to prevent this trouble developing in service). Slight galling can be cleaned up with emery cloth. See that clutch flange has no radial play in drum slots and that plates are free fit over clutch hub and in clutch flange. Check clutch plates for burning and wear. Check low sun gear for nicked, burred, or scored teeth. Check relief valve for free operation. Replace damaged valve by cutting off rivet heads with a sharp chisel, driving out old rivets with a small punch, and installing new valve with two new rivets (CAUTION—support drum securely while peening over rivets).

►**Clutch Hub Thrustwasher Note**—New .020" thick spring-steel thrustwasher, No. 3694444, now installed between clutch hub and clutch flange to prevent galling. This washer can be installed on earlier transmissions if galling noted at this point when transmission being overhauled. Install washer with four equally spaced tabs engage slots in clutch hub which will prevent washer riding on mainshaft.

►*CAUTION*—Following parts not interchangeable between first and later (cast piston) type clutches: Clutch Piston, Drum and Bushing Assy., Spring, Spring Seat, and Snap Ring.

Reassembly—Install new outer ring seal on piston (lip of seal toward oil pressure end of piston) and new inner ring seal on clutch drum inner hub (lip in toward bottom of clutch chamber). Lubricate inner diameter of clutch drum and seals with transmission oil, install piston (CAUTION—use feeler gauge to seat outer seal ring in drum without damaging seal lip). Install clutch spring and spring seat, compress spring with J-3364 tool in arbor press (CAUTION—see that spring seat does not hang up in snap ring groove), install snap ring. Place clutch hub in clutch flange (open side up), install all clutch plates, starting with steel plate with concave or "dished" side down toward clutch flange, and alternating steel and composition plates. Install clutch drum assembly over flange assembly, invert and install clutch flange retainer and retainer ring. Check endplay with feeler gauge inserted in drive slot in drum below clutch flange drive lug. Maximum allowable endplay is .013" and is adjusted by selecting clutch flange retainer of correct thickness (.055", .064", .073").

Modulator: Disassembly. First lift out hydraulic plunger and body assembly (CAUTION—do not allow plunger to drop out or assembly to be damaged). Take out outer cover attaching screws **while holding cover down** against spring pressure, lift off cover, diaphragm spring, and diaphragm.

Inspection—Wash all parts in solvent, blow out all passages and dry with air. Check diaphragm and outer cover for cracks. Inspect hydraulic plunger and body for wear, nicks or scoring. See that plunger operates freely in body and body is free in modulator.

Reassembly—Place assembly tool J-4261 (centering plug) in modulator body in place of hydraulic plunger and body, assemble diaphragm and spring, install two 10-24x3" guide pins in opposite cover holes, install attaching screws and tighten evenly and securely, remove guide pins and install screws in these holes. Remove assembly tool, install hydraulic plunger and body (body against diaphragm, plunger pointing out).

Servo Cover: Disassembly. Take out retaining screw and remove lubrication valve bi-metal strip and retainer. Take out lubrication by-pass valve plug and copper gasket, remove by-pass ball spring and ball. Do not remove modulator control lever.

Inspection—Wash all parts in solvent, blow out all passages and dry with air. Inspect cover for cracks and nicks or burrs on mounting face. Check by-pass ball spring and valve bi-metal strip for distortion. See that modulator lever operates freely without binding.

Reassembly—Install valve by-pass ball, spring, and plug (use new gasket), tighten plug securely. Install bi-metal strip retainer, bi-metal, and retaining screw.

Front Oil Pump: Disassembly. Remove stator support from pump body, lift out pump gears (CAUTION—gears not heat-treated and must be handled carefully to avoid nicking or marring). Remove seal ring from drive gear (compress one end into groove and push other end out to free interlocked ends). Remove and discard "O" seal ring on pump body.

Inspection—Wash all parts with solvent, blow out all passages and dry with air. Check drive gear oil ring and ring groove for nicks and burrs (ring must be free in groove), and check ring in pump body bore (hooked ring ends must have clearance). Inspect pump body and face of stator support for nicks, burrs, or scoring. Inspect oil seal in pump body and replace if worn or damaged (pry out old

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CHEVROLET POWERGLIDE (Cont.)

seal, use Driver J-4240 to install new seal). Install pump gears and check all clearances with feeler gauges:

Driven Gear Clearance—.0025-.0055" clearance between outer diameter of gear and pump body.

Gear-and-Crescent Clearance—Check by pressing gear away from crescent and inserting feeler gauge between end of gear teeth and face of crescent. Should be .003-.009" (Internal Gear).

Gear End Clearance—Check with feeler gauge inserted between gear face and straightedge on face of pump housing. Should be .0005-.0015".

Reassembly—Install new "O" seal ring in pump body (see "O" Ring Installation Note), install drive gear seal ring and pump gears (lubricate gears with transmission oil—insert drive gear with drive lugs extending through oil seal). Assemble stator support on body and align mounting holes.

Rear Oil Pump: Disassembly. Take out two flat head screws in pump body plate, remove plate, lift out pump gears. Do not remove ball bearing unless new bearing to be installed.

Inspection—Wash parts in solvent, blow out oil delivery holes and dry parts with air. Inspect rear bearing for roughness (to replace bearing, take out 3 capscrews, drive old bearing out, press new bearing in place). Inspect pump body and cover for nicks or burrs, inspect gears and check gear clearances with feeler gauges:

Driven Gear Clearance—.003-.007" clearance between outer diameter of gear and pump body.

Gear & Crescent Clearance—Check by pressing gear away from crescent and inserting feeler gauge between end of gear teeth and crescent. Clearance should be .002-.009" (Internal Gear).

Gear End Clearance—Check with feeler gauge inserted between gear face and straightedge placed across face of pump housing. Clearance should be .0005-.0015".

Reassembly—Lubricate gears with transmission oil and install in body. Install pump body plate and tighten two flat-head screws.

Valve Body: Disassembly. Use special pliers J-4245 to remove special snap ring in end of accumulator cylinder, remove accumulator valve spring washer and all accumulator valve parts from valve body. Remove two oil seal rings from valve body hub (rings have interlocking ends, released by pressing one end into groove and pushing other end out). Unscrew and remove pressure relief valve assembly.

Inspection—Wash all parts in solvent, blow out all passages and dry with air. Check accumulator body, piston, and body for scoring, see that these parts operate freely. Check small fibre valve in accumulator valve body for free operation. Check springs for distortion. Inspect oil seal rings for nicks and burrs, see that rings are free in grooves and that hooked ends have clearance in clutch drum bore (check by installing rings in drum).

Reassembly—Install all accumulator parts in valve body (CAUTION—accumulator piston must seat over inner and outer accumulator springs and special snap ring must seat firmly in snap ring groove in valve body). Install both oil seal rings in hub grooves. Install pressure relief valve assembly and tighten securely.

Low Servo Piston: Low servo piston and spring can be lifted out after servo cover removed. Check piston ring gap by installing ring in cylinder. Gap should be .005-.010".

Reverse Servo Piston: Disassembly. Place assembly in bench press with spring end up, use tool J-3377 to compress spring (position tool legs on spring retainer), remove retainer key locks. Release spring tension, lift off retainer, springs, and piston.

Checking & Reassembly—Check piston ring gap by installing ring in cylinder. Gap should be .005-.010". Assemble parts on piston stem and use tool J-3377 to compress springs. Make certain key locks fully engaged in groove in stem.

Planet Carrier Assembly: ***Furnished as an assembly and should not be disassembled.***

Inspection—Wash in solvent, blow out all passages and dry with air. Inspect all gear teeth for nicks, scoring, or other damage. Check end clearance of planetary pinions with feeler gauge (endplay should be .006-.030"). Check reverse sun gear rear thrustwasher for wear and damage. Inspect drum bushing for wear, scoring, or damage; check outer diameter of drum for scoring or burning.

Input Shaft: Inspect shaft splines for wear, nicks, or other damage; check spline fit in clutch hub, reverse sun gear, and turbine hub. Inspect oil seal ring for wear and free fit in shaft groove, remove ring (compress one end and expand the other to free interlocked ends), install ring in valve body bore and check clearance of hooked ends, re-install ring on shaft.

Transmission Case & Rear Bushing: Check case for cracks, inspect rear bushing for wear or damage and replace if necessary.

Bushing Replacement—Press old bushing out using tool J-4275 in an arbor press (place case on press with rear end upward). Install rear oil pump in case so that rear bearing can be used as a pilot in installing new bushing. Place case on press with front end upward, assemble bushing on Installer Tool J-4276 (square end of bushing against shoulder on tool), enter tool pilot in rear bearing, press new bushing into place. Bushing is precision type and does not require reaming.

Low & Reverse Brake Bands: Inspect bands for wear, cracks, and scored or burnt lining. Lining is bonded to band. Inspect linkage for wear.

REASSEMBLY

After all Major Units reassembled (see OVERHAUL), make certain that all parts and units are absolutely clean and all moving parts lubricated, use all NEW GASKETS & SEALS, and tighten all parts evenly to specified torques. Proceed in reverse order of disassembly directions and note the following important points:

Valve Body & Front Oil Pump Installation: Install suction screen in converter housing oil sump. Install two ¼-20 x 3½" guide pins in valve body attaching holes in housing, install valve body and new gasket over guide pins, tighten attaching bolts evenly (in criss-cross pattern) to 10 ft. lbs. torque EXCEPT bolt over pressure regulator valve tightened to 8 ft. lbs, torque (CAUTION—check manual valve and pressure regulator valve for free operation after all bolts tightened). Align bolt holes in stator support and front pump body assembly, install two ¼-20 x 3½" guide pins through pump body, then use driver J-4263 to seat assembly in converter housing (CAUTION—See "O" Ring installation note). Install five pump mounting self-locking bolts through valve body, tighten the two bolts over pressure regulator valve to 8 ft. lbs. torque, and remaining bolts to 10 ft. lbs. torque.

►***CAUTION—Check pressure regulator valve, manual valve, and front pump for free operation after all bolts tightened.***

Rear Oil Pump, Planet Carrier & Output Shaft, Reverse Servo Installation: Install two 5/16-18 x 3" guide pins in two rear pump attaching bolt holes in rear end of transmission case, install pump and new gasket over guide pins **aligning oil suction and delivery holes,** tighten all pump mounting bolts evenly and securely. Install reverse servo piston (use Ring Compressor J-3365 to avoid damage to piston ring) with notch on shaft toward front of transmission. Install reverse brake band and strut assembly in case with **thin end of band away from piston,** thread adjusting screw in case until it indexes with hole in anchor. Place bronze thrustwasher on reverse drum hub, install drum within reverse band in case. Position rear pump drive gear with lug at top, install planet carrier assembly in case with slot in shaft aligned with pump gear lug. Check planet carrier for correct position and seating of pump gear lug by measuring output shaft for ⅞" minimum protrusion through rear bearing. Install universal joint yoke on shaft and tighten universal bolt securely (this will draw planet carrier into its seat).

Reverse Servo Band Adjustment: Use tool J-4277 (combination screwdriver and locknut wrench). Tighten adjusting screw slowly and at the same time, check endplay in linkage by pushing and pulling on servo return spring. Continue to turn screw in until endplay is just taken up (at this point band must be free on drum and drum should be easily rotated by hand), then **back adjusting screw off ⅛-¼ turn** and tighten locknut.

►***CAUTION—Above procedure supersedes previous instructions and will provide sensitive adjustment.***

Sun Gear Endplay Adjustment: After planet carrier assembly installed in case, determine thickness of sun gear thrustwasher needed for correct transmission endplay to .007-.035" as follows:

(1) Measure distance from face of transmission case flange to face of reverse sun gear in planetary unit with tool J-4260 by placing bar of tool against case flange and extending tool stem until it contacts face of gear, tighten thumbscrew to retain this tool setting.

(2) Install bronze thrustwasher and clutch assembly on oil delivery sleeve on rear of converter housing.

(3) Without disturbing tool setting secured in step (1), place .095" thick steel washer over tool pilot (short plug on tool bar), install tool over clutch assembly with tool pilot entered in low sun gear and tool stem against gasket on rear face of housing. Measure clearance between face of low sun gear and steel washer on tool pilot with a feeler gauge. If clearance not within .007-.035", repeat this procedure with .120" or .145" steel washer on tool pilot (see Note below on .070" washer). On transmissions before No. HT-3837-A3, if .070" washer required to bring clearance within limits of .007-.035", replace

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CHEVROLET POWERGLIDE (Cont.)

Low Sun Gear and Flange Assembly with later type parts and repeat above procedure (these later parts will not require less than .095" thick washer).

►**Tool Washer Note**—This tool originally furnished with three washers—.070", .095", .120" thick. The .070" washer is now obsolete (.070" bronze thrustwashers not furnished) and tool sets now furnished with .145" washer instead (.095" and .120" washers continued). This .145" washer is available to replace .070" washer on early tool sets.

(4) When correct clearance of .007-.035" obtained in step (3), note thickness of steel washer used on tool and **select bronze thrustwasher of same thickness** for installation on input shaft splines when this shaft installed (see below). Remove clutch assembly and thrustwasher from oil delivery tube.

►**Low Sun Gear Thrustwasher Note**—This bronze thrustwasher now furnished in three thicknesses as follows: No. 3689772—.095", No. 3689770—.120", No. 3694433—.145". The .070" thrustwasher is not now furnished for service.

►***EARLY TRANSMISSION CAUTION***—On Transmissions before No. HT-3837-A3, if .070" thrustwasher required for correct clearance (3 above), replace Low Sun Gear and Flange Assembly with later type parts (new parts will not require less than .095" thrustwasher).

Parking Lock Mechanism Installation: Install parking lock lever shaft and apply spring assembly in case, place small seal over end of shaft and into counterbore in case with small lip on seal toward inside of case, install flat washer and lever on shaft pressing lever in until clearance between lever and washer is .000" to .010", then tighten lever clampscrew. Install parking lock pawl over pawl support rod, install pawl spring. Use tool J-3383 to wind up pawl spring until end catches on inside of case.

Low Servo & Input Shaft Assembly Installation: Install input shaft in clutch assembly, place bronze thrustwasher of correct thickness (as selected in "Sun Gear Endplay Adjustment" above) on rear end of input shaft aligning missing spline opening on washer with oil hole in reverse sun gear splines on shaft. Install entire assembly in transmission case, indexing input shaft pilot with pilot in output shaft and meshing low sun gear with short pinions in planet carrier. Assemble low servo piston release spring on servo piston shaft, install assembly in case (CAUTION—use Ring Compressor J-3365 to avoid damage to piston ring). Install low brake band over clutch drum with thin end of band toward piston, place strut guide spring over end of piston stem, install strut with one end engaging slotted end of piston stem and other end engaging brake band. Install second strut similarly with one end engaging band and opposite end engaging slotted anchor with anchor fitted over end of adjusting screw in transmission case. Install speedometer driven gear. Do not adjust low band at this time.

Transmission & Turbine Housing Assembly: Install manual valve in valve body, install manual valve inner lever in turbine housing and engage lever pin in valve slot, position valve so that outer end is 1½" from face of valve body (reverse position). Install new valve body-to-case gasket on valve body. Raise transmission manual valve lever to top detent position (reverse) to align reaction lever with manual valve inner lever. Install clutch drum thrustwasher over oil delivery sleeve. Install two ⅜"-16 x 3¾" guide pins in turbine housing, install transmission assembly over guide pins, making certain that reaction lever engages manual valve inner lever properly (CAUTION—remove left hand sump cover to check this engagement). Install transmission case-to-turbine housing bolts and tighten evenly and securely.

Servo Cover Installation: Install lubrication check valve parts: spring, ball, ball seat (with radius toward ball), lubrication sleeve. Install two 5/16"-18 x 3" guide pins in servo cover mounting bolt holes, install new gasket over guide pins. Install pressure regulator valve and assemble inner and outer valve springs on valve stem. Install large return spring on reverse servo piston rod. Install servo cover over guide pins (CAUTION—see that regulator and servo springs seat properly in pockets in cover), apply pressure to cover to compress springs, install and tighten all servo cover bolts. Install modulator cover with new gasket, tighten modulator bolts evenly and securely.

Low Servo Band Adjustment: Using tool J-4277 (combination screwdriver and locknut wrench), tighten adjusting screw until band is tight, then **back screw off 3 complete turns**, tighten locknut.

Converter Assembly: Align front oil pump drive gear tangs with drive slots in primary pump hub, install primary pump in turbine housing (CAUTION—see that drive tangs and slots engaged—face of primary pump will be flush with face of bell housing if properly installed), install retaining washer and snap ring in stator support. Install stator assembly (CAUTION—smaller primary stator must be to rear). Install two 5/16"-24 x 1½" guide pins in primary pump bolt holes, align dowel pin hole in cover with dowel in primary pump, install turbine cover on primary pump, remove guide pins and install cover capscrews, installing one capscrew on each side of dowel, then skipping one hole (for flywheel attaching bolt), and installing screws in next two holes, repeating this order around cover rim. This will leave six evenly spaced holes around cover for flywheel attaching bolts (when transmission installed in car). Tighten capscrews evenly and securely. Install sump cover and new gasket on right side of housing.

Universal Joint Ball Adjustment: Before installing transmission, determine thickness of shims required for universal ball adjustment: Install ball seat and "O" ring, ball, and collar with sufficient shim thickness under collar for smooth firm fit of the ball (add shims if too tight, remove shims if too loose). Remove ball assembly and save shim pack for later installation.

Bench Testing of Overhauled Transmission: Transmissions can be tested and checked for oil leakage before installation in the car. Proceed as follows:

1) Use ½" or ⅝" electric drill to drive converter at 300 RPM. or greater (J-4290 Transmission Torque Converter Cover Turning Tool and ¾" drive socket and extension will be required to hook up drill to converter).

2) Replace drilled universal joint yoke attaching bolt with plain undrilled bolt to prevent oil loss at this point during test.

CAUTION—Special drilled bolt must be replaced after testing completed (drilled passage in bolt provides lubrication for universal joint and propeller shaft bushing).

3) Disconnect oil cooler line fittings at rear of transmission and install pipe plugs at these points.

4) Connect four pressure gauges at following points: (1) Front Pump; (2) Low Servo Apply; (3) High Clutch (release side of Low Servo); (4) Reverse Servo.

5) Fill transmission with 8 qts. of Automatic Transmission Fluid Type A. *CAUTION*—Use electric drill to rotate transmission while adding last 5 qts. of fluid (necessary to fill converter and oil passages).

6) Rotate transmission with electric drill and note pressures indicated on gauges with selector lever in each position as follows:

Neutral—150-160 lbs. (higher than for regular operation because Vacuum Modulator not operating).

Drive—80-100 lbs. (higher than for regular operation because Vacuum Modulator not operating).

Low & Reverse—125-130 lbs. in each position.

7) Check for oil in converter housing indicating leakage at primary pump hub "O" ring seal, front pump oil seal, front pump "O" ring seal, or at sand hole in converter housing. Also check for leakage at Converter Cover or Turbine Bolt "O" ring seals.

8) Check for leakage at servo cover and housing side covers, check vacuum line connection in modulator cover.

9) If transmission checks OK., drain transmission, remove drill and drive attachment tool, re-install special drilled universal joint yoke bolt, remove pipe plugs and re-install oil cooler line fittings.

INSTALLATION IN CAR

►**Balance Mark Caution**—When installing transmission on car, "X" mark stamped on front face of torque converter cover (lightest point of assembly) must be lined up with "X" mark stamped on face of flywheel (heaviest point) to nearest bolt hole.

Flywheel Pilot Caution—Lubricate pilot with Lubri-plate and use extreme care not to damage pilot by bumping or scratching when raising transmission into place.

Flywheel Attaching Bolt Installation—Turn flywheel until one bolt hole visible in bell housing opening, install one 5/16"-24 guide pin in corresponding hole in turbine cover, carefully guide pin through flywheel hole as transmission raised into position, install all turbine housing-to-bell housing bolts, tighten bolts evenly and securely. Remove guide pin, install all six flywheel-to-turbine cover bolts (rotate flywheel with J-4281 indexing tool for access to bolt holes), tighten bolts evenly and securely.

CHRYSLER, DE SOTO, DODGE FLUID DRIVE

Chrysler 6, DeSoto, Dodge Models (1941-51)
Chrysler 8, All Models (1939-51)①
①Not used when Fluid-Torque Unit installed.

►**INSTALLATION OF FLUID DRIVE SEAL DAMPER (To correct squeal on Early 1946 Chrysler 6 & 8, DeSoto, & Dodge Cars with carbon type seal).** To correct complaints of a "squeal" in this seal, install seal damper as follows: With Fluid Drive unit removed from car (see directions below), remove clutch plate nut using tool C-607. Pull clutch plate using tool C-665. Remove snap ring and seal spring (use sleeve C-613 and clutch plate nut to relieve spring tension). Install damper (consists of a ribbed sleeve) on inner end of spring, re-install spring, spring retainer, and snap ring. Reassemble fluid drive unit and re-install in car.

NOTE—This Seal Spring Damper installed on Chrysler cars in production beginning with the following 1946 Serial Numbers: C38S Royal—70,020,706; C38W Windsor—70,539,906; C38W Town & Country—71,000,004; C39K Saratoga—6,765,678; C39N New Yorker—7,029,848; C39 Town & Country—7,400,513.

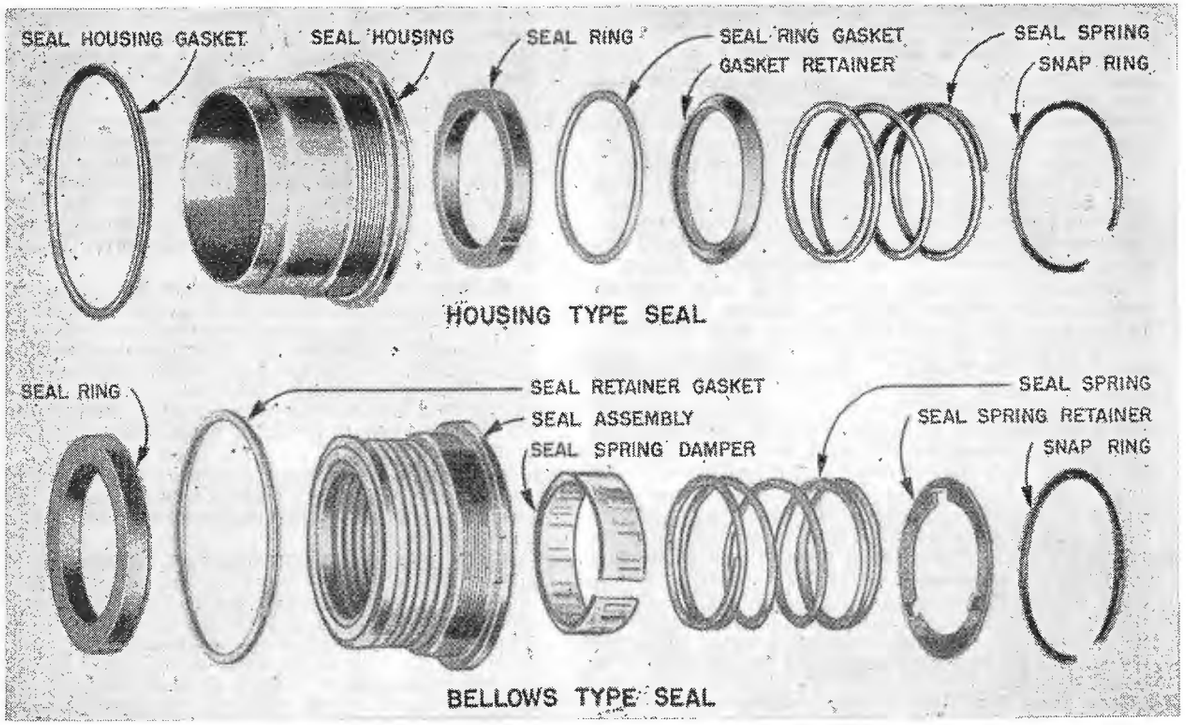
►**FLUID DRIVE SEAL NOTE:** Both "Bellows Type" and "Housing Type" seals have been used. *See illustration and seal installation data.*

DESCRIPTION & OPERATION: The Fluid Drive (Fluid Coupling) Assembly consists of a self-contained, factory-sealed assembly which is mounted on the rear end of the crankshaft in place of the conventional flywheel (unit has ring gear for starter mesh on outer rim and separate clutch driving plate for clutch mounting bolted on end of runner shaft at rear end). The case and integral 'driver' vanes rotate with the crankshaft and transmit power to the 'runner' or free vane assembly within the case without any mechanical connection through the oil with which the case is filled. The 'Runner' is integral with the hub (short hollow shaft extending through rear of case with clutch driving shaft mounted on rear end) and is mounted on a large ball bearing within the fluid drive case at the forward end and piloted on the clutch shaft at the rear end (clutch shaft mounted on needle bearings within runner hub at each end). Oil leakage is prevented by spring-loaded Sylphon Assembly or bellows and Sealing Ring (press fit type on 1939 models). On 1940 and later models, seal ring is a floating carbon-graphite type. See Seal Ring Renewal data under Servicing (below).

1939 Note—Rubber grommets on mounting bolts (fitted in recess on front face of case) and thin gasket between fluid drive case and crankshaft flange used to seal fluid drive unit and prevent leakage at these points.

1940 & Later Note—A Driver Flange Plug is installed in the forward end of the driver hub (or the fluid drive case is continuous at this point) to prevent leakage and no rubber grommets are required on the mounting bolts. Fluid drive housing is provided with cooling fins.

Chrysler 6, DeSoto, Dodge Note—On these cars, Runner Hub Nut, which retains clutch driving plate is threaded in end of hub (no leather oil seal used). A leather type oil seal is installed within the retainer nut on Chrysler 8 Cylinder cars to prevent leakage at this point.



FLUID DRIVE ASSEMBLY REMOVAL & INSTALLATION: Unit should be removed as an assembly and all service work performed on the bench.

Removal (All Models): Remove transmission (see Transmission Removal on car model pages), remove clutch release bearing, clutch housing pan, and dust shield. Remove clutch (see Clutch Removal on car model pages). Take off nuts on mounting bolts on front face of crankshaft flange (use special box wrench C-589), pull fluid drive unit back free of the crankshaft flange and remove from below.

Installation (1939): Use new grommets on mounting bolts, seating grommets in recess in front face of fluid drive case. Carefully clean face of crankshaft flange and fluid drive unit case (remove all traces of old gasket and any burrs which might prevent flat, even contact of mounting faces). Coat both sides of new .010" thick gasket with shellac, install gasket on fluid drive case (one bolt hole 4° out of line to insure installation in correct position), install fluid drive assembly on crankshaft flange threading mounting bolts through holes in flange, install nuts on mounting bolts, tighten nuts evenly

Installation (1940 & Later Cars): Clean back face of crankshaft flange and mating face of fluid drive unit thoroughly (remove all burrs, dirt and other particles), place fluid drive unit in position on crankshaft flange and install mounting nuts, tighten nuts evenly to torque of 135-145 ft. lbs.

SERVICING:—Unit is sealed and no adjustment required. Service operations are restricted to keeping unit filled with oil (inspect at end of first 1000 miles and at 10000 mile intervals in service) and renewal of seal parts to correct leakage.

Checking Oil Level: Fluid drive case filled to 80% volume and level should be checked as follows to prevent overfilling. Turn crankshaft until one fluid drive filler (2 plugs—180° apart) is at filler hole in upper right hand surface of clutch housing, remove filler plug. Fluid level should be even with bottom of filler plug opening. Add fluid as required

►***CAUTION: Always check fluid with unit COLD.***

Capacity—Approx. 8 qts. (8's), 6 qts. (6's).

NOTE—Use only Mopar Fluid Drive Fluid.

Bellows Type Seal Ring & Sylphon Assembly Renewal: Remove fluid drive unit (see Removal) and drain. Bend down tab on lockwasher, use special socket wrench C-607 (Chrysler 6, DeSoto, Dodge), C-541 (Chrysler 8) and remove clutch driving plate retainer nut. Mark one spline on runner hub and mating spline on clutch driving plate (to insure reassembly in correct position), use special puller C-665 (Chrysler 6, DeSoto, Dodge), C-692 (Chrysler 8) to remove clutch driving plate. Use special bellows seal spring compressing sleeve C-613 (Chrysler 6, DeSoto, Dodge), C-614 (Chrysler 8) to compress spring within bellows (use clutch driving plate retainer nut to push sleeve in to compress spring), remove spring retainer snap ring, remove nut, sleeve, and spring (CAUTION—Spring must be removed before bellows seal removed or seal will be damaged). Use special spanner wrench C-545 to unscrew bellows seal, remove bellows seal and floating seal ring (floating seal ring used on 1940 and later models only, do not disturb inner ring on 1940

CONTINUED ON NEXT PAGE

CHRYSLER, DE SOTO, DODGE FLUID DRIVE (Cont.)

cars). Use special puller to remove press-fit type seal ring on 1939 cars. NOTE—Floating seal ring bears against inner ring (1940), or runner hub (1941 and later models). If surface of inner ring or hub is damaged, fluid drive unit should be replaced. IMPORTANT NOTE—Bearing surfaces on Sylphon and Sealing Ring must be smooth and show continuous line of contact over entire circumference. Replace Sylphon and Sealing Ring if surfaces damaged in any manner (rough, scratched, or marred).

Installation—Install sealing ring and sylphon seal (see that gasket in place), tighten bellows retainer securely. Install seal spring (and damper—see Seal Spring Damper Note below), and retaining snap ring (use sleeve to compress spring so that retainer can be installed), install clutch driving plate making certain that marks on plate and runner hub are lined up, tighten clutch driving plate retainer nut securely. Fill unit with fluid (see directions above. Install Fluid Drive unit on car.

1939 Note—To install press fit type sealing ring, screw ring in special installing tool, heat ring in boiling water, shake free of water and quickly push ring snugly in place against ground face of runner

Seal Spring Damper Note (All Cars with Carbon type Seal)—Damper consists of a ribbed sleeve which should be installed on inner end of spring before spring is installed in bellows, and this assembly **should be rotated counter-clockwise while it is being installed.**

Housing Type Seal Ring Assembly Renewal: Remove fluid drive unit (see Removal) and drain unit. Bend back tab on lockwasher, use special socket wrench C-607 to remove drive plate retainer nut, use Puller C-665 to remove drive plate (CAUTION—remove key). Clean area on fluid drive adjacent to seal ring. Use towel or other cloth to protect hands while prying out snap ring (CAUTION—spring will spring out if not restrained), remove snap ring and spring. Use special Spanner Wrench C-545 to unscrew seal housing (screw retainer nut on hub above wrench to hold wrench in place), lift out seal housing, seal ring gasket, and seal ring gasket retainer. Lift out seal ring (use two pieces of wire bent to form hooks).

►***CAUTION: Use care not to scratch or damage sealing faces and do not atempt to remove seal housing without first removing snap ring and spring.***

Installation—Make certain that sealing surfaces are clean and free from scratches, **replace seal ring** if surface is damaged (surfaces can be cleaned with cloth followed by chamois applied with soft pressure preferably eraser end of a pencil but no attempt should be made to recondition these surfaces.) Remove all burrs from spanner wrench slots, chamfer, top edge of bore, and snap ring groove. Screw seal housing in place finger tight so that gasket contacts seal housing flange and machined face on back plate. Wipe seal ring clean with chamois and install ring using tools SP-788 and SP-791 (place seal ring squarely on locators of aligning tool SP-791, insert in seal housing with button on tool aligned with wrench slot nearest center punch mark, slide pilot sleeve down inside tool and push seal ring off onto the two small indentations at the bottom of the seal housing), remove installing tools. Install seal ring gasket, gasket retainer (angular face down), and spring. Use special tool C-884 to compress spring and install snap ring. Tighten seal housing with spanner wrench to 270 ft. lbs. torque. Install drive plate and key, tighten retainer nut securely and lock nut by bending edge of washer up and center-punching washer at drive plate hole.

Fluid Drive Bushing Replacement: Remove old bushings by first removing the clutch driving plate nut (special socket wrench C-607). **Do not remove clutch driving plate.** Pull outer hub bushing with special puller, sleeve, and expansion jaw (C-680 tool kit). Remove inner bushing similarly using puller and expansion jaw without sleeve. Clean inside of hub thoroughly.

Bushing Installation—Place new Inner and Outer Oilite Bushings on special drift C-708. Position drift in fluid drive hub, drive bushings into hub with a mallet until bushings are firmly seated. Bushings will be burnished by the tool as it is withdrawn. Reinstall clutch driving plate nut, tighten nut securely and lock it by bending edge of washer up. CAUTION—Use only Oilite bushings for replacement.

Fluid Drive Bearing Replacement: When replacing needle roller bearings (used on some cars), install new Oilite bushings as replacement. See Bushing data above.

FLUID DRIVE SLIPPAGE TEST: To determine definitely if fluid drive slipping, use electirc tachometer for accurate engine speed check. With engine properly tuned up, apply hand brake and foot brake firmly, place transmission in direct drive, operate engine with wide open throttle and note speed. If engine speed greater than 1100 RPM., slipping is occurring. Check fluid coupling for low fluid level (CAUTION—do not check level until coupling has cooled off), fill to correct level and repeat test. Check for oil leaks if low fluid level is found.

STARTER RING GEAR REPLACEMENT ON FLUID DRIVE: Removing Old Ring Gear—With fluid drive unit removed from car, use hacksaw to cut six weld spots around ring gear parallel with back face of gear and to within 1/16-1/32" of the housing using care **not to cut too deep.** Scribe a line around housing at back face of gear (for use is positioning new gear), drive ring gear off using a heavy drift and hammer with fluid drive unit resting face down on bench. Remove all remaining weld material from housing with a bastard file (CAUTION—do not file more than necessary to remove weld material).

Installing New Ring Gear—Heat new ring gear to uniform temperature of not more than 212°F. (see Heating Note below), place gear on fluid coupling with chamfered teeth up (pointing to front), use rawhide mallet or fibre block to drive gear down until scribed mark on housing is just visible above gear. Check gear position with aligning gauge C-896 placed in crankshaft counterbore. Clearance between gauging leg and face of gear should be uniform and should not exceed .020" (use .020" feeler gauge as "No Go"). Adjust by tapping gear up or down on housing. Reweld ring gear at same spots used previously applying **equal amount of welding material at each point to maintain balance and using ARC welding equipment only.**

►***CAUTION—Arc should be directed at approximately 45 angle from face of gear to avoid burning through housing, and GAS WELDING EQUIPMENT MUST NEVER BE USED.***

Heating Note—Use Oven C-794 or submerge gear in boiling water for approximately 5 minutes. If torch used, direct flame at outer face of ring gear at inner diameter **not on the gear teeth** and use drops of water on ring gear to check temperature (gear will probably be expanded enough for installation before water begins to boil).

CHRYSLER FLUID-TORQUE DRIVE

Chrysler Eight, Models C52, C53, C54 (1951)
Std. or Optl. with "Fluid-Matic" Transmission

►CHANGES, CAUTIONS, CORRECTIONS

►**OIL PUMP RELIEF VALVE CHANGE (To improve performance and correct oil loss on first cars).** New type Relief Valve (used in production beginning Eng. No. C51-8-19615) can be installed on earlier cars to correct loss of fluid due to one of the following causes: (1) First type valve sticking open, allowing oil to become overheated and expand out through vent to rear engine crankcase breather. (2) First type valve sticking closed, allowing pressure to develop within unit and causing noise in pump gears and displacing impeller hub seal and turbine shaft seal. (3) Leakage around holes in reservoir due to "O" rings on connectors between reservoir and torque converter not seating properly (will be corrected by installation of new rings furnished in Relief Valve Service Pkg. 1450072 containing all new relief valve parts). *See OVERHAUL data for Relief Valve Installation instructions.*

DESCRIPTION: The "Fluid-Torque Drive" (Torque Converter) consists of four elements: an impeller (driving member), a turbine (driven member) and two reaction members (stators), which provide a maximum torque multiplication of 2.34-1 (starting torque) to 1.0-1 (driving torque). The converter housing is attached to the rear end of the crankshaft through a flexible steel disc which permits some flexibility. The starter ring gear is mounted on the rim of the flexible disc. The turbine shaft is connected through a splined shaft to the clutch driving plate.

Oiling System—The oil is delivered to the converter housing under approx. 30 lbs. pressure by a geared pump and control valve body mounted on the converter stationary support plate. The oil is drawn from the oil reservoir (mounted under clutch housing) and delivered to converter housing and then to the oil cooler (mounted at the water pump flange) where it is cooled by water from the radiator and an air blast from the fan, before its return to the reservoir.

OPERATION: The impeller being integral with the converter housing and driven by the engine forces oil toward the turbine causing it to rotate in the same direction. The turbine is mounted on a forged steel hub which is splined to the turbine shaft and clutch drive plate transmitting power to the transmission. The two stators are mounted between the impeller and turbine and are provided with overriding clutches that allow them to rotate only in the direction of impeller travel. At low car speeds (maximum torque) both stators remain stationary and control the direction of oil flow toward the

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CHRYSLER FLUID-TORQUE DRIVE (Continued)

turbine. When turbine speed approaches impeller speed (low torque) both stators 'free-wheel' in the direction of rotation and all elements in the converter rotate as a unit.

LUBRICATION: Check oil level in reservoir every 1000 miles, drain and refill unit every 20000 miles (see procedure below).
Capacity—Approximately 10½ qts.
Recommended Oil—Use "Mopar Fluid Drive Fluid" or high quality SAE. No. 10W Engine Oil.
Checking Oil Level—Oil level should be even with bottom of filler plug hole on left side of reservoir below clutch housing.
Draining—Drain reservoir by taking out drain plug in bottom. Drain Fluid-Torque unit by taking out both drain plugs in case (accessible after removing flywheel housing bottom cover plate—remove one drain plug and allow oil to drain, then rotate unit 180° and remove second plug to complete draining). Replace all plugs.

Refilling—Replace plugs in converter. Fill oil reservoir to level of hole with MOPAR Fluid Drive Fluid. Start engine and run between 500 and 700 RPM. with transmission in neutral. With engine running, continue adding fluid to reservoir until oil level remains at bottom of filler opening. Replace filler plug in reservoir. To eliminate air bubbles from oil, shift transmission into high range and apply parking brake. Then run engine between 500 and 700 RPM. for not over two minutes. Check oil level and replenish to bring oil level up to bottom of filler hole.

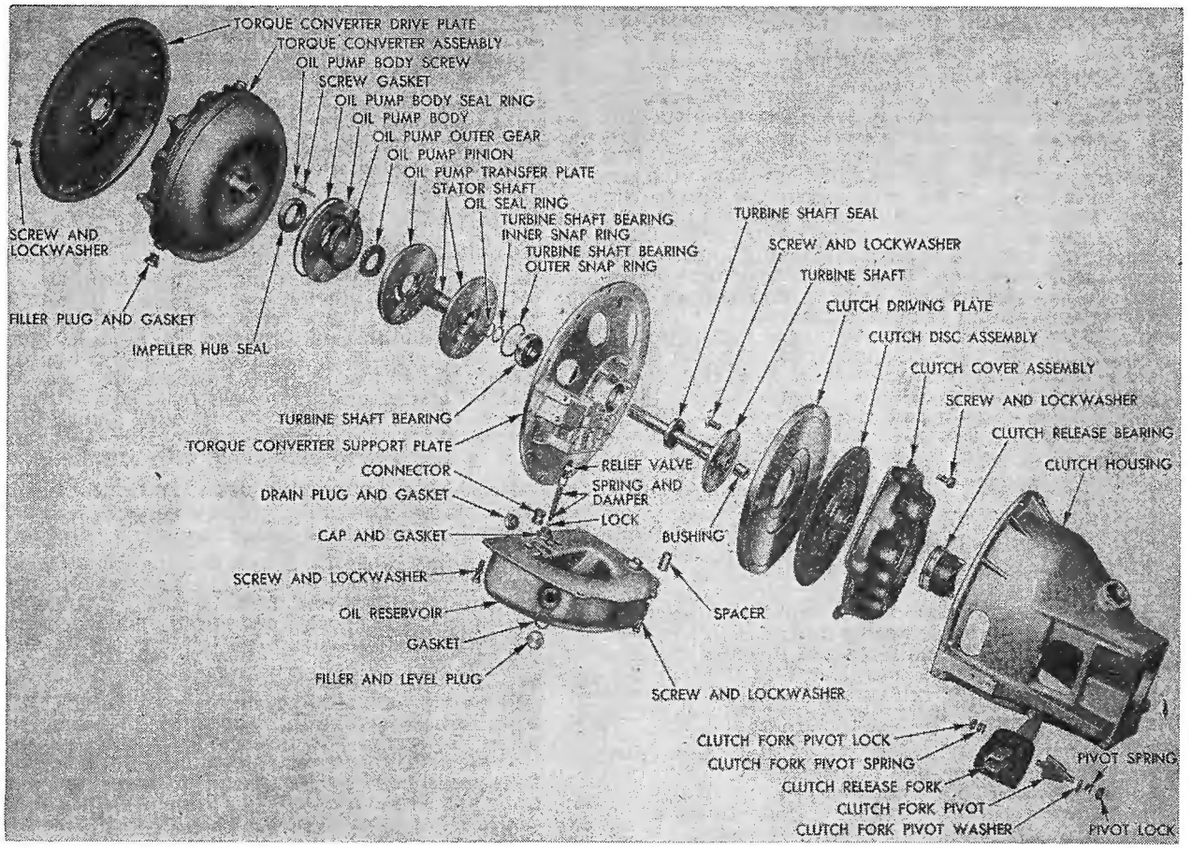
REMOVAL: Drain oil reservoir and remove reservoir from bottom of clutch housing. Remove starter from front of flywheel housing and remove lower half of flywheel housing pan. Drain converter and disconnect oil lines from converter support plate. Remove transmission ***(see Transmission Removal on individual car model page)***. Remove clutch ***(see Clutch Removal on individual car model page)***. Pull clutch driving plate and converter support plate assembly from converter and flywheel housing. Remove the six converter drive plate-to-converter attaching cap screws and remove converter.

TROUBLE SHOOTING: Check possible trouble as follows:
Car Creeps when idling—Throttle opening excessive. Check and adjust engine idle speed to 450-500 RPM.

Slippage—Check following conditions:

(1) With car parked, apply parking brakes, place transmission in direct speed, operate engine at 500-700 RPM. If slippage noted, check for oil leakage from converter onto clutch assembly. Correct oil leaks, clean oil from clutch assembly, replace clutch driven disc. ***See Oil Pump Relief Valve Change above.***

(2) If slippage noted with car in motion, check for low oil level in reservoir or low oil pressure. ***See Oil Pump Relief Valve Change above.***
Overheating—Check for low oil level or lack of oil in converter, low water level or no water in radiator, fan belt loose or broken, water pump defective or water passages clogged, converter oil lines or cooler unit clogged, engine overloaded due to dragging brakes, etc.



CHRYSLER FLUID-TORQUE DRIVE ASSEMBLY

►***TORQUE CONVERTER UNIT REPAIR NOTE***—Torque converter unit is sealed and no adjustments or repairs are necessary except periodic draining and refilling. Replace complete converter unit if repairs are required.

OVERHAUL: Overhaul of Fluid-Torque assembly is limited to the following operations:

Oil Pump Relief Valve Installation (New Type Relief Valve): Remove reservoir from bottom of clutch housing, take out three connectors in bottom of torque converter support plate. Remove relief valve plug and gasket from valve chamber in support plate. Withdraw and discard the **old type** relief valve assembly (valve, spring, spring damper, and horseshoe lock). Install new type relief valve (see note below). Re-install valve plug and gasket, connectors (CAUTION—use new rubber seal "O" rings furnished in valve package and lubricate seals with chassis lubricant), and reservoir. Refill torque converter (see LUBRICATION data).

Relief Valve Installation Note—New type valve should be installed in following order: Slide valve sleeve into valve chamber with slotted side first, slide valve spacer in with two tongues on end of spacer bearing against bottom of valve sleeve, install valve ball through spacer and follow with valve spring so that spring holds ball against its seat on bottom of valve sleeve, install retaining plug.

►***VALVE SPRING CAUTION***—Spring used in new type relief valve is longer but has less tension than first type valve spring. Old type spring MUST NOT BE USED with new valve assembly (valve could not open).

Replacing Starter Ring Gear (on Converter Drive Plate): Remove converter and drive plate assembly from crankshaft (see Removal above). Take out six converter-to-drive plate bolts and separate drive plate from converter. Then service ring gear as follows:

Removing Ring Gear—Support the drive plate in vise and carefully remove staking lugs retaining ring gear with a file (CAUTION—use care not to distort drive plate when clamping it in vise). Support drive plate on 6" blocks of wood and use a blunt chisel or drift to tap ring gear off support plate. Use a file to remove all burrs or raised spots on gear contact surface of plate (CAUTION—do not remove any more metal than necessary to clean up this surface).

Installing Ring Gear—Heat new ring gear (see Heating Note below), place gear over flange surface

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CHRYSLER FLUID-TORQUE DRIVE (Continued)

of drive plate with rear face of gear contacting flange evenly around entire diameter. Weld gear to plate, spacing welds evenly and using same amount of metal at each weld to maintain balance. Clean surfaces of drive bosses on converter and mating surfaces on drive plate (CAUTION—Dirt or burrs on these surfaces will cause converter hub to run out of true and create converter unbalance). Install converter to drive plate bolts (CAUTION—check length of each bolt against bottoming in converter and use shorter bolts if bolts bottom before coming up against lockwashers). Check and correct converter hub run-out as directed below.

►**Ring Gear Heating Note**—Ring gear can be heated by any of the following methods: (1) Use C-794 oven, setting temperature at 150°F. and allowing gear to remain in oven for 15-20 minutes. (2) Place ring gear in shallow container of water and allow it to remain for 8 minutes after water has come to a boil. (3) If steam used, direct steam flow around gear for approximately 2 minutes. (4) If direct flame used, place support plate on flat surface with ring gear squarely on plate, direct slow flame around outer rim of gear using care to direct flame away from gear teeth and not at support plate, check heat with few drops of water on face of gear, gear should be hot enough when water boils.

Converter Hub Run-out: Check run-out after drive plate and converter assembly mounted on flywheel. Use dial indicator mounted on flywheel housing with plunger against converter hub (CAUTION—plunger must clear oil pump drive lugs). Rotate torque converter two complete turns while checking run-out. Maximum allowable run-out is .005". If run-out greater than .005", mark high point, turn converter until high point on same side of flywheel housing as dial indicator (to prevent damage to indicator) with one of the drive plate-to-converter bolts about 3" down from flywheel housing, use pry bar between flywheel housing and bolt to flex drive plate sufficiently to reduce run-out. Repeat this operation, if necessary, and recheck until run-out is within .005".

Support Plate & Oil Pump Overhaul: ***CAUTION—Support plate must be heated to remove or install oil pump in pump body recess (if not heated, recess will be scored or scuffed necessitating replacement of the support plate).***

Disassembly: Take out the six oil pump-to-support plate bolts. Place support plate on level surface with turbine and stator shafts upward, heat the plate (see Heating Note below). **After support plate heated** properly, install tools C-3126 (hex-head studs) in threaded holes in pump body until they bottom in support plate, turn these pulling tools in evenly until pump body is free of support plate. Lift stator shaft, plate, and transfer plate from the support plate. Take out turbine shaft snap ring (Tool C-484), install Tool C-3121 in pump recess and press shaft from bearing leaving the bearing in the support plate. To remove bearing, use Tool C-484 to remove snap ring and pull bearing out with Tool C-3138 (CAUTION—do not drive bearing out of support plate which will damage the plate).

►**Support Plate Heating Note**—Support plate may be heated by any of the following methods: (1) Use three or four 125 watt or 250 watt infrared or heat lamps placed 2-3" from plate (not touching) and rotate plate to provide even heating. If four 250 watt lamps used, time required should be approximately 15 minutes. (2) If oven C-794 used, set temperature to 160-170°F. and heat plate for approximately 20 minutes. (3) If gas torch used, make certain all converter oil removed from support plate, direct flame at immediate area of pump body. Temperature when heated should be 160-170°F. (above that which can be held with bare hand).

Inspection: Thoroughly clean and inspect turbine shaft oil seal ring, relief valve chambers, and support plate passages. Replace all parts as necessary.

Reassembly—Position new bearing squarely over bore in support plate and drive bearing into position in housing using Drift C-3123 (CAUTION—plate must be supported on opposite side when driving bearing in place), install large turbine shaft bearing snap ring. Install new seal in opposite side of housing using Drift C-3122. Replace support plate and bearing on turbine shaft using Drift C-3124, install small turbine shaft bearing inner snap ring using ring which provides best fit in slot (this snap ring furnished in three thicknesses). Make certain that pump body recess free from scores and burrs and that recess and passages are clean. Install new impeller hub seal in pump body (Tool C-3125), install new seal ring on outer diameter of pump body. Install oil pump outer gear and inner gear (hub of inner gear entered in body) in pump body, use transfer plate as surface plate on face of pump body and check clearance between pump body face and face of gears. This clearance should be .001-.003". Install transfer plate on stator shaft and plate with large counterbore in transfer plate facing stator shaft plate. Hold pump body upright, pour fluid drive oil or SAE 10W engine oil in gear recess (to facilitate priming of pump), invert stator shaft and plate assembly and insert shaft through pump pinion gear hub, turn assembly over and align holes in pump body, transfer plate, and stator plate (holes will line up in only one position). Coat seal ring on pump body with SAE 10W engine oil. **After heating support plate** (see Heating Note above), position pump body and stator shaft assembly over support plate recess with the six holes in both parts aligned and lower assembly into pump recess (CAUTION—use care to position oil seal ring on impeller shaft). Pump assembly should slip into recess easily, **if force required, oil seal ring on impeller shaft is not entering hub and stator shaft or support plate has not been heated sufficiently.** Start several of pump body-to-support plate bolts to serve as guides but **do not tighten** these bolts. Use light hand pressure to seat pump body in recess (only slight resistance of outer seal ring compressing against body in recess should be noted). Install all pump body-to-support plate bolts using **new** copper gaskets, tighten all bolts evenly to 17 ft. lbs. torque (CAUTION—make certain that bolts do not bottom in plate).

Transmission Drive Pinion Bushing Replacement: Use tool C-41 to remove bushing from turbine shaft. Check hole in shaft for metal chips and cuttings after bushing removed. Use tool C-3077 to install new bushing (tool will install and burnish bushing in one operation). Slip new bushing over ground end of tool (after removing outer sleeve and nut), use tool as driver to install bushing in shaft, then place outer sleeve and nut on tool and tighten nut to withdraw tool which will burnish bushing at same time.

INSTALLATION: Mount converter to converter drive plate positioning offset hole in converter to match offset hole in drive plate and install six attaching cap screws finger tight. Line up the two slots in pump pinion gear so that they index with the two oil pump drive lugs on converter when converter support plate and clutch driving plate is assembled to converter. Then, assemble the support plate and clutch driving plate assembly to the converter so that the external splines on turbine shaft index with the internal splines of the turbine in the converter, and so the external splines on the stator shaft will index with internal splines of the stators in the converter. ***(CAUTION***—If difficulty is experienced in indexing these parts, rotate converter while pushing in on support and clutch driving plate assembly. Under no circumstances should the clutch housing cap screws be installed until after the face of support plate is flush with flywheel housing). Hold converter support plate and clutch driving plate assembly up in position and tighten the six converter-to-converter drive plate cap screws. ***(CAUTION***—Make sure all oil has been cleaned from clutch assembly). Install clutch and transmission. Lubricate rubber oil seals with chassis lubricant and install the three connectors in their holes in converter reservoir and install reservoir.

1941 CHRYSLER 8 VACAMATIC OVERDRIVE

Chrysler 8, Models C30, C33 (1941)

►**CONTROL BUTTON NOTE:** The "OD" button (at left of steering column can be pulled out—but only when car is standing still—to lockout 2nd & 4th Speed (free-wheeling gears) if desired. Button can be pushed in (to make 2nd & 4th Speeds operative) at speeds under 27 MPH (clutch disengaged).

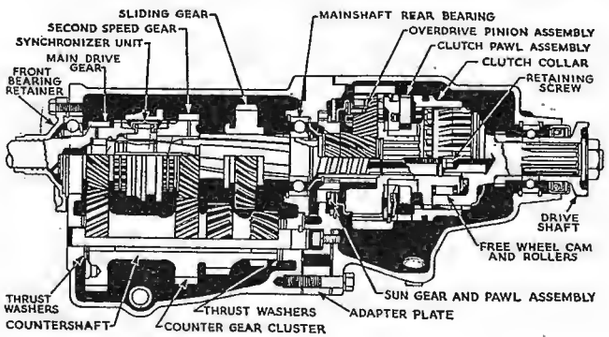
Starting Engine by Pushing or Towing Car—Control button must be pulled out to insure transmission being in 1st or 3rd gear (2nd & 4th are free-wheeling and will not crank engine). CAUTION—Above data applies only to Vacamatic Transmission on Chrysler Eights. ***See 'Important Note' at beginning of following article for Control Button data on Chrysler Six which operates differently.***

►**EMERGENCY LOW GEAR NOTE:** Vacamatic Overdrive Transmission has conventional Low Speed Gear in transmission case but this gear ratio is ordinarily not required and a lock plate or collar is used to prevent the steering column gear shift lever being moved to the conventional "Low" position which would engage this low speed gear. If car is being operated in mountainous country, or **whenever it is desired to use this Emergency Low Gear,** lock-out device can be removed as follows:

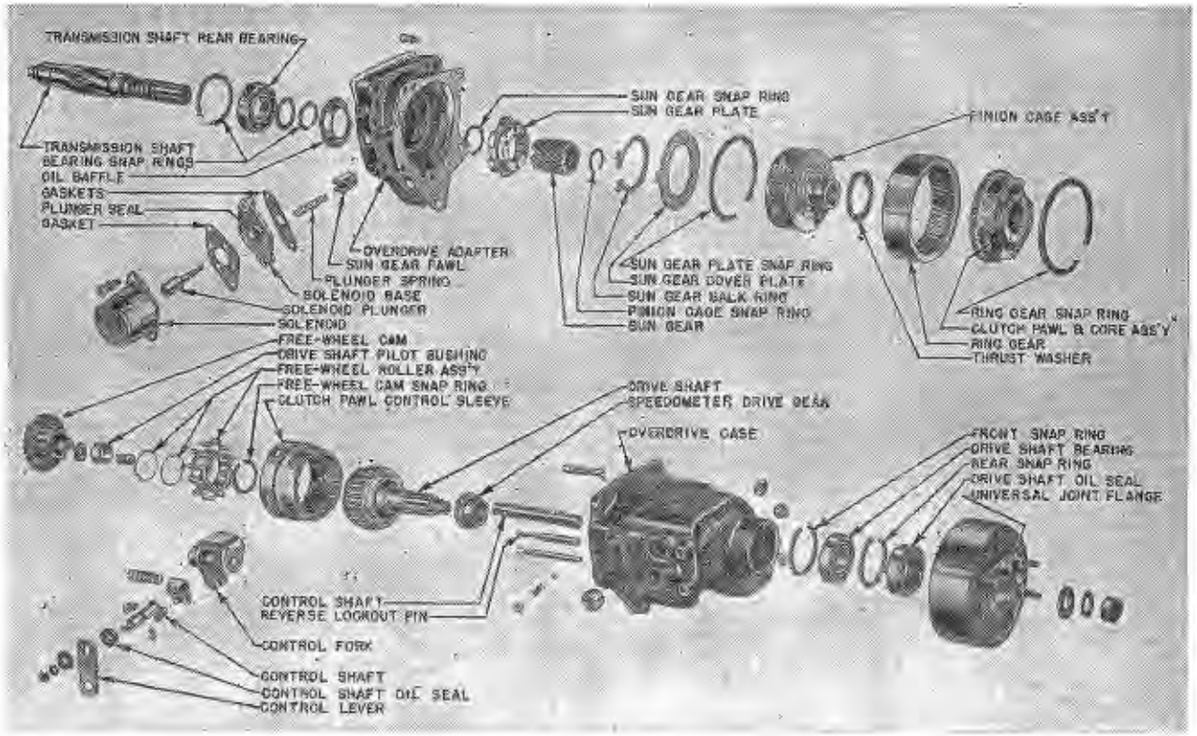
Lock-out Plate Removal (First Cars)—Remove nut on lower end of steering column gearshift rod end and remove lock-out plate from rod.

Lock-out Collar Removal (Later Cars)—Collar is attached around steering column to prevent gearshift rod lever moving into conventional low speed position. Remove collar from steering column by taking out attaching screw.

DESCRIPTION: 4-Speed type transmission consisting of a two-speed manually controlled unit in conjunction with an Automatic Overdrive unit which provides two additional speeds (similar to previous 3 speed and Overdrive models except that conventional Low Speed Gear blocked out (see Emergency Low Gear Note above). Reverse is engaged in the usual manner by shifting the mainshaft sliding gear to the rear so that it meshes with the reverse idler gear. Gearshift lever on steering column has two forward positions—Low (corresponding to conventional 'Second Gear' position) and High—in addition to the usual Reverse position. Each of these lever positions furnishes two gear ratios as follows: Low—**1st.** (Overdrive inoperative), **2nd.** (overdrive operating); High—**3rd.** (Overdrive inoperative), **4th.** (overdrive operating).



1941 CHRYSLER 8 TRANSMISSION VACAMATIC OVERDRIVE TYPE



OVERDRIVE USED ON 1941 CHRYSLER 8 VACAMATIC TRANSMISSION

OPERATION: Manual Control. Steering column gearshift lever operates a conventional blocker type synchronizing clutch. With the gearshift lever in 'Low', the synchronizer unit is shifted backward on the mainshaft to engage the intermediate constant mesh gear so that the drive is transmitted through the countergears. When the gearshift lever is moved to the 'High' position, the synchronizer unit is shifted forward to engage the clutch teeth on the clutch shaft main drive gear so that the engine drives straight through without gear reduction (corresponding to the conventional High Gear). Each of these drives is modified by the Overdrive Unit to provide additional gear ratios as follows:

Automatic Overdrive Control:—Overdrive unit is of the conventional 'centrifugal pawl' engagement type and cuts in at approximately 21-25 MPH (if accelerator pedal is released momentarily) to secure 2nd. Speed (with manual control in 'Low'), 4th. Speed (with manual control in 'High'). Overdrive unit has electrical 'kick-down' control (similar to type used on 1940 Chrysler models) so that transmission can be shifted down automatically from 4th. to 3rd. or from 2nd. to 1st. by depressing the accelerator pedal beyond the wide open throttle position.

Lockout Control Button:—'OD' button on left of steering column can be pulled out to lock out 2nd & 4th speeds (car will operate in 1st or 3rd depending on gearshift lever position).
CAUTION—Pull out button only when car standing still. Button can be pushed in at any speed under 27 MPH with clutch disengaged.

Kick-down Switch (for Automatic Downshift): Controlled by accelerator linkage.
Switch Adjustment—3/32" gap between plunger and contact screw with throttle just wide open (over-travel must be sufficient to close switch contacts).

Throttle Guard (Slow-Closing Throttle): Vacuum controlled unit prevents engine stalling when throttle closed.
See "Chrysler Eight Throttle Guard" in Carburetion Equipment Section.

REMOVAL OF TRANSMISSION: ***See "Transmission" on car model page.***

TRANSMISSION DISASSEMBLY: Disassembly is same as Std. Chrysler Transmission (see preceding article). When disassembling this transmission, take out capscrews holding overdrive and adapter plate on transmission case, remove overdrive and adapter as an assembly by withdrawing mainshaft from rear of transmission case (adapter fastened to overdrive by screws which will prevent overdrive case separating). ***See preceding article on Chrysler Synchromesh Transmission for all other transmission servicing data.***

Overdrive Unit:—Overdrive is Warner Type AS1-R7B.
See article on Warner Type R7 Overdrive for all Overdrive servicing data.

CHRYSLER 6 & 8 VACAMATIC DE SOTO SIMPLIMATIC (1941-EARLY 1942 UNDERDRIVE TYPE)

Chrysler 6, C28 Royal & Windsor (1941)
Chrysler 6, C34 Royal & Windsor (Early 1942)
Chrysler 8, Models C36, C37 (Early 1942)
DeSoto, Model S8 (1941), S10 (Early 1942)

►CHANGES, CAUTIONS, CORRECTIONS

►**LATE 1942 CAR NOTE:** Later cars in 1942 have Piston Type Power Cylinder (replacing first type Diaphragm Type Power Unit). *See following article for data on cars with Piston Type Power Cylinder and control units.*

►**CONTROL BUTTON CAUTION:** Locknut control at steering column should be used only when it is necessary to start the car by pushing or towing. **Button should never be pulled out at any other time, and must be released (pushed in fully) as soon as engine starts.** To start the engine by pushing or towing car, proceed as follows: Turn on ignition, place gearshift lever in 'High Speed' position, pull out lockout control button at left of steering column, hold lever in this position until engine starts. Disengage clutch, push or tow car with clutch disengaged, when car speed reaches 5 MPH., engage clutch. **Release lockout control button as soon as engine starts.**

►**INTERRUPTER SWITCH INSULATOR INSTALLATION:** To correct complaints of engine cutting out caused by mud and water splashing on interrupter switch on transmission and shorting the switch, install special Interrupter Switch Insulator, No. 870833. Switch located on underside of vacuum unit assembly on left side of transmission.

►**NO UPSHIFT COMPLAINTS (Transmission remains in First or Third):** Caused by breaking of diaphragm in vacuum power unit. Can be corrected by installing late 1942 Piston Type Power Unit. *See Late 1942 data (following).*

►**KICK-DOWN SWITCH CHANGE (For Improved Transmission Performance):** *See "Chrysler, DeSoto, Dodge Kick-down Switch" in Electrical Equipment Section.*

DESCRIPTION: Transmission (Vacamatic—Chrysler 6, Simplimatic—De Soto) is used in conjunction with Fluid Drive. Transmission is entirely new design 4-speed type with a two range manual control (Low-High) and an automatic two speed shift (vacuum and spring operated with accelerator pedal control) within each range (First & Second in Low range, Third & Fourth or Direct in High range). Transmission shifts up from First to Second (above 8 MPH. with gearshift lever in Low range) or from Third to Fourth (above 15 MPH. with gearshift lever in High range) when the accelerator pedal is released momentarily. A step-down or 'kick-down' feature is provided by which a shift from Fourth to Third (at speeds below 53 MPH.), or from Second to First (at speeds below 27 MPH.) occurs automatically when the accelerator pedal is depressed past the wide open throttle position. The manual control (gearshift lever shift between Low-High) operates in exactly the same manner as the Second-High shift on previous transmission. The automatic control is entirely new and operation is described below.

OPERATION: Manual Control. The gearshift lever has three positions corresponding to previous designs with Low Speed omitted (Low Range secured with lever in customary 'Second' position). This lever controls a conventional synchronizer clutch unit on the mainshaft which locks the Low Speed Gear to the shaft (rear position—Low Range) or the Direct Speed Gear to the shaft (forward position—High Range). The two speeds in each range are controlled by the automatic synchro-clutch as follows:

Automatic Control:—Consists of a vacuum and spring operated synchro-clutch which locks the mainshaft Direct Speed Gear to the clutch shaft drive gear (for Second and Fourth or Direct Drive with synchro-clutch in forward position). With the synchro-clutch in the rear position, Direct Speed Gear is free to revolve on mainshaft (for First or Low Gear in which drive is transmitted through Low Speed Gear on mainshaft meshing with gear on countergear cluster), or drives mainshaft (for Third Gear when manual synchronizer unit is in forward position). The synchro-clutch shift lever is spring-loaded so that it is in the forward position (Second & Fourth) except when the vacuum unit assembly operates to shift the synchro-clutch to the rear position (First & Third). This vacuum unit assembly operates as follows:

Vacuum Unit Assembly:—Consists of a diaphragm type vacuum unit with solenoid operated valve mounted on a pivot on the side of the transmission case so that the vacuum unit plunger stem operates the synchro-clutch shift lever. With the solenoid not energized, valve is in lower position so that diaphragm chamber is connected to vacuum source (engine manifold). Vacuum causes plunger to move fully to the right until the latch under the solenoid valve engages the notch in the plunger stem holding the plunger in this position with the vacuum diaphragm spring fully compressed (this action permits shift lever spring to move synchro-clutch to forward position). Whenever the solenoid is energized (circuit completed by Governor, Kick-down Switch, or Ignition switch—when turned to "off" as described below), the valve is drawn up, cutting off the vacuum and opening the atmospheric valve so that air is admitted to the diaphragm chamber. This movement of the valve stem also releases the plunger stem latch so that the plunger is free to move to the left to shift the synchro-clutch to the rear position. As the plunger moves to the left, the ridge on the end of the plunger stem rides over the ball of the interrupter switch, closing the switch contacts and cutting out the ignition momentarily, which relieves the torque on the synchro-clutch and allows it to be shifted. As soon as the plunger ridge passes the interrupter switch ball, the switch contacts are opened by a spring and the ignition is restored (this entire action occurs so rapidly that the interruption of the ignition is not apparent).

Control Circuit & Switches:—The vacuum unit solenoid valve is connected through a 30 ampere fuse to the "SF" terminal of the control relay so that the solenoid circuit is 'hot' whenever the ignition switch is turned on through lead from ignition switch), or whenever the generator is rotating at a speed sufficient to close the control relay contacts (through lead from regulator "B" terminal). The solenoid is energized (to operate the transmission power unit) whenever the solenoid circuit is completed to ground in any one of the following ways:

Governor Switch—Governor switch contacts are closed (so that solenoid is energized) with the car at rest. As the car speed increases, the governor weights move out and open the switch contacts which breaks the solenoid circuit. Governor switch is driven by a special gear of the countergear cluster so that the cut-in and cut-out speeds are twice as high in 'High' range as in 'Low' range.

Carburetor Kick-down Switch: Plunger operated by the throttle valve lever completes circuit to ground (so that solenoid is energized) when the accelerator is depressed past the wide open throttle position at car speeds under 27 MPH. (low range for kick-down to First), 53 MPH. (High range for kick-down to 3rd). Above these speeds, vacuum in carburetor pulls the piston and ground contact up against spring tension so that the plunger does not complete the circuit to ground.

Ignition Switch Ground—A special terminal and ground connection in the ignition switch completes solenoid circuit to ground when ignition turned off.

Control Relay: Auto-Lite Model HRE-4001. Relay is single winding type. Relay winding terminal (A) is connected directly to generator main brush (at regulator "A" terminal) so that winding is energized and relay contacts closed whenever the generator is rotating. This provides an alternate feed for the control relay even though the ignition switch may be turned off.

Ignition Interrupter Switch: This switch does not ground the solenoid circuit but does ground the ignition primary (short-circuiting the breaker contacts) when the switch contacts are closed (this occurs only momentarily during the vacuum unit plunger movement) for synchro-clutch shift.

Lockout Control (For Starting the Engine by Pushing or Towing Car)—Entire vacuum unit assembly is mounted on a pivot on the side of the transmission case and is controlled by a button on the side of the steering column. When button is pulled out, plunger stem end of vacuum unit is tilted down so that it does not contact synchro-clutch shift lever

ADJUSTMENT: Diaphragm Type Vacuum Power Unit. Clearance between end of vacuum unit stem and shift lever must be 5/32" with vacuum unit in latched position. To adjust, make certain that vacuum unit in latched position and that lockout button is all the way in with vacuum unit against stop on mounting bracket, see that synchro-clutch is in engaged position (spring will engage synchro-clutch if clutch driving plate rocked by hand through fluid drive filler plug hole in clutch housing with engine at rest). Loosen jam nut on shift shaft, loosen locknut and turn adjusting screw on shift shaft until clearance between lever and vacuum unit stem is exactly 5/32", tighten locknut and jam nut.

NOTE—Vacuum unit can be "latched" for above adjustment by removing fuse (in lead between control relay and solenoid), starting engine, accelerating slightly, and turning ignition "off".

Control Relay: Winding resistance is 22.2-26.2 ohms (measured between "A" and "B" terminals).

Contact Gap—.026". Adjust by varying height of stationary contact.

Air Gap—.020-.024" with contacts open (adjust by bending armature stop). With armature sealed against core, gap between armature and yoke should be .008-.012".

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VACAMATIC & SIMPLIMATIC 1941-EARLY 1942 UNDERDRIVE (Cont.)

Contacts Close—4.0 volts maximum.

Contacts Open—.3-.5 volts (with voltage decreasing from 6.0 volts). Adjust by bending armature hinge ears (CAUTION—keep both ears in line).

Kick-down Switch: *See "Chrysler, DeSoto, Dodge Kick-down Switch" in Electrical Equipment Section.*

Slow-Closing Throttle: Later solenoid type not adjustable. Adjusting screw on early type should be turned out 5 turns (for 7/32" stroke). *See "Chrysler, DeSoto, Dodge Slow-Closing Throttle" in Carburetion Equipment Section.*

Governor (First Type): Contact opening and closing points are adjustable. Governor speed must be accurately determined when adjustments are being made. Governor can be mounted on a Distributor Synchroscope or other driving unit with accurate tachometer. Use test lamp and battery connected between governor terminal and ground (governor frame) to check opening and closing (lamp will go out when contacts open, light when contacts close). NOTE—Test lamp should "snap" on and off. If lamp flickers or is dim, governor switch contacts are defective and governor should be replaced.
Contact Opening—460-560 RPM. (12-14 MPH.).
Contact Closing—500-400 RPM. (12-10 MPH.).

To Adjust—Necessary to remove sealing compound from two adjusting screw wells on governor cover. "Ascending Speed Adjusting Screw" is closest to open end of adjusting screw well, "Descending Speed Adjusting Screw" is farther from open end of well. Turn correct screw in or out as follows:
Contact Opening—Turn "Ascending Speed Adjusting Screw" **out to increase speed** at which contacts open, turn this screw **in to decrease speed** at which contacts open.

Contact Closing—Turn "Descending Speed Adjusting Screw" **out to increase speed** at which contacts close, turn this screw **in to decrease speed** at which contacts close.

IMPORTANT NOTE—After completing governor adjustment, tighten adjusting screw locknuts securely and fill well with sealing compound having melting point higher than 250°F. This is important to prevent moisture leaking past adjusting screws.

Governor (Later Type): Governor is not adjustable and should be replaced if tests indicate that it is not performing correctly.

TESTING: Tests can be made on car to locate units which are defective or out of adjustment as listed below. Tests should be made with engine warmed up and idling at 450 RPM.

Control Relay: Connect test lamp between relay "SF" terminal and ground. Lamp should light. Speed engine up and turn ignition off. Lamp should remain lighted until engine stops turning and should then go out. Replace relay if performance not correct (first check lead between relay "A" terminal and regulator "A" terminal).

Governor: Connect test lamp between regulator "B" terminal and kick-down switch terminal on carburetor. Lamp should be lighted with engine idling. If lamp is not lighted, check for open-circuit between kick-down switch and governor, and for defective governor (ground lead at governor terminal, if lamp lights, governor is defective). Slowly increase engine speed to 800-1000 RPM. La should go out sharply. If lamp remains lighted, check for ground between kick-down switch and governor (remove lead from governor terminal, if lamp goes out, governor is defective). Slowly decrease engine speed to 675-800 RPM. Lamp should light sharply as governor contacts close. If lamp does not light, or if it is dim or flickering, governor is defective or circuit is open between kick-down switch and governor.

Diaphragm Type Vacuum Power Unit: With engine running, increase and decrease speed between idling and 1000 RPM. points. Vacuum unit should operate in this range (plunger stem should pull in rapidly and snap out quickly. If operation is sluggish, remove and service unit (see Servicing). If operation not satisfactory, connect test lamp leads to solenoid valve terminals, check as follows:

Engine Idling at 450 RPM.—Test lamp should be lighted and vacuum unit plunger stem "out." If stem is in "in" position, check for faulty solenoid or valves. If test lamp not lighted, and vacuum unit stem is in "in" position, check for blown fuse, open-circuit between solenoid and governor, or defective governor.

Engine Speed increased to 1000 RPM.—Test lamp should not be lighted and vacuum unit plunger stem should be "in". If plunger stem "out", check vacuum line connections and lines for obstructions (connect vacuum gauge at power unit, gauge reading must be 15" minimum). If vacuum reading correct, check power unit and vacuum valve. If test lamp is lighted and power unit plunger "out", check for ground between governor and solenoid, or between solenoid and kick-down switch. Check governor (contacts not opening).

Engine Speed returned to Idle (450 RPM)—Test lamp should be lighted and power unit plunger stem "out". If lamp not lighted, and plunger stem "in", check for blown fuse, open-circuit between governor and solenoid, or defective governor.

Interrupter Switch: Operation can be checked by disconnecting switch lead at distributor terminal and connecting voltmeter between this lead and the terminal. Run engine at 1000 RPM., press kick-down switch plunger in. Voltmeter should show reading momentarily (as circuit completed).

Kick-down Switch: Connect one test lamp lead to regulator "B" terminal, other test lamp lead to kick-down switch terminal. Lamp should be lighted. Increase engine speed until lamp goes out (governor contacts open). Depress kick-down switch plunger. Lamp should light. To check high speed limit feature of switch, increase engine speed to equivalent of 55 MPH., depress switch plunger. Lamp should not light. If lamp lights, switch piston is sticking. *See "Chrysler, DeSoto, Dodge Kick-down Switch" in Electrical Equipment Section.*

Slow-Closing Throttle: *See "Chrysler, DeSoto, Dodge Slow-Closing Throttle" in Carburetion Equipment Section.*

Control Wiring & Fuse: See wiring diagram for proper connection of all units.
Fuse—30 ampere. In Solenoid Valve lead.

REMOVAL OF TRANSMISSION: *See "Transmission" on car model page.*

TRANSMISSION DISASSEMBLY: Remove vacuum power unit. Unscrew and remove governor, remove speedometer pinion. Lock transmission in reverse, shift synchro-clutch sleeve to forward position to lock gears. Remove companion flange nut, take off brake drum, pull oil seal with special puller C-497, remove detent ball retaining screws and springs in gearshift housing, place gearshift levers in neutral, remove gearshift housing. Remove capscrews in brake support, turn support counterclockwise to expose shift rail holes, remove shifting fork and reverse idler shaft retaining screws, slide shift rails out through rear of case (top rail first—use care not to lose detent balls and spacer on lower reverse rail), remove reverse fork. Take off drive pinion bearing retainer, remove main shift fork guide pin (unscrew pin and pull out at front

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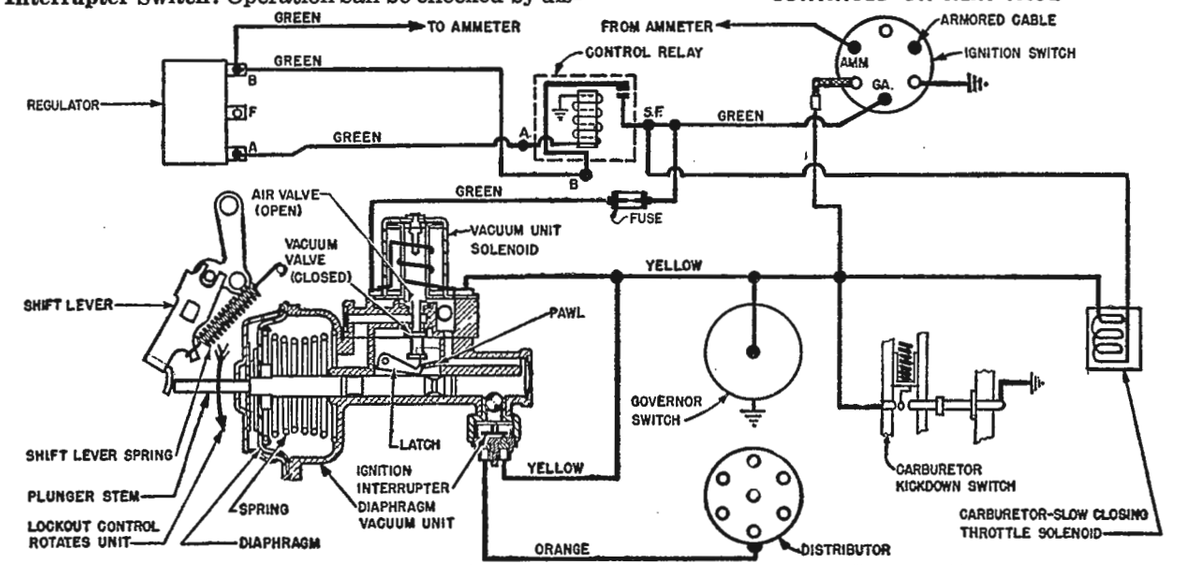


DIAPHRAGM TYPE CONTROL (1941-EARLY 1942) FOR UNDERDRIVE TRANSMISSION

VACAMATIC & SIMPLIMATIC 1941-EARLY 1942 UNDERDRIVE (Cont.)

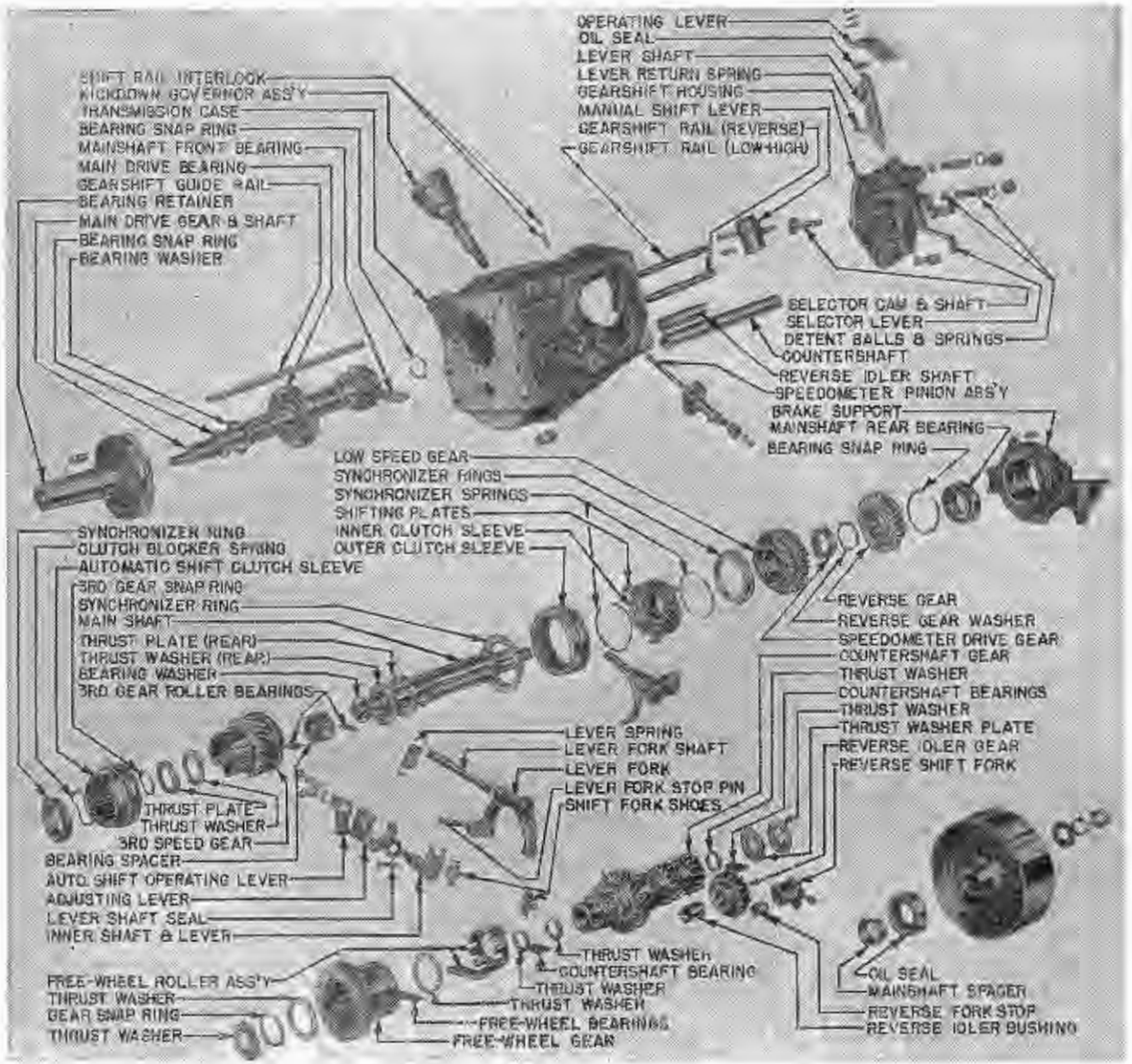
of case), remove manual shift fork. Use puller C-604 to remove reverse idler shaft through rear of case, lift out reverse idler gear. Use special C-605 arbor to drive countershaft out through rear of case and allow countergears to drop down in case. Pull mainshaft and gear assembly out through rear of case, remove drive pinion and synchro-clutch sleeve, lift out countergear assembly.

Mainshaft Gear Assembly:—Remove blocker ring on forward end of shaft, remove synchro-clutch spreader ring, remove direct speed gear snap ring, remove gear being careful not to lose roller bearings, bronze thrust washer, and roller bearing thrust washer. Remove gear stop ring, thrust washer, clutch sleeve, and shifting plates (synchronizer assembly). Remove brake support housing by tapping rear end of shaft with a lead hammer. Remaining gears can be pressed off shaft in an arbor press or removed with a gear puller. When assembling shaft, use new snap rings, see that low speed and reverse gears installed with long hubs toward rear. Endplay between low speed gear and speedometer drive gear should be .003-.009" with feeler gauge inserted between shoulders of gears (spacers furnished .041", .045", .050", .055" thick for this adjustment). When installing the direct speed (third speed) gear, install 36 rollers in forward end, then install spacer with holes and groove toward rear so that oil holes line up (this is important), then install 36 rollers in rear end, small steel thrust washer next to rollers and bronze thrust washer, then install assembly on shaft (use cup grease to hold rollers in place). Install forward bronze thrust washer with oil groove to rear, steel thrust washer with tapered face to front, use new snap ring. Endplay between steel thrust washer and snap ring should be .003-.009" (adjust by using snap ring of correct thickness—furnished .087", .092", .097", .101" thick).

Manual Control Synchronizer Assembly: When assembling this unit, install new snap ring in forward end of mainshaft spline, install synchronizer hub with long portion of hub toward rear of transmission. Install springs and shifting plates in hub, engaging hook on each spring in same groove.

Automatic Control Synchro-clutch:—When assembling, make certain that teeth on clutch hub mesh with center space of each set of teeth on clutch sleeve (CAUTION—clutch sleeve cannot be shifted unless meshed in this manner). With two capscrews installed in brake support to align mainshaft assembly, install spreader ring and synchro-clutch blocker ring, see that clutch sleeve can be pulled all the way over the dogs of the blocker ring.

Countergear Assembly:—To dismantle free-wheeling gear, remove snap ring in end of cluster gear, remove thrust washer, free-wheeling gear, thrust washer and roller bearings, free-wheeling rollers, roller cage and springs (use care not to lose two springs under the cage). Reassemble in same manner using cup grease to retain free-wheeling rollers, install roller thrust washer with beveled side toward rollers, turn roller cage clockwise and install free-wheeling gear. Install the 36 rollers in forward end of cluster gear for free-wheeling gear (use cup grease to hold rollers in place), install retainer washer and new snap ring. Measure endplay between free-wheeling gear and cluster gear



1941-42 VACAMATIC & SIMPLIMATIC UNDERDRIVE TRANSMISSION

(use feeler stock) which should be .003-.009". Adjust by installing thrust washer of correct thickness (furnished .084", .087" .091" thick). When installing countergear assembly, make certain bronze thrust washer in place on forward end of gear cluster, large steel thrust washer (next to gears) and large bronze thrust washer (next to case) on rear end of gear cluster. Countergear assembly endplay should be .005-.011" (measure with feeler gauge between thrust washer and case at rear). Adjust by installing rear bronze thrust washer of correct thickness (furnished .087", .091", .095", and .098" thick).

VACUUM POWER UNIT SERVICING: Diaphragm Type. Remove unit from transmission by removing mounting clevis pin. Disassemble unit as follows:

Power Unit Diaphragm: Remove six screws in diaphragm housing (remove screws evenly to relieve spring tension, inspect diaphragm. Replace diaphragm if leaking, or if hardened or spongy. Install diaphragm with mouth toward main body, tighten shaft nut securely and lock nut by staking threads. Clean shaft and cylinder body thoroughly, lubricate shaft with graphite grease or lubriplate.

Solenoid & Valve Assembly: Solenoid can be removed by taking out three mounting screws. Replace solenoid if terminals loose or if winding open-circuited (test for continuity with lamp and battery). Valve washers must be clean and smooth, replace if worn. Lubricate latch and trigger. Do not lubricate solenoid plunger.

(LATE 1942 UNDERDRIVE TYPE) DE SOTO SIMPLIMATIC CHRYSLER 6 & 8 VACAMATIC

Chrysler 6, Model C34 (Late 1942)①
Chrysler 8, C36 Saratoga (Late 1942)②
Chrysler 8, C36 New Yorker (Late 1942)③
Chrysler 8, C37 Crown Imperial (Late '42)④
DeSoto, S11 Custom & Deluxe (Late 1942)⑤
①—Beginning Serial Number 70,008,211 (Royal), 70,510,807 (Windsor and Town & Country).
②—Beginning Serial No. 6,763,446.
③—Beginning Serial No. 6,679,669.
④—Beginning Serial No. 7,808,650.
⑤—Beginning Engine No. 18,085.

►CHANGES & CORRECTIONS

►**TRANSMISSION CONTROL CHANGE:** The Piston Type Power Cylinder described below was used on Late 1942 cars and replaced earlier type diaphragm cylinder. Diaphragm type cylinder on first 1942 cars used Neoprene diaphragm.

►**CHRYSLER EIGHT NOTE:** Vacamatic transmission used on 1942 Eights is same as type used on Six Cylinder cars and is not same type used on 1941 Eights (Underdrive type not Overdrive type).

►**KICK-DOWN SWITCH CHANGE (For Improved Transmission Operation):** *See "Chrysler, DeSoto, Dodge Kick-down Switch" in Electrical Equipment Section.*

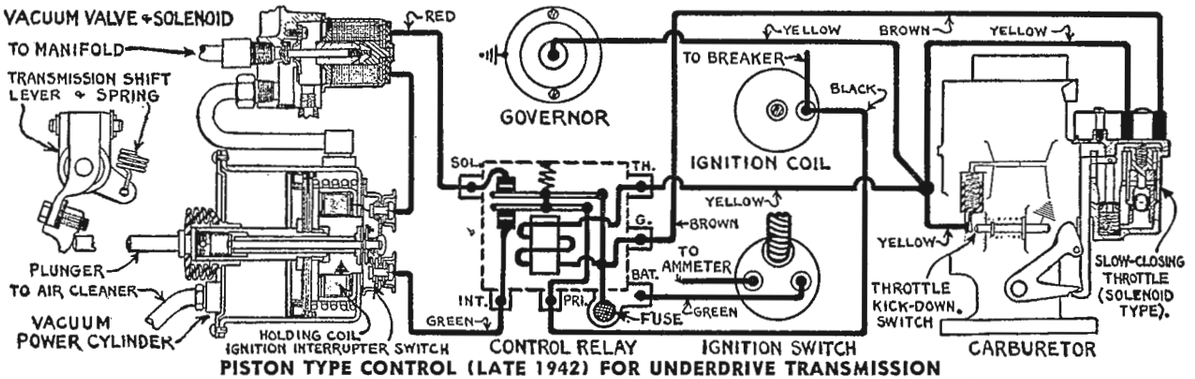
DESCRIPTION: Four speed type transmission with manual control (Low-High) and two speed automatic shift in each range (First & Second in Low Range, Third & Fourth or Direct Drive in High Range). Two types of automatic control used on 1942 cars. First type control with diaphragm type vacuum unit is same design as used on 1941 cars. Second type control with piston type vacuum unit is entirely new design and is described below. *Refer to 1941-42 Chrysler Vacamatic & DeSoto Simplimatic Type Transmission article (preceding) for all data on first (Diaphragm Type) control.*

OPERATION: Automatic Control. Transmission synchro-clutch which controls the automatic Upshift and the 'kick-down' Downshift in each transmission range is same design as used on 1941 cars and operates in the same manner. Synchro-clutch (automatic) shifting is actuated by new design piston type vacuum unit as follows:

Vacuum Unit (Piston Type):—Consists of a piston type power cylinder and plunger assembly mounted on a rigid bracket at the right of the transmission case (not pivot mounted—instrument panel lock-out button operates differently with this type cylinder). Solenoid valve is separately mounted on engine cylinder head near carburetor. Vacuum unit return spring is located within cylinder and a 'holding coil' and Ignition Interrupter unit is built in the rear end of the cylinder. Separate air cleaners are used on the atmospheric vents of the vacuum cylinder unit and the solenoid valve unit (small air cleaner mounted on side of solenoid valve assembly, air cleaner for vacuum cylinder mounted on frame side rail). Vacuum unit operates as follows:

Upshift—When solenoid valve energized (controlled by Governor and throttle kick-down switch through relay), valve opens and admits vacuum to cylinder, piston and plunger are then pulled into cylinder so that spring is free to shift synchro-clutch into Second or Fourth Gear position. Holding coil in vacuum unit is connected in series with valve solenoid and is also energized so that vacuum unit piston is held in the retracted position with the return spring behind the piston compressed. In this position, the rod within the vacuum unit plunger closes the Ignition Interrupter contacts but the ignition is not disturbed because the ignition (lower) contacts of the kick-down relay are open whenever the upper (solenoid valve) contacts are closed.

Downshift—When the kick-down relay is actuated by Governor or Throttle Kick-down Switch to de-energize the solenoid valve and vacuum unit holding coil, the opening of the relay solenoid contacts occurs simultaneously with the closing of the relay ignition contacts which grounds the ignition coil and interrupts the ignition so that the engine coasts momentarily to remove torque from the transmission synchro-clutch. The compressed return spring in the vacuum unit cylinder then moves the piston and plunger out in the vacuum cylinder so that the plunger engages the synchro-clutch shift lever and shifts the synchro-clutch into the First or Third Gear position. As soon as the vacuum unit plunger has moved out slightly, the rod within the plunger stem also moves out allowing the Ignition Interrupter contacts to open and restore the ignition (this action occurs so rapidly that interruption of the ignition is not apparent). These Upshift and Downshift circuits are controlled by the Kick-down Control Relay as follows:



PISTON TYPE CONTROL (LATE 1942) FOR UNDERDRIVE TRANSMISSION
SLOW-CLOSING THROTTLE NOT USED ON CHRYSLER 8 WITH STROMBERG CARBURETOR

Kick-down Control Relay:—Relay has two sets of contacts and a single coil winding which is controlled by the Governor Switch and Throttle Kick-down Switch as described below. Solenoid Valve (upper) contacts are held closed by spring tension when relay winding is not energized and are opened when the relay coil circuit is completed to ground through either the Governor Switch or Throttle Kick-down Switch. Ignition (lower) contacts of relay operate in a reverse manner (open when upper contacts are closed, close when upper contacts open). A fuse is mounted on the relay 'BAT' feed terminal and an extra 'C' terminal is provided for connection of the carburetor Slow-Closing Throttle (Chrysler 6 & DeSoto). Chrysler Eight has vacuum type Throttle Guard.

Governor Switch—Operates in same manner as type used with 1941-42 type (Diaphragm) control.

Carburetor Throttle "Kick-down" Switch—Same type as used with 1941-42 Diaphragm type control. NOTE—This type kick-down switch used only on Chrysler 6 & DeSoto with Carter (B&B) Carburetors. Throttle switch on Chrysler 8 is different type

Lock-out Control (For Starting Engine by pushing or towing car)—Synchro-clutch shift lever on transmission case is hinged so that it may be pivoted sideways to disengage from vacuum unit plunger to place transmission in non-free-wheeling Second or Fourth Gear engagement to permit engine to be started by pushing or towing car (new type vacuum unit is rigidly mounted on bracket and does not pivot). When control button on instrument panel is pulled out, the cam lever on the transmission case (connected to control button by adjustable cable) presses in on the spring-loaded section of the synchro-clutch shift lever which carries the plunger contact pad and swings the pad out of engagement with the plunger.

ADJUSTMENT: Piston Type Vacuum Power Unit. Clearance between contact pad on synchro-clutch lever and end of vacuum unit plunger should be 1/16" (limits 1/64-3/32") when synchro-clutch engaged (Second or Fourth Gear position) and plunger fully retracted within vacuum cylinder. Adjust by adding or removing shims (1/32" thick) between pad and shift lever. NOTE—This clearance not as critical as on previous diaphragm type vacuum unit.

Kick-down Switch: *See "Chrysler, DeSoto, Dodge Kick-down Switch" in Electrical Equipment Section.*

Slow-Closing Throttle: *Different type on Chrysler 8.* **Chrysler 6 & DeSoto**—*See "Chrysler, DeSoto, Dodge Slow-Closing Throttle" in Carburetion Equipment Section.*

CONTROL UNIT SPECIFICATIONS (For Testing):
Control Relay (Auto-Lite HRM-4001):—Winding resistance 17.5-19.4 ohms at 77°F.
Contacts Close—2.8-3.6 volts (seals 5.0 volts maximum). Bend lower armature spring hanger.
Contacts Open—0.9-2.5 volts. Adjust by varying height of lower stationary contact support.
Air Gap—.031-.036" with lower contacts open.

Solenoid Vacuum Valve (Auto-Lite SSJ-4001, 1B):—Winding resistance 1.82-1.93 ohms at 77°F.
Operation—Must open manifold valve seat and close atmospheric valve seat with 3.0 volts max. at 77°F (with 20" HG. at manifold connection).
Leakage—No leakage permissible through manifold valve seat (solenoid not energized), or through air intake valve seat (3.0 volts on solenoid) at 77°F.

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LATE 1942 UNDERDRIVE (Cont.)

Governor Switch (Auto-Lite TG-4002R):—Maximum endplay is .003-.010".
Contacts Open—530-600 RPM (on acceleration).
Contacts Close—440-530 RPM (on deceleration).
NOTE—Difference in RPM between opening and closing points must not be less than 80 RPM.

Vacuum Piston Assembly (Auto-Lite VP-4001):—Unit must complete stroke with vacuum of 12" HG. max.
Holding Coil—Must hold piston and plunger at end of stroke with current draw of 1.4 amperes max. at 1.2 volts max. (both ends of cylinder open to atmospheric pressure).
Voltage Drop—Not to exceed .10 volts with 10 amperes (from 'I' terminal to ground on base) with ignition interrupter contacts closed.
Leakage—With holding coil not energized, apply 15" HG. vacuum to complete stroke of piston and spring, shut vacuum off; spring must not move piston more than ⅛" in 10 seconds.

Control Circuits: Check all wiring for loose connections and open-circuits (see wiring diagram).
Fuse—30 ampere. On relay 'BAT' terminal.

TESTING: Make tests on the car to locate units which are defective or out of adjustment as listed below. It is recommended that voltmeter (rather than test lamp) be used in making tests.

Kick-down Relay: Check for full voltage at relay by connecting voltmeter from relay fuse (BAT. terminal) to ground. Voltage should be 6-8 volts and battery should be charged if reading less than 4.5 volts. Check fuse block and fuse by connecting voltmeter between relay "C" terminal and ground. Voltage reading should be 6-8 volts. If no reading secured, check for blown fuse or poor contacts. Check relay operation by connecting voltmeter between relay "SOL" terminal and ground with engine idling. Voltmeter reading should be zero (if 6-8 volts, check governor; if governor O.K., replace relay). Increase engine speed to 1000 RPM. Voltmeter reading should be 6-8 volts (if zero, check governor; if governor O.K., replace relay).

Vacuum Valve & Solenoid: Disconnect lead to vacuum unit at Solenoid valve terminal (both wires are Red—wire leading to vacuum unit must be disconnected). Connect voltmeter from this terminal (at which wire removed) to ground, idle engine. Voltmeter reading should be zero. Increase engine speed to 1000 RPM., voltmeter reading should be 6-8 volts (if voltage reading low at 1000 RPM., check for loose wiring connections between relay and solenoid, defective relay contacts, or defective solenoid).

Piston Type Vacuum Power Unit: Connect voltmeter between vacuum unit terminal on solenoid valve and ground. Idle engine. Voltmeter reading should be zero and power unit plunger stem should be "out." Increase engine speed to 1000 RPM. Voltmeter reading should be approximately 2 volts and plunger stem should snap "in." If voltmeter reading not correct within 1 volt, remove and service power unit (see Servicing). Vary engine speed between idle and 1000 RPM. Power unit plunger stem should snap "in" and "out" rapidly. If action sluggish, check air cleaners for dirt or obstructed air passage, check vacuum and air lines for leaks and obstructions, check solenoid valve.

Governor: Connect voltmeter between relay "TH" terminal and fuse block (relay "BAT" terminal). Idle engine. Voltmeter reading should be 6-8 volts. If reading not correct and steady, check for loose or corroded connections, defective governor contacts. Increase engine speed to 1000 RPM. Voltmeter reading should be zero. If any other reading noted, check for grounds or sticking governor contacts. Reduce engine speed to idling. Voltmeter reading should be 6-8 volts. NOTE—Governor not adjustable.

Interrupter Switch: Idle engine. Short relay "SOL" and "BAT" terminals with short jumper. Engine should stall if interrupter switch and circuit O.K. If engine does not stall, leave jumper in place, ground interrupter switch terminal. If engine stalls, switch is defective. If engine does not stall, leave jumper in place, short relay "INT" and "PRI" terminals with jumper. If engine stalls, relay is defective. If engine does not stall, check wiring for open-circuits.

Kick-down Switch: Connect voltmeter between relay "TH" terminal and fuse block ("BAT" terminal). Operate engine and increase speed to 1000 RPM. Voltmeter reading should be zero. Depress kick-down switch plunger by hand. Voltmeter reading should be 6-8 volts. If readings not correct, disassemble and service switch. To check high speed limit feature of switch, increase engine speed beyond 55 MPH. point, depress kick-down switch plunger by hand. Voltmeter should read zero. If not, switch piston is sticking. *See "Chrysler, DeSoto, Dodge Kick-down Switch" in Electrical Equipment Section.*

VACUUM POWER UNIT (PISTON TYPE): Remove unit from transmission for following operation.

Disassembly of Power Cylinder: Take out screws in cover plate. Clean cylinder walls carefully (replace unit if rough or scored). Clean dirt and gum from piston and holding coil solenoid with alcohol—do not use emery cloth (NOTE—These surfaces must be absolutely clean to insure magnetic attraction between holding coil core and piston, if not, holding coil may release causing incorrect kick-down). Lubricate piston leather ring with neatsfoot oil or shock absorber fluid, apply film of light cup grease to cylinder walls. Remove coil terminal face assembly using extreme care not to break wire, clean all surfaces including contacts with alcohol. When reinstalling this unit, make certain that white (silvery) face of contact disc is toward contacts and turn disc so that new contact surface opposite contacts. When installing piston and stem assembly in cylinder, insert one tablespoon of oil in unit.
Reassembly Check—After reassembling unit, check operation by connecting it to a 6 volt battery with a 21 cp. bulb in series (to limit current). Push plunger stem all the way in. Stem should be held in against spring tension until battery disconnected.

Solenoid Valve Assembly: Disassemble and inspect all parts. Replace coil if terminals loose. Clean plunger with solvent but do not lubricate plunger, make certain that plunger slides freely in coil. Clean and inspect valve seat, replace rubber valve if worn or distorted. Securely tighten all screws when reassembling unit.
Reassembly Check—After reassembling unit, check operation by connecting 6 volt battery across terminals with 21 cp. bulb in series to limit current. Lamp should glow dimly and valve should operate.

REMOVAL OF TRANSMISSION: *See "Transmission" on car model page.*

TRANSMISSION DISASSEMBLY & REASSEMBLY: *See "1941-Early 1942 Underdrive Type" Vacamatic data (preceding).*

1946-48 CHRYSLER HYDRAULICALLY OPERATED & DE SOTO TIP-TOE SHIFT

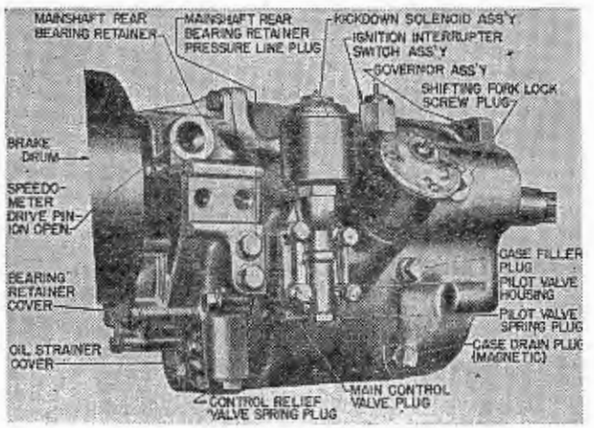
Chrysler 6, Model C38 (1946-47-48)
Chrysler 8, Models C39 & C40 (1946-47-48)
DeSoto, Model S11 (1946-47-48)

►**KICK-DOWN SWITCH CHANGE (For Improved Transmission Operation):** *See "Chrysler, DeSoto, Dodge Kick-down Switch" in Electrical Equip. Section.*

DESCRIPTION: Own Make, semi-automatic, 4-speed transmission with hydraulic actuation and electrical (governor switch and throttle "kick-down" switch) control. Transmission has "Low Range" and "High Range" controlled by Shift Lever on steering column and two speeds within each range (First & Second in Low Range, Third and Fourth or Direct Speed in High Range) engaged automatically by the hydraulic shift mechanism. Automatic shifting is dependent on car speed and throttle position. Except for new automatic hydraulic shifting mechanism, transmission design is similar to the Vacamatic and Simplimatic "Underdrive" transmission used on previous Chrysler & DeSoto models.

Free-Wheel Control—Consists of a sleeve on the countergear cluster which is shifted forward by the movement of the Direct Speed clutch (Second and Fourth Speed position). Sleeve engages a lug on the free-wheel roller cage and rotates rollers to a disengaged position (cage is spring-loaded and returns to normal position when released). This action prevents roller engagement if the Direct Speed Clutch should happen to remain in the engaged (forward) position when the car is stopped.

Hydraulic Shift Mechanism: Consists of a spring-loaded hydraulically actuated piston mounted concentrically on the Direct Speed shift rail. This piston merely compresses the return spring and the engaging spring which perform the actual shifting operation (both springs compressed by initial movement of the piston, expansion of engaging spring moves Direct Speed Clutch forward for Second or Fourth, expansion of return spring moves clutch to rear for First or Third Speeds).



1946-48 CHRYSLER, DE SOTO HYDRAULIC TRANSMISSION

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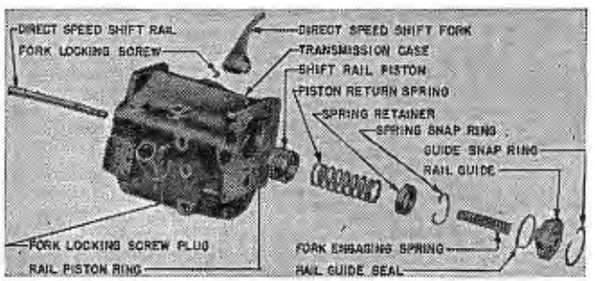
1946-48 CHRYSLER HYDRAULICALLY OPERATED AND DE SOTO TIP-TOE SHIFT (Cont.)

Control Units: Consist of hydraulic system units (Oil Pump, Pressure Regulator, Pilot Valve, and Main Valve), and electrical control units (Relay, Governor, Pilot Valve Solenoid, Ignition Interrupter Switch, Throttle Kick-down Switch).

Oil Pump—Pump is "Gerotor" type (same as engine oil pump) located under rear cover plate in transmission case and is driven from the mainshaft (operates whenever rear wheels are turning). Pressure should be 40 lbs. to approximately 60 lbs. at 15 MPH. (pressure drops when upshift starts).

Oil Pressure Regulator—In transmission case on right side. Set to maintain pump pressure at approx. 50 lbs. Regulator by-passes oil back to inlet side of pump when pressure exceeds this figure.

Pilot Valve Solenoid—Auto-Lite No. SSS-4002. Solenoid pushes pilot valve down when energized. Pilot valve should be in upper position with solenoid inactive or removed and should move freely.
Control Relay—Auto-Lite No. HRM-4102. Relay has two sets of contacts which open and close together (contacts closed when relay coil energized). Fuse on relay is 30 ampere capacity.



DIRECT SPEED & KICKDOWN MECHANISM

Governor Switch—Auto-Lite No. TG-4202R or TG-4203R. Governor contacts are closed (completing circuit to ground) with car at rest and are opened by action of the centrifugal weights at a car speed of 6-7 MPH (Low Range), 12-14 MPH (High Range).
Accelerator Pedal Kick-down Switch—Built in the carburetor. *See "Chrysler, DeSoto, Dodge Kick-down Switch" in Electrical Equipment Section.*

OPERATION: Manual control (Shift Lever on steering column) operates in the usual manner by shifting the "Manual Clutch Sleeve" on the transmission mainshaft. The automatic (hydraulically operated) control operates as follows:

Automatic Upshift—Governor switch contacts open at car speed of 6-7 MPH. (Shift Lever in "Low Range"), 12-14 MPH. (Shift Lever in "High Range"), de-energizing the control relay and pilot valve solenoid. The pilot valve actuates the main valve which admits oil under pressure from transmission oil pump to the hydraulic cylinder causing the piston in the cylinder to move forward which compresses the return spring and the engaging spring on the shift rail. When the throttle is released momentarily, the engaging spring causes the Direct Speed Clutch to engage the higher gear (Second in "Low Range," Fourth in "High Range").
NOTE—Hydraulic piston actuates Interrupter Switch in moving forward but ignition is not interrupted because circuit is open at upper relay contacts (no interruption required for shifting since transmission "free-wheels" before shift occurs.

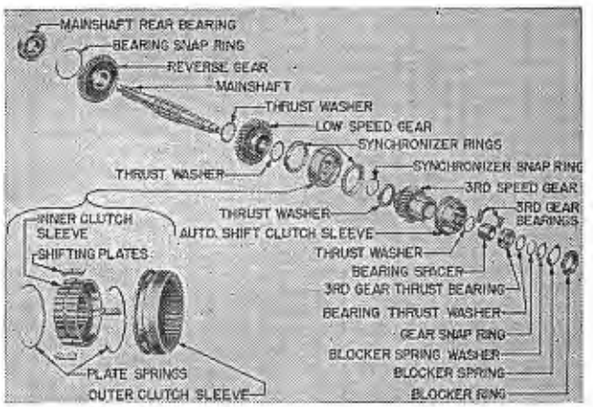
Automatic Downshift—When car speed drops to 6-7 MPH ("Low Range"), 12-14 MPH ("High Range"), governor switch contacts close, energizing control relay and pilot valve solenoid. The pilot valve causes the main valve to close, shutting off oil pressure (oil is by-passed into transmission case through pump pressure relief valve) and opening a passage to the case for oil drainage from the hydraulic cylinder. The return spring in the cylinder moves the piston backward and when the piston strikes the shoulder on the shift rail, the rail and Direct Speed Clutch are moved back into the lower gear position (First in "Low Range," Third in "High Range"). NOTE—During the initial movement of the piston, a shoulder on the piston causes the Interrupter Switch to close momentarily, grounding the ignition coil, and interrupting the ignition to relieve the engine torque and allow the shift to occur. Further movement of the piston opens the Interrupter Switch and restores the ignition.

Accelerator Pedal "Kick-down" Downshift—At car speeds under approximately 27 MPH (Low Range), 53 MPH (High Range), the transmission can be shifted down from Second to Low (Low Range), Fourth to Third (High Range) by fully depressing the accelerator pedal which causes the kick-down switch contacts on the carburetor to close and provides an alternative ground for the control relay circuit (governor switch contacts open) and energizes the relay. The downshift then occurs in exactly the same manner as for the Automatic Downshift (above). NOTE—The transmission can not be "kicked-down" at higher speeds since the kick-down contact plunger is held up out of engagement by manifold vacuum.

LUBRICATION: Check oil level in the transmission case every 1000 miles or 30 days, drain and refill with new oil every 10,000 miles or yearly. To check oil level, remove plug on right front side of case (to rear of lower transmission mounting bolt), maintain oil level even with bottom of filler plug hole. CAUTION—Clean magnetic plug (drain plug) and oil pump screen (under cover on lower left rear corner of transmission case) when transmission case drained. *Keep dirt out of transmission.*
Recommended Lubricant—Use only No. 10-W engine oil in this transmission. Capacity 3 pints.

REMOVAL OF TRANSMISSION: *See "Transmission" on car model page.*

DISASSEMBLY OF TRANSMISSION: With transmission off car and Governor assembly and solenoid removed, lift out governor pinion (use long-nosed pliers), remove ignition interrupter switch. Make certain manual gear shift controls in Neutral (selector shaft and gear engagement shaft), remove gearshift housing assembly from left side of case. Move reverse idler gear and clutch gear sleeve back so as to lock mainshaft, remove mainshaft flange nut, brake drum and flange (tool C-452). Take out rear bearing retainer mounting screws, pull out retainer and mainshaft assembly as a unit. Remove main drive gear bearing retainer on front end of case, remove snap ring and withdraw direct speed rail guide (in recess to right of bearing retainer). Remove main control valve plug and gasket, withdraw valve and spring. Remove pilot valve and spring. Remove shifting fork lock screw plug, loosen shifting fork locking screw so that fork is loose on rail (use screwdriver with ¼" blade or tool C-738 inserted through plug hole). Push direct speed gearshift rail out through rear of case, remove fork, clutch sleeve and engaging spring and direct speed blocker ring. Push countershaft out through rear of case with arbor, C-716, allowing countershaft gear assembly to drop down in case (arbor remains in gear cluster to retain bearing rollers). Remove main drive gear assembly (pack recess in gear with grease to retain mainshaft front bearing rollers). Lift countershaft gear assembly out of case (CAUTION—use care that free-wheeling gear does not fall off). Remove reverse idler shaft through rear of case (Puller C-604), lift idler gear out. Remove oil strainer cover and strainer from case. Use Tool C-714 to compress direct speed rail return spring, remove snap ring from case in front of spring, slowly release spring tension, remove tool, lift out spring



MAINSHAFT DISASSEMBLED

retainer, spring, piston, and piston ring through front of case. This completes transmission disassembly. Disassemble sub-assemblies as required.

REASSEMBLY OF TRANSMISSION: Note the following points when installing transmission parts and sub-assemblies:

Free-wheeling Gear Assembly on Countershaft Gear Cluster—Install control sleeve key and slide control sleeve on countershaft gear. Hook anchor ends of two free-wheeling cam roller retainer springs in holes in countershaft gear so that springs wrap around gear in clockwise direction from anchor end. Install free-wheeling cam roller retainer with lugs over spring anchors, rotate retainer clockwise until lugs are over slots in control sleeve, make certain that spring ends are snapped into grooves in retainer, then press retainer in until lugs fully

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1946-48 CHRYSLER HYDRAULICALLY OPERATED AND DE SOTO TIP-TOE SHIFT (Cont.)

engage slots in control sleeve. Install free-wheeling cam rollers and thrust washer, then place free-wheeling gear on countershaft gear and install the 45 bearing rollers.

Mainshaft Manual Shift Clutch (Synchronizer) Installation—Install on front of mainshaft with long portion of hub toward rear of shaft, use thickest snap ring which can be installed to retain the clutch (snap rings furnished .087" and .090" thick). Install shifter plate spring and three shifter plates, then install clutch sleeve with taper of sleeve toward front end of shaft.

Mainshaft Third-and-Direct Speed Gear Installation—Install rear thrust washer with recess side toward rear end of shaft. Assemble bearings in Third Speed Gear as follows: Insert thrust bearing race (one with larger hole) in gear with groove toward forward end of shaft, assemble one set of 36 bearing rollers in forward end of gear, insert bearing spacer, insert second set of 36 bearing rollers in rear end of gear, install needle bearing thrust washer. Install the gear and bearing assembly on mainshaft, install ball thrust bearing and thrust bearing washer, then install gear snap ring using thimble and driver (Tool C-717). Check gear endplay which should be .003-.008". Adjust by installing snap ring of correct thickness (furnished .087", .092", .097", .101" thick).

Main Drive Gear Installation—With main drive gear assembly installed in case, install the bearing retainer **without a gasket** and secure it in place with regular mounting capscrews. Check clearance between bearing retainer flange and front of case with a feeler gauge. Select a gasket of same thickness as feeler gauge clearance (or nearest oversize) and **install this gasket under the bearing retainer.**

Mainshaft Assembly Installation—Use aligning studs (C-730) in case to align mainshaft gear assembly. Mesh gear teeth of Third-and-Direct speed gear hub with center space of each set of teeth on direct speed clutch sleeve. CAUTION—Do not force mainshaft assembly into place. Shaft will enter easily if main drive gear is turned in both directions until lugs on direct speed clutch blocker ring index with slots in direct-and-third speed gear. NOTE—When installing mainshaft rear bearing retainer screws, use rubber gasket on middle screw on left hand side.

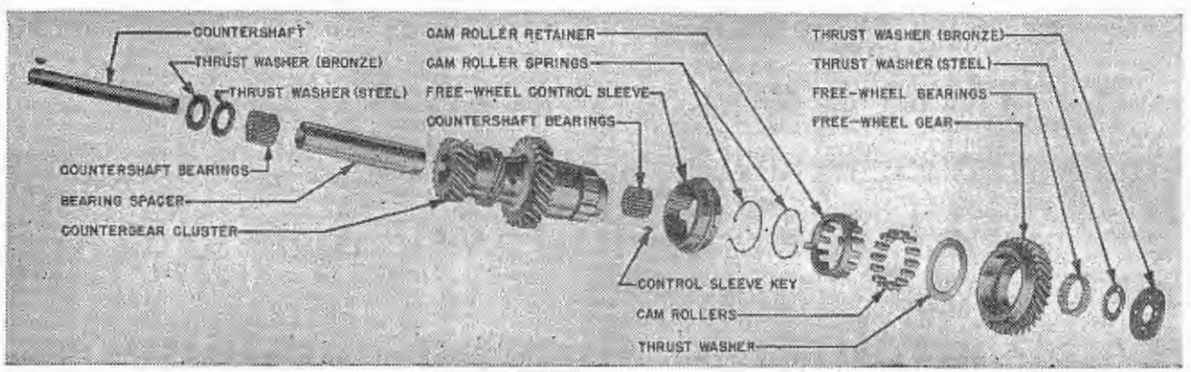
Countershaft Gear Assembly—Make certain that ridge on free-wheeling control sleeve engages groove in direct speed clutch sleeve when raising countergear cluster in position, install bronze thrust washer next to gear and steel thrust washer next to case at each end of gear cluster, check endplay which should be .002-.008". Adjust by selecting bronze thrust washer of correct thickness for installation at **rear end of gear cluster** (furnished .087", .090", .093", .096" thick).

TESTING (ELECTRICAL CONTROL UNITS): First check oil level in transmission, remove right side of front floor mat and floor panel cover for access to transmission. Inspect wiring and tighten all connections, make certain that engine properly tuned up so that it idles smoothly at 450-475 RPM. Use test lamp and test leads to make following tests in order as given:

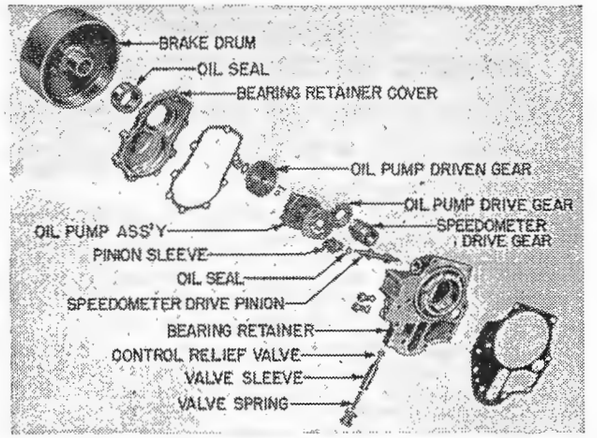
Control Relay: (1) Connect one test lamp lead to relay "BAT" terminal, other lead to ground, turn on ignition. Lamp should light. If not, check for open-circuit between ignition switch and relay. (2) With engine idling, connect test lamp between relay "SOL" terminal and ground. Lamp should light. If not, check for blown fuse, or poor fuse contacts. Then ground relay "TH" terminal. If lamp does not light relay is defective. (3) With test lamp connected between relay "SOL" terminal and ground, increase engine speed. Lamp should go out. If lamp remains on, relay contacts are not opening. Disconnect lead at relay "TH" terminal. If lamp does not go out, relay contacts are sticking. (4) With engine idling, ground relay "INT" terminal. Engine should stall. If not, ground "PRI" terminal. If this causes engine to stall, relay contacts are not operating properly. If engine does not stall, check for open-circuit between "PRI" terminal and ignition coil.

Relay Specifications

Auto-Lite Model HRM-4102. Both sets of contacts open and close together but circuits are independent (each set of contacts insulated from other).
Winding Resistance—17.6-19.4 ohms (measured between terminals #1 and #2).



COUNTERSHAFT GEAR ASSEMBLY



MAINSHAFT REAR BEARING RETAINER

Closing Voltage—3.0-4.0 volts (adjust both sets of contacts to open and close simultaneously). Adjust by bending lower spring hanger.

Armature Sealing to Core—5.0 volts maximum. Adjust by bending lower spring hanger.

Opening Voltage—1.1-2.5 volts. Adjust by raising or lowering stationary contact.

Armature Air Gap—.031-.036". Adjust by bending armature stop.

Fuse Capacity—30 amperes.

Governor & Kick-down Switch: Connect test lamp between relay "SOL" terminal and ground. Idle engine. Lamp should be lighted. If not, ground governor terminal. If lamp lights, governor contacts are sticking open and governor should be replaced or serviced. If lamp does not light, check for open-circuit between relay and governor. Increase engine speed. Lamp should go out. If lamp remains lighted, disconnect lead at kick-down switch on carburetor. If lamp is still lighted, governor contacts are not opening and governor should be replaced or serviced. If governor operation satisfactory with kick-down switch lead disconnected (lamp lighted at idle speed indicating governor contacts closed, lamp out at higher engine speed indicating governor contacts open), kick-down switch is defective and should be repaired or replaced. To check kick-down switch operation, with test lamp connected between relay "SOL" terminal and ground, increase engine speed to point where lamp goes out, depress kick-down switch plunger by hand. Lamp should light with switch plunger pressed in and should go out when plunger released.

Governor Specifications

Auto-Lite Model TG-4202R or TG-4203R (Early 1946), TG-4204R (1946-48). Rotation clockwise viewed from the top (all models).

Contact Closing (on deceleration)—(TG-4202R and TG-4203R) 450-550 RPM., (TG-4204R) 385-450 RPM.

Difference between Closing & Opening—40-150 RPM. (all models).

Endplay—.005-.010" (all models).

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1946-48 CHRYSLER HYDRAULICALLY OPERATED AND DE SOTO TIP-TOE SHIFT (Cont.)

Kick-down Switch: *See "Chrysler, DeSoto, Dodge Kick-down Switch" in Electrical Equipment Section.*

Slow-Closing Throttle: *Different type on Chrysler 8.*

Chrysler 6 & DeSoto—*See "Chrysler, DeSoto, Dodge Slow-Closing Throttle" in Carburetion Equipment Section.*

Chrysler 8—*See "Chrysler Eight Throttle Guard" in Carburetion Equipment Section.*

Transmission Valve Solenoid: With engine idling slowly, and with test lamp connected between solenoid terminal and ground, lamp should be lighted and distinct magnetic attraction noted at solenoid cap (test with small steel tools or other objects). If lamp not lighted, check for open-circuit in solenoid lead. If lamp lighted but no magnetic pull noted, solenoid coil is open and should be replaced. To check solenoid, remove solenoid, reconnect lead, turn ignition on, invert solenoid and ground it on transmission. Plunger should snap out. If not, replace solenoid.

Solenoid Specifications

Auto-Lite Model SSS-4002. Single winding type.

Winding Resistance—1.8-2.1 ohms measured between terminal and ground on base.

Plunger Position—At Rest—.632" maximum from mounting face to end of plunger rod. **Energized**—.778-.793" from mounting face to end of plunger rod.

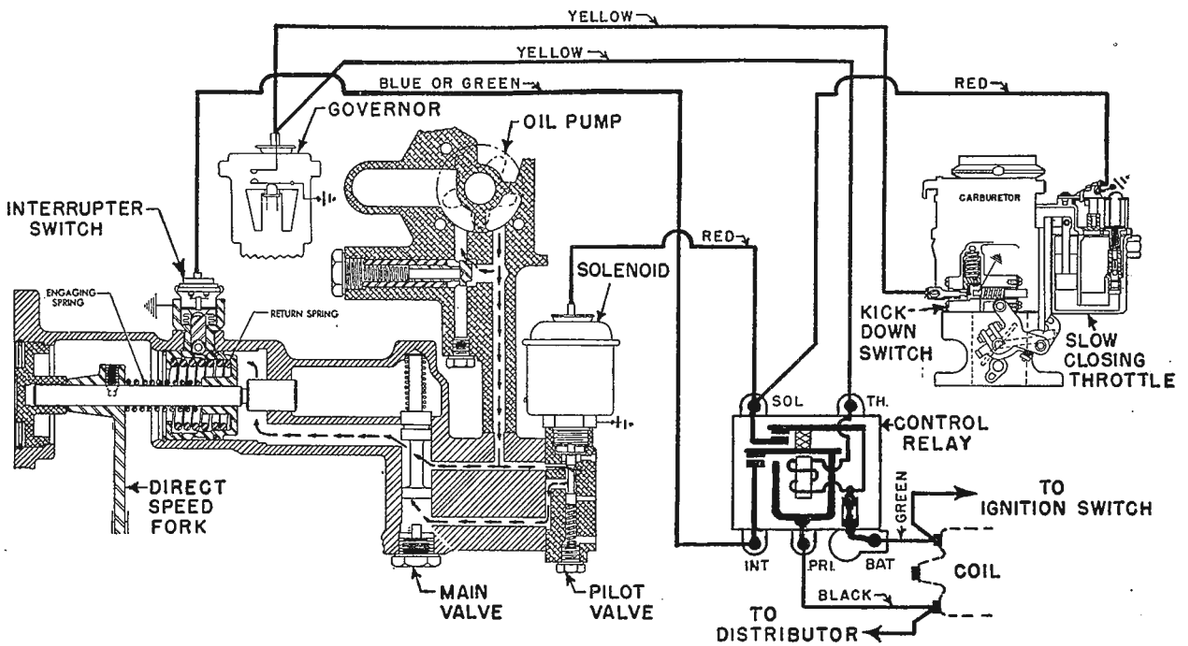
Load—Plunger force should be 6 lbs. minimum with 4 volts applied to coil at 77°F. Measure with plunger in "at rest" position.

Ignition Interrupter: Block rear wheels securely, run engine with transmission in third gear. Disconnect lead from "INT" terminal on relay. Connect test lamp between relay "BAT" terminal and interrupter switch terminal. Lamp should flash when engine speed increased. If lamp does not flash, replace interrupter switch. If lamp remains lighted more than momentarily, interrupter switch is sticking (would cause engine to stall).

TESTING (HYDRAULIC UNITS): Check transmission oil level and fill to filler plug hole level. Then test hydraulic system as follows:

Hydraulic Oil Pressure: Remove "Mainshaft Rear Bearing Retainer Pressure Line Plug" on right side of transmission (see illustration), connect test oil pressure gauge at this point. Block up rear wheels securely, run engine with transmission in high range. Oil pressure should be 40-60 lbs. at 15 MPH. If pressure less than 40 lbs., inspect and service oil pump, check oil pressure relief valve for sticking open, check for dirty or clogged oil pump screen and oil pressure leaks.

NOTE—Pressure will drop momentarily when transmission upshift occurs.



1946-48 TRANSMISSION CONTROL UNIT WIRING DIAGRAM

Automatic Shift Action: With rear wheels blocked up and engine running with transmission in gear, remove interrupter switch so that movement of hydraulic piston shift rail can be noted. Increase speed above 15 MPH. Piston should move forward and close off interrupter switch hole. If piston does not move forward, check hydraulic valves (see below). If piston moves forward but upshift does not occur, check hydraulic shift mechanism for binding. Stop engine and note if piston is in rear position (interrupter switch hole uncovered). If piston in rear position but transmission does not downshift, check for loose shift fork. If piston does not move to rear (hole remains covered), check for binding of shift rail, direct speed sleeve, or free-wheel control sleeve.

Hydraulic Valves: Check each valve as follows:

Pilot Valve—Remove solenoid assembly. Pilot valve should be up against upper stop and should work freely. If not, remove and clean valve and valve chamber.

Main Control Valve—Remove valve plug on right side of transmission (see illustration). Valve should work freely against spring tension. If not, remove and clean valve and valve chamber.

Control Relief Valve—Remove plug on right side of transmission (see illustration). Check valve for free movement. If valve is sticking or sluggish check for weak or broken spring, clean valve.

CHRYSLER PRESTOMATIC & FLUID-MATIC, DE SOTO TIP-TOE SHIFT, DODGE GYROMATIC

Chrysler 6, C45 (1949), C48 (1950), C51 (1951)
Chrysler 8, C46 & C47 (1949), C49 & C50 (1950)
Chrysler 8, Models C52, C53 C54, C55 (1951)
De Soto, Model S13 (1949), S14 (1950), S15 (1951)
Dodge, Model D30 (1949), D34 (1950), D42 (1951)

►CHANGES & CORRECTIONS

►**STARTING ENGINE BY PUSHING OR TOWING CAR:** Turn ignition on, place gearshift lever in Low Range, disengage clutch and do not engage clutch until car speed is approximately 10 MPH. At this speed, transmission will automatically shift into 2nd Speed and engine will be cranked.

►**KICK-DOWN SWITCH CHANGE (For Improved Transmission Operation):** *See "Chrysler, DeSoto, Dodge Kick-down Switch" in Electrical Equipment Section.*

►**MANUAL CLUTCH GEAR SYNCHRONIZER PRODUCTION CHANGE:** "Plate Type" Synchronizer used on first transmissions, superseded by "Pin Type" Synchronizer on later transmissions. See illustrations and disassembly data for each type. *NOTE*—Transmissions with Pin Type Synchronizer marked by four-leaf clover on model number pad on transmission case cover face.

►**INTERRUPTER SWITCH MOUNTING PRODUCTION CHANGE:** On later transmissions, interrupter switch relocated toward rear of transmission and operated by pin located in rear end of direct speed rail (first type operated directly by piston skirt).

►*SWITCH TESTING CAUTION*—Manufacturer recommends that Interrupter Switch NOT BE REMOVED to check operation of hydraulic mechanism (new switch location may allow oil to spurt out over interior of car).

DESCRIPTION

DESCRIPTION: Own make, semi-automatic, 4-speed transmission with hydraulic actuation and electrical control. Transmission is similar to design used on corresponding previous models but control units (hydraulic and electrical) have been simplified and operate as follows:

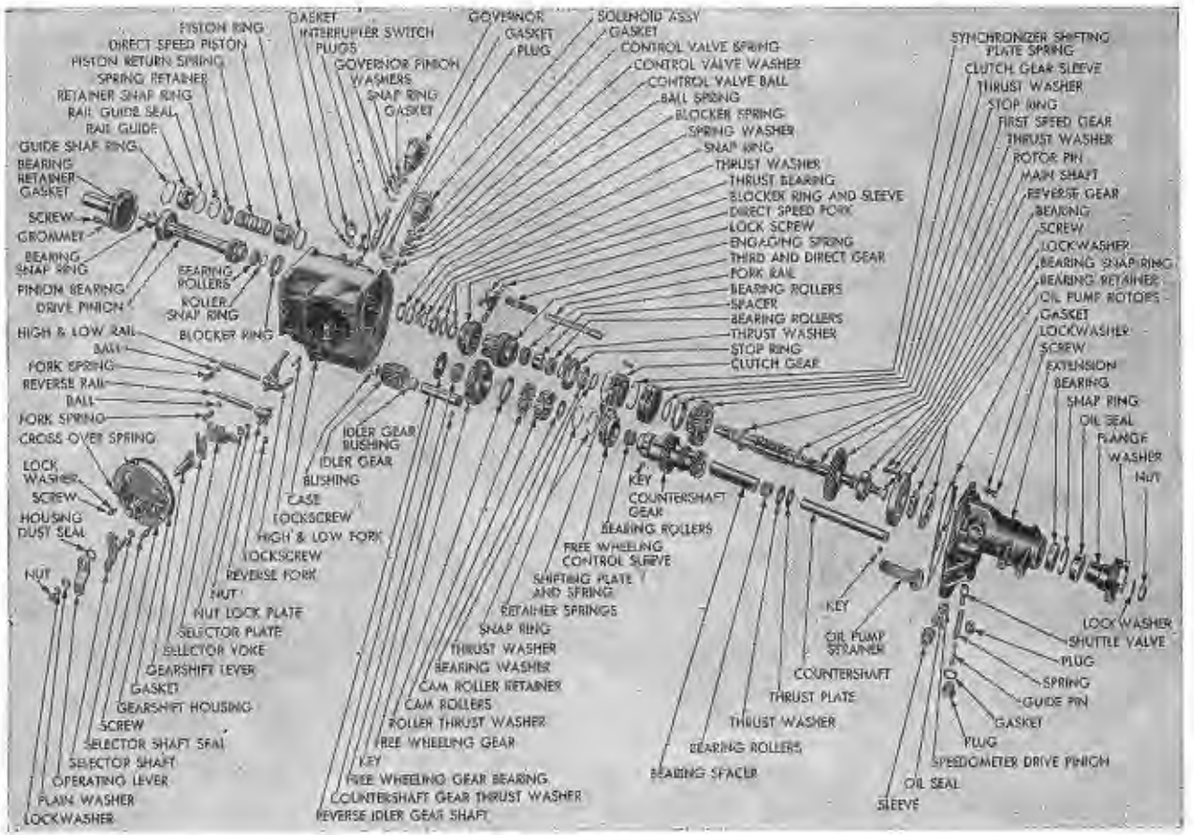
Hydraulic Shift Mechanism: Spring-loaded, hydraulically actuated piston of same design as used previously except that piston acts as the oil pump pressure relief valve by uncovering two ⅜" relief holes in cylinder wall when in forward (2nd. or 4th. Speed) position thus limiting oil pressure to approximately 38-40 lbs.

Hydraulic Control Units: Hydraulic system has been simplified with new type pump and valves as follows:

Oil Pump—Gerotor type (concentric gears) mounted on mainshaft in transmission case extension housing and driven directly by a pin in the rear end of the mainshaft. Pump is accessible after extension housing and mainshaft bearing retainer removed.

Shuttle Valve—Located in extension housing. Prevents long periods of ignition interruption which might be caused by failure of solenoid to open main control valve on downshifts. Under these conditions, spring under shuttle valve forces valve upward so that oil trapped behind direct speed piston is returned to transmission case, permitting return spring to move piston back.

Main Control Valve—Spring-loaded ball type which is held off its seat by solenoid plunger when solenoid is energized (1st. or 3rd. Speed) so that oil from pump is by-passed directly back into the transmission case. When solenoid de-energized (2nd. or 4th. Speed), ball is held on seat by spring and oil pressure directed to direct speed piston for automatic shift.



CHRYSLER, DE SOTO, DODGE AUTOMATIC TRANSMISSION WITH PLATE TYPE MANUAL CLUTCH GEAR SYNCHRONIZER

Electrical Control Units: No control relay is used and new control circuits and units operate as follows:

Main Control Valve Solenoid—Solenoid plunger opens valve when solenoid energized, and permits spring to close valve when solenoid de-energized.

Governor—Centrifugal weight type driven from transmission countershaft. Contacts are closed with governor at rest so that solenoid circuit completed to ground (solenoid energized). When contacts open, circuit is broken and solenoid de-energized. Contact opening (for upshifts) and closing (for downshift) occur at following car speeds:

Automatic Shifting Speeds

Upshifts①		Downshifts②	
1st. to 2nd.	8 MPH.	2nd. to 1st.	6 MPH.
3rd. to 4th.	14 MPH.	4th. to 3rd.	12 MPH.

①—Governor contacts open.
②—Governor contacts close.

Kickdown Switch—On carburetor. Contacts are normally open but can be closed by fully depressing accelerator pedal. Closing of contacts completes solenoid circuit to ground, energizing solenoid, and causing transmission to downshift (from 4th. to 3rd., or 2nd. to 1st.). This "kickdown" downshift only occurs at car speeds below 40 MPH. (4th. Speed) or correspondingly lower speed in 2nd. Speed (at higher car speeds, switch contact is held up out of engagement by manifold vacuum).

See "Chrysler, DeSoto, Dodge Kick-down Switch" in Electrical Equipment Section.

Ignition Interrupter Switch—Mounted on transmission and operated by direct speed piston (first transmissions), or by pin in rear end of direct speed rail (later). Switch momentarily grounds ignition coil and interrupts ignition to permit downshifts to be completed. A resistor connected in the switch circuit (see diagram) prevents the ignition circuit energizing the solenoid when switch is closed momentarily during upshifts (which would prevent completion of automatic upshift).

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CHRYSLER PRESTOMATIC & FLUID-MATIC, DE SOTO TIP-TOE SHIFT, DODGE GYROMATIC (Cont.)

Circuit Breaker & Resistor—Thermostatic vibrating type circuit breaker connected in transmission control circuit feed (line from ignition switch side of coil) to protect circuit from overload (replaces fuse used on previous models). Resistor is 12 ohm type and is connected in Interrupter Switch circuit to prevent ignition circuit energizing solenoid when contacts closed (see Ignition Interrupter Switch).

LUBRICATION

LUBRICATION: Check oil level in transmission every 1000 miles or 30 days, drain and refill every 10000 miles or once each year, maintain oil level even with bottom of filler plug hole.
Recommended Oil—Use only 10W Engine Oil.
Capacity—3 pints (refill).

►***CAUTION—Add additional ½ pint (3½ pints total) whenever transmission extension housing removed and drained (additional oil will work back into extension housing in service).***

REMOVAL

See TRANSMISSION on individual car model pages.

DISASSEMBLY

►***DISASSEMBLY CAUTION***—Before disassembling transmission, clean outside of transmission case thoroughly to prevent dirt and foreign material from entering case or getting on transmission parts.

DISASSEMBLY OF TRANSMISSION: With transmission off car and Governor, Solenoid, and Interrupter Switch removed, proceed as follows:

1) Make certain that governor drive pinion removed from case (can be lifted out with long-nosed pliers), remove speedometer drive gear and sleeve assembly.

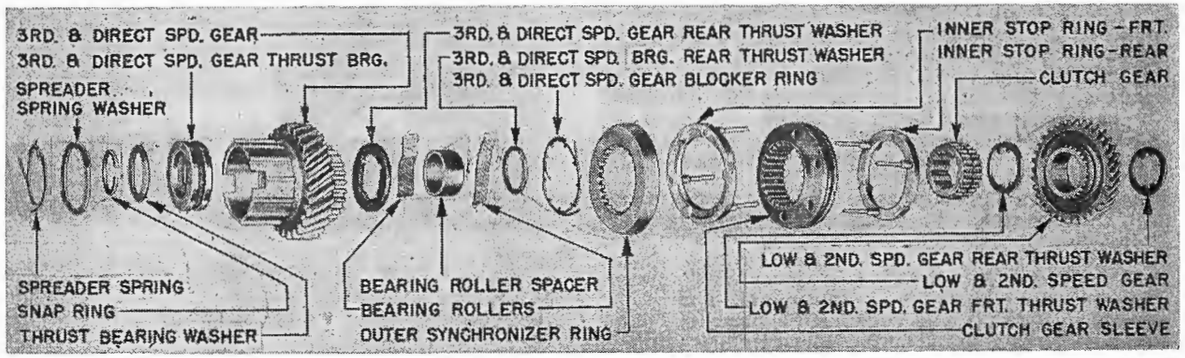
2) Place gearshift control levers in neutral, remove gearshift housing assembly by taking out attaching capscrews.

3) If brake drum and propeller shaft flange not removed previously, lock mainshaft by moving the manual clutch gear sleeve and the reverse idler gear backward so that both gears are engaged, then remove nut, lockwasher, and plain washer from rear end of shaft, use Puller C-452 to remove propeller shaft flange and brake drum assembly.

4) Take out capscrews attaching extension housing on back of transmission case, remove extension housing and mainshaft as an assembly (Direct Speed Clutch will slide off Third & Direct Speed Gear and remain in case—note that sleeve and gear are paint-marked to insure correct reassembly), remove housing gasket.

5) Use Puller C-604 to remove reverse idler gear shaft through rear of case (CAUTION—do not lose shaft key), lift gear out.

6) Remove direct speed blocker ring from forward end of direct speed clutch sleeve. Remove snap ring in forward end of case retaining direct speed gearshift rail guide, remove guide and guide seal from case. Take out upper plug on right side of transmission case, insert a screwdriver in this hole and pry shifting fork backward just enough to allow direct speed clutch sleeve to be withdrawn through side opening in case.



PIN TYPE MANUAL CLUTCH GEAR SYNCHRONIZER

7) Using screwdriver inserted through plug hole on right side of case, loosen locking screw in direct speed gearshift fork until the fork is forced forward by the engaging spring, then cock the fork on the shaft and pull the fork toward the rear of the case which will move the direct speed gearshift rail to the rear. Repeat this procedure (hold rail while moving fork forward for additional travel) until the rail is free, then remove rail, spring, and fork from the case using care not to lose interrupter switch operating pin (see Caution).

►***CAUTION—Later transmissions have loose fitting taper pin hole in rear end of direct speed gearshift rail for interrupter switch operation and this pin must not be lost when rail removed.***

8) Use Tool C-714 to compress direct speed piston spring (insert tool through gearshift rail hole from front of case), remove spring retaining snap ring (use long-nosed pliers inserted through guide hole in front of case), relieve spring tension, remove tool, withdraw spring retainer, spring, piston, and piston ring through front of case.

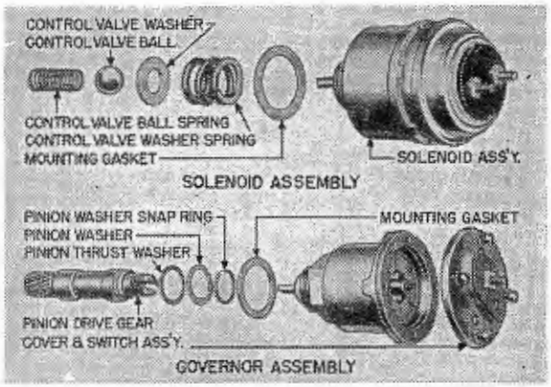
9) Drive countershaft out through rear of case using Arbor C-716 **leaving arbor within the countergear** cluster to retain the countergear bearing roller assemblies (CAUTION—do not lose woodruff key in rear end of shaft which locks shaft in case). This will allow countergear assembly to drop down in bottom of transmission case to allow main drive gear to be removed.

10) After countergear cluster lowered in case, take out attaching screws and remove drive gear bearing retainer and gasket on front end of transmission case. Use puller to remove drive gear and bearing assembly through front of case.

11) After drive gear removed, lift countergear cluster assembly up and remove from case using care not to lose thrustwashers (CAUTION—note location of bronze and steel washers to insure correct reinstallation), or disturb arbor within cluster which would allow bearing rollers to fall out.

12) Disassemble all sub-assemblies as follows:

Extension Housing & Mainshaft Disassembly: Remove speedometer drive pinion and sleeve assembly. Use Puller C-748 to remove oil seal from rear end of housing. Press mainshaft assembly out of housing (see below for mainshaft disassembly).



SOLENOID & GOVERNOR ASSEMBLY

Extension Housing Disassembly: Remove capscrews holding mainshaft bearing retainer in front face of housing, lift off bearing retainer and oil pump inner and outer rotors. Remove shuttle valve retainer plug (on bottom of housing), withdraw valve parts (guide pin, spring, and valve). Remove oil seal, take out rear bearing snap ring, drive rear bearing out at rear of housing.

Mainshaft Disassembly: ***CAUTION—Mainshaft with Plate Type Synchronizer serviced differently than later type with Pin Type Synchronizer:***

Mainshaft Disassembly (Plate Type Synchronizer Remove direct speed blocker spring and washer from forward end of shaft, remove snap ring, slide 3rd and direct speed gear off end of shaft (Caution —Use care not to lose bearing rollers, spacer, bearing front thrust washer, and needle bearing washer), remove rear thrust washer. Remove clutch gear synchronizer snap ring and front stop ring, remove clutch gear sleeve assembly as a unit, remove rear stop ring. Remove 1st speed gear front thrustwasher, slide gear off, remove rear thrustwasher. Remove oil pump drive pin from rear end of shaft, remove bearing snap ring from rear end of shaft, press bearing and reverse gear off rear end of shaft.

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CHRYSLER PRESTOMATIC & FLUID-MATIC, DE SOTO TIP-TOE SHIFT, DODGE GYROMATIC (Cont.)

on the clutch gear teeth with paint mark on clutch gear teeth *(CAUTION*—this alignment necessary to insure free sliding fit between these parts), install this assembly on shaft with extended portion of sleeve hub and shoulder side of gear facing forward, install inner (front) synchronizer stop ring with the pins extending through the second set of three holes in the clutch sleeve. Install outer synchronizer stop ring. *NOTE*—Outer synchronizer stop ring spreader spring (blocker ring) should be assembled on rear of 3rd and direct speed gear and installed with the gear.

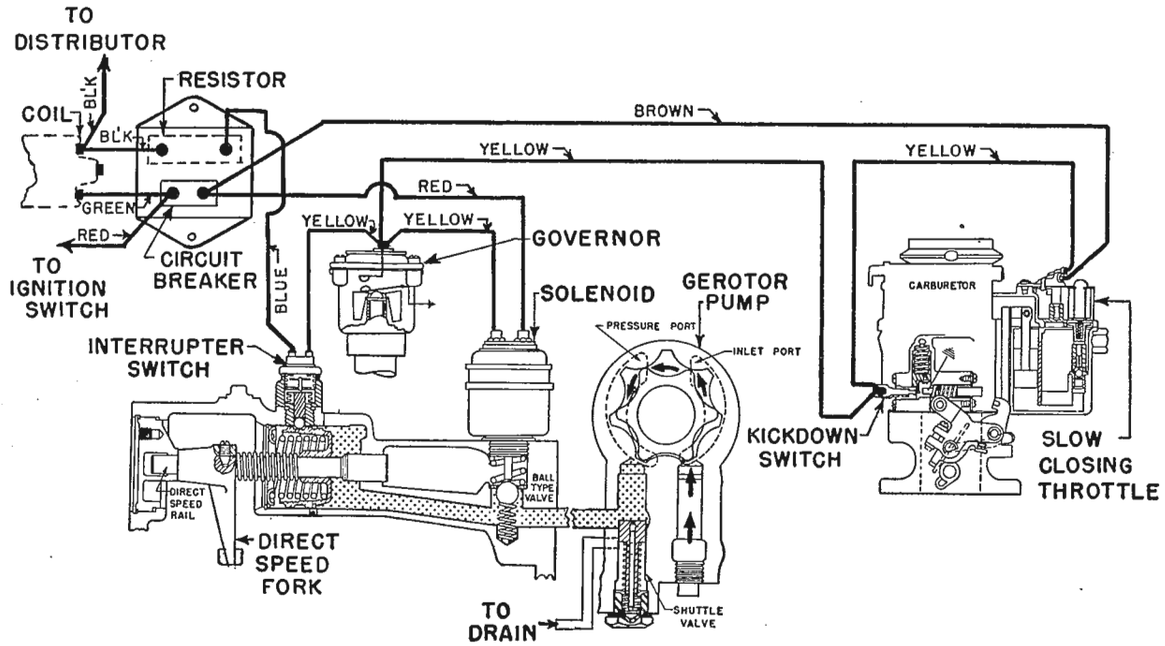
3rd & Direct Speed Gear Assembly—Install thick rear thrustwasher on shaft (recess side toward rear) and make certain that it is indexed with shaft splines. Assemble bearings in 3rd and direct speed gear as follows: Insert thrust bearing in forward end of 3rd and direct speed gear (end with largest hole first and grooved end toward front of gear), install one set of 36 bearing rollers (use cup grease to hold rollers in place), bearing spacer, second set of 36 bearing rollers, and bearing roller thrustwasher. Install this gear assembly on shaft (CAUTION—If Pin Type synchronizer used, make certain that synchronizer outer stop ring spreader spring is in place on rear end of 3rd and direct speed gear when gear installed). Install thrust bearing washer. Use thimble, Tool C-717, to install snap ring in shaft groove ahead of 3rd and direct speed gear (drive it into position with driver portion of tool and soft mallet). Check gear endplay (see Endplay note below) and adjust by selecting snap ring of correct thickness. On later transmissions with Pin Type synchronizer, install spreader spring washer and spreader spring on shaft using cup grease to hold these parts in place *(CAUTION*—these parts must not be allowed to drop down into case when installing mainshaft assembly). *NOTE*—On early transmissions with Plate Type synchronizer, blocker ring, blocker spring, and blocker spring washer are installed in direct speed clutch sleeve.

3rd.-&-Direct Speed Gear Endplay—Check clearance between bearing thrust washer and snap ring with a feeler gauge. If not within .003-.008", select snap ring of correct thickness to give this endplay. This snap ring furnished in thicknesses of .083", .088", .093", .098", .102".

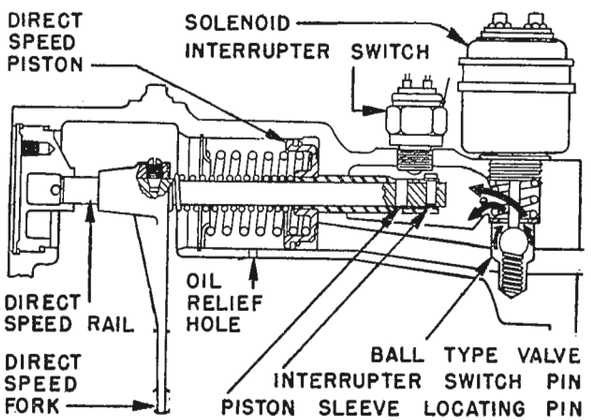
Extension Housing Assembly: Make certain that small hole in top of shuttle valve is open, install shuttle valve assembly (valve, spring, guide pin), then install and tighten valve retainer plug and gasket. Install oil pump inner and outer rotors, mainshaft bearing retainer, extension housing bearing, and bearing snap ring. Use Driver C-850 to install oil seal in rear end of housing (leave 3/32" of seal protruding beyond rear machined face of housing). Install mainshaft assembly in extension housing (CAUTION—line up pump drive pin in shaft with slot in oil pump inner rotor before inserting shaft in housing), pressing the shaft bearing in the bearing retainer in the housing.

Propeller Shaft Flange Nut Note—When installing flange and brake drum assembly, tighten flange nut to 95-105 ft. lbs. torque.

Mainshaft & Extension Housing Installation: See that free-wheel control sleeve is back toward rear



TRANSMISSION CONTROL UNIT WIRING DIAGRAM (FIRST TYPE INTERRUPTER SWITCH)



CONTROL UNIT WITH LATER TYPE INTERRUPTER SWITCH

of case and engaged in groove of direct speed clutch sleeve. On first transmissions with Plate Type synchronizer, place blocker ring in direct speed clutch sleeve with large end of taper forward and anchor lugs back, install blocker spring and blocker spring washer (coat lightly with grease to hold in place). Insert mainshaft assembly through rear of case, align paint marks on clutch sleeve and gear (see Note below), and index teeth on gear hub with center tooth in sleeve. See that lugs on blocker ring are aligned with slots in gear hub. Tighten capscrews to 30-35 ft. lbs. torque.

►*CAUTION—Do not force extension housing against transmission case, as blocker ring might become damaged. If housing does not move freely into position, the blocker ring is not indexed in 3rd speed gear slots. This ring should be properly indexed before housing is installed.*

►**Direct Speed Clutch Sleeve & Gear Marks**—These marks are made in production after selective matching for approximately .005" min. backlash.

NOTE—If new parts being installed, match parts for correct backlash and mark them to insure correct installation.

Direct Speed Gearshift Rail Installation: On early transmissions with Interrupter Switch mounted above hydraulic piston, install direct speed rail with offset screwdriver slot (in rear end of rail) horizontal and smallest shoulder toward side of case (this will position the setscrew hole for the gearshift fork properly in line with hole in case). On later transmissions with Interrupter Switch mounted to rear of hydraulic piston, make certain that loose taper pin in hole in rear end of shaft is in place and that pin points upward toward switch.

Gearshift Housing Installation: Before installing this assembly, position manual clutch gear sleeve in neutral and move reverse idler gear to fully disengaged position *(CAUTION*—shifting forks in housing assembly will not enter grooves properly unless parts positioned as above).

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CHRYSLER PRESTOMATIC & FLUIDMATIC, DESOTO TIP-TOE SHIFT, DODGE GYROMATIC (Cont.)

TESTING: Before checking transmission, make certain that engine tuned up so that it idles smoothly at 450-475 RPM. and that throttle linkage operates freely. Check oil level in transmission case (see LUBRICATION above). Raise right side of front floor mat, remove floor panel access cover over transmission. Inspect all control wiring and tighten connections. Use test lamp with insulated leads and make following tests in order given:

Control Mechanism Tests (Control Units & Wiring):

1) Circuit Breaker & Wiring—Connect test lamp, between ignition coil side of circuit breaker and ground. Lamp should light when ignition turned on. If not, check connections and replace wire. Connect test lamp between solenoid side of circuit breaker and ground. Lamp should light when ignition switch turned on. If not, replace circuit breaker (NOTE—if circuit breaker clicks indicating a ground, check solenoid and slow-closing throttle unit and wires connecting these units for short-circuit or ground). Connect test lamp between red-wire terminal of solenoid and ground. Lamp should light when ignition turned on. If not, replace this red wire. Connect test lamp between brown-wire terminal of slow-closing throttle unit and ground. Lamp should light when ignition turned on. If not, replace wire.

2) Slow-closing Throttle (Anti-Stall)—Turn ignition switch on. Place a steel screwdriver on peened rivet head on coil (on top of carburetor). If no magnetic "pull" noted, replace slow-closing throttle. *See "Chrysler, DeSoto, Dodge Slow-Closing Throttle" in Carburetion Equipment Section.*

3) Solenoid—Connect test lamp between two solenoid terminals. Lamp should light with ignition on (indicates that circuits to and from solenoid are operating). Hold steel screwdriver or other steel tool against solenoid body. Turn ignition on and off. If no magnetic "pull" noted with ignition on, remove solenoid and test as follows: Connect solenoid to a battery independently of the car wiring. Solenoid plunger should move outward and force of 25 lbs. should be required to push plunger in. If not, replace solenoid.

4) Governor—Connect test lamp between governor terminal and red-wire (feed) terminal on solenoid. Lamp should light with ignition on (if not, governor contacts are open). Raise rear end of car and securely block car so that engine can be run with transmission engaged. Start engine, place gearshift lever in High Range, accelerate engine to 14 MPH. and note test lamp. Lamp should go out at approximately 14 MPH. (governor contacts opening) and should come on again when speed dropped to approximately 12 MPH. (governor contacts closing). If governor does not operate correctly, remove and examine governor cover and switch assembly. Leave car blocked up and transmission in High Range for tests (5) and (6) following. NOTE—Above test can be made without blocking wheels up if transmission gearshift lever placed in Neutral.

Governor Specifications

Auto-Lite No. TG-4205R (1949-50), TGG-4001 (1951)
Contacts Open (On acceleration)—575 RPM. max.
Contacts Close (On deceleration)—390-455 RPM.
Range between Opening & Closing—40 to 150 RPM.
Governor Endplay—.005-.010".

►**Replacement Governor Note**—Governor Cover & Switch Assembly furnished separately for replacement (not necessary to replace entire unit if trouble is found in switch).

5) Kickdown Switch—With test lamp connected as for governor test (above), run engine at car speed between 15 MPH. and 40 MPH., push kickdown switch plunger in by hand. Lamp should light with plunger in (contacts closed) and should go out when plunger released (contacts open). *See "Chrysler, DeSoto, Dodge Kick-down Switch" in Electrical Equipment Section.*

6) Ignition Interrupter Switch—Disconnect blue-wire at interrupter switch terminal, connect test lamp between this switch terminal and red-wire terminal on solenoid. Run engine with gearshift lever in High Range, accelerate engine to 15 MPH., then slowly decelerate to 8 MPH. On deceleration, from approximately 12 MPH. to 10 MPH., test lamp should show a faint glow (switch contacts closed).

7) Ignition Interrupter Resistor—With engine running, ground blue wire at resistor or at interrupter switch terminal. Engine should stall. If engine continues to run, check resistor and wires from resistor to coil and to interrupter switch for open-circuit.

Hydraulic Mechanism Tests: *CAUTION—Before making tests, check transmission for proper grade and correct level of lubricant (see LUBRICATION).*

1) Jack up car so that rear wheels are clear of floor (to enable engine to be run in gear). Raise floor mat and remove floorboard access cover.

2) Remove transmission case shifting fork lock-screw plug (upper plug on right side of transmission case). Insert eraser end of pencil in this hole so as to contact shifting fork for check of shifting fork movement.

3) Start engine, place gearshift lever in Low Range position. Slowly accelerate engine and determine point at which shift fork begins to move (can be readily felt by holding pencil against fork). Shift rail and fork should move forward at 6-8 MPH. indicating correct hydraulic pressure of 38-40 lbs. and proper functioning of hydraulic shift mechanism.

►*CAUTION*—Manufacturer recommends above procedure for checking operation of hydraulic mechanism rather than removal of Interrupter Switch and sighting down switch mounting hole. Removal of switch may allow oil to be forced out over interior of car (particularly on cars with later Interrupter Switch mounting).

If hydraulic mechanism not functioning properly, check for sticking direct speed piston, worn piston or bore, worn or broken piston ring, oil pump rotors worn or have excessive clearance, control valves leaking or valve springs weak or broken.

INSTALLATION

Install transmission assembly in car by reversing the removal instructions (see data on individual car model pages). Tighten transmission-to-clutch housing nuts and bolts to 45-50 ft. lbs. See control unit wiring diagram and individual car wiring diagrams for control unit wiring connections.

CHRYSLER, DE SOTO, DODGE, PLYMOUTH SYNCHRO-MESH

Chrysler, DeSoto, Dodge, Plymouth—All Models with Synchro-mesh Trans. (1940-51—See Note

►**OTHER (OPTL.) TRANSMISSIONS:** As follows:

Chrysler 8 (1941)—*See Pg. 2733 "1941 Chrysler 8 Vacamatic Overdrive" Transmission.*

Chrysler 6 & DeSoto (1941), Chrysler 6 & 8, DeSoto (Early 1942)—*See Pg. 2734 "Chrysler 6 & 8 Vacamatic, DeSoto Simplimatic Underdrive" Transmission.*

Chrysler 6 & 8, De Soto (late 1942)—*See Page 2737 "Chrysler 6 & 8, DeSoto Simplimatic Underdrive" Transmission.*

Chrysler 6 & 8, De Soto (1946-48)—*See Page 2738 "Chrysler Hydraulically Operated, DeSoto Tip-Toe Shift" Transmission.*

Chrysler 6 & 8, DeSoto, Dodge (1949-51)—*See Pg. 2742 "Chrysler Prestomatic & Fluid-Matic, DeSoto Tip-Toe Shift, Dodge Gyromatic" Transmission.*

►**Chrysler & DeSoto 1940 Optl. Overdrive**—Warner R7B Overdrive unit electrical 'kick-down' control is mounted on rear end of transmission (in place of regular extension housing) as Optl. equipment. *See Pg. 2649 "Warner R6 & R7 Overdrives."*

►**HARD SHIFTING CORRECTION:** If hard shifting complaints can not be corrected by transmission control adjustment, replace original type stamped synchronizer plates with new solid machined type plates (furnished in package with needed springs). *See Transmission Disassembly and Reassembly data below.*

DESCRIPTION: Own Make, constant-mesh synchro-mesh, all helical gear type (sliding gear for low-reverse). Main drive gear and clutch shaft mounted on ball bearing in front of case (retained by retainer bolted on case). Mainshaft mounted on roller bearings (in drive gear pilot hole) at front end, ball bearing in rear of case and additional ball bearing at rear end of transmission case extension. Second speed gear retained on shaft with inner sleeve of synchronizer assembly by snap ring on shaft in front of synchronizer unit. Counter gear cluster mounted on roller bearings on stationary shaft (spacer on shaft between bearings) with thrust washer and plate on each end of cluster.

Synchronizing Unit—Double-blocker, double-spring type. Synchronizer rings are free in ends of inner clutch sleeve and are actuated by three shifting plates or struts fitted in slots in inner clutch sleeve which engage notches in synchronizer rings. Struts are centered in outer clutch sleeve by two wire springs (within struts on either side of inner clutch sleeve web) and move with the outer clutch sleeve to engage the synchronizer rings with the cones on the gear hub. Teeth on the outer rim of the synchronizer rings block or prevent gear engagement until synchronization completed when final movement of outer clutch sleeve causes the clutch teeth on the inner rim of the clutch sleeve to slide past the synchronizer ring teeth and engage the clutch teeth on the gear hub. Inner clutch sleeve is stationary on shaft and does not move during synchronization and gear engagement.

REMOVAL OF TRANSMISSION: *See "Transmission" on car model page.*

OVERDRIVE DISASSEMBLY NOTE: When used, overdrive adapter plate is fastened to overdrive case by special screws installed in recesses in front

CONTINUED ON NEXT PAGE

CHRYSLER, DE SOTO, DODGE, PLYMOUTH SYNCHRO-MESH (Cont.)

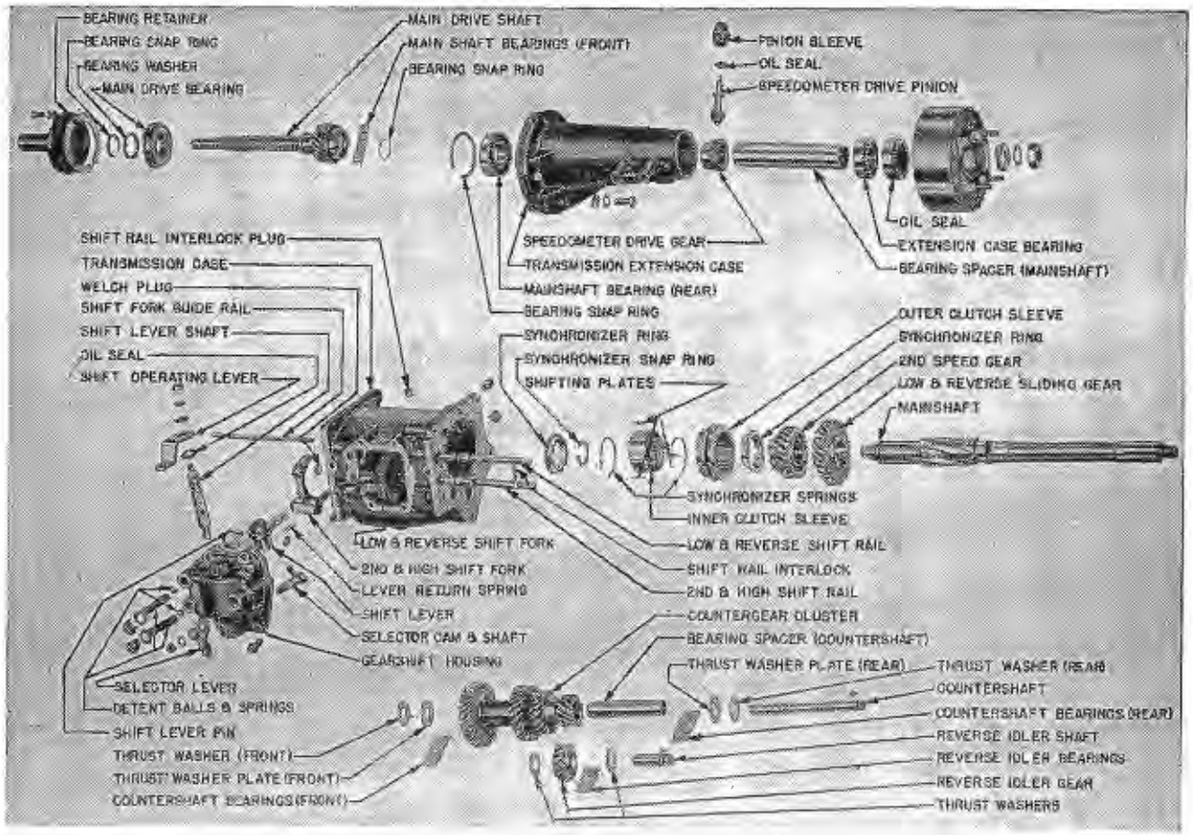
face of adapter plate. Overdrive and adapter must be removed as an assembly (after taking out capscrews mounting adapter on rear of transmission case) before adapter plate can be removed (use special wrench C-577 to remove the three screws which mount the adapter plate on the overdrive case. *See Warner Overdrive for all Overdrive data.*

DISASSEMBLY OF TRANSMISSION: On cars with Power Shift, disconnect link and remove power shift assembly. Then remove speedometer drive pinion, remove nut on rear end of driveshaft. pull universal joint yoke flange and brake drum assembly. Take out two plugs on transmission side cover, remove detent balls and springs, remove cover and gear selector assembly. Unscrew shifter fork guide rail and remove guide rail through front end of case. See that gears in neutral, take out lockscrews holding shifter forks on shift rails, remove welch plug in lower shifter rail hole on front of case (collapse plug by striking in center with punch), remove shifter rails through front of case, lift out shifter forks (use care not to lose gear selector balls). Remove interlock plug on top of case (drive plug down into interlock hole), lift out the interlock plunger. Take out the four capscrews in extension housing on transmission case, remove extension and mainshaft assembly through rear of case using care that synchronizer assembly does not slide off shaft. Use special arbor C-578 and soft hammer to drive countershaft out toward rear of case (remove locking key from shaft as soon as it is exposed at rear of case), allowing counter gear cluster to drop down in case. Take out mounting screws and remove main drive gear bearing retainer from front end of case, pull main drive gear and bearing assembly out toward front. Lift counter gear cluster, thrust washers, and bearing rollers out of case. To remove reverse idler, drive shaft out toward rear using special arbor C-464 to retain bearing rollers in gear (remove locking key from shaft when exposed at rear of case), lift out idler gear thrust washers, and bearing rollers.

REASSEMBLY OF TRANSMISSION: Reverse disassembly directions (above) and note following data on servicing of sub-assemblies.

Mainshaft & Bearing Assembly:—To remove mainshaft from extension housing, take out snap ring at forward end of synchronizer unit, remove synchronizer assembly, second speed gear, and low speed gear from shaft. Remove snap ring in housing in front of bearing outer race, withdraw shaft from housing, then remove bearing, spacer, and speedometer drive gear from housing. Remove oil seal and bearing from rear end of housing (bearing is press fit in housing and is positioned by spacer on shaft—no snap rings used). When reassembling mainshaft, use new snap rings. If oil seal being replaced, soak leather in thin oil for 30 minutes and work leather with smooth bar. Seal must protrude 7/32" from end of case (use C-579 drift to install seal) to prevent damage to seal and bearing.

Synchronizer Assembly:—Install struts or shifting plates in slots in inner clutch sleeve with open face of strut in, assemble outer clutch sleeve and synchronizer springs making certain that hooked ends of both springs engage same strut, install synchronizer rings with notches engaging ends of struts.



CHRYSLER, DE SOTO, DODGE, PLYMOUTH SYNCHRO-MESH TRANSMISSION

Synchronizer assembly is retained on shaft with second speed gear by single snap ring.

Second Speed Gear:—Gear endplay on shaft should be .003" min., .008" max. To install gear, place gear on shaft, install synchronizer assembly, install snap ring in groove in shaft in front of synchronizer.

Main Drive Gear & Bearing:—Bearing retained on shaft by snap ring and can be removed after snap ring taken out and thrust washer removed. Use new snap ring when re-installing bearing. Mainshaft pilot bearing rollers are retained in drive gear recess by snap ring. Use cup grease to hold rollers in position until mainshaft is installed.

Counter Gear Cluster:—When replacing this assembly, use arbor C-578 to position bearing rollers and pack rollers with cup grease to hold rollers in place. Install steel washer next to gear cluster at each end and bronze thrust washer between steel washer and case. Endplay should be .002" min., .008" max. Adjust by selecting washers of correct thickness (furnished in three thicknesses—'A' thinnest, 'B', 'C' thickest). Make certain that locking key is in place in slot in rear end of countershaft.

Reverse Idler Gear:—Use C-464 arbor to retain bearing rollers when idler gear being installed. See that thrust washer installed at each end of gear and that locking key is in place in rear end of shaft.

Oil Seal Replacement: Use Puller C-497 to remove old seal and special drift to install new seal. This drift will locate seal in correct position (protruding 7/32" from housing).

Gearshift Mechanism:—To assemble gearshift mechanism, hold shifter forks in position and insert guide rail through front end of case. Install lower shift rail, insert interlock plunger down through hole in top of case so that plunger engages groove in shift rail, then install upper shift rail (see Note below). Lock shifter forks to rails by installing lockscrews and locknuts, make certain that locking washers are crimped in place. Install welch plug in forward end of lower shift rail. CAUTION—This hole is below lubricant level and plug must be installed tightly to prevent lubricant loss. Install two C-590 cover locating pilots in cover screw holes on case, install cover and gear selector assembly, making certain that selector lever enters shifter fork slots. Install two cover capscrews, remove pilots, install remaining cover screws. Install detent balls and springs, tighten retaining plugs. Install new plug in interlock plunger hole (cup shaped plug), driving the plug in with a hammer.

See Chrysler Transmission Control articles for adjustment directions when transmission installed on car.

Shift Rail Note—Rails are similar in appearance but **Low-Reverse rail has detent grooves farther apart. This rail should be installed on top.**

FORD TRUCK 4-SPEED (SYNCHRO-MESH)

Std. Equip.—1951 2 Ton F-6 (6 Cyl. "M" Eng.)
Optional Equip.—1951 1-Ton F-4, 1½-Ton F-5, 2-Ton F-6 (With 8 cyl. "R" or 6 cyl. "H" engine).

DESCRIPTION: Four-speed constant-mesh, synchro-mesh, helical gears (Second, Third & Fourth). Sliding spur gears (First & Reverse). Synchronizer assemblies are friction ring-and-sleeve type.

TRANSMISSION REMOVAL: *See "Transmission" on truck model page.*

TRANSMISSION DISASSEMBLY: Remove parking brake assembly. Remove speedometer driven gear retaining nut and the driven gear. Remove rear bearing retainer and gasket (noting location of longest retainer-to-case bolt). Remove reverse idler shaft and countershaft retainer plate from rear of case. Slide speedometer drive gear and spacer off main shaft. Remove gear shift housing assembly and gasket. Unhook clutch release bearing return spring and remove release bearing and hub assembly. Remove capscrews from front bearing retainer and the nuts from clutch housing-to-case attaching bolts then remove clutch housing and retainer from case. Remove snap ring from main drive gear bearing and from main drive gear and then remove the bearing using Tool 7025-C (Puller). Remove oil baffle and the snap ring from rear main shaft bearing and pull the bearing with Tool 7025-C. Drive countershaft from case, working from the front, using dummy shaft, Tool 7111-A. *(CAUTION*—Keep dummy shaft in contact with countershaft to avoid dropping needle bearings). Allow cluster to remain in bottom of case. Remove main drive gear through the front end of case, then remove synchronizer blocker ring and needle bearings from gear. Pull reverse idler shaft out of case, using Tool 7140. Slide reverse shifter fork off shaft and remove from case. Tilt main shaft assembly and remove through top of case. Take out reverse idler gear. Position case with power take-off side next to bench. Roll cluster gear assembly toward top of case until cluster gear small end can be pushed through main shaft bearing bore in case. Using extreme care not to disturb needle bearings, remove gear assembly out of case.

DISASSEMBLY OF COMPONENT PARTS:

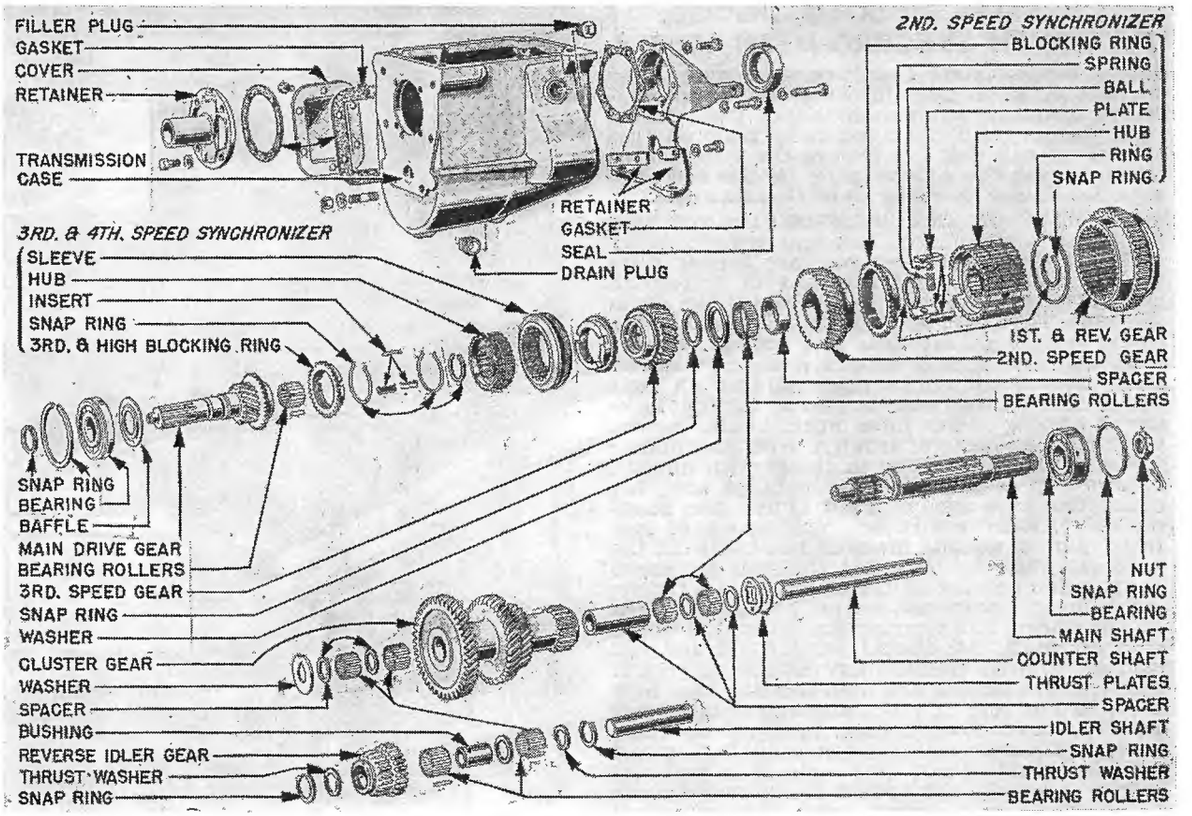
Main Shaft: Remove third and high synchronizer snap ring from main shaft, then slide third and high speed synchronizer assembly and third speed gear off shaft. Remove second speed synchronizer snap ring and slide second speed synchronizer hub gear off synchronizer, using care not to lose balls, springs and plates. Pull synchronizer hub off shaft. Remove snap ring at rear of second speed gear and remove gear, spacer, rollers, and thrust washers.

Cluster Gear: Remove dummy shaft, 88 bearing rollers, bearing spacer washers and bearing spacer.

Gearshift Housing: Remove gearshift lever cap, then lift lever out of cover. Remove lock wires and lock screws, shifter forks and shifter shaft gates. Remove expansion plugs from front end of housing and tap shifter shafts out of housing while holding one hand over holes in housing to prevent loosing springs and steel balls. Remove two lock plungers.

REASSEMBLY OF COMPONENT PARTS:

Cluster Gear: Slide the long spacer into cluster gear and then insert dummy shaft into spacer. Hold cluster gear in a vertical position and install 22 bearing rollers. Install spacer washer on top of rollers and then install 22 bearing rollers and a spacer washer on top of rollers. Hold a large thrust washer against end of cluster gear to keep rollers from falling out, and invert the gear assembly. Install bearing rollers in opposite end (above).



FORD TRUCK 4-SPEED SYNCHRO-MESH TRANSMISSION

Main Shaft: Install second speed gear thrust washer on main shaft. Hold shaft in vertical position and slide second speed gear on main shaft. Insert second speed gear bearing rollers in gear, then slide spacer into gear hub. Install spacer snap ring in groove of main shaft. *(CAUTION*—Do not invert shaft. Rollers will slide out of shaft). Press second speed synchronizer hub on shaft and install snap ring. Place main shaft in vertical position in a vice. Position synchronizer springs and plates in hub and place second speed synchronizer ring on hub. Hold ring above hub spring and ball holes and position one ball at a time in hub. Push down to depress ball into hole and slide ring down to retain ball in hub, then repeat the foregoing procedure and install remaining two balls. Remove main shaft from vice and install the third speed gear, and sychronizer blocking ring on shaft. Install a snap ring at each end of hub with spring openings staggered. Place synchronizer inserts on sleeve and slide the assembly onto main shaft, making sure slots in blocker ring in line with inserts. Install front snap ring.

Gearshift Housing: Place spring on reverse gate plunger and install plunger and spring in reverse gate. Press plunger through the gate and secure it with the clip. Place reverse gate plunger ball and spring in poppet hole. Compress the spring and install cotter pin. Place shifter shaft lock plunger spring and steel ball into reverse shifter shaft hole in housing. Press down on ball with a long, narrow drift, then position reverse shifter shaft so reverse arm notch does not slide over the ball, and insert shaft part way into housing. Slide reverse shaft gate onto shaft, and drive shaft into housing until ball snaps into groove of shaft. Install lock screw and lock wire to secure gate to shaft. Insert the two interlock plungers into pockets between shifter shaft holes. Place the spring and a steel ball into the first and second shifter shaft hole. Press down on steel ball, then insert shifter shaft part way into housing. Slide first and second gear shifter fork onto shaft so the offset of fork is toward rear of housing. Push shaft all the way into housing until ball snaps into place in groove. Install lock screw and wire to secure fork. Install third and high shifter shaft in same manner, then install expansion plugs in shaft bores.

TRANSMISSION REASSEMBLY: Lubricate all parts with transmission lubricant. Enter countershaft

CONTINUED ON NEXT PAGE

FORD TRUCK 4-SPEED (SYNCHRO-MESH) Continued

into hole in rear of case and tap shaft until forward end is flush with inside of case. Slot in end of shaft must be at rear and faced toward idler gear shaft. Position case with power take-off plate downward. Hold the two thrust washers at each end of cluster gear and install gear in bottom of case, then install the third thrust washer between case and rear washer. Position idler gear shaft into case with slot at rear and faced toward countershaft and while holding reverse idler gear in position, tap shaft until slot is aligned with rear face of case. Align cluster gear with holes in case and push the dummy shaft out through front of case with countershaft. (*CAUTION*—Be sure to keep cluster gear in contact with dummy shaft to prevent bearing from dropping into gear). Align slot in countershaft with rear edge of case. Install main shaft pilot bearing rollers in main drive gear, and position gear in front bearing bore, working from inside the case. Position the stop yoke Tool No. 2025-D to prevent jamming synchronizer rings. Install oil baffle and main shaft bearing on shaft and drive bearing into position with Tool 7065-A, install snap ring. Using same tool, drive rear bearing on shaft and into rear bearing bore, then install rear bearing snap ring. Install main drive gear snap ring on shaft. Install front bearing retainer and clutch housing on front of transmission. Install gear shift housing and gasket. Install idler and countershaft retainer plate, securing with two capscrews. Install rear bearing retainer and new gasket making sure the longest screw is installed in correct hole. Install speedometer drive gear and spacer on end of main shaft and install driven gear and retaining nut. Install flange and parking brake drum and tighten nut, locking in place with cotter pin.

FORD TRUCK 4-SPEED (SPUR GEAR)

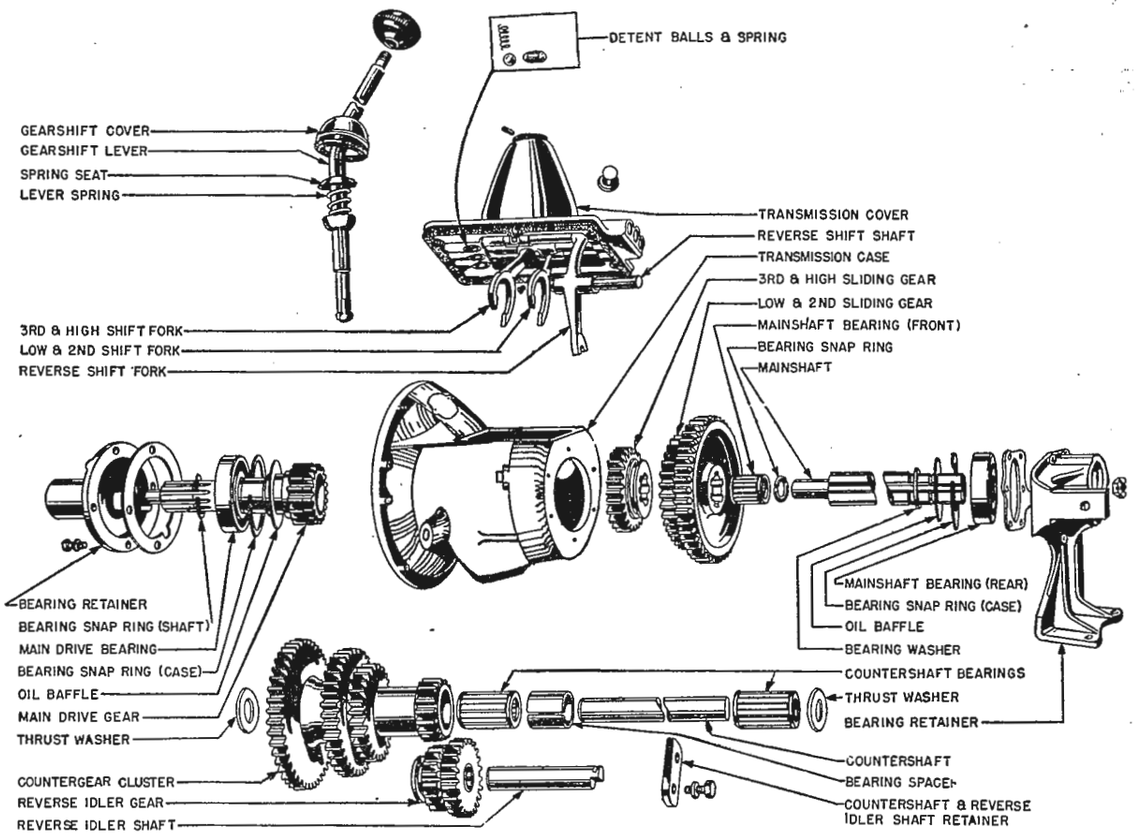
All Trucks except ½ & ¾ Ton (1939-51)

►**Half-Ton & ¾ Ton Transmission Note**—This Four-Speed Transmission Optl. on these models.

DESCRIPTION: Four-speed, sliding spur gear type. Main drive gear and shaft mounted on ball bearing at front end of transmission case. Mainshaft mounted on roller bearing in main drive gear at front end, ball bearing in case at rear. Counter gear countershaft. Reverse idler gears mounted on bronze bushing on stationary shaft.

REMOVAL OF TRANSMISSION: *See "Transmission" on car model page.*

DISASSEMBLY: Remove gearshift housing (transmission cover) assembly and gasket. Remove the clutch release bearing spring, release bearing, and retainer. Take out screws in bearing retainer on front end of case, remove retainer, withdraw clutch shaft main dive gear and bearing assembly (tap main drive gear with a brass hammer if required). Remove mainshaft front (roller) bearing and spacer from mainshaft. Take off nut on rear end of main shaft and remove universal joint flange and brake drum. Take out screws in bearing retainer on rear end of case, remove retainer, withdraw speedometer gear and spacer from shaft. Remove speedometer driven gear bearing and gear from retainer. Withdraw mainshaft and bearing out through rear of case (use brass hammer and tap on front end of shaft until bearing free of case) and remove sliding gears out through top of case. Take out cotter pin from front end of reverse idler, shifter shaft on left side of transmission and drive shaft out through rear of case and lift out shifter fork. Take off reverse idler retainer (lock plate) on rear of case and pry out reverse idler shaft with screwdriver engaging slot in end of shaft, lift out reverse idler gear. Drive countershaft out through rear of case, lift out cluster gear. Remove bearings and spacer from cluster gear.



1940 & LATER FORD TRUCK 4-SPEED SPUR GEAR TRANSMISSION

CLEARANCES & PARTS CHECK: Replace gears if worn excessively or teeth chipped or broken. Replace bearings discolored by overheating or if binding or looseness noted when rotating bearing on shaft by hand. Replace parts worn beyond the following limits:

Countergear Cluster: Endplay .009-.021" (new), .025" (worn limit). Measure between gear and case. Inside diameter 1.6255-1.6265" (new), 1.630" (worn).

Countershaft: Diameter .9995-1.0000" (new), .9945" (worn limit).

►*CAUTION—Do not measure slotted end (.003" greater diameter at this point for press fit in case).*

Reverse Idler Gear: Inside diameter .9890-.9900" (new), .991" (worn limit). If bushing worn, replace gear. Do not remove bushing from gear (gear furnished with bushing installed).

Reverse Idler Shaft: Diameter .9872-.9877" (new), .986" (worn limit).

Mainshaft Assembly: 3rd & High Gear—Fit to shaft correct if gear holds own weight on shaft splines.

First & Second Gear—Backlash limit .003".

Mainshaft—Pilot (front) end diameter .8110-.8115" (new), .806" (worn limit).

Mainshaft Bearing—Use arbor press to press shaft out of bearing. When pressing on new bearing, first place bearing washer and oil baffle (with outer edge away from bearing) on shaft.

Main Drive Gear Assembly: Gear end inside diameter 1.312-1.313" (new), 1.316" (worn limit).

Main Drive Gear Bearing—To replace bearing, remove snap ring (on front side of bearing), tap on outer race evenly to remove bearing. When installing new bearing, first install oil baffle with outer edge away from bearing. Press bearing on main drive gear, install lock ring.

REASSEMBLY: Assemble in reverse order of disassembly (above) and note following points:

Mainshaft Assembly: Install first and second gear and third and fourth gear with shifter fork channels facing each other (first and second facing toward front, 3rd & 4th channel facing rear).

1939-48 FORD, LINCOLN, MERCURY 1939-51 FORD TRUCK 3-SPEED

Ford 6 Cyl. & V8 Pass. Car Models (1939-48)
Ford Comm'l, Half-Ton Truck (1939-51)
Ford Comm'l, ¾ Ton Truck (1940-51)
Ford One-Ton Truck (1940-47)
Lincoln, All Models exc. V12 (1938-48)
Mercury, All Models (1939 to 1948)

►NOTES, CAUTIONS, & CHANGES

►**Ford, Lincoln, Mercury Passenger Car Gearshift 1940 & Later Cars**—New type consisting of two independent shifting levers and shafts mounted on side cover on transmission case (no top cover used) *See Ford Transmission Control for adjustment data.*

►**Ford F-1 (Late 1950 & 1951) & F-3 Parcel Delivery (1950-51) Remote Control Gearshift**—*See Remote Control Gearshift Housing (at end) for disassembly and reassembly data. See Ford Truck Transmission Controls for adjustment data.*

►**Ford Truck Optl. Transmission**—Four-speed type optional on these truck models. *See preceding pages for 4-Speed Transmission data.*

►**Lincoln 1941-48 Overdrive**—*Special Warner Optl. See Pg. 2753 "1941-48 Lincoln Overdrive."*

►**Lincoln & Mercury 1942 Liquamatic Drive**—Optl. *See Pg. 2752 "Liquamatic Drive."*

DESCRIPTION: Constant-mesh, synchro-mesh, helical gear (Second & High), sliding gear (Low & Reverse). Main drive gear mounted on ball bearing in case. Mainshaft mounted on roller bearing (front), ball bearing (rear). Countershaft mounted on roller bearings on stationary countershaft with thrust washer at each end. Gears are engaged by a sliding clutch sleeve (outer sleeve or synchronizing unit) which engages clutch teeth on the main drive gear and second speed gear hubs.

Synchronizing Unit: Various types used as follows:

Plain Type Synchronizer—Consists of an inner hub splined on the mainshaft with synchronizing rings at each end and outer clutch sleeve splined on this hub. Sleeve is centered on hub by spring-loaded detent balls (mounted in holes in hub, engage groove in sleeve) so that entire synchronizing assembly moves as a unit, when clutch sleeve shifted to engage gears, until synchronizing rings engage synchronizing cones on gear hubs. Clutch sleeve then slides further to engage clutch teeth on gears (synchronizing rings prevent this engagement until synchronization completed).

Ball & Strut Type Blocking Synchronizer—With this type synchronizer unit, both synchronizer rings are loose in ends of clutch sleeve and are actuated by struts assembled in slots in inner clutch sleeve and engaging notches in synchronizer rings. Struts are centralized in clutch sleeve assembly by the regular poppet balls and springs so that struts move with the outer clutch sleeve during initial movement to engage the synchronizer rings with the cones on the gear hubs. Teeth on outer rim of synchronizer rings block or prevent gear engagement until synchronization completed when the final movement of the outer clutch sleeve causes the clutch teeth on the inner rim of the sleeve to slide through the synchronizer ring teeth to engage clutch teeth on gear hubs. Inner clutch sleeve is stationary on mainshaft (retained as unit with second speed gear by snap ring in groove on shaft). NOTE—This Ball & Strut type synchronizer can be distinguished from Wire-Bound Strut type synchronizer (below) by absence of shoulder on second speed gear end of outer clutch sleeve.

Wire Bound Strut Type Blocking Synchronizer—Both synchronizer rings are loose in ends of clutch sleeve and are actuated by struts assembled in slots in inner clutch sleeve and engaging notches in synchronizer rings. Struts are centralized in clutch sleeve assembly by lock ring or wire installed in outer clutch sleeve which engages notches on struts. Struts move with the outer clutch sleeve during initial movement to engage synchronizer rings with cones on gear hubs. Teeth on outer rim of rings "block" or prevent gear engagement until synchronization completed when the final movement of the clutch sleeve causes clutch teeth on sleeve to slide through the synchronizer ring teeth to engage clutch teeth on gear hubs. Inner clutch sleeve is stationary on mainshaft (retained as unit with 2nd. speed gear by snap ring in groove on shaft).

Gearshift Assy. (1940 & Later Pass. Cars): Consists of two independent shifting levers and shafts mounted on transmission case side cover (rear lever is Low-Reverse, forward lever Second-High). Fork on inner end of lever shaft engages gears directly and no shifter rails are used. Detent balls and interlock mechanism consist of a spring, plunger, and two balls assembled in a tube in a boss within the transmission case so that the balls engage notches in sectors on each of the shifter shafts. The entire gearshift mechanism can be removed as a unit with the side cover by disengaging the forks from the gears. CAUTION—When reassembling cover, make certain that rear fork engages low speed gear, forward fork engages outer sleeve of synchronizer unit.

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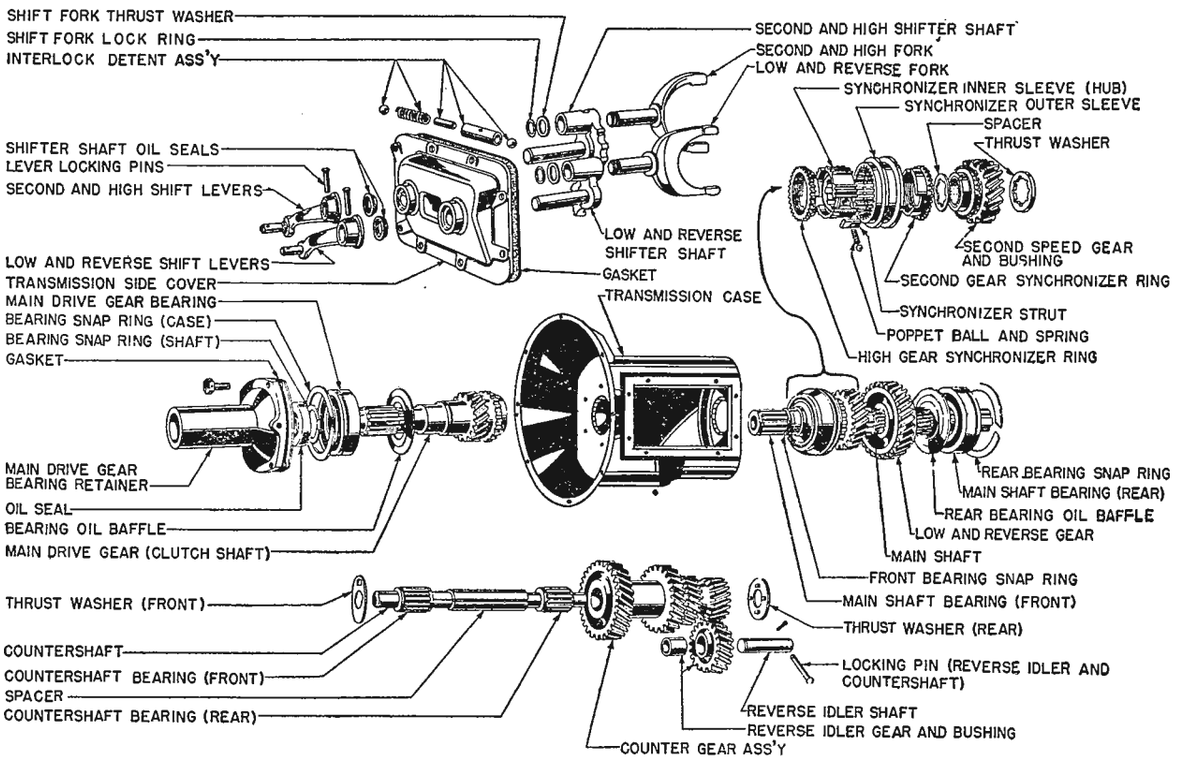
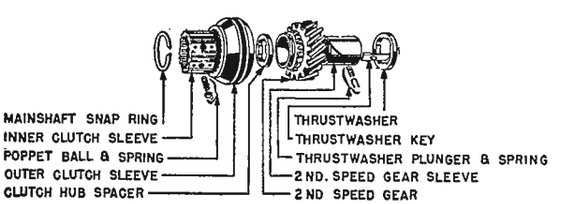
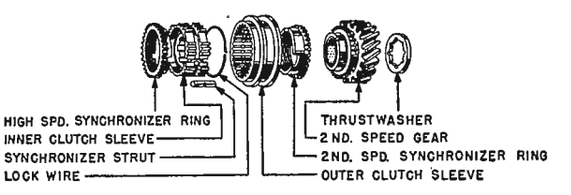


1940-48 FORD, LINCOLN, MERCURY 3-SPEED (BALL & STRUT TYPE SYNCHRONIZER)



PLAIN TYPE SYNCHRONIZER



WIRE BOUND STRUT TYPE SYNCHRONIZER

1939-48 FORD, LINCOLN, MERCURY 1939-51 FORD TRUCK 3-SPEED (Cont.)

Gearshift Assembly (1950-51 F-1 & F-3 Parcel Delivery Trucks): Remote control type. F-1 type similar to Pass. Cars (above). F-3 type has mechanism built in top cover with separate gear engagement lever and gear selector (cross-shift) lever. *See Remote Control Gearshift Housing data (at end).*

REMOVAL OF TRANSMISSION: *See "Transmission" on car model page.*

DISASSEMBLY (1939-48 exc. 1948 Truck): Remove transmission cover and shifter assembly (on 1939 types), remove side cover and shifter mechanism as an assembly (1940 & later). Take out capscrews in universal joint front yoke, remove yoke from shaft. Take out capscrews mounting universal joint housing on rear of case, remove housing. Remove locking pin and drive out countershaft. Take out bearing retainer screws on front of case, withdraw clutch shaft main drive gear and bearing assembly (On Lincoln beginning 1942, gear can be removed without dropping countergear cluster by turning drive gear until "cutout" section of clutch teeth on gear provide clearance for counter gear). Tap mainshaft back in case until rear bearing clears rear face of case, remove snap ring from bearing. Tap mainshaft forward until bearing clears inner face of case, remove mainshaft, synchronizer, and gears from the case as an assembly (lift out bearing end of shaft first). Lift out countergear cluster and thrustwashers. If reverse idler gear to be removed, tap shaft out from rear end of case (retained by same lockpin as countershaft), lift gear out.

DISASSEMBLY (1948 & Later Trucks): Remove gearshift housing assembly from case. Unhook clutch release bearing hub return spring, slide release bearing and hub off front bearing retainer. Take out front bearing retainer screws, tap retainer lightly and slide retainer and gasket off shaft. On std. transmission, remove lock pin securing countershaft and reverse idler shaft in case. On heavy duty transmission, take out screws and remove locking plate from lower rear end of case. Remove mainshaft bearing retainer, remove bearing snap ring. Remove bearing from shaft with a puller, slide oil baffle off shaft. Drive countershaft out through rear of case. Pull main drive gear forward as far as possible, lift mainshaft assembly out through opening in case. Remove main drive gear bearing snap ring, tap on end of shaft until bearing is free, then lift gear and bearing assembly out of case. Lift countergear cluster and thrustwashers out of case. Drive reverse idler shaft forward in case until it is free, then lift gear and shaft out of case.

REASSEMBLY: Reverse disassembly instructions above and note following points:

Mainshaft Assembly: See Synchronizer, Second Speed Gear, and Sliding Gear for removal and installation of these parts. Rear bearing should be replaced as follows:

Mainshaft Rear Bearing—Press old bearing off shaft. Install oil baffle on shaft with outer edge of baffle away from bearing, press new bearing on shaft until seated against shoulder.

Synchronizing Unit:—Can be removed from front end of mainshaft without being dismantled. If clutch sleeve is to be removed from the inner clutch hub mark both parts and reassemble in same positions, use extreme care not to lose detent balls and springs (will jump out when parts separated).

Blocking Type Synchronizers—Mark both rings as well as inner and outer clutch sleeves before disassembly to insure reassembling in same relative positions. When installing struts, make certain that they engage poppet balls (Strut Type) or that locking wire engages notches in struts and is installed with hook on open end engaged between two clutch teeth on outer sleeve midway between struts (Wire Bound Strut Type). Wire Bound Strut Type Synchronizer is mounted on mainshaft as an assembly with the second speed gear as shown below.

Second Speed Gear Assembly (With Plain Type Synchronizer): Gear is retained on shaft by thrustwasher at rear and thrustwasher (spacer) at front which are locked in place by locking key and plunger within the gear sleeve. To remove the gear, insert a punch (or wire) through the hole at center of gear, rotate the gear until wire can be pushed through hole in sleeve, depress plunger, until locking key is freed, push key forward to release rear thrust washer, turn washer until prongs (engaged in slot in splines) line up with shaft splines, move washer to rear slightly. Move key back to free front washer (plunger will engage key at center position and must be depressed again to allow key to be shifted further), withdraw wire and move second speed gear back to expose front thrust washer, turn washer until prongs are freed from splines, remove washer and gear. When installing gear, make certain that both thrust washers are turned so that prongs engage slots in splines (to prevent endwise movement) and that key engages both washers and that key is locked by plunger.

Gear Endplay—.004-.008" (new), .020" (worn limit). Controlled by thrust washers as follows:

Front (Spacer)—B-7069. .183-.184" thick.

Rear (Thrustwasher)—68-7071. .1875" thick.

Second Speed Gear Assembly (With Blocker Type Synchronizer): Gear and inner sleeve or hub of synchronizer are mounted as an assembly on the mainshaft with a thrustwasher (spacer) between the gear and synchronizer. Assembly is retained on shaft by snap ring at forward end of synchronizer clutch sleeve. To dismantle assembly, remove snap ring from groove at forward end of shaft, withdraw synchronizer assembly, thrustwasher, and second speed gear. NOTE—Gear and bushing are furnished as an assembly.

Gear Endplay—.004-.008" (new), .020" (worn). Install spacer (front thrustwasher) of the correct thickness for this endplay as follows:
81A-7069-A—.0630-.06355" (new), .060" (worn limit).
81A-7069-B—.068-.071" (new), .066" (worn limit).
Rear thrustwasher furnished in one thickness only:
81A-7071—.184-.185" (new), .179" (worn limit).

Second Speed Gear Assembly (1948-51 Trucks): When assembling mainshaft, install second speed gear on forward end of shaft, coat synchronizer ring with grease and install ring, then install synchronizer assembly and make certain that cutouts on ring mate with inserts on hub, install snap ring on shaft. Check endplay with feeler gauge inserted between shoulder on shaft and rear face of second speed gear. This endplay should be .003-.011" (Std. 3-Spd. Trans.), .003-.016" (Heavy Duty 3-Spd. Trans.) and must not exceed .020".

Countergear Assembly:—Counter shaft is retained by locking pin driven in through hole in case and rear end of shaft (pin also locks reverse idler gear shaft in place) and shaft can be driven out after pin removed. Gear cluster is mounted on roller bearings with spacer on shaft between bearings. When installing gear cluster, make certain that tongue on thrust washer at forward end engages slot in case and that rear thrust washer prongs engage gear.

NOTE—On '60' models, floating bushings are used. Spacer (74-7115) installed between bushings.

Countergear Endplay—Endplay must not exceed following specifications (replace thrustwashers if excessive):

1939-48 Pass. Cars—.005-.015" (new), .025" (worn).

1939-47 Trucks—.005-.017" (new), .025" (worn).

1948-51 Trk. (Std. Trans.)—.0045-.0185".

1948-51 Trk. (Heavy Duty Trans.)—.006-.020".

Reverse Idler Gear:—Shaft retained by countershaft locking pin, may be removed after pin driven out. Install gear with shoulder toward rear of case. See that locking pin hole in shaft lined up with hole in case and install locking pin after countershaft installed (same pin locks both shafts).

GEARSHIFT ASSEMBLY (Pass. Cars): To dismantle shift assembly, remove lockrings on shifter shaft ends of forks, remove forks from shifter shafts. Drive out locking pins in lever at outer ends of shifter shafts, withdraw shafts from inside of cover using extreme care not to lose detent balls, spring, and plunger. Reassemble shifter mechanism in same manner. See that oil seal in recess in cover at outer end of each shifter shaft is in good condition. See Ford & Lincoln Transmission Control articles for adjustment directions.

REMOTE CONTROL GEARSHIFT (F-1 & F-3 Parcel Delivery Trucks): *Two different types used.*

Disassembly: F-1 Truck—*See Pass. Car data above.*

Parcel Delivery F-3: Remove selector lever assembly and shifter shaft outer lever from housing. Remove lockwires and screws attaching shifter shafts to forks. Insert a drift into lock screw hole in one of the shifter shafts and gently tap shaft and expansion plug out of housing. (*CAUTION*—Hold plunger spring and ball hole to avoid losing parts). Remove other shaft in same manner and tag both shafts and housing holes so parts will be reassembled in correct manner. Remove snap rings on shaft. Tap on inner lever until shaft key is exposed, then remove key. Slide shaft out of housing, and remove inner lever. Remove plunger plug and plunger.

Reassembly: F-1 Truck—*See Pass. Car data above.*

Parcel Delivery F-3—Slide plunger into position in housing and install plug. Install shifter shaft spring, shaft inner lever and shaft in housing. Press spring away from inner lever and insert key in shaft. Align key with keyway in inner lever, then force lever over key. Install a snap ring at each side of lever. Drop a shaft lock plunger spring and ball through one of the housing holes, then place proper fork in position. Move ball down with a drift and slide correct shaft into housing and fork. Install lock screw in fork and shaft and secure with lock wire. Install remaining shaft and fork in a like manner. Install expansion plug in housing at ends of each shaft. Place selector lever assembly on stud in housing and install spacer, lock washer and nut. Install outer lever on shaft and secure in place.

1942 LINCOLN & MERCURY LIQUAMATIC DRIVE

Lincoln & Mercury Models (1942)—Optl.

DESCRIPTION: Liquamatic Drive consists of Fluid Coupling, conventional Single Plate Clutch, new design 3-speed Transmission with automatic shifting between Second & High Gear, and an Overdrive Unit (Lincoln only) with Governor control.

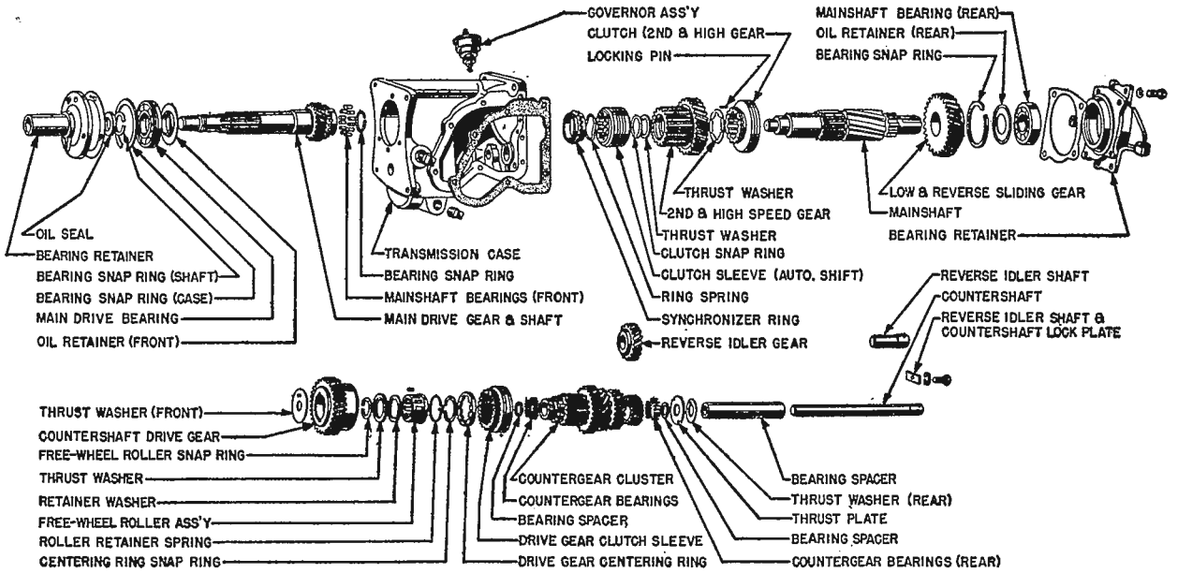
Fluid Coupling—This unit is similar to other Fluid Couplings and consists of a driving member and a driven member within a housing mounted on the rear end of the engine crankshaft.

Automatic Transmission—Warner AS1-T94 (Mercury), T94A with R10A Overdrive (Lincoln). Special design with free-wheel unit or overrunning clutch incorporated in the drive gear on countershaft so that Second Gear or High Gear effective (depending on car speed and consequent position of automatic shift mechanism) with steering column gearshift lever in 'High' position. Transmission can be 'kicked down' from High Gear to Second Gear at car speeds below 35 MPH. by fully depressing the accelerator pedal (accelerator pedal action also controls Overdrive on Lincoln as described below). With the gearshift lever in the 'Second' position, overrunning clutch is locked out.

Overdrive Unit (Lincoln)—Same design as used on other Lincoln models (Warner Type R10). *See "1941-48 Lincoln Overdrive (Special Warner R10)."*

OPERATION: Mercury Transmission. The gearshift lever on the steering column is normally left in the High position (for starting and running) but transmission automatically shifts down to Second Gear (without gearshift lever change) at car speeds below 11 MPH. so that all starts are made in Second. When accelerator pedal is depressed to accelerate engine, fluid coupling transmits torque and car starts in normal manner. At car speeds above 11 MPH., transmission automatically shifts to High Gear when accelerator pedal is released momentarily (second speed gear is not disengaged but freewheels on countershaft) and transmission remains in High until car speed decreases to 11 MPH. or accelerator pedal is fully depressed for 'kick-down' downshift to Second for acceleration (transmission returns to High when pedal released below 38 MPH).

Lincoln Overdrive Transmission—Lincoln transmission shifts in same manner as Mercury (above) when engine accelerated normally and shift from Second to High occurs between 12 & 23 MPH. whenever the pedal is released momentarily. However, if car is accelerated beyond 23 MPH. without releasing the pedal, Overdrive engages when the pedal is released so that transmission is in Second-Overdrive. At the next release of the pedal, High is automatically engaged so that transmission is in High-Overdrive (normal position at speeds above 23 MPH.). Likewise, when accelerator pedal is fully depressed for 'kick-down' downshift at speeds between 23 & 35 MPH. (with transmission in High-Overdrive), Overdrive remains engaged and transmission shifts down to Second-Overdrive. The second full depression of the pedal disengages Overdrive so that the transmission is in Second Gear. At car speeds above 35 MPH., this 'kick-down' disengages Overdrive only so that transmission is in High Gear (Second Gear downshift inoperative above 35 MPH.).



MERCURY LIQUAMATIC DRIVE (LINCOLN SAME WITH OVERDRIVE)

Transmission Gearshift Mechanism:—Automatic shift mechanism consists of a special sliding clutch collar on the hub of the Second Speed Gear on the transmission mainshaft which locks this gear to the clutch gear (main drive gear) for High Gear or direct drive operation (Second Speed Gear will be locked to mainshaft by manually controlled sliding clutch collar directly behind gear when the steering column gearshift lever is in the High Gear position). This direct drive is permitted by the 'free-wheel' unit in the countershaft driving gear(countershaft gear cluster overruns this driving gear as it is being driven at faster speed by the second speed gear on the mainshaft when transmission is in High). The automatic shift sliding clutch collar is operated by the vacuum power cylinder as described below. When clutch collar is shifted to rear (second speed gear free) transmission will be in Second Gear, when clutch collar shifted forward (second speed gear locked), transmission in High.

Transmission Control Vacuum Cylinder:—Consists of a piston type vacuum power cylinder and solenoid valve assembly mounted on the right hand side of the transmission case with the piston rod linked to the automatic shift clutch collar shift lever (see above). A large return spring is located within the vacuum cylinder behind the piston (downstroke or outward movement of piston rod is spring actuated, upstroke or inward movement of the piston rod only is vacuum actuated) and a 'holding solenoid' coil and Ignition Shorting Switch is built in the end of the vacuum cylinder. When the solenoid valve is energized, valve opens and admits vacuum to power cylinder so that piston and rod are drawn into cylinder shifting the transmission into Second Gear. Piston and rod are held in this inner position by the 'holding coil' in the cylinder which is connected in series with the valve solenoid and is likewise energized. In this inner position, the piston actuates the Ignition Shorting Switch plunger and closes the switch contacts but the ignition is not shorted out because right hand (ignition) contacts in control relay are normally open. When the left hand contacts of the control relay open to de-energize the solenoid valve and vacuum cylinder holding coil (actuated by Governor, Throttle Kick-down Switch, or Interlock Switch as described below), the right hand (ignition) contacts also open and, as the ignition shorting switch contacts in the vacuum cylinder are likewise open, the ignition coil is grounded and engine ignition is cut out momentarily allowing engine to coast and relieving the torque from the automatic shift clutch collar. The return spring in the vacuum cylinder then pushes the piston and rod outward to shift the automatic shift clutch collar into Second Speed position (balk ring in clutch collar prevents engagement until torque has been relieved). As soon as the vacuum cylinder piston has moved out 3/8", the contacts in the ignition shorting switch open and ignition is restored (this entire action occurs so fast that this cutting out not noticed.

Transmission Control Relay:—Relay has two sets of contacts and when relay winding is energized, left hand (solenoid valve & holding coil circuit) contacts will be closed and right hand (ignition) contacts will be open. When relay winding is de-energized by opening of the control switch contacts, left hand contacts open and right hand contacts close.

Governor—Governor is mounted on right side of transmission and driven from a special gear of the countergear cluster. Governor is two-stage type. At car speeds below 11 MPH. both sets of contacts are open. At 11 MPH., low speed contacts close to actuate relay and energize solenoid valve and vacuum cylinder holding coil so that transmission shifts to High Gear. At 38 MPH., the high speed contacts close and transmission remains in High.

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LIQUAMATIC DRIVE (Continued)

Throttle Kick-down Switch—Throttle Kick-down switch is connected in Governor low speed contact circuit and is normally closed so that transmission operation is controlled by the governor. Whenever the accelerator pedal is fully depressed for 'kick-down' to Second (at car speeds between 11 and 38 MPH.), throttle switch contacts open and break the circuit to ground (through governor low speed contacts) so that solenoid valve and vacuum cylinder holding coil are de-energized and downshift to Second occurs. At speeds above 38 MPH., circuit is completed through governor high speed contacts and throttle switch operation has no effect.

Interlock Switch—Mounted on left hand side of transmission. Switch is connected in circuit between relay and governor and is normally closed. Whenever gearshift lever is moved to any other position than High Gear, interlock switch contacts open so that automatic shift is inoperative.

ADJUSTING & SERVICING: Fluid Coupling. Fluid coupling is filled with SAE #10W oil which is correct for all operating conditions and need never be changed. Check fluid level at 5000 mile intervals. CAUTION——Never remove fluid coupling plug to check oil level when oil hot (check at 70°F).

Checking Oil Level—Remove hand hole cover on top of clutch housing (left side on Mercury). Turn fluid coupling until plug in coupling cover is opposite lower mark on clutch housing (Lincoln), centered between two marks or ribs on housing (Mercury), remove plug (see Caution above). Fill coupling to point even with bottom of filler hole with SAE #10W engine oil, replace plug and tighten securely. Fluid Coupling must be turned so that plug position is correct (above) to avoid overfilling.

Capacity—10½ quarts (Lincoln).

Vacuum Cylinder Piston Rod Adjustment:—Adjust rod length so that there is slight tension on rod in Second Gear position (rod adjustment set a maximum of one turn long from point where it has no backlash in second speed position). Incorrect adjustment will cause sluggish kick-down from high to second speed or failure to kick-down.

Throttle Kick-down Switch Adjustment:—Kicker on throttle rod should be set so that switch contacts open when throttle rod extended beyond wide open throttle position. Incorrect switch adjustment will cause failure of kick-down from high to second.

FUSE:—Fuse is 15 ampere. Located in lead between ignition switch and #1 relay terminal.

TROUBLE SHOOTING:—If transmission does not operate satisfactorily, check for trouble as follows:

Sluggish High Gear Upshift—Accelerator linkage binding or sticking, engine idle speed too fast (set engine idle speed at 350 RPM when warm.

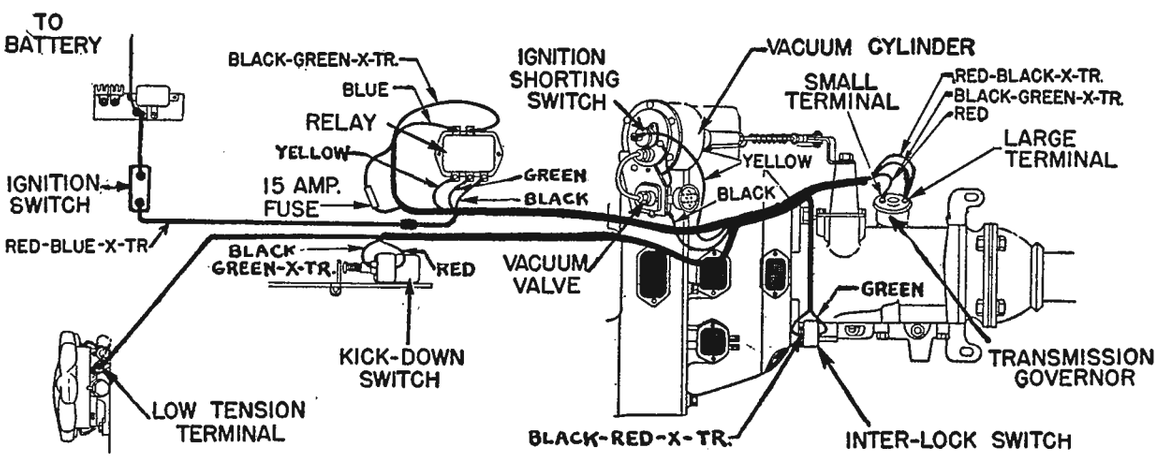
Remains in Second Gear (No High Gear Upshift). Check for burned out fuse, accelerator linkage sticking or engine idling too fast (set idle speed at 350 RPM.), check vacuum lines and connections for leaks, check automatic shift clutch lever engaging spring tension, check relay, governor, interlock and throttle kick-down switches, check vacuum valve, check all wires for loose connections and breaks.

Remains in High Gear (No Second Gear Downshift). Check relay and governor operation, check circuit between center terminal at bottom of relay and governor low-speed terminal for grounds.

Sluggish Kick-down to Second Gear. Check vacuum cylinder piston rod adjustment (above), check for loose connections at distributor primary terminal, vacuum cylinder center terminal, and relay terminals, check wiring for open-circuits.

Remains in High Gear (No Kick-down to Second). Check vacuum cylinder piston rod adjustment and throttle kick-down switch adjustment (above), check relay, ignition shorting switch (on vacuum cylinder), and circuit between ignition shorting switch and distributor primary terminal. Check ignition shorting switch spring tension (contacts should close with 6-8 ozs. pressure on plunger).

Second Gear Kick-down occurs above 38 MPH. Check relay, check high speed contacts in governor (contacts should close at 38 MPH.).



LIQUAMATIC DRIVE CONTROL (MERCURY SHOWN—LINCOLN SIMILAR)
SEE 1942 LINCOLN CAR WIRING DIAGRAM FOR OVERDRIVE WIRING

1941-48 LINCOLN OVERDRIVE (SPECIAL WARNER R10)

Car Model	Warner Model
Lincoln, All Models (1941-42)	AS1-R10
Lincoln, All Models (1946-47)	AS2-R10
Lincoln, All Models (1947-48)①	AS3-R10

①—After approximately March 1, 1947.

►**Overdrive on Liquamatic Drive Cars**—Overdrive is a part of the Liquamatic Drive (Liquamatic Drive consists of Fluid Coupling, Automatic Transmission and Overdrive on Lincoln—no Overdrive used with Mercury Liquamatic Drive) and may also be found on cars with Std. synchro-mesh transmission. Refer to separate article for all data on Liquamatic Drive except Overdrive servicing data which is given below.

►**Overdrive Solenoid Removal & Installation**—Solenoid is special type and solenoid pawl rod has 2 "flats" on ball end to permit solenoid to be removed and installed without disassembling the overdrive unit. Manufacturer recommends that solenoid be installed only after overdrive installed on transmission to avoid damage to solenoid. ***Refer to Overdrive Servicing data (below) for complete instructions.***

DESCRIPTION: Warner special R10. New design overdrive unit with solenoid control (no centrifugal clutch pawls). This R10 type similar to Type R9 (Hudson, Packard models) except for control circuits and lockout mechanism which are entirely new design as described below. Solenoid pushes sun gear pawl in (to engage Overdrive), withdraws pawl (for Direct Drive). Solenoid is controlled by Governor Switch (Overdrive does not engage above cut-in speed until accelerator pedal released momentarily) and has 'kick-down' direct drive feature.

Lockout Mechanism—Consists of a shift collar positioned on the sun gear by snap rings so that the sun gear can be shifted to the rear to engage clutch teeth in a lock plate mounted on the planetary pinion assembly so that the planetary gears are locked together for direct drive. CAUTION—This lockout action can only take place with overdrive in direct drive (sun gear and lockplate turning at same speed) and overdrive must be 'kicked-down' to direct drive (see "Control" article following).

Lockout Switch (AS1-R10, AS2-R10). Switch is mounted on side of overdrive case (retained by setscrew and locknut directly ahead of switch) with switch plunger contacting rear end of overdrive control shaft.

Lockout Switch (AS3-R10). Switch mounted on side of case and retained by two screws in switch base plate. Switch plunger extends through base into hole in overdrive case and is actuated by ball riding on overdrive control shaft.

CAUTION—When removing and installing this switch, make certain that switch ball is in place in plunger recess in case.

REMOVAL OF OVERDRIVE: ***See "Overdrive" on car model page.***

TRANSMISSION DISASSEMBLY & REASSEMBLY: See "Ford-Lincoln-Mercury 3-Speed" Transmission (transmission is same as std. type without over-

CONTINUED ON NEXT PAGE

1941-48 LINCOLN OVERDRIVE (Continued)

drive) except that mainshaft is extended back into overdrive case and has pinion assembly and freewheel cam mounted on this extension.

SOLENOID REMOVAL & INSTALLATION: Disconnect wires at terminals, take out mounting screws in base flange, **rotate solenoid approximately 60° to right** to disengage pawl rod from pawl (this will line up flats on end of rod with slot in pawl), withdraw solenoid and pawl rod assembly. To install solenoid, insert pawl rod in adapter with flats horizontal, make certain that short pilot on end of solenoid body enters counterbore in adapter casting, **rotate solenoid approximately 60° to left to engage pawl rod end in pawl** and line up solenoid flange with mounting holes. Check engagement of pawl rod and pawl by attempting to pull solenoid off (solenoid should not come out and resistance of solenoid spring should be felt). Install solenoid mounting screws and connect wires at terminals.

CAUTION—Solenoid must be installed with wire terminals "up".

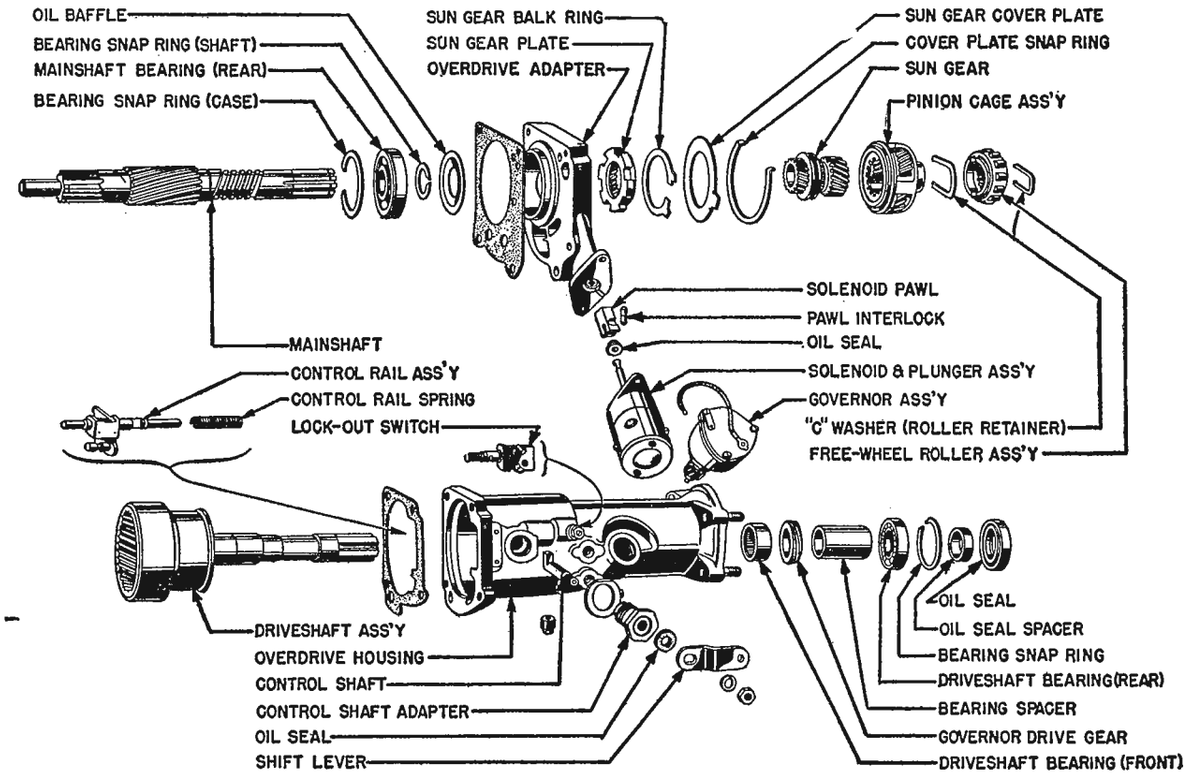
ASSEMBLY OF OVERDRIVE: Install rear bearing on transmission shaft, install bearing lock ring (see end play note below), install oil baffle, transmission shaft and bearing in adapter plate, install bearing snap ring (see bearing endplay note below), install sun gear plate and balk ring assembly in adapter, install pawl in adapter slot. Install cover plate with tongue over pawl, install cover plate snap ring. Install interlock plunger in hole between pawl and shifter shaft, install shifter shaft assembly. Slide sun gear in place on transmission shaft and enter shifting fork in sun gear groove. Assemble overrunning clutch on pinion cage assembly and fasten with retainer, then install assembly on rear end of transmission shaft and install retainer on rear end of overrunning clutch. Install rear shaft assembly over pinion cage assembly and push it forward until overrunning clutch enters its outer race (use a rubber band to hold clutch rollers in place and rotate shaft counter-clockwise to facilitate assembly). Install shifter shaft retractor spring in housing, install housing and attach to adapter plate using gasket 16H-7661. Install governor gear and spacer on shaft. Install rear bearing and bearing snap ring (see Overdrive rear bearing endplay note below). Install oil seal and spacer at rear of case. Install universal joint yoke and tighten mounting screw securely. Install governor, lock-out switch (fasten with setscrew), and solenoid grease retainer. Install shift lever in bushing, install grease retainer in hexagonal end of bushing, place lever in position and install in overdrive case with lever "up." Install solenoid (see Solenoid data above).

Transmission Rear Bearing Endplay—When installing bearing on shaft, select snap ring of correct clearance so that there is no endplay but bearing turns freely. Snap ring supplied in following thicknesses: .087"—16H-7667A, .090"—16H-7667B, .093"—16H-7667C, .096"—16H-7667D, .102"—16H-7667E. Snap ring which retains this bearing in adapter plate should also be selected to control endplay and is furnished in following thicknesses: .087"—16H-7669A, .090"—16H-7669B, .093"—16H-7669C, .096"—16H-7669D.

Solenoid Pawl Interlock—Consists of a short plunger installed in hole in adapter plate between pawl and shifter shaft. Install plunger in hole before installing shifter shaft assembly.

Overdrive Rear Bearing Endplay—Endplay is controlled by thickness of snap ring which retains bearing in overdrive case. Snap rings furnished as follows: .062"—16H-7656A, .065"—16H-7656B, .068"—16H-7656C, .071"—16H-7656D.

Governor Drive Gear—Gear is free on overdrive shaft and will turn with universal joint yoke not tightened on shaft (gear clamped in place by yoke when yoke retaining screw is properly tightened).



1941-48 LINCOLN OVERDRIVE (SPECIAL WARNER R10)

1941-48 LINCOLN OVERDRIVE CONTROL

Lincoln, All Models (1941 to 1948)

►CHANGES, CAUTIONS, CORRECTIONS

►**Relay Mounting Change (Recommended for First 1941 Cars)**—On first cars with overdrive relay mounted on engine dash with terminals 4, 5, 6 upward, it is advised that relay be dismounted and reversed with terminals 1, 2 upward. Any foreign material lodged on terminals should be carefully cleaned off. Grounding of terminal #5 will prevent overdrive releasing and may damage transmission

►**Throttle Kick-down Switch Caution (First 1941 Cars)**—If floor tunnel screws removed, use care to install special short screw immediately ahead of kick-down switch. If regular length screw installed in this hole, screw may contact upper switch terminals and cause ground in circuit at this point.

NOTE—Kick-down switch location changed on later cars and special short screw not required.

►**Control Wiring Change on 1941 Cars**—Wiring was changed after Nov. 10, 1940 (see illustration). "First Type" wiring diagram applies before this date, "Second Type" diagram applies after this date.

Control Wiring (1942-48)—See car wiring diagrams in Car Model Section for overdrive control wiring on each car model.

DESCRIPTION: Note—Overdrive operates similarly to R9 type with "push type" solenoid controlled by Governor Switch and throttle operated kick-down switch as described below. A lock-out switch is also provided which is operated by the overdrive lock-out mechanism.

Control Mechanism—Overdrive operating solenoid is controlled by a Control Relay mounted on the dash, a Governor Switch mounted on the overdrive case extension and driven from the drive-

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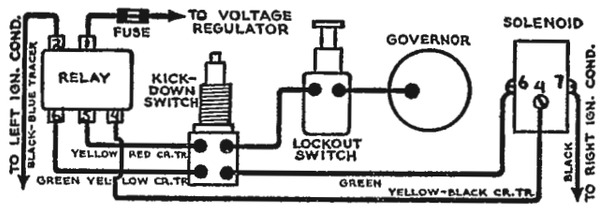
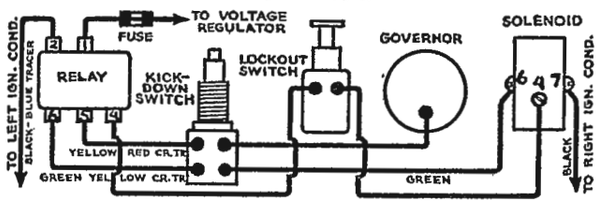
1941-48 LINCOLN
OVERDRIVE CONTROL (Cont.)

shaft, a Lockout Switch mounted on the overdrive case and operated by the lockout shift rail which is linked to the lockout control button on the instrument panel, and a Kickdown Switch operated by the accelerator pedal. See wiring diagram for wiring circuits for these units. NOTE—Since ignition system for each bank of cylinders is independent, two separate ignition cut-out circuits (for momentary cutting out of ignition to permit kick-down direct drive to be engaged) are required and these ignition connections are shown in the diagram.

OPERATION & ADJUSTMENT:—Lockout Control—If dash control button is to be pulled out (to lockout overdrive), accelerator pedal should first be fully depressed (to place overdrive in direct drive), button then pulled out, and accelerator pedal released. NOTE—Lockout will not engage unless overdrive in direct drive (sun gear teeth will strike lock plate clutch teeth causing 'buzzing' sound) and accelerator pedal must be fully depressed to complete lockout engagement.



FIRST TYPE



SECOND TYPE

Adjustment—If dash control button cable is adjusted too short, buzzing sound will be noticed when button pushed all the way in. Noise will disappear when operated with engine pulling car below cut-in speed and will reappear when accelerator pedal released. To adjust cable, turn adjusting nuts at end of cable where it is attached to lever.

Cut-in Speed—25 MPH (governor switch contacts close). Overdrive does not engage until accelerator pedal released momentarily. Overdrive cuts out at 22 MPH (or at any speed if 'kick-down' operated). No cut-in speed adjustment provided.

TROUBLE SHOOTING:—If overdrive does not operate satisfactorily after adjustments have been made correctly, determine trouble as follows:

Overdrive remains engaged, Will not 'kick-down', Car will not roll backward in Neutral—Caused by ground in lead between #5 relay terminal and governor switch. Check by disconnecting lead at #5 terminal and noting if relay 'clicks' when wire touched to terminal (click indicates ground or other defect). Check lead, relay terminals, and kickdown switch for grounds (see Special Service Notes above). To check relay, remove fuse. If relay 'clicks' as fuse removed, relay is defective.

IMPORTANT NOTE—If attempt made to reverse car under above conditions (ground in #5 circuit), overdrive unit may be seriously damaged.

Ignition Cuts Out—If left cylinder bank cuts out when idling, check for grounded relay (internally or at terminals #2 & 6), ground between #6 relay terminal and kickdown switch or in kickdown switch, ground in lead between #2 terminal and distributor or within distributor (if ignition restored when lead disconnected from #2 relay terminal, this lead and distributor are not at fault). If right cylinder bank cuts out when idling, check for ground in lead between #7 solenoid terminal and distributor, in solenoid, and in distributor (if ignition restored when lead disconnected from #7 solenoid terminal, this lead and distributor not at fault). If one bank of cylinders cuts out when overdrive engaged, check for defective solenoid or ground between solenoid terminal #6 and kickdown switch lower terminals.

Overdrive will not engage—Check for open-circuit between relay terminal #5 and governor switch. Check by grounding #5 relay terminal (relay and solenoid should 'click' simultaneously). If relay does not click, check for blown fuse or defective relay. If relay clicks but solenoid does not, check for defective relay, defective solenoid or open-circuit between #4 relay and solenoid terminals. If both relay and solenoid click but overdrive will not engage, check for jammed solenoid or damage within overdrive unit.

Overdrive will not kick-down—Check for ground between relay and kick-down switch or at upper terminals of kickdown switch (see Special Service Note above). Check for open-circuit between relay terminal #2 and ignition condenser, solenoid terminal #7 and ignition condenser, solenoid terminal #6 and kick-down switch, relay terminal #6 and kick-down switch, or within relay. Check for defective kick-down switch.

FUSE:—15 ampere. In connector in control relay lead. Serviced with 20 ampere capacity fuse.

LINCOLN V12

Lincoln V12, All Models (1939-40)

TYPE:—Constant-mesh, synchro-mesh (Second and High) helical gear type with sliding helical gear for Low and Reverse. Clutch shaft and main drive gear mounted on ball bearing in front end of case. Mainshaft mounted on roller bearing at front, ball bearing at rear. Shaft extends through into free wheel case with integral free wheel cam on the rear end (cars with free wheeling). Counter gear cluster mounted on roller bearings on stationary countershaft with ball thrust washer at each end.

Synchronizing Unit:—This unit consists of an inner hub splined on the mainshaft with synchronizing rings at each end and outer clutch sleeve splined on this hub. Sleeve is centered on hub by spring-loaded detent balls (mounted in holes in hub, engage groove in sleeve) so that entire synchronizing assembly moves as a unit, when clutch sleeve shifted to engage gears, until synchronizing rings engage synchronizing cones on gear hubs.

Strut Type Blocking Synchronizer. Synchronizer rings are loose and are actuated by three struts assembled in slots in inner clutch sleeve which engage notches in the rings. Struts are centered in the synchronizer assembly by the regular poppet balls and springs (ball and spring entered through hole in center of strut). Struts move with sleeves during initial movement to engage synchronizer rings. Teeth on rings block or prevent gear engagement until synchronization completed when clutch teeth on outer clutch sleeve slide through synchronizer to engage gear hub clutch teeth.

REMOVAL OF TRANSMISSION: *See "Transmission" on car model page.*

SERVICING:—Main Drive Gear & Bearing Assembly. To remove, take off bearing retainer on front of case, withdraw assembly. Bearing retained on shaft by locking nut, and locking ring. Oil baffle is assembled in front of bearing (inner ring clamped between bearing inner race and locknut on shaft, outer ring between outer race and retainer.

Synchronizing Unit:—Should be removed from shaft as a unit and dismantled in special fixture, Part No. 16Z-58861. Fixture allows detent balls and springs to be removed one at a time and lessens chance of losing these parts. When installing unit, see that internal groove in inner sleeve (at end), and extended hub of outer clutch sleeve are toward front **Strut Type Synchronizer.** Inner and outer clutch sleeves marked by etched line. Make certain that these marks lined up when reassembling and that synchronizer rings replaced in same relative positions. See that struts engage poppet balls and springs and that balls are free in struts so that they engage groove in outer clutch sleeve. Backlash between inner and outer sleeves should be .000-.001" (selective fit). Force required to break poppets (so that outer sleeve slides on inner sleeve) should be 6-8 lbs. with struts held stationary on inner sleeve.

Second Speed Gear Assembly:—Gear mounted on taper roller bearings on mainshaft and is locked in place on bearing cup (single unit for both bearings) by locking ring screwed in gear hub at rear. Bearing cones are held in position on mainshaft by locking ring at forward end with spacer between cones.

FORDOMATIC & MERCOMATIC TRANSMISSION

Ford, 6 Cyl. & V8 Pass. Cars (1951)
Mercury, Model 1M (1951)

►CHANGES, CAUTIONS, CORRECTIONS

►**TRANSMISSION IDENTIFICATION NOTE:** Transmission Model No. and Serial No. on name plate on left side of case must be used to identify individual units for parts replacement etc.

Model No.—On left hand boss on plate (prefix indicates year and model).

Serial No.—On right hand boss on plate (prefix indicates manufacturing plant).

►**STARTING ENGINE BY TOWING OR PUSHING CAR:** Pushing is recommended. Place selector lever in Neutral "N" position. When car speed reaches 20 MPH., turn on ignition, move selector lever to "LO", depress accelerator pedal to half-throttle position until engine begins to run. *NOTE*—In ice or snow where traction not good, move selector lever to "DR" position to crank engine.

►**TOWING CAR:** ***Do not tow car at speed greater than 40 MPH. and observe following precautions:***

If Transmission Operating Properly—Place selector lever in Neutral "N" position. Car can be towed normally for distances not to exceed 3 miles. **For greater distances, use same procedure as for inoperative transmission.**

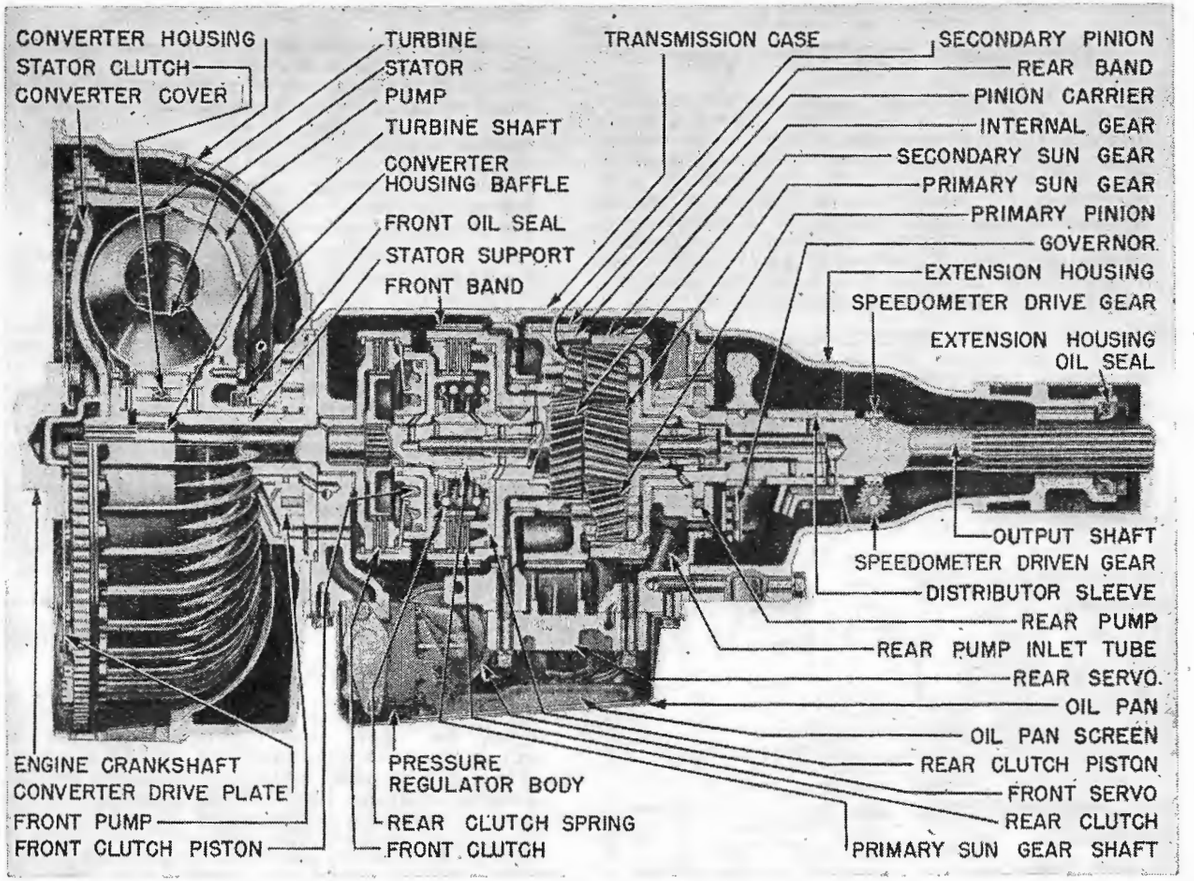
If Transmission Inoperative—Tow car with rear wheels lifted off road, or disconnect and remove propeller shaft and protect rear end of transmission from entry of dirt (U-joint Knuckle 1M-4841 can be installed and wired in place for this purpose).

►**MERCURY ENGINE STALLING AT IDLE SPEED (After Idle Speed and Anti-stall Dashpot properly adjusted):** May be caused by excessive tension of torsion spring on accelerator cross-shaft (Z-Bar) preventing proper operation of the dashpot which should retard closing of the carburetor throttle to prevent stalling. Correct by bending tail or straight portion of torsion spring DOWN (at point midway between spring coil and bracket on firewall) to lessen spring load. *NOTE*—Spring can be bent UP to increase spring load if tension not sufficient to return cross-shaft to off position when accelerator released (see rattle correction following).

►**MERCURY ACCELERATOR SHAFT RETRACTING SPRING RATTLES:** If cross-shaft spring rattles (see stalling correction above), correct by lifting spring tail from notch in bracket on firewall and position it on left side of bracket. This will place enough tension on spring to prevent rattles.

►**MERCURY ENGINE REAR LEFT SUPPORT BOLT CHANGE (to correct loosening of bolt in service):** Where loose bolt encountered, check for use of first type 1" long bolt (which may bottom in hole) and replace with later type ¾" long bolt No. 24348-S8 (use with ⅜" external tooth lockwasher No. 351487-S). *NOTE*—This ¾" long bolt used in production after Sept. 1951.

►**FORD THROTTLE LINKAGE PRODUCTION CHANGE:** Original design "B" throttle linkage has been revised to provide quieter and more efficient operation. ***New design "C" throttle linkage requires different adjustment. See LINKAGE ADJUSTMENT.***



FORDOMATIC & MERCOMATIC TRANSMISSION

►**INSTALLATION OF LATER TYPE THROTTLE LINKAGE ON EARLY FORD CARS (Replacement of "B" design by "C" Throttle Linkage):** Will provide quieter and more efficient operation.

Parts Required: All attaching bolts and screws (except bolt at "X"—see illustration) are re-used and following new parts required:

Part	Ford No.
Accelerator Shaft Assy.	1BA-9725-C
Trans. Control-to-Accel. Shaft Assy.	1BA-77230-B
Accelerator Shaft Hanger Support	1BA-99838-A
Bolt & Nut (5/16-24 x 3/4)	20347-S8 & 33909-S8
Lockwasher for above	34806-S7
Bolt (3/8-16 x 1 1/2 Hex. Hd.)	20468-S8

Installation—Remove old accelerator shaft assembly, transmission control-to-accelerator shaft assembly, and accelerator shaft bracket; discard these parts. Install new transmission control-to-accelerator shaft assembly using attaching parts from old assembly except that new 20468-S8 (1½") bolt should be installed at "Y" (see illustration) in place of old 1 5/8" bolt. Attach new accelerator shaft assembly to dash, using screws from old assembly, connect these two assemblies together using new accelerator shaft hanger support (see illustration inset for correct location of these parts). The support will lift the shaft hanger bracket (while attaching bolt being tightened) to bring upper surface of hanger bracket in contact with under surface of mounting bracket (CAUTION—support will be bent in this tightening operation and must be straightened or replaced **if a second tightening of the attaching bolt is necessary).** Connect all linkage shafts to original connecting rods and adjust linkage (see Linkage Adjustment).

►**REAR OIL PUMP PRODUCTION CHANGE & REPLACEMENT CAUTION (Transmissions beginning Nos. 1-84567 & 2-83007):** Cast iron type oil pump used optionally on these transmissions and is interchangeable with previous type aluminum pump but **correct type pump cover and output shaft thrustwasher must be used** with each type as follows:

	Rear Oil Pump	
	Aluminum Pump	Cast Iron Pump
Pump Body	1P-77850-A	1P-77850-C
Pump Cover	①1P-77860B	②1P-77860-C
Thrustwasher	1P-77066-A	1P-77066C-

①—Phosphate-coated.
②—Plain (not phosphate-coated).

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FORDOMATIC & MERCOMATIC (Continued)

See Rear Oil Pump Reassembly data for correct use and installation of above parts.

►**CONTROL VALVE BODY PRODUCTION CHANGE & REPLACEMENT CAUTION:** First type 1P-77700-A control valve body superseded by later 1P-77700-C which has changes to insure smoother performance and lessen possibility of leakage. Later type control valve body can be used to replace first type by reworking front servo release tube as follows:

Installation of 1P-77700-C Control Valve Body (when replacing first type 1P-77700-A body): Cut 7/32" off end of **longer** (4 21/32") front servo release tube, remove all burrs, chamfer cut end to 1/64" x 30°, make certain that all chips removed before installing tube and control valve body. *NOTE*—After this rework, both tubes will be same length (4 7/16").

►**CONVERTER COVER BOLT INSTALLATION CAUTION:** Later type production bolt (1P-7964-B 1" long) and locknut (34393-S7 .320-.336" thick) should be used as replacement for both the converter cover attachment and drive plate mounting bolts used originally. On early transmissions with different bolts and nuts (15/16" long bolt for converter cover, 1 1/16" long bolt for drive plate), it will be necessary to **install new bolts directly opposite each other to maintain converter balance.**

►**FRONT & REAR CLUTCH PLATE CAUTION:** Four different clutch plates used or furnished for front and rear clutches as listed below. All plates are FLAT type except as noted.

Front & Rear Clutch Plates

Type of Spline	Front	Rear
External (steel)	1P-77573-A ①	1P-77518-A
Internal (bronze)	②1P-77519-A	1P-77519-A
Internal (bronze)	③1P-77519-B	

①—CONED type (.015-.020"). Identify by 4 teeth omitted at two points diametrically opposite.

②—First type. Use in front clutch only if later 1P-77519-B plates not available.

③—Identify by 2 teeth omitted at two points diametrically opposite.

CONVERTER INSTALLATION CAUTION (to prevent damage to Front Pump): Converter pilot bore in crankshaft must be clean and relatively free of lubricant and without burrs or scratches which would prevent pilot entering bore freely (lubricate pilot with Lubriplate). If converter does not have slight endplay (before drive plate connected), converter assembly may be forced back so that converter hub presses against front pump drive gear causing damage to front pump. ***See Transmission & Converter Installation data.***

DESCRIPTION

The Ford and Mercury automatic transmission consists of a hydraulic torque converter and an automatic transmission which provides automatic operation in the "Dr" range and additional Low, Reverse, Neutral and Parking positions controlled manually.

Torque Converter: Mounted in a housing and connected to rear end of crankshaft in place of the conventional flywheel, and consists of the Torque Units listed below. Torque converter is fully automatic in its operation, acting as torque converter for low speed and starting operations (when input torque is less than output torque), and as a fluid coupling at higher car speeds (when input and output torque are equal). The change from torque converter to fluid coupling and the operating phases of the torque converter unit is governed by the car operating conditions and do not occur together or at any particular time.

Pump (Driving Member)—Mounted on engine crankshaft and bolted to converter cover. Pump rotates at engine speed to transmit engine power to turbine thru the medium of converter oil.

Turbine (Driven Member)—Splined to output shaft forward of converter pump and driven by oil flow from converter pump. Turbine transmits power to the planetary gears (Low, Intermediate & Reverse) and to the propeller shaft (Driving Range).

Stator—Consists of reaction blades and a one way clutch mounted on the converter cover hub. The Stator redirects the fluid flow to turbine, increasing torque for low and starting speeds (when input torque is less than output torque) being held from rotating in a direction opposite to the pump and turbine by the one way clutch. At higher speeds (when input torque equals output torque) the Stator rotates in the same direction and at the same speed as the pump and turbine causing the torque converter to automatically become fluid coupling.

Planetary Transmission: Hydraulically controlled planetary transmission employs a gearset of the compound type consisting of long and short pinions, two sun gears and a single internal gear, providing three forward speeds and one reverse. Controlling bands, multiple disc clutches and servo mechanisms are within the transmission case.

Planetary Pinion Assembly—Consists of three Primary Pinions (Short) and three Secondary Pinions (Long) mounted in a pinion carrier. The Primary Pinion is driven by the Primary Sun Gear and

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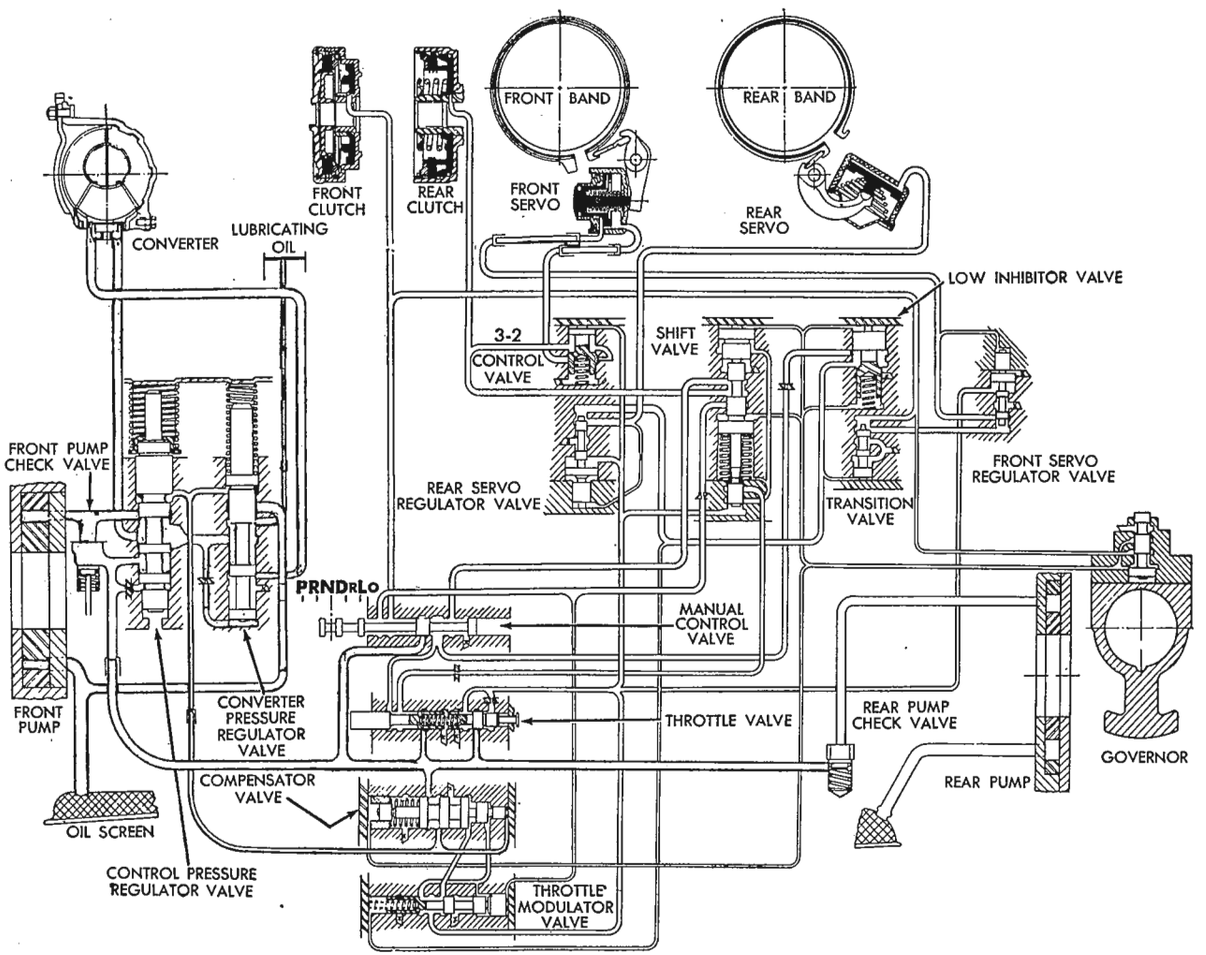

FORDOMATIC & MERCOMATIC TRANSMISSION HYDRAULIC CIRCUITS

FORDOMATIC & MERCOMATIC (Continued)

drives the Secondary Pinion which is meshed with the Secondary Sun Gear and the Internal Gear. The pinion carrier is controlled by the Rear Servo and the Rear Band.

Primary Sun Gear—Integral with Primary Sun Gear shaft which is splined to the driven flange of the Front Clutch unit. Power is transmitted thru this gear to the Pinion assembly (Low & Intermediate Range).

Secondary Sun Gear—Located forward of the Primary Sun Gear and in mesh with the Secondary (Long) Pinions. Mounting is on a hub connected to the driven flange of the Rear Clutch. Power transmitted from the Rear Clutch to Secondary Pinions (Reverse).

Front Clutch—Front (input) member of clutch is integral with Turbine Shaft and is splined to Front Clutch drum. The Front Clutch drum is formed so that it is also the inner (input) member of the Rear Clutch. Front Clutch hub (output) is splined to the Primary Sun Gear Shaft. The Front Clutch is engaged by a hydraulic piston within the clutch drum and locks the Primary Sun Gear Shaft to the Turbine Shaft. Clutch is engaged for all forward speeds and is disengaged by an internal spring for neutral and reverse.

Multiple Rear Clutch—Clutch Drum (output) is integral with the Secondary Sun Gear and is provided with a brake band and operating servo. Clutch Hub (input) member is integral with the front clutch drum. When clutch is engaged, the Secondary Sun Gear is locked to the Turbine Shaft. Clutch engagement is by a hydraulic piston within the unit. A coil spring between the hub and the drum provides the release.

Front Brake Band and Servo Assembly—Band holds the Secondary Sun Gear stationary when it is applied on the clutch drum by the Servo which consists of a hydraulic piston linked to band. One end of the band is held stationary by a strut and anchor which has an adjusting screw for band adjustment. Servo is fluid applied and spring released.

Rear Brake Band and Servo Assembly—Band holds planet carrier stationary when it is applied by the rear Servo which consists of a hydraulic piston linked to one end of the brake band. The opposite end is held stationary by a strut and anchor.

Oil Pumps: Two pumps used to supply oil pressure for hydraulic controls, oil supply for converter and transmission lubrication.

Front Pump—Internal - External gear type mounted between the transmission and torque converter and driven by the converter pump through a tongue and slot coupling. This pump has a large capacity and begins to operate as soon as the engine is started, supplying oil to the torque converter and for transmission lubrication and hydraulic controls.

Rear Pump—Internal-External gear type mounted at the rear of transmission and driven by the output shaft. Pump operates whenever rear wheels are turning and supplements the front pump volume. When car reaches sufficient speed, two ball check valves open and allow the oil from the rear pump to enter the hydraulic system.

Hydraulic Controls: Consist of manual and automatic valves, controlling the operation of the transmission servos and clutches.

Control Pressure Regulator—As pump speed varies, spring loaded valve maintains constant pressure. Excess volume is returned to oil pan.

Manual Valve—Control pressure is directed to manual control valve for proper distribution to accomplish the performance desired. Valve is actuated from the selector lever on the steering column.

Throttle Valve—Actuated by the accelerator through linkage. Control Pressure is directed to the throttle valve from the Control Pressure Regulator Valve. As the accelerator is depressed, moving the Throttle Valve towards the open position modifies the Control Pressure in proportion to the degree of throttle opening.

Shift Valve—Automatically changes the speed from Intermediate to High. Valve is spring loaded and is controlled by Governor Pressure and Throttle Pressure.

Hydraulic Governor—Mounted on output shaft at rear of transmission. Rotation of the Governor Valve causes centrifugal force to act on the valve plunger and regulate the pressure in direct proportion to the car speed.
regulates a pressure in proportion to the degree of throttle opening.

Front Servo Apply Regulator Valve—Provides for smooth changes between Intermediate and High speed, by controlling the flow of oil to the Front Servo. Valve is controlled by throttle pressure.

3-2 Control Valve—Provided for Down-Shifting from High to Intermediate on either open or closed throttle.

Down-Shift Valve—Operated by accelerator pedal. Allows speed change from High to Intermediate by depressing the accelerator pedal past it's fully open position.

Parking Mechanism: Consists of a locking pawl actuated by the Transmission Selector Lever which engages gear teeth cut into the face of the Internal Gear flange of the output shaft, and locks the output shaft to the transmission case.

OPERATION

Torque converter automatically provides a torque multiplication ranging from 2.1-1 (maximum for starting and acceleration) to 1.0-1 (normal driving range with torque converter acting as fluid coupling). This torque multiplication is supplemented by the planetary gears when selector lever placed in "Drive," "Low" and "Reverse" Range. Transmission operates in each range as follows:

Neutral Range—Front and Rear Clutches fully released, and Front and Rear Brake Bands fully released so that gears are free to turn. Drive is not transmitted through transmission and this "N" position can be used to start and warm up engine.

Drive Range—Car starts in Intermediate Gear with Front Clutch applied locking the Primary Gear to the Turbine Shaft and the Front Band applied, holding Secondary Sun Gear stationary, the power flow is from the Turbine Shaft through the Front Clutch to the Primary Pinion to the Secondary Pinions to the Internal Gear to the Output Shaft. As car speed is increased to a certain point, the Front Band is released and the Rear Clutch is applied automatically causing the transmission to change to direct (1.0—1) drive. The power flow in "High" is from the Turbine Shaft through the Front and Rear Clutches to the Planetary Gear which are locked together and rotates as a unit, causing the Output Shaft to rotate at engine speed.

Low Range—Front Clutch applied, locking the Turbine Shaft to the Primary Sun Gear, and the Rear Band applied, holding the Pinion Carrier stationary, the flow of power is from the Turbine Shaft through the Front Clutch to the Primary Pinions, to the Secondary Pinions, to the Internal Gear and out the Output Shaft at the ratio of 2.44-1.

Reverse Range—Rear Clutch applied, locking the Turbine Shaft to the Secondary Sun Gear and the Rear Band applied, holding the Pinion Carrier stationary, the flow of power is from the Turbine Shaft through the Rear Clutch to the Secondary Sun Gear, to the Secondary Pinions, to the Internal Gear. The Secondary Pinions acting as idlers on stationary axis, drive the Internal Gear in a reverse direction.

LUBRICATION

►***CAUTION:*** Transmission oil level should be checked at 1000 mile intervals and should be changed at 15000 mile intervals. It is recommended that the oil pan be removed and thoroughly cleaned, transmission inspected, and bands adjusted at this time.
Recommended Oil—Part No. 8L-19582-C, Automatic Transmission Oil "A", in sealed containers.
Capacity—Approximately 9 qts.
Checking Fluid Level—Apply emergency brake, place the transmission selector lever in neutral ("N") position, then run the engine at idle speed approximately four minutes. Clean all dirt and lint from the right hand section of the floor mat, then roll the mat back to gain access to the fluid level indicator inspection plate. Clean the area around the cover plate to prevent dirt getting into the transmission. Remove the four screws and the cover plate. With the emergency brake applied and the engine running at slow idle, move the selector lever to the park (P) position. When the engine and transmission have reached normal operating temperature, move the lever through all ranges to assure fluid distribution throughout the transmission. Clean all dirt from the fluid level indicator cap. Turn the cap ½ turn counterclockwise with pliers, then remove the indicator. Wipe the indicator clean and insert in the transmission, making sure the indicator is seated and locked. Remove the indicator and read the fluid level. If necessary to add fluid, use only Automatic Transmission Fluid, Type A, in the amount sufficient to raise the fluid level to the full mark on the indicator. Replace the indicator, making sure it is firmly seated and tightened. Install the inspection plate and replace floor mat.

►**Check for Oil Leaks**—Inspect the bottom of the floor pan at the rear of the transmission for evidence of fluid. If fluid is found here, the rear extension housing seal is leaking between the two sections of the telescopic shield. Replace the seal. Check the speedometer cable connection at the transmission and replace the rubber seal if necessary. Check the governor inspection plate and install a new gasket if necessary. Leaking around the oil pan gasket generally can be stopped by tightening the attaching screws to proper 10-13 ft. lbs. torque. If neces-

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FORDOMATIC & MERCOMATIC (Continued)

sary install a new gasket. Inspect the drain plug, tighten to 20-25 ft.lbs. torque. If tightening does not stop the leak replace plug. (NOTE—The drain plug gasket is not serviced separately). If leakage is evident at either the throttle lever shaft or manual lever shaft, replace either of the seals. Inspect the two hexhead pipe plugs at each side of the transmission case at the front. If either plug shows leakage, tighten to 7-15 ft.lbs. torque. Inspect the discharge air duct for evidence of fluid. If transmission fluid is found, make certain that converter cover bolt nuts tightened to 25-28 ft. lbs. torque, and drain plugs tightened to 7-10 ft. lbs. torque.

►***CAUTION—Fluid found in the discharge air duct may be engine oil that has leaked past the rear main bearing. Be sure to determine which type of leak exists.***

Drainage and Refilling—Remove converter housing lower plate and drain converter by removing one drain plug, then rotate the engine 180° and remove the second drain plug. Remove transmission bottom pan drain plug and drain fluid from the transmission. Allow to drain thoroughly. Install converter and transmission drain plugs, then add 5 qts. of automatic transmission fluid, start engine and allow to idle two minutes. Add 4 qts. of fluid and bring transmission to operating temperature. Place selector lever in parking (P) position and check oil level. If level is not up to dip stick level mark, add additional fluid as required.

►***CAUTION—Correct fluid level should be determined by dipstick reading rather than actual number of qts. installed.***

LINKAGE ADJUSTMENT

►*FORD THROTTLE LINKAGE CHANGE CAUTION*—Two types of linkage used which require DIFFERENT adjustment procedure (see illustration for identification of linkage type used on the car.

MAKE ADJUSTMENTS IN FOLLOWING ORDER:

CARBURETOR IDLE SPEED: With engine at normal operating temperature (choke valve wide open and fast idle inoperative) and selector lever in Neutral "N" position, set throttle stopscrew for idle speed of 415-425 RPM.

►*CAUTION*—If Anti-stall dashpot adjusting screw prevents correct idle setting being obtained by holding throttle open, loosen locknut and turn adjusting screw in to provide clearance at dashpot rod. Adjust Anti-stall after adjusting idle speed.

ANTI-STALL: *CAUTION—Ford and Mercury adjusted differently:*

Ford Adjustment—Loosen the dashpot adjusting screw locknut (on throttle lever), hold throttle lever in closed position, turn adjusting screw out (counter-clockwise) until the screw causes the dashpot rod to bottom in the dashpot (additional movement of screw will cause throttle valve to open), **then turn the adjusting screw in 1½-2 turns** and tighten the locknut. This will provide correct clearance of .045-.064" between dashpot rod and adjusting screw (apparent only when rod bottomed in dashpot).

NOTE—Above setting supersedes earlier data.

Mercury Adjustment—Back throttle stopscrew off until throttle valves are tightly closed with the

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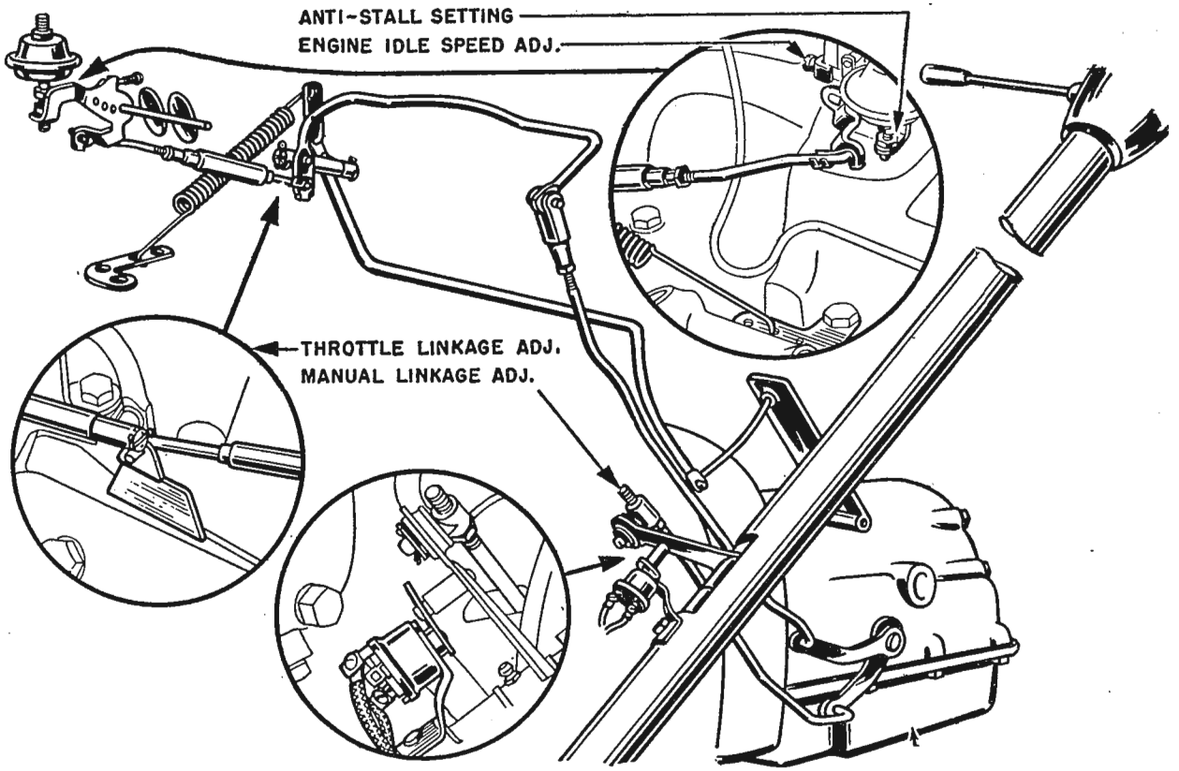
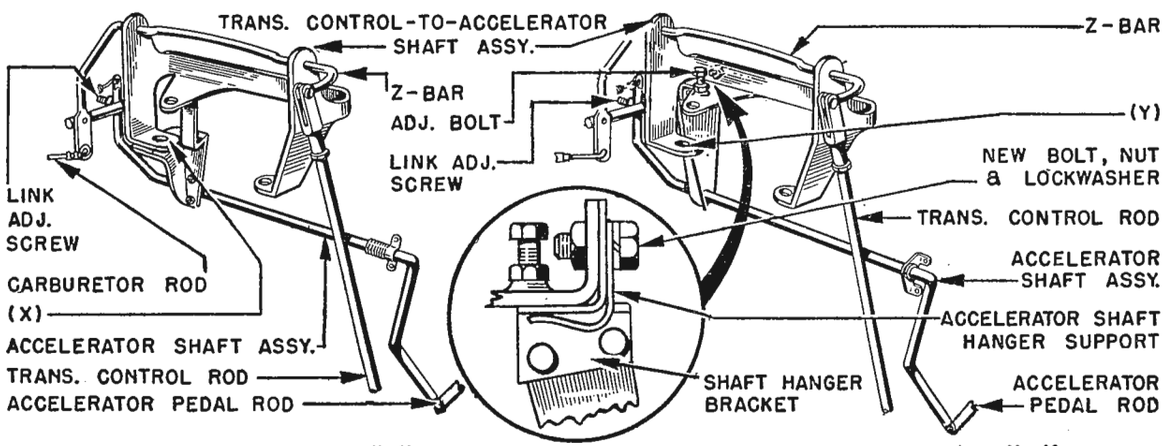


FORDOMATIC & MERCOMATIC TRANSMISSION CONTROL LINKAGE



FORD THROTTLE LINKAGE "B" DESIGN FORD THROTTLE LINKAGE "C" DESIGN

FORD THROTTLE LINKAGE (SHOWING PRODUCTION CHANGES)

FORDOMATIC & MERCOMATIC (Continued)

screw just contacting the lowest step of the fast idle cam (cam in hot or slow idle position). Loosen dashpot adjusting screw locknut (on throttle lever), turn adjusting screw out (counter-clockwise) until throttle stopscrew just begins to leave the fast idle cam (when dashpot rod bottomed in dashpot), **then turn adjusting screw in one complete turn** and tighten the locknut.

►***CAUTION—Reset carburetor idle speed after dashpot adjustment completed.***

THROTTLE LINKAGE: ***CAUTION—Later Ford cars with "C" design linkage adjusted differently than Ford with "B" linkage.***

Adjustment (Ford "B" design linkage & All Mercury):

►*CAUTION*—On Mercury, Z-bar-to-carburetor rod must be connected at FORWARD hole in carburetor throttle lever. If rod connected at rear hole, disconnect and lengthen rod as necessary to connect at forward hole when making the linkage adjustment below.

1) Disconnect rod and remove the clip from the carburetor to Z-bar rod at the Z-bar end. Reinsert the rod in the Z-bar lever, place tool No. 77230M (Mercury), tool No. 77230F (Ford), on the end of the rod. With the tool resting on the finished surface of the cylinder block (CAUTION—tool must rest on clean finished surface of block, not on manifold gasket or foreign material), adjust the rod length so that carburetor throttle lever is held against the idle stop. Remove the tool and assemble the rod to the Z-bar with the clip.

►*CAUTION*—If above setting results in insufficient accelerator pedal travel and prevents high-to-intermediate kick-down with normal throttle linkage setting (2 below), adjust carburetor-to-Z-bar rod so that tool is .125" away from surface of engine block and adjust linkage to 2½-3½ turns off stop (below).

2) At the Z-bar, remove cotter pin and clevis pin from the upper end of the Z-bar-to-transmission rod and pull upward gently but firmly on the rod from the transmission throttle lever to hold the lever against the stop. Adjust the clevis so that the clevis pin will freely enter the clevis and Z-bar hole. **Lengthen the rod by turning the clevis counter-2 full turns (Mercury), 2½ full turns (Ford)** except as noted in CAUTION below, then assemble the rod to the Z-bar with the clevis pin and cotter pin. Lock the clevis on the rod with the locknut while holding the clevis in alignment (necessary to prevent binding of the linkage).

►*CAUTION*—If clutch or band slippage noted with above setting, or if setting in (1) above varied to secure correct kick-down operation, the rod setting should be lengthened to **3 full turns but must not exceed 3½ turns.**

Ford ("C" Design linkage) Adjustment:

1) Check position of accelerator Z-bar-to-carburetor connecting link. If link is not parallel to centerline of engine, loosen locknut and turn link adjustment screw (see illustration) until link position is correct, tighten locknut while holding the screw.

2) Check position of accelerator shaft hanger support in relation to accelerator shaft. If support is not perpendicular to shaft, loosen bolt securing support to engine bracket and move top of support to correct position, tighten the bolt **while holding two horizontal legs of support together** with vise-grip pliers.

3) Install special adjusting tool 77230-FA on rear end of carburetor-to-Z-bar rod with slot in tool engaging end of rod and leg at rear of tool behind accelerator shaft and make certain that tool rests on finished surface of cylinder block (CAUTION—see that block is clean and that gauge is not resting on manifold gasket). Hold the rod at the bottom of the slot in the gauge, loosen locknut on adjustment bolt in Z-bar bracket, turn adjusting bolt until tool leg just touches accelerator shaft, tighten locknut.

4) With tool in place on carburetor-to-Z-bar rod, loosen the locknut on the rod, turn barrel on rod until idle adjustment screw (throttle stopscrew) just touches its stop when rod is held at bottom of tool slot, then tighten the locknut. Remove the adjusting tool.

5) Remove cotter pin and clevis pin from upper end of Z-bar-to-transmission rod, pull gently but firmly upward on rod to hold transmission lever against its stop, adjust clevis on rod until clevis pin freely enters holes in clevis and Z-bar, **then lengthen rod by turning clevis 2½ full turns** counter-clockwise (off) rod. Assemble rod to Z-bar with clevis pin and cotter pin, tighten clevis locknut.

6) Lubricate all bearing points in linkage and check for free operation throughout entire range without binding. Check and reset engine idle speed.

Check operation of car after all adjustments completed. If clutch or band slippage occurs at part throttle, increase transmission-to-Z-bar rod adjustment (5 above) to 3 full turns **but do not exceed 3½ turns.**

MANUAL LINKAGE: Disconnect the manual rod from the transmission selector arm at the upper end. Position the selector lever so that the indicator at the steering wheel is down against the stop in the drive position. Position the transmission manual lever in the drive (Dr) position (second position from the bottom). Adjust the rod length so that the sleeve trunnion freely enters the grommet in the selector arm. **Lengthen the rod by turning the sleeve one full turn counter-clockwise.** Reassemble the rod to the selector arm and lock sleeve nut with locknut. Check alignment of the pointer for all positions of the selector lever.

STARTER NEUTRAL SWITCH: Loosen the neutral switch to steering column attaching screws. Position the switch so that the starter circuit is closed when the selector lever is in the neutral (N) position. Check the starter circuit in all selector lever positions. NOTE—The circuit must be open in all positions except neutral.

BAND ADJUSTMENT

►***Band Adjustment is recommended to be made at 15000 mile intervals when transmission fluid is changed (pan should be removed and cleaned at this time).***

FRONT BAND ADJUSTMENT: Drain fluid from pan and remove pan, using a drain can with a fine mesh screen. Remove fluid screen from transmission and loosen the front servo adjusting screw locknut TWO FULL TURNS, using a 11/16" wrench. Using front band adjusting tool No. 7225, insert gauge block between servo piston and adjusting screw and tighten adjusting screw until wrench overruns. Back off adjusting screw exactly ONE COMPLETE TURN and remove gauge block. While holding adjusting screw stationary, tighten locknut clockwise (20-25 ft.lbs.). Install fluid screen and install pan using new gasket. Install the drain plug and refill transmission to "Full" mark using fluid drained from transmission unless fluid being changed. Check fluid level (see LUBRICATION).

REAR BAND ADJUSTMENT: Fold back floor mat to expose right side of floor pan and remove access hole cover on right side of transmission floor pan. Using rear band adjusting tool No. 7195, loosen rear band adjusting screw locknut. Using "T" handle of tool No. 7195, tighten rear band adjusting screw until wrench overruns. (If screw was found to be tighter than wrench capacity (10 ft. lbs.), loosen several turns and retighten until wrench overruns). Back off adjusting screw 1½ turns. While holding adjusting screw stationary, tighten adjusting screw locknut (35-40 ft.lbs.).

TESTING & TROUBLE SHOOTING

STALL TEST: The stall test is made in the drive range and the reverse range. The test determines whether the bands and clutches are holding properly.

►***CAUTION—While making the test never hold the throttle open longer than 5 seconds and RELEASE THROTTLE IMMEDIATELY if speed exceeds 1565 RPM. (indicating band or clutch slippage).***

Connect a tachometer to read on the high scale, and make sure the engine is idling properly (425 RPM) at normal operating temperature. Firmly apply the brake pedal with the left foot, place the selector lever in drive (Dr) range, and press the accelerator all the way down to the floor. The engine speed should be 1365-1565 RPM. (Ford), 1400-1600 RPM. (Mercury). If engine speed is below this lower RPM., tune up the engine and repeat test. If engine speed exceeds the higher figure, release the accelerator immediately because it indicates the front band or clutch is slipping. Repeat the test with the selector lever in reverse (R) position. If slippage occurs, it is the rear band or rear clutch. Release the accelerator immediately. If the stall test shows proper band and clutch operation, proceed with the shift point test. If slippage is evident, make a pressure test.

SHIFT TEST: Select a smooth level road for the test. First check the shift from intermediate to high with a light throttle. Place the selector in drive (Dr) position and starting from a standstill, apply the accelerator lightly but steadily. The shift from intermediate-to-high should occur at the correct MPH. Allow the car to decelerate until downshift from high-to-intermediate occurs. See table for correct shifting speeds. With the selector lever still in drive (Dr) position, press down hard on the accelerator until the car shifts from intermediate to high. See table for correct shifting speeds. Reduce the car speed to a point below 50 MPH., then press the accelerator pedal quickly to the floor. This action engages the kickdown valve which shifts the transmission from high to intermediate. The kickdown shift occurs only with the car in high gear and at a speed below the full throttle (kick-down) point as shown in the table below.

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FORDOMATIC & MERCOMATIC (Continued)

FORD & MERCURY SHIFT SPEEDS

Automatic Shifts

	Min. Throttle	Full Throttle
2-3 Upshift	14-19 MPH	64-69 MPH.
3-2 Downshift	7-3 MPH	①Below 55 MPH.

Manual Shift ("Dr" to "Lo")

3-2 (Intermediate)	Above 23-27 MPH.
3-1 (Low)	Below 23-27 MPH.

①—Forced downshift or "kick-down."

OPERATING PRESSURE TEST: Set the parking brake firmly and hoist the car until the rear wheels clear the floor. Remove the converter air intake duct and screen. Disconnect the throttle linkage at the outer throttle lever. Remove the ¼" pipe plug located near throttle levers, then connect pressure gauge No. 77820 and mount gauge so that it can be read under the car. Position the throttle lever protractor gauge No. 77270A (Ford), 77270 (Mercury) on the throttle lever shaft (see Gauge Note below if gauge will not fit over shaft), locating large elongated hole in gauge over the large shaft to rear of control lever. Set gauge indicator to 0° and lock in place with knurled thumbscrew. Hold throttle lever against stop (up), insert gauge pin 7000-B-1 through the small elongated hole in the gauge and the hole in the throttle lever. If the gauge pin enters these two holes freely the throttle mechanism has not been distorted and need not be replaced. Replace the throttle control mechanism if it is distorted. With the throttle lever still held against the stop (up), lock the throttle lever to the gauge by tightening the thumb screw on the gauge. Remove the gauge pin, then loosen the knurled screw and advance the lever fully (down). The lever should travel 28°-33°. Use an engine tachometer and set the engine idle speed to 600 RPM. by adjusting the idle adjusting screw. Make tests in Reverse "R" and Drive "DR" positions as directed below.

►**Protractor Gauge Installation Note**—If gauge can not be installed on shaft due to flow of brazing metal on end of shaft, remove this metal by reducing shaft to original diameter for distance of ¼" from end. **Do not rework the gauge.**

Reverse Test—With engine idling at 600 RPM., place selector lever in Reverse "R" position. Observe the pressure at 0° throttle lever position. The pressure should be 60-80 p.s.i. From underneath the car advance the throttle lever slowly and observe the angular reading at the point the pressure begins to rise. Pressure rise should begin between 3½-4½° throttle advance. Continue to advance the throttle lever slowly until maximum pressure is indicated (should be 140-165 lbs.) and observe angular reading which should be 4½-7½°. If above points not correct, adjust by changing throttle valve stop position (see Throttle Valve Stop Adjustment below).

Drive Test—Place selector lever in Drive "Dr" position and repeat above test procedure. Maximum pressure should be 120-145 lbs. with angular reading of 7-10½°. If above points not correct, adjust by changing throttle valve stop position.

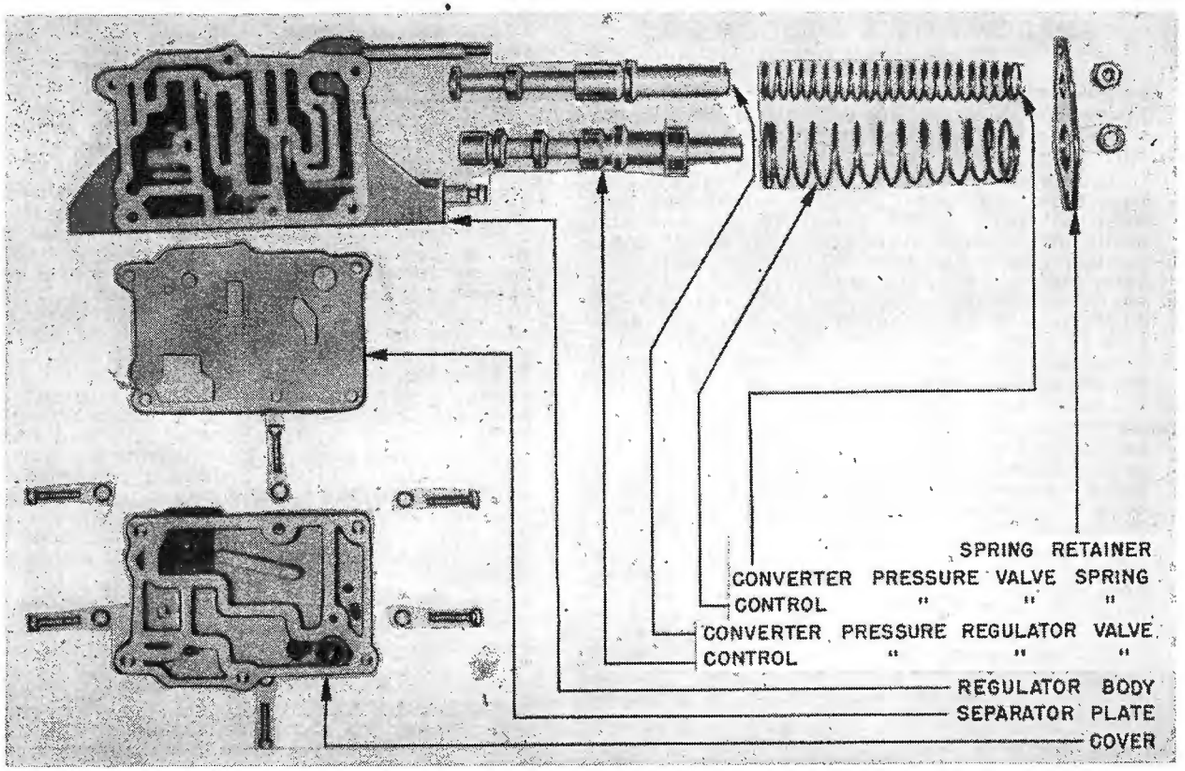
Throttle Valve Stop Adjustment—This adjustment requires draining transmission and removing oil pan. Use Bending Tool No. 77763 to bend the throttle valve stop within transmission case as follows:

If Pressure Rise Start is over 4½° (in Reverse "R" Range)—Hold outer throttle lever against its stop, clamp protractor gauge on lever and set to read 0°, then advance lever to maximum travel. Install bending tool over throttle valve stop, bend stop TOWARD valve body to advance the stop position the required number of degrees to bring the pressure rise start to 4° in "R" range. Check by returning the lever to stop position and reading protractor gauge (reading will indicate change in stop position).

If Pressure Rise Start is under 3½° (in Reverse "R" Range)—Bend stop AWAY from valve body, following same procedure as above except that protractor gauge must be set at some positive reading such as 5° (instead of zero). Final gauge reading subtracted from initial gauge reading will indicate change in stop position.

After making above adjustment, re-install oil pan, fill transmission with fluid, recheck pressure rise start in "R" range.

After completing above tests—Remove protractor gauge and pressure gauge, re-install pipe plugs and tighten to 7-15 ft. lbs. Connect link to throttle lever using a new cotter pin. Install converter air intake and duct. Reset engine idle speed to 425 RPM. Adjust throttle linkage. *See Linkage Adjustment.*



FORDOMATIC & MERCOMATIC PRESSURE REGULATOR

MINOR REPAIRS (TRANSMISSION IN CAR)

The following transmission units can be removed for repairs while the transmission remains in the car. Raise car on hoist for these operations.

►**NOTE:** For disassembly and overhaul of the following units, see "Overhaul (All Transmission Units)."

Governor Removal: Remove governor inspection cover from extension housing. Rotate the drive shaft to bring governor body in line with inspection hole. Remove the two screws that secure governor body to sleeve. Remove governor.

►***CAUTION—Use care not to drop bolts or governor valve into housing.***

Installation—Lubricate governor valve and install into governor body. Install assembly on governor sleeve and install attaching bolts. Install inspection cover using new gasket.

►**NOTE:** For the following operations, remove transmission fluid level indicator. Remove transmission drain plug and drain the fluid into a clean container using a fine mesh wire screen for straining. (fluid may be re-used). Then remove transmission oil pan.

Front Servo Removal: Loosen lubrication tube from pressure regulator and rear pump and remove. (NOTE—If necessary, tap tube with soft hammer to

CONTINUED ON NEXT PAGE

FORDOMATIC & MERCOMATIC (Continued)

remove—*CAUTION*—Do not bend or distort tube). Loosen control valve body attaching bolts. Remove servo attaching bolt and while holding servo strut with fingers, remove servo assembly.

Installation—Position servo band forward in case with band ends down. Position servo strut with large end indexing with servo actuating lever and small end indexing with band end. Rotate band, strut and servo into position, indexing tubes from valve body to servo, and anchor end of band with anchor in case. Install attaching bolt, tightening to 30-35 ft.lbs. Tighten control valve attaching bolts to 8-10 ft.lbs. Install lubrication tube and adjust servo band. See "Front Band Adjustment." Install pan using new gasket. Tighten screws to 12-17 ft.lbs. Fill transmission to correct level with fluid.

Rear Servo Removal: Remove lubrication tube from rear pump and regulator. (NOTE—If necessary tap tube with soft hammer to remove). Remove rear pump intake tube and remove rear servo attaching bolts. While holding strut with fingers, remove servo from case.

Installation—Position servo anchor strut and rotate servo band to engage strut. Hold in position with fingers. Position actuating lever strut and install servo and install servo attaching bolts, tightening to 40-45 ft.lbs. Install rear pump intake tube. Adjust servo band. *See "Rear Servo Adjustment."* Install pan using new gasket and tighten screws to 10-13 ft. lbs. Fill transmission with fluid to correct level. *See LUBRICATION.*

Control Assembly Removal: Remove compensator pressure tube and control pressure tube from valve body and regulator. Loosen front servo attaching bolt several turns and remove the valve body attaching bolts. Remove valve body by disengaging tubes to front servo.

Installation—Install valve body. Use care to index servo tubes, inner throttle lever between lever stop and downshift valve, manual valve with actuating pin and at the same time push throttle valve in to clear case. Install valve body attaching bolts. Tighten to 8-10 ft.lbs. Tighten front servo attaching bolt to 30-35 ft.lbs. Install control pressure tube in valve body and regulator and install compensator tube in valve body and regulator. Install pan using new gasket and tighten screws to 10-13 ft. lbs. Fill transmission with fluid to correct level *See LUBRICATION.*

Pressure Regulator Removal: Remove lubrication tube. Remove control pressure tube and compensator tube from valve body and regulator. Remove pressure regulator spring retainer. *(CAUTION*—Maintain pressure on retainer to prevent springs flying out). Remove control pressure valve. Remove regulator body attaching screws and remove regulator body.

Installation—Install regulator body and attaching bolts and tighten to 17-22 ft.lbs. Install converter valve and control pressure valve. Install valve springs and retainer. Install compensator pressure tube and control pressure tube in regulator and valve bodies. Install lubrication tube. Install pan using new gasket and install transmission drain plug. Fill transmission to correct level with fluid.

Throttle and Manual Controls Removal: Remove control pressure and compensator pressure tubes. Loosen front servo attaching bolt and remove control valve assembly. Disconnect throttle and manual rods from outer levers. Remove throttle lever shaft nut and inner lever. Remove outer throttle lever and shaft. Remove parking mechanism actuating rod and detent lever nut. Remove detent, ball and spring. Remove outer manual lever and shaft.

Installation—Install manual shaft seal, using tool IP-77288. Install outer manual lever and shaft. Install detent lever and attaching nut, detent ball and spring, tighten nut to 35-40 ft. lbs. Install parking mechanism actuating rod and secure with cotter pins. Install new throttle shaft seal, outer throttle lever and shaft, inner throttle lever and attaching nut, tighten nut to 25-28 ft. lbs. Connect manual and throttle rods to outer levers. Check linkage for free movement. Install control valve assembly, tighten bolts to 8-10 ft.lbs. Tighten front servo attaching bolt to 30-35 ft.lbs. Install compensator tube and pressure control tube and install pan, using new gasket and tightening pan attaching screws to 10-13 ft. lbs. Tighten oil pan drain plug to 20-25 ft. lbs. Fill transmission with fluid to correct level (see LUBRICATION), adjust manual control and throttle linkage (see LINKAGE ADJUSTMENT). Road test car and check shift points (see TESTING).

NOTE: Transmission may be removed without removing the converter. *See "Transmission Removal (Less Converter Assembly)".*

REMOVAL FROM CAR

TRANSMISSION REMOVAL (Less Converter Assembly): Follow the above instructions to the point where "Lift has been lowered to allow engine to rest on support tool." At this point, reposition the lift under assembly and raise lift to relieve weight of the transmission. Remove the four bolts holding the transmission to the converter housing. Remove the transmission by sliding the assembly toward the rear of car sufficiently to disengage turbine shaft. Lower the assembly and remove from under the car.

Installation—*See INSTALLATION IN CAR data.*

TRANSMISSION & CONVERTER REMOVAL: Remove spark plugs from engine. Place car on support stands with all four wheels approximately 12" above the floor. Disconnect manual linkage at transmission manual lever and disconnect throttle linkage at transmission throttle lever. Disconnect speedometer at extension housing and disconnect the drive shaft at rear universal joint flange and remove drive shaft and universal joint from transmission output shaft. Remove air duct from converter housing and take off converter housing lower plate. Drain converter by removing one drain plug, then rotate engine 180° and remove the second drain plug. Remove transmission bottom pan drain plug and drain transmission. Remove rear engine mount to frame crossmember bolts. Position transmission lift under transmission and raise engine and transmission sufficiently to install engine support tool ST-0714. Remove rear engine mount from transmission and remove the detachable frame crossmember from the frame "X" member. Lower lift under transmission to allow the engine to rest on support tool. Reposition transmission lift under assembly and raise lift just enough to relieve the weight of the transmission on the engine. Remove starter and upper converter housing plate with seal. Remove the six bolts securing the converter housing to the engine block. Remove the transmission and converter assembly by sliding the assembly towards the rear of car sufficiently to disengage the converter housing dowels and converter cover pilot. Secure converter to converter housing to prevent damage to converter. Lower the assembly and remove from under car.

►**NOTE**—Before disassembly of the transmission, clean transmission thoroughly to avoid the possibility of road dirt entering the mechanism.

TORQUE CONVERTER REMOVAL (From Transmission): Grasp converter cover with both hands and pull straight out. *(CAUTION*—To prevent damage to front seals, do not rock assembly from side to side). Remove converter housing attaching bolts and remove housing from transmission.
See "Torque Converter Overhaul."

OVERHAUL—TORQUE CONVERTER

Disassembly—Remove converter cover attaching bolts and nuts. Remove cover and gasket. Remove bronze thrust washer from turbine and lift turbine out of pump housing. Lift stator out of pump housing. *(CAUTION*—Note position of stator when removing so that it can be installed in the same manner). Remove thrust washers from pump hub and from turbine hub. Remove the one way clutch inner race from stator and take out the snap ring retaining outer hub to stator. *(CAUTION*—Do not burr snap ring groove). Remove outer hub, sprag assembly and outer race and then remove snap ring retaining inner hub to stator. Remove inner hub.

Inspection—Inspect all converter blades for looseness, and check thrust surfaces for scores and splines for burrs and wear. Inspect seal surfaces and front pump driving lugs for wear. Inspect sprag assembly for worn or broken sprags or broken or distorted spring. Inspect bushings for wear or scoring (if bushings worn, polish bearing surface of journal with crocus cloth to eliminate possibility of wear having been caused by rough bearing surface). Wear limits for bushing inside diameters are: Stator Support Assy. Bushing .906-.910", Stator Clutch Retainer Assy. Bushing 2.1573-2.1603".

Assembly—Install stator inner hub and snap ring. Turn assembly over and install sprag assembly into outer race. *(CAUTION*—Make sure sprags are pointed in the right direction). Install outer race and sprag assembly into stator. Install outer hub and snap ring. Insert tool IP-7946, tapered side first into sprag assembly while rotating tool counterclockwise to position sprags. Install inner race with spline section up. Guide tool IP-7946 with hand while pushing inner race into position. Check stator for clockwise rotation while holding inner race. Install thrust washer into hub of converter pump and install stator with "Front" (Stamped into face of stator) up. Install thrust washer into hub of turbine and install turbine. Install bronze thrust washer on turbine hub. Position converter cover on pump housing with new gasket, properly align balance marks on cover and housing (see Converter Balance Mark Caution below), install all 28 converter bolts (see Cover Bolt Installation Caution below for proper location of several types used), tighten bolt nuts evenly to 25-28 ft. lbs. Install converter housing on transmission case and tighten attaching

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FORDOMATIC & MERCOMATIC (Continued)

bolts to 40-45 ft. lbs. Install converter assembly and press it firmly in position on turbine shaft (CAUTION—do not rock assembly which may damage seals).

►**Converter Balance Mark Caution**—Converter cover stamped "W" or "O" at point directly below one of the drain plugs, pump housing stamped similarly between cooling vanes on outer diameter of housing. When installing cover, these marks must be aligned by being placed together or 180° opposite each other as follows:

Cover Mark	Housing Mark	Mounting Location
W	W or O	Together
O	W or O	180° opposite each other

►**Cover Bolt Installation Caution**—When installing replacement cover bolts and nuts (1" long bolts—same as later production type) on early transmissions equipped with original 15/16" long bolts, it will be necessary to **install new bolts and nuts in pairs and directly opposite each other to maintain converter balance.**

DISASSEMBLY—TRANSMISSION

►***DISASSEMBLY & REASSEMBLY CAUTION: CLEANLINESS IS EXTREMELY IMPORTANT WHEN OPENING UP TRANSMISSION. Thoroughly clean outside of case first. CLEAN each part as removed with cleaning fluid or gasoline and dry with air—wiping cloths will leave lint on parts.***

DISASSEMBLY OF TRANSMISSION (Into Major Units): With transmission on bench fixture, (tool No. 7000-C-D recommended for holding transmission), remove all transmission units as follows:

1) Remove pan and gasket and take out fluid screen.

2) Remove pressure regulator spring retainer, regulator springs, control pressure and converter pressure regulator valves.

►***CAUTION—Maintain pressure on retainer to prevent valve springs from flying out.***

3) Loosen pressure regulator and valve body attaching bolts, and remove lubrication tube from pressure regulator and rear pump. NOTE—If necessary tap tube with soft hammer to remove.

►***CAUTION—Do not bend or distort tube.***

4) Remove rear pump intake tube, being careful not to bend or distort it.

5) Remove compensator pressure tube (small) and control pressure tube (large) from pressure regulator and valve body. NOTE—If necessary, tap tube with hammer.

6) Loosen front and rear servo band adjusting screws five turns and loosen front servo attaching bolt three turns. Remove valve body attaching bolts and raise valve body to clear case and disengage valve body servo tubes. Remove valve body.

7) Remove front servo attaching bolt. Hold front servo strut with fingers and lift servo assembly from case. NOTE—Remove tubes if they should remain in servo.

8) Remove regulator body attaching bolts and washers and remove regulator body from case.

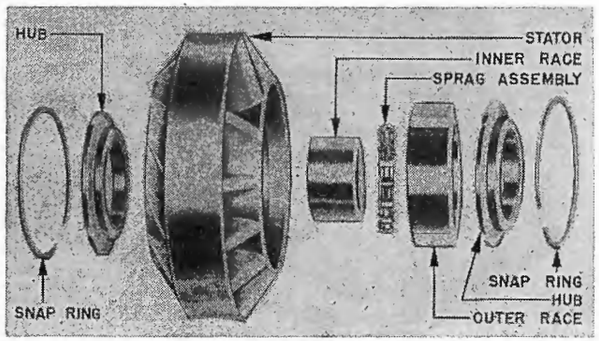
9) Remove rear servo attaching bolts and while holding actuating and anchor struts with fingers, lift servo from case. (*CAUTION*—Do not permit struts to drop into case).

10) Mount dial indicator on front pump so that contact rests on end of turbine shaft. Use Extension tool IP-77067. Insert tool IP-7657 into extension block and with a large screwdriver pry front clutch cylinder to rear of transmission. Set dial indicator to zero (0). Remove screwdriver and pry units toward front of transmission by inserting screwdriver between large internal and rear clutch drum. Record endplay as indicated on dial indicator for use in step 17 (below). This endplay should be .010-.019". Remove dial indicator and support.

11) Remove front pump attaching bolts and remove front pump assembly. (NOTE—If pump is tight in case, use soft hammer to loosen pump). Remove pump to case gasket.

12) Remove extension housing. (*CAUTION*—Guide housing to avoid damage to rear oil seal).

13) Remove speedometer drive gear snap ring from output shaft and take off the speedometer drive gear. (*CAUTION*—Do not lose drive ball).



CONVERTER STATOR UNIT (DISASSEMBLED)

14) Remove fluid distributor attaching bolts and slide distributor and tube from transmission. Remove distributor sleeve from output shaft.

15) Remove governor snap ring from shaft and slide governor assembly from output shaft. (*CAUTION*—Use care so as not to damage seal rings on output shaft. Do not lose governor drive ball).

16) Remove rear pump discharge tube using tool IP-77869 and remove pump from case. Remove extension housing and pump gaskets. Remove rear pump drive key from output shaft. Remove bronze thrust washer from output shaft. (NOTE—Washer may come off with pump). Hold rear drum forward and remove the output shaft.

17) Remove selective thrust washer from rear of pinion carrier. If endplay as recorded in step 10 (above) was not within limits of .010-.029", replace this washer with one of proper thickness to give this desired endplay. This washer furnished in following sizes: .063-.061", .069-.067", .076-.074", .083-.081".

18) Remove four seal rings from output shaft and two seal rings from primary sun gear shaft. (*CAUTION*—Do not distort rings).

19) Remove pinion carrier from case and remove bronze thrust washer from sun gear shaft.

20) Mark rear band position so that it can be assembled in the same position, and remove from case.

21) Remove special bolts (one each side) from outside of transmission case and remove center support from case.

22) Remove rear and front clutch assemblies from transmission case as a unit. Install clutch assembly into bench fixture, tool No. IP-77530 and remove thrust washer from front of turbine shaft. Remove the front band from case. Lift front clutch assembly from primary gear shaft. (*CAUTION*—Do not rock assembly while lifting to prevent damage to seal rings).

23) Remove bronze and steel thrust washers from primary sun gear shaft and then remove the front clutch seal rings from primary sun gear shaft. Lift rear clutch assembly from shaft. (*CAUTION*—Do not rock assembly while lifting to prevent damage to seal rings). Remove rear clutch seal rings and thrust washers from shaft.

OVERHAUL (ALL TRANSMISSION UNITS)

►***CAUTION: Care must be exercised when handling parts to avoid burrs on bearing surfaces. If mating parts do not assemble freely, DO NOT USE FORCE. Examine the parts for the cause of the difficulty.***

►***CAUTION: Use automatic transmission fluid Type "A" only to lubricate parts on assembly. Under no circumstances should other lubricants be used.***

►**NOTE**—New gaskets must be used on assembly. Tighten bolts and screws to the correct torque specifications.

Front Clutch: Disassembly. Remove clutch cover snap ring and remove turbine shaft from clutch drum. Remove thrust washer and take out clutch hub. Remove three (3) bronze, two (2) steel clutch plates and pressure plate. Using arbor press and tool IP-77565 depress clutch release spring and remove snap ring. Clutch release spring can now be removed. Place splined end of primary sun gear shaft in clutch piston bore, entering it as far as it will go, and apply air pressure to the hole in the opposite end of the primary shaft, forcing clutch piston out of the cylinder. (*CAUTION*—Hold hand over piston to prevent damage). Remove inner seal from clutch cylinder and outer seal from clutch piston. These two seals should be discarded and not re-used.

Inspection—Inspect clutch cylinder, thrust surfaces, piston bore and clutch plate serrations for scores or burrs. Check fluid passages for obstructions. Check clutch release spring for distortion and cracks. Inspect bronze clutch plates for scored bearing surfaces, and fit on clutch hub serrations. Inspect steel plates for scored surfaces, and fit of serrations in the clutch drum. Check pressure plate for scored bearing surfaces. Check clutch hub thrust surfaces and bronze thrust washers for scored surfaces. Check clutch hub splines and turbine shaft splines for wear. Inspect clutch cover bearing surfaces and bushings for wear and scoring. Wear limit for bushing inside diameters are: Front Drum and Sun Gear Assy. Bushings 1.062-1.065" and 1.2495-1.2535".

►**Clutch Plate Replacement Caution**—See "Front & Rear Clutch Plate Caution" for identification of various types used. All front clutch plates are flat (not coned).

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FORDOMATIC & MERCOMATIC (Continued)

►*DO NOT REASSEMBLE CLUTCH AT THIS TIME (parts installed during reassembly of clutches & shafts).*

Rear Clutch: Disassembly. Remove clutch pressure plate snap ring and remove pressure plate. Remove the four (4) bronze and four (4) steel clutch plates from drum. Using arbor press and tool IP-77515, depress clutch release spring and remove clutch release spring retainer snap ring. *(CAUTION*—Guide spring retainer while releasing press to prevent retainer interfering with snap ring groove). Remove retainer and released spring. Place splined end of primary sun gear shaft in clutch piston bore, entering it as far as it will go, and apply air pressure to the hole in the opposite end of the primary shaft, forcing clutch piston out of the cylinder. *(CAUTION*—Hold hand over piston to prevent damage). Remove inner seal from clutch piston. These two seals should be discarded and not re-used.

Inspection—See "Front Clutch Inspection." Follow same procedure (see Clutch Plate check below). Wear limit for bushing inside diameters are: Rear Drum & Planetary Gear Assy. Bushing 1.000-1.004".

►**Rear Clutch Plate Checking (External Spline Steel Plates)**—These clutch plates are "coned" or dished on one side. Check plates for correct coning by placing each plate on flat surface with dished side down. Clearance between inner edge of plate and flat surface should be .015-.020" measured with a feeler gauge.

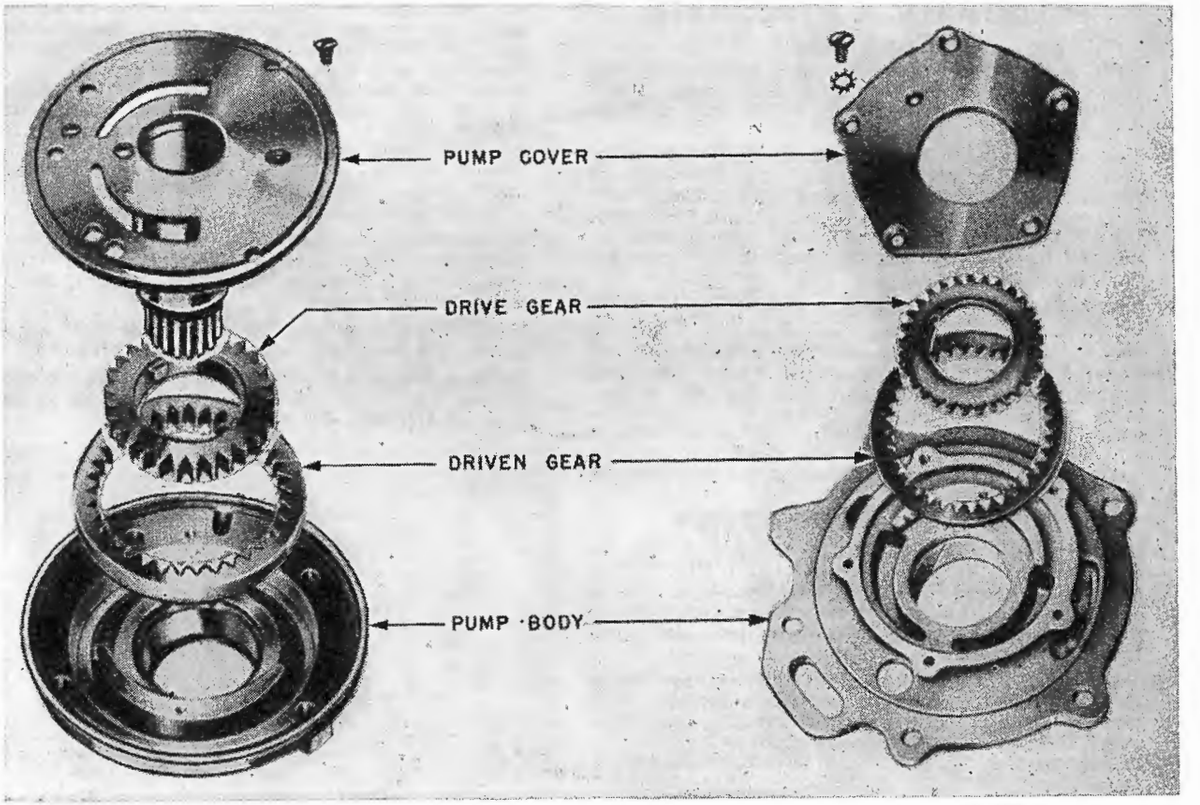
►**Clutch Plate Replacement Caution**—See "Front & Rear Clutch Plate Caution" for identification of these plates. External splined plates are steel and are "coned." Internal splined plates are bronze and are flat.

Assembly—Install inner seal ring in groove in drum and outer seal in groove in piston. Install piston in clutch drum using automatic transmission fluid as a lubricant to facilitate assembly. *(CAUTION*—Make sure seals are not twisted or distorted during assembly). Install four steel and four bronze clutch plates alternately, starting with a steel plate convex side up. (NOTE—Lubricate plates as they are installed). Install clutch pressure plate with bearing surface down. Install snap ring making sure it is fully seated in groove. Install clutch release spring and position retainer on spring. Using tool IP-77515 in arbor press, compress clutch spring and install snap ring. *(CAUTION*—While compressing spring, guide retainer to avoid interference of retainer with snap ring groove). Make sure snap ring is fully seated in groove.

Front Pump Disassembly: Remove pump cover attaching screws and remove cover with stator support. Mark the driven gear with Prussian Blue to assure correct assembly and remove drive and driven gears from pump body. To remove seal from pump body, mount the pump body on transmission case and using tool 4235-A remove the seal.

►*CAUTION*—Extreme care must be taken not to scratch or mar pump gears or bearing surfaces.

Inspection—Inspect bushing, gear pockets and crescent for scores. Inspect front cover, pump body, gear teeth and stator support splines for burrs. Check pump for evidence of contact between outside diameter of drive gear and crescent. Replace pump if such contact noted. Check bushing for wear and scoring. Wear limit for bushing inside diameter is: Front Pump Body Assy. Bushing 1.940-1.943".



FRONT OIL PUMP — REAR OIL PUMP

FORDOMATIC & MERCOMATIC HYDRAULIC PUMPS

Assembly—Use tool 1P-77837 to install new seal in pump body (CAUTION—coat outside diameter of seal with Permatex No. 3 before installation to prevent fluid seepage). Install pump driven gear in pump body in accordance with marks made before disassembly, install drive gear. Install pump cover and attaching screws **without** lockwashers, tighten cover screws evenly to 1-3 ft. lbs. Check pump assembly for free movement.

►*CAUTION—Use of lockwashers on pump cover screws may cause leakage.*

Rear Pump Disassembly: Remove screws and lockwashers securing pump cover to pump body and remove cover. Using Prussian Blue, mark pump drive and driven gears to assure correct assembly, and remove gears from body.

►*CAUTION—Handle pump parts with care to avoid scratching or marring.*

Inspection—Inspect all pump parts for excessive wear, scores or burrs. Check fluid passages for obstructions. Check pump for evidence of contact between outside diameter of drive gear and crescent, replace pump if such contact noted. Check bushing for wear and scoring. Wear limit for bushing inside diameter is: Rear Pump Body Assy. Bushing 2.061-2.065".

Assembly—Install pump driven gear into pump body, positioning gears as marked on disassembly. Install drive gear into position as marked. Install pump cover (see Pump Change Caution Note below), install cover screws with lockwashers, tighten screws evenly to 4-6 ft. lbs. Check pump for free movement.

►**Pump Change Caution**—Two different types of interchangeable pumps used (aluminum & cast iron) and **correct type cover must be used with each type pump** as follows: Phosphate coated cover (Aluminum Pump), Plain cover (Cast Iron Pump).

Regulator Pressure Body Disassembly: Remove regulator cover and remove separator plate.

Inspection—Inspect regulator body and cover mating surfaces. Check fluid passages in body and fluid passage holes in separator plate for obstructions. Inspect valves and valve bores for scoring and check freedom of valves in valve bores. Check regulator valve springs for distortion.

Assembly—Wash thoroughly in clean solvent and blow dry with air. Position separator plate on regulator, install regulator cover and screws.

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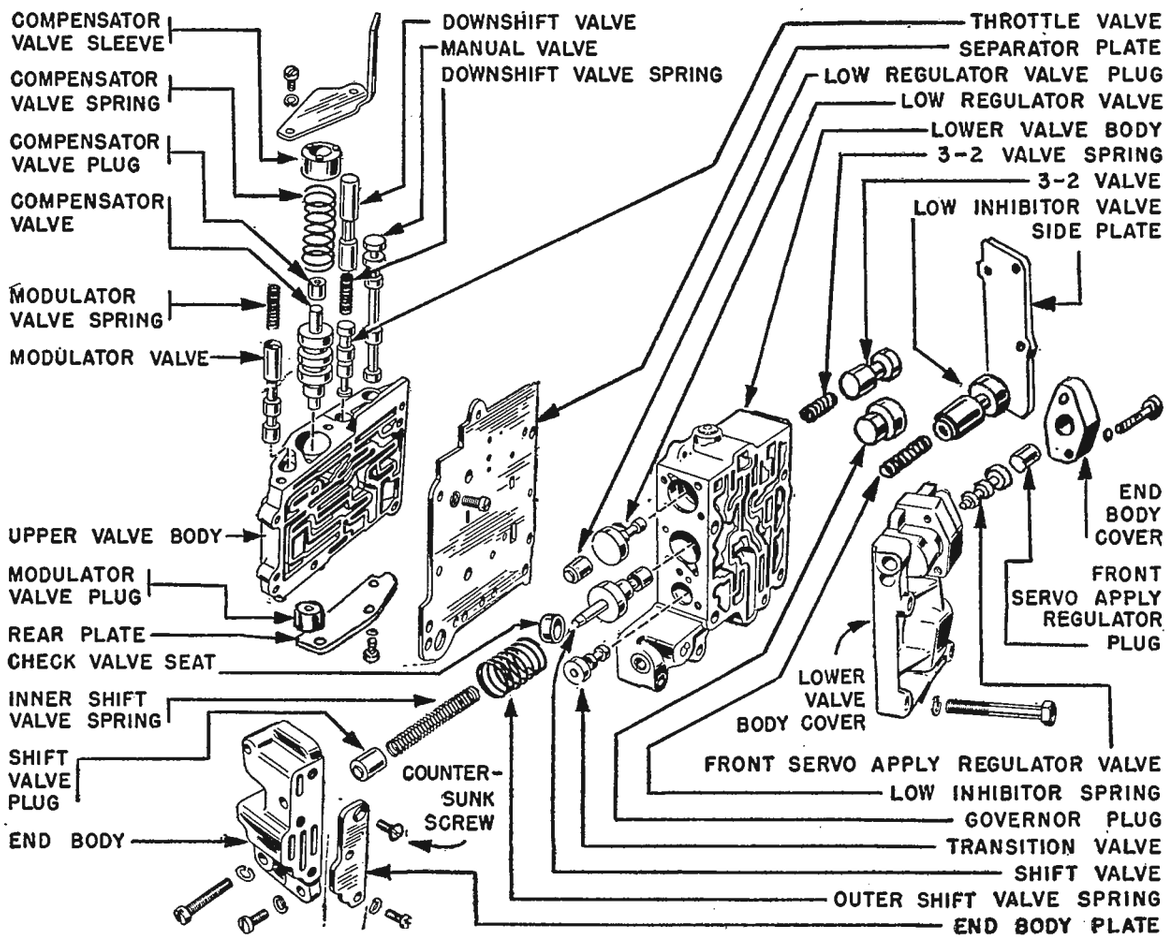
FORDOMATIC & MERCOMATIC (Continued)

Control Valve Disassembly: Remove manual valve. Take out one screw attaching separator plate to valve body. Remove upper body front plate. (NOTE—Plate is spring loaded, apply pressure to plate while removing attaching screws). Remove compensator sleeve, plug and compensator spring, modulator valve spring and valve, downshift valve and spring, compensator valve. Remove the upper body side plate and take out the throttle valve and modulator plug. Remove the lower body side plate. (NOTE—Plate is spring loaded, apply pressure to plate while removing attaching screws). 3-2 control valve and spring, low inhibitor valve and spring and governor plug can now be removed. Remove end body. (NOTE—End body is spring loaded. Apply pressure to body while removing attaching screws). Remove regulator plug and shift valve plugs from end body. Remove end body plate noting position of countersunk head attaching screw. Shift valve outer and inner spring, shift valve, low regulator valve and transition valve can now come out. Remove attaching bolts and separate bodies. Remove separator plate from upper body and remove check valve seat from lower body.

Inspection: ***CAUTION—Handle all parts carefully to avoid scoring, burrs, and distortion.*** Clean all parts thoroughly in clean solvent and blow dry with air. DO NOT USE CLOTH FOR WIPING PARTS (lint left by a cloth may cause poor valve operation). Inspect all mating surfaces for burrs, scratches, and flatness. Check all passages for obstructions. Inspect all valves and valve bores for scoring and check valves for free movement in bores (valves should slide in bore of own weight). Valves can be polished with crocus cloth.

►***CAUTION—Do not round the sharp edges of valves and plugs.***

Assembly: ***CAUTION—Use care when installing valves and plugs in their bores not to shear soft body castings*** (rotate valves and plugs as they are entered so that sharp edges will not be damaged or cut into the valve body castings). Install the separator plate on upper valve body, install but **do not tighten** separator plate screws. Install check valve seat in lower valve body, position lower body on upper body, install lower body attaching bolts and tighten to 4-6 ft. lbs., then tighten separator plate screws. ***(CAUTION—excessive tightening of these bolts may cause valve body distortion and sticking of the valves).*** Install plate on end body. Check for correct position of countersunk head screw. Install low regulator and shift valve plugs in end body. Install transition valve in lower body and install low regulator valve and shift valve. Install shift valve inner and outer springs, and install end body on lower body. Install governor plug, low inhibitor valve and spring, 3-2 control valve and install lower body side plate. Install modulator valve plug in upper body. (NOTE—Install plug with flat surface towards valve). Install throttle valve. Mount the upper body rear plate on the upper body and install the modulator spring and valve, compensator valve and spring, and downshift valve and spring. Install plug in compensator valve sleeve and install assembly in body. Install upper body front plate. Install separator plate to lower body with the one screw, and install the manual valve.



FORDOMATIC & MERCOMATIC CONTROL VALVE ASSEMBLY

Governor Disassembly: Remove governor body attaching screws and remove body from counterweight. Remove governor valve and side plate.

Inspection—Inspect valve and valve bore for scores and check free movement of valve in bore. Inspect all fluid passages for obstructions. Inspect mating surfaces for burrs and distortion.

Assembly—Install governor valve in bore of governor body and install body cover plate and attaching screws. Mount governor body on counterweight. (NOTE—Make sure fluid passages in body line up with passages in counterweight). Install body attaching screws.

Front Servo Disassembly: Remove servo piston guide snap ring. ***(CAUTION***—Servo piston is spring loaded, apply pressure to piston when removing snap ring). Remove servo piston and guide from servo body. (NOTE—If necessary, tap servo piston guide slightly with soft hammer to remove from servo body). Remove servo spring, servo guide and seal rings from piston and guide.

Inspection—Inspect servo body for cracks. Inspect piston and piston bore for scores. Check fluid passages for obstructions. Check actuating lever for free movement and inspect for wear. (NOTE—If necessary to replace actuating lever or shaft, remove retaining pin and push shaft out of bracket). Inspect threads in lever and on adjusting screw. Check servo spring and servo band for distortion. Inspect servo band lining for excessive wear and bond to metal band. (NOTE—Band should be replaced if worn to a point where grooves are not evident). Inspect bands for cracks and distortion.

Assembly—Install servo spring in body. Install new, large and small seal rings on servo piston and new seal rings on servo guide. Install guide on servo piston. ***(CAUTION***—Use care not to distort seals). Install piston and guide assembly into piston body. (NOTE—Lubricate parts to facilitate assembly). Install adjusting screw and locknut in actuating lever if previously removed. Press cover down and then install snap ring. ***(CAUTION***—Make sure snap ring is fully seated in groove).

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FORDOMATIC & MERCOMATIC (Continued)

Rear Servo Disassembly: Using ⅛" pin punch, remove servo actuating lever shaft retaining pin and remove shaft and actuating lever. While pressing down on servo spring retainer, remove snap ring. NOTE—Release pressure on retainer slowly, to avoid snap ring from flying out. Remove retainer and servo spring. Use air pressure to force piston out of servo body. *(CAUTION*—Hold hand over piston to prevent damage). Remove piston seal ring.

Inspection—See "Front Servo Inspection."

Assembly—Install new seal ring on servo piston and install piston into servo body. (NOTE—Lubricate parts to facilitate assembly). Install servo spring with small coiled end against servo piston. Install spring retainer and compress spring and install snap ring. *(CAUTION*—Make sure snap ring is fully seated in groove). Install actuating lever with socket in lever bearing on piston stem and install lever shaft, aligning the retainer pin holes, and install pin. Check actuating lever for free movement.

Distributor Sleeve Inspection—Inspect all passages for obstructions. Inspect sleeve bore for scores or excessive ring wear. Inspect mating surfaces for burrs and flatness. Check fit of fluid tubes. NOTE—Make sure spacer is on center tube.

Pinion Carrier Inspection—Inspect servo band surface for scores. Inspect inner bushing for scores. Check free movement of pinions on pins and inspect for worn or broken teeth. Check pinion end play. Should be .010 to .020". Pinion pins should be a tight fit in carrier. NOTE—The planet carrier is serviced as an assembly.

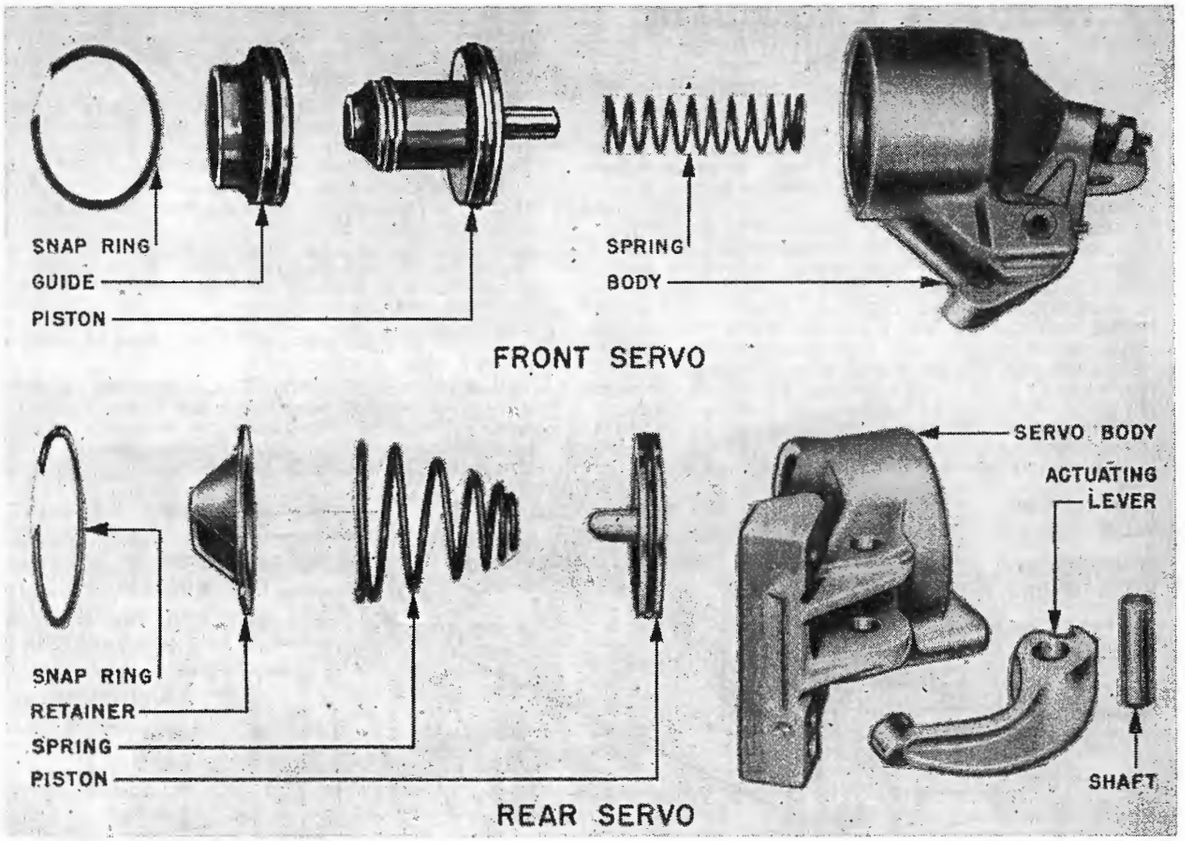
Primary Sun Gear and Shaft Inspection—Inspect sun gear for broken or worn teeth. Inspect thrust surfaces and journals for scores. Check fluid passages for obstruction and leakage. Inspect ring grooves and splines for burrs or wear.

Output Shaft Inspection—Inspect external parking gear teeth for damage. Inspect ring grooves and splines for burrs or wear.

Extension Housing Inspection—Inspect housing for cracks and inspect drive shaft slip yoke bearing surface for scores. Inspect gasket surfaces for burrs. Remove rear seal, using tool 4235-A. (NOTE—Rear seal may be replaced without removing the transmission from car). Using tool IP-7675 install new seal in extension housing, coating outer diameter of seal with Permatex No. 3 (to prevent fluid seepage around seal), and positioning seal with felt side to rear. Remove inspection cover and gasket and inspect fluid baffle for tight fit in housing.

►**Extension Housing Change Note**—Two optional types of extension housings used: 1P-7650-A (aluminum) and 1P-7650-B (cast iron). Later type cast iron housing requires bushing No. 8M-7041-B (same as type used in standard transmission). Bushing wear limit (inside diameter) is 1.4995-1.5045".

Transmission Case Linkage Disassembly: Remove throttle lever nut and take off inner and outer throttle levers. Remove throttle lever shaft seal from counterbore in manual lever shaft. Remove parking mechanism actuating rod, detent ball and spring. Remove manual lever shaft nut, detent and outer manual lever and shaft. Remove torsion lever retainer clip and take off torsion lever assembly. Disassemble torsion lever assembly by rotating lever while holding spring. Disengage pawl return spring from toggle link pin and remove pin. Remove pawl pin by working pawl fore and aft until pin protrudes from case. Remove toggle pin retainer clip, toggle pin, pawl return spring, spring retainer and link. Remove toggle lever pin by tapping lever toward rear of case and remove pin and lever. Remove manual shaft seal and transmission vent.



Inspection—Inspect case for cracks, and stripped threads. Inspect gasket and bearing and mating surfaces for burrs. Inspect each part of parking mechanism for wear, distortion, or other damage. Check all fluid passages for obstructions. Inspect bushing for wear and scoring. Bushing wear limit (inside diameter) is 1.375-1.379".

Assembly—Assemble toggle lever, link, pawl return spring and pawl and install assembly in transmission case. Install toggle lever and pawl pins. Install torsion lever assembly. (NOTE—Use screwdriver to position spring on torsion lever). Install washer and retainer clip. Using tool IP-77288 install new manual shaft seal in case. Install manual lever and shaft in case and mount the detent lever and attaching nut. Install detent spring and ball. (NOTE—Use a piece of tubing to depress balls and spring while rotating detent). Install parking mechanism actuating rod and secure with cotter pins. Install new seal on throttle lever shaft and install throttle lever and shaft in case. Install inner throttle lever and attaching nut. Check operation of linkage for free movement. Install transmission vent.

REASSEMBLY—TRANSMISSION (AFTER OVERHAUL OF UNITS)

►***REASSEMBLY CAUTION—Use Automatic Transmission Fluid Type A only to lubricate parts on assembly. DO NOT use any other lubricants. Use all new gaskets on assembly and tighten all bolts and screws to correct torque specifications.***

Preliminary Assembly of Clutches & Shafts: Position primary gear shaft in bench fixture IP-77530, and install bronze thrust washer against thrust face of primary gear. Install two rings in grooves of primary shaft next to primary gear. Check rings for free movement in grooves. Install rear clutch assembly on primary gear shaft. Lubricate parts to facilitate assembly. *(CAUTION*—Center rings on shaft to prevent breaking). Install steel and bronze thrust washers on primary sun gear shaft. Install seal rings in the two upper grooves on shaft and check for free movement in grooves. Install new inner seal in groove in clutch cylinder and new outer seal in groove in piston. Install piston in clutch cylinder. (NOTE—Make sure steel bearing ring is on piston). Install release spring with concave side up. Using tool IP-77565 in arbor press, compress release spring and install snap ring. (NOTE—Make

CONTINUED ON NEXT PAGE

FORDOMATIC & MERCOMATIC (Continued)

sure snap ring is fully seated in groove). Install two front clutch seal rings in primary sun gear shaft grooves. Install front clutch cylinder on primary sun gear shaft *(CAUTION*—rotate clutch units to mesh rear clutch plates with clutch hub serrations and use care to avoid breaking the seal rings on the shaft). Install clutch hub with the deep counterbore down. Install bronze thrust washer on clutch hub. Install pressure plate and then three (3) bronze and two (2) steel clutch plates alternately, starting with a bronze plate. Lubricate plates as they are installed. Install turbine shaft and snap ring. (NOTE—Make sure snap ring is fully seated in groove). Install bronze thrust washer on turbine shaft.

►**Front Clutch Plate Change Caution**—*See "Front & Rear Clutch Plate Caution" for various types of clutch plates used.*

Clutch & Shaft Assembly and Front Servo Band: Install front servo band in transmission case indexing anchor end with anchor case. Insert the front and rear clutch assembly into transmission case from the rear while positioning servo band on drum. *(CAUTION*—Hold units together while making installation). Install center support into case, aligning the support with the mounting bolt holes in right and left side of case, install special support bolts in these holes and tighten bolts to 28-33 ft. lbs.

Rear Servo Band: Position rear servo band in case, according to indicating mark made at disassembly, with strut ends up. Install bronze thrust washer behind primary sun gear.

Pinion Carrier: While meshing planet pinions on sun gears, position rear band over carrier drum. Install two seal rings on sun gear shaft and check for free movement. Install selective thrust washer (see note) on rear of pinion (hold in place with fluid).

►**Thrust Washer Note**—This selective thrust washer controls endplay (.010-.029") and should be selected during transmission disassembly (see step 10 of "Disassembly of Transmission into Major Units."

Output Shaft: Install output shaft, carefully meshing internal gears with pinions. *(CAUTION*—Position seal rings on primary shaft with gaps up to prevent breakage during installation of output shaft).

Rear Pump: Install four rings into distributor sleeve and check ring gap. Position rear pump drive key in keyway on output shaft. Position new front and rear gaskets on pump body. Install thrust washer on pump body with bronze side up. Make sure to index thrust washer tangs with bosses on pump body (see Pump & Thrust Washer Change Caution below). Install rear pump (CAUTION—use care to index drive key with keyway in pump drive gear).

►**Pump & Thrust Washer Change Caution**—Two types of pumps used which require **different thrust washers.** Thrust washer used with first type aluminum pump has four sets of lugs on outer diameter which engage four lugs on pump cover, thrust washer for second type cast iron pump has two lugs on outer diameter which engages recesses in cover.

►*CAUTION—Correct type thrust washer must be used with each type pump cover.*

Governor: Position governor drive ball in pocket in output shaft. Retain in place with fluid. Install governor assembly, indexing groove with ball in output shaft. (NOTE—Governor installed with body plate toward front of transmission). Install snap ring and install distributor sleeve on output shaft. Mount distributor and tubes on distributor sleeve making sure fluid passages in sleeve and distributor index. Install attaching bolts and lock washers and tighten finger tight. With tubes positioned into transmission case up to the spacer on center tube, tighten distributor attaching bolts to 8-10 ft.lbs. Position speedometer drive gear ball into pocket of output shaft and install speedometer gear with chamfered side towards front of transmission. Install snap ring.

Extension Housing: Use tool IP-7657 to center housing over output shaft and install housing. Install attaching bolts and tighten finger tight. Install new seal ring on rear pump discharge pipe and using tool IP-77869 install pipe. (NOTE—Make sure pipe is in position and below upper surface of transmission case). Tighten extension housing attaching bolts to 28-33 ft. lbs. Install governor inspection cover, using a new gasket and tightening attaching screws to 4-6 ft. lbs.

Front Pump: Install new front pump gasket into counterbore in transmission case and install front pump. Line up dowel hole in pump with dowel in case. Install three pump attaching bolts and lockwashers (do not install fourth bolt until endplay has been checked as directed below), tighten bolts evenly to 17-22 ft. lbs. *Check Transmission Endplay before proceeding with assembly.*

Transmission Endplay Check & Adjustment: Mount extension tool 1P-77067 and dial indicator on front pump (use hole from which pump attaching bolt omitted for this purpose) with dial indicator resting on end of turbine shaft. Insert tool 1P-7657 in end of transmission extension housing. Use large screwdriver to pry front clutch drum toward rear of transmission, set dial indicator at zero. Remove screwdriver and pry units toward front of transmission (insert screwdriver between large external gear and rear clutch drum). Indicator reading will be the endplay and should be .010-.029". If reading within these limits, proceed with reassembly. If endplay not within limits, it will be necessary to change selective thrust washer on rear of planetary pinion (see Pinion Carrier assembly above). Remove checking tools, install remaining front pump attaching bolt and tighten to 17-22 ft. lbs.

Rear Servo: Position servo anchor strut and rotate rear band to engage strut. Hold in position with fingers. Position servo actuating lever strut and install servo, tighten bolts to 40-45 ft. lbs.

Front Servo: Position front band forward in case with band ends up. Position servo strut with slotted end indexing with servo actuating lever and small end indexing with band end. Rotate band, strut and servo into position engaging anchor end of band with anchor pin in case. Locate servo on dowel in case and install attaching bolt. (NOTE—tighten bolt only two or three threads). Install servo tubes.

Pressure Regulator Body: Install pressure regulator body and attaching bolts. Tighten to 17-22 ft.lbs. Install control and converter pressure regulator valves in valve body. Install control and converter valve springs, retainer and retainer attaching nut and lockwasher. Install new seal ring on rear pump intake tube and install tube in case.

Control Valve: Install control valve assembly using care to index servo tubes with control valve (see Control Valve Body Change note below), also index inner throttle lever between throttle lever stop and downshift valve—and at the same time push throttle valve in to clear transmission case. *(CAUTION*—Make sure manual valve indexes with actuating pin in manual detent lever). Install large tube into valve body and regulator. Install control pressure compensator tube and lubrication tube. Install control valve body attaching bolts. Tighten to 8-10 ft.lbs. Tighten front servo attaching bolts to 30-35 ft.lbs.

►**Control Valve Body Note**—See "Control Valve Body Production Change & Replacement Caution" for instructions on reworking Front Servo Release Tube required when installing later type 1P-77700-C Control Body to replace first type No. 1P-77700-A.

Fluid Screen and Pan: Position fluid screen over inlet tubes of front and rear pumps. Mount pan on transmission case using a new gasket and tightening attaching bolts to 10-13 ft. lbs. Tighten oil pan drain plug to 20-25 ft. lbs. and install fluid level indicator

INSTALLATION IN CAR

TRANSMISSION & CONVERTER ASSEMBLY: Lubricate converter pilot with lubriplate. Make certain that converter pilot bore in crankshaft is clean, not scratched or burred, and relatively free of lubricant (would prevent pilot entering bore freely).

►*CAUTION*—Excess lubricant or foreign material in pilot bore may force converter assembly back so that converter hub presses against front pump drive gear causing damage to front pump.

1) Mount transmission and converter assembly on a lift, under the car, raise assembly and carefully move it forward into position *(CAUTION*—guide assembly to avoid damage to flexible drive plate and converter pilot).

2) Install converter housing attaching bolts and tighten evenly to 40-45 ft. lbs.

3) Check converter endplay to make certain that pilot is free in bore by moving converter back and forth **before** flexible drive plate is bolted to converter. This endplay should be 1/32" minimum.

4) Position converter drive plate so that **center** hole in plate is spaced **exactly six bolt holes away** from the bolt hole in line with the drain plug on the converter cover in either a clockwise or counterclockwise direction (CAUTION—this positioning necessary to avoid interference between drive plate and starter ring gear welds on cover). Install six bolts attaching drive plate to converter assembly (CAUTION—see Drive Plate Bolt Installation Caution below for proper location of several types used), installing the **center bolt on each side first,** tighten these bolts evenly to 25-28 ft. lbs.

►**Drive Plate Bolt Installation Caution**—When installing replacement drive plate bolts and nuts (1" long bolts—same as later production type) on early transmissions equipped with original 1 1/16" long bolts, it will be necessary to **install new bolts and nuts in pairs and directly opposite each other to maintain converter balance.**

5) Install engine rear support cross-member on frame "X" member. Install engine rear mount-to-transmission bolts and tighten to 20-25 ft. lbs.

6) Raise engine and transmission, remove engine support tool, then lower engine and transmission until support rests on cross-member, install the

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FORDOMATIC & MERCOMATIC (Continued)

engine mount-to-cross member bolts and tighten to 40-45 ft. lbs. Remove transmission lift.
7) Connect speedometer cable at extension housing.
8) Connect throttle and manual linkage to transmission levers. Adjust linkage (see LINKAGE ADJUSTMENT).
9) Install converter housing upper plate with new seal, tighten attaching bolts to 10-15 ft. lbs.
10) Install starter and tighten front and rear attaching bolts to 10-15 ft. lbs.
11) Install converter drain plugs (tighten to 7-10 ft. lbs.), and oil pan drain plug (20-25 ft. lbs.).
12) Install converter housing lower plate and tighten attaching bolts to 10-15 ft. lbs.
13) Install air duct.
14) Install drive shaft. NOTE—Lubricate front universal joint slip yoke with transmission fluid to facilitate installation.
15) Check operation of Neutral Switch. Remove supports, lower car to floor, install spark plugs.
16) Fill transmission (see LUBRICATION).
17) Road test car and check for correct operation and proper shift points (see TESTING).

TRANSMISSION (Converter in Car): Install two guide pins, ST-0711, into top transmission-to-converter housing attaching bolt holes. Mount transmission on lift and position under car. Rotate engine to position front pump drive lugs, on converter pump housing in a vertical position. Rotate transmission front pump to position slots in pump drive gear in a vertical position. Apply lubriplate to seal surface on converter pump cover hub and raise transmission and move towards front of car. *(CAUTION—Use care to index turbine shaft splines with splines in turbine hub, and lugs on converter pump with slots in front pump drive gear).* Install two lower transmission to converter housing attaching bolts, then remove guide pins and install two upper bolts, tighten all four bolts to 40-45 ft. lbs.

REMAINDER OF INSTALLATION PROCEDURE IS SAME AS FOR "TRANSMISSION & CONVERTER ASSEMBLY" ABOVE beginning with Step (5).

1949-51 FORD, LINCOLN, MERCURY SYNCHRO-MESH

Ford, 6 Cyl. & V8 Pass. Car Models (1949-51)
Lincoln & Cosmopolitan Models (1949-51)
Mercury, V8 Models (1949-51)

►CHANGES, CAUTIONS, CORRECTIONS

►**Lincoln Transmission Note**—Transmission is Warner Type AS1-T85B (No Overdrive), AS2-T85B (With Overdrive. ***Data below applies to these transmissions.***

►**Elimination of Overdrive Lock-out Switch (1949-50 Cars)**—Switch not furnished for service and can be wired out of control circuit if defective. ***See Ford, Lincoln, Mercury Overdrive data.***

►**Transmission Jumping out of Low Gear (1951 Ford & Mercury Cars)**—May be caused by excessive clearance between major diameters of mainshaft splines and internal splines on low and reverse sliding gear. This clearance should be .000-.0015". To correct this complaint, measure outside diameter of splines on mainshaft with a micrometer. If shaft does not check to 1.6235-1.6240", replace the shaft. If outside diameter is correct, replace the low and reverse sliding gear. If shaft clearance is correct (.000-.0015"), slight pressure should be required to push the sliding gear on the shaft.

►**Ford Transmission Locking In Reverse Complaints (Transmission without Overdrive)**—May be caused by mainshaft drive gear snap ring or mainshaft rear bearing snap ring not correctly installed (see illustration). Correct by disassembling transmission (remove mainshaft assembly from extension housing) and checking these snap rings.
See Disassembly & Reassembly data below.

►**Ford Overdrive Transmission on First Cars Inoperative in Reverse (Reverse Lock-out Inoperative)**—May be due to use of wrong Reverse Shifter Fork Cam & Shaft (8A-7282-A instead of 8A-7282-B). Check and correct this condition as follows:

To Check—Place gearshift lever in Reverse position. Release hand brake. Push car **forward.** If car rolls freely, this indicates wrong cam installed.

To Correct—Disassemble Overdrive and install new No. 8A-7282-B Reverse Shifter Fork Cam & Shaft which provides automatic **lock-out for Reverse Gear.**
See "Ford, Lincoln, Mercury Overdrive" (following) for disassembly directions.

►**Ford Overdrive Transmission Noisy in Operation**—May be caused by interference between overdrive case and rear engine support. Correct as follows:

(1) Interference between Rear Engine Support Bolt and Overdrive Case—Correct by grinding off head of bolt for clearance. Thin head bolt No. 355519-S2 used at this point on later cars.

►***CAUTION—Bolt head thickness must be at least 1/8".***

(2) Interference between Rear Engine Support & Overdrive Case—Case is grooved for clearance at flanges on support. If grooves in case not deep enough (particularly at ends where casting flash protrudes), clean up this flash and deepen grooves by filing.

DESCRIPTION: Three-speed, all helical gear type with constant-mesh, synchro-mesh (Second & High), sliding gear (Low & Reverse). Overdrive is optional. Std. transmission has extension housing at rear which has rear engine mounting. Mainshaft extends through extension housing with splines at rear end for propeller shaft engagement (front universal yoke hub slides on shaft—no slip-joint used on propeller shaft).

REMOVAL OF TRANSMISSION: ***See "Transmission" on car model page.***

OVERDRIVE SERVICING NOTE: On transmission with Overdrive, overdrive unit can be disassembled separately without disturbing transmission.
See "Ford, Lincoln, Mercury Overdrive" (following).

TRANSMISSION DISASSEMBLY: Take out mounting screws and remove gearshift housing (side cover) assembly. Drive countershaft and reverse idler shaft pin out through case side (Ford & Mercury, Lincoln shafts locked by separate key in rear end of each shaft). Take out extension housing screws, rotate extension housing ¼ turn to expose end of

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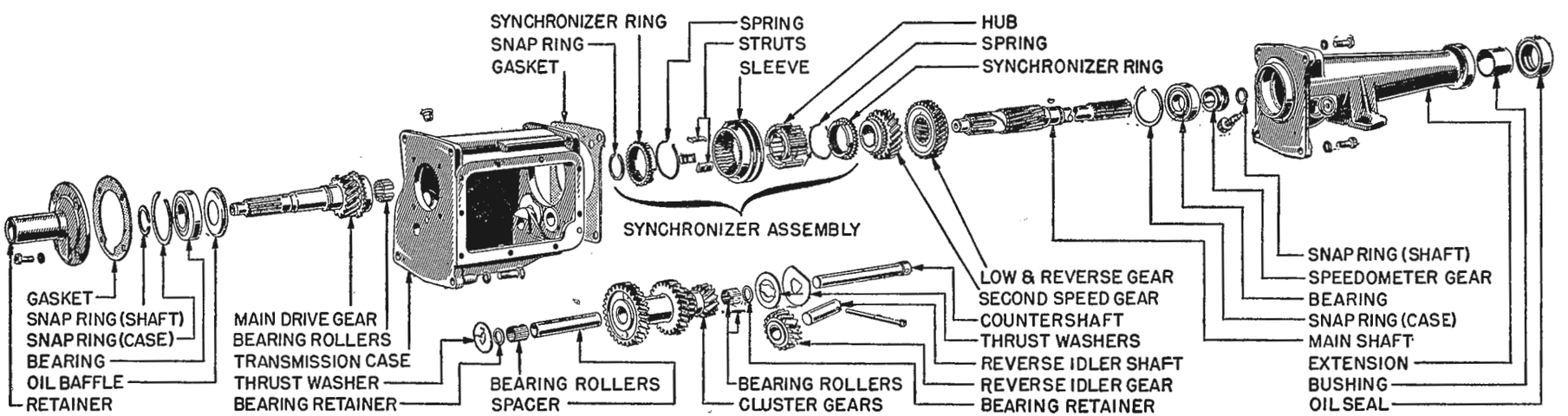


FORD & MERCURY TRANSMISSION (LINCOLN SIMILAR)

1949-51 FORD, LINCOLN, MERCURY SYNCHRO-MESH (Cont.)

countershaft, drive countershaft to rear until it clears front of case, use Tool 7121-N (or counter shaft cut to length of countergear cluster) to push countershaft out through rear of case (leave tool or dummy shaft in gear cluster to retain bearing rollers), drop gear cluster to bottom of case. Tap lightly on extension housing to loosen it from case, withdraw housing and mainshaft assembly from case (CAUTION—use care not to lose mainshaft pilot bearing rollers). Lift countergear cluster and thrustwashers from case, remove tool and take out bearing retainers, rollers, and spacer. Take out capscrews in bearing retainer on front of case, remove retainer and gasket. Tap main drive gear assembly out through front of case, using a soft hammer. To remove reverse idler gear, use brass drift to drive shaft out, lift gear out. Disassemble and service subassemblies as follows:

Mainshaft & Extension Housing Assembly: Remove snap ring in front of rear bearing in extension housing, use a soft hammer to tap mainshaft and bearing out of housing. Remove snap ring on forward end of mainshaft, pull or press synchronizer assembly, 2nd speed gear, and sliding gear off shaft. On Lincoln, remove speedometer gear snap rings, remove speedometer gear and woodruff key. On all models, remove bearing snap ring from groove in shaft (on Ford & Mercury, this snap ring retains speedometer gear also—note position of shoulder on gear to insure correct reassembly—remove gear and woodruff key). Press rear bearing off shaft.

Extension Housing Oil Seal & Bushing: Oil seal and bushing can be replaced after mainshaft removed from housing.

TRANSMISSION REASSEMBLY: Assemble all subassemblies as noted below and install in transmission by reversing the disassembly directions given above.

Reverse Idler Gear: Ford & Mercury gear has bushing, Lincoln gear has 25 bearing rollers and thrust washer at each end. Install gear with chamfered end of teeth forward, see that locking pin hole in line with hole in case (Ford & Mercury), install key in slot in rear end of shaft (Lincoln).

Countergear Cluster: Place bearing spacer in gear cluster, insert tool 7121-N (or dummy countershaft cut to length of gear cluster), install bearing rollers in each end (on Lincoln, two sets of 20 bearing rollers used at each end with retainer washer at outer end of each set). Coat thrustwashers with grease to hold them in position, install bearing retainer in each end of gear cluster. Install front thrust washer so that tongue will enter groove in case when assembly installed, place rear thrust washer with slotted hole on gear cluster with babbitted face out toward steel washer which must be next to case. Place this assembly in the case and after mainshaft installed, raise assembly and insert countershaft from rear, pushing dummy shaft out at front of case. On Ford & Mercury, align locking pin hole in shaft with hole in case, install locking pin through reverse idler and countershafts. On Lincoln, install locking key in slot in rear end of shaft before shaft fully inserted in case. On Ford & Mercury, countergear endplay should be .0045-.0185"

Main Drive Gear Assembly: Install oil baffle and drive gear bearing on shaft, press bearing in place firmly, install snap ring in shaft groove (see Lincoln Note below). Install snap ring in groove in bearing. Install main drive gear in case. Use new gasket with retainer (Lincoln gasket furnished in thicknesses of .010", .015", .020", .025" for selective fitting), make certain oil drain groove in retainer is at bottom.

Lincoln Snap Ring Note—This shaft snap ring furnished in thicknesses of .086-.088", .089-.091", .092-.094", .095-.097" for selective fitting).

Synchronizer Assembly: Install synchronizer springs at each end of hub with spring openings staggered. Install three struts on hub, slide outer clutch sleeve over the assembly. Place synchronizer ring on each end of assembly making certain that struts engage slots in rings. Backlash of synchronizer sleeve on hub must not exceed .001".

Mainshaft Assembly: Use special press tool 7699-N to install new bushing in rear end of extension housing, install oil seal. Press rear bearing in place on mainshaft. On Ford & Mercury, install speedometer gear key and gear (on Lincoln, speedometer gear is mounted separately on shaft). Select snap ring of correct thickness and install in groove in shaft. This snap ring furnished in following thicknesses: (Ford & Mercury) .090", .093", .096", .100". On Lincoln, install speedometer gear on shaft with woodruff key in gear and snap ring in shaft groove. Install sliding gear, 2nd. speed gear, and synchronizer assembly on shaft, install snap ring in shaft groove to retain assemblies. Check 2nd. speed gear endplay which should be .002-.011" on Ford & Mercury. Clearance between outside diameter of splines on mainshaft and internal splines on low and reverse gear should be .000-.0015" and shaft or gear should be replaced if clearance exceeds .002" (see Transmission jumping out of Low Gear Correction above).

Mainshaft & Extension Housing Installation: Install mainshaft assembly in extension housing, seating rear bearing firmly in housing recess (Ford and Mercury), against bearing rear snap ring (Lincoln). Select snap ring for correct fit—this ring furnished in following sizes (Ford & Mercury) Thin .086-.088", Medium .089-.091", Thick .092-.094", Extra Thick .095-.097", (Lincoln) .087-.089", .090-.092", .093-.095", .096-.098", .099-.101" for selective fitting, install ring in housing to retain bearing. Make certain pilot bearing rollers in place in recess in main drive gear (use cup grease to hold rollers in place), use new gasket on extension housing, insert mainshaft assembly through rear of case and enter shaft in pilot bearing. Turn extension housing to permit countershaft to be installed (see Countergear Cluster above), install extension case washers and capscrews.

►***CAUTION—On Ford & Mercury, use lead washers on two lower extension case capscrews and secure these screws with lockwire.***

1949-51 FORD, LINCOLN, MERCURY (WARNER) OVERDRIVE

Car Model	Warner Model
Ford 6 Cyl. & V8 Pass. Cars (1949-50)	AS1-R10E
Ford 6 Cyl. & V8 Pass. Cars (1951)	②AS4-R10E
Ford Sta. Wgn. & Convt. (1949-51)	AS3-R10E
Lincoln & Cosmopolitan (1949-51)	①AS2-T85B
Mercury, V8 Models (1949-50)	AS1-R10C
Mercury, V8 Models (Early 1951)	AS1-R10E
Mercury, V8 Models (Late 1951)	②AS4-R10E

①—Transmission & R10 Overdrive Assembly.
②—New type **without** Lock-out Switch.

►CHANGES, CAUTIONS, CORRECTIONS

►**FORD & MERCURY OVERDRIVE LOCK-OUT SWITCH PRODUCTION CHANGE:** Ford Overdrives (beginning with 1951 production) and Mercury Overdrives (beginning January 1951) do not have any provision for Lock-out Switch and Governor is connected directly to "A" terminal on Kick-down Switch.

►**FORD, LINCOLN, MERCURY OVERDRIVE LOCK-OUT SWITCH REMOVAL:** If Lock-out Switch defective on early overdrive units where this switch installed originally (see Production Change above), both switch wires should be detached and connected together so that switch eliminated from the circuit (CAUTION—wires should be soldered together for good connection and taped for protection from moisture and grease). Leave switch installed to act as cover for switch mounting hole (if switch cannot be used for this purpose, make up sheet metal cover for installation over switch mounting hole).

►**PROLONGED SHORTING OF IGNITION CORRECTION:** If shorting out of ignition during Overdrive Kick-down is prolonged (normal shorting out period is very brief), correct by installing insulator inside solenoid cover as follows: Make up insulator strip from treated paper .03" thick, .76" wide, 2.38" long with hole for cover screw .25" from each end. To install insulator, remove terminal screws, nuts, and lockwashers on side of cover, remove cover, place insulator over cover studs, re-install cover.

►**OVERDRIVE SOLENOID SHORTING OUT (Convertible Models):** Correct by installing new RUBBER-COATED solenoid, No. 8A-6916-C, which will prevent this shorting out in wet weather.

►**OVERDRIVE NOT ENGAGING CORRECTION (Convertible Models):** Check sliding pawl operating rod lever (in adapter) for binding or sticking. If this condition noted, remove solenoid and adapter, disassemble linkage, polish pins and pawl operating rod to provide free movement of rod through seals in plate.

►**OVERDRIVE GOVERNOR PRODUCTION CHANGE:** New type governor used which is interchangeable with first type **except on Convertibles.** Governors can be distinguished as follows:

First Type—Unpainted Body with Bakelite Top.

Later Type—Body painted Black, Top unpainted.

►***CAUTION—Later type governor cannot be installed on Convertible models (will not clear X-member).***

DESCRIPTION: Solenoid operated type similar in design to other Warner Type R10 Overdrives except for different overdrive case and rear bearing construc-

CONTINUED ON NEXT PAGE

1949-51 FORD, LINCOLN, MERCURY WARNER OVERDRIVE (Continued)

tion which requires different disassembly directions as given below. Overdrive used on Ford Station Wagons and Convertible models has special solenoid

Ford Solenoid Assemblies: Special type Solenoid, Ford No. 8A-6916 (used with 8A-6925 Adapter on AS3-R10E Overdrives) can be distinguished from std. solenoid Ford No. 8M-6916 (used with AS1-R10E Overdrive) by location of pawl flats on solenoid plunger as follows:

8A-6916—Flats are 5° counter-clockwise from line at right angles to center line through mounting screw holes.

8M-6916—Flats are 35° counter-clockwise from center-line through mounting screw holes.

►***CAUTION—These solenoids not interchangeable.***

Ford Solenoid Adapter (AS3-R10E Overdrive): Ford No. 8A-6925. Consists of a case bolted on the overdrive housing providing for offset mounting of solenoid (for clearance in special "X" type frame). Adapter has idler lever and plunger which engages sun gear pawl (solenoid actuates lever).

REMOVAL OF OVERDRIVE: *See "Overdrive" on car model page.*

DISASSEMBLY OF OVERDRIVE: Remove Lock-out Switch and switch operating balls, remove governor and speedometer drive pinion. Remove solenoid by taking out mounting screws and rotating solenoid 55° clockwise (35° on Convertible & Station Wagon) to disengage plunger from pawl, then pull solenoid and plunger out. Drive out tapered pin holding control lever shaft in overdrive case, pull shaft out as far as possible to disengage operating cam from shift rail. Take out four mounting screws holding overdrive case and adapter on transmission case. Remove small rectangular cover plate on top of case by taking out two screws. Working through slot under this plate, spread bearing snap ring with special pliers 7059-N to free rear bearing. Withdraw overdrive case while pressing forward on rear end of shaft to prevent shaft coming off with housing CAUTION—Do not allow adapter plate to separate from transmission case. Disassemble overdrive parts as follows:

Overdrive Case & Control Mechanism: Remove reverse lock-up spring from case. Remove lever on end of control shaft, push shaft through and remove from within housing, remove shaft oil seal from case. Compress rear bearing snap ring (insert pliers through slot in case), remove ring. Bushing and oil seal at rear end of case are similar to regular transmission. *See Extension Housing data in Ford-Lincoln-Mercury Transmission article.*

Driveshaft & Gear Assembly: Install one screw to retain adapter plate on transmission case, pull driveshaft off to rear (CAUTION—catch free-wheel rollers as they drop out). If bearing to be removed from shaft, take out snap ring and remove speedometer gear taking care not to lose woodruff key from gear (on Lincoln, remove both speedometer gear snap rings and additional snap ring at rear of bearing), remove bearing. Take out retaining clip ("C" washer) at rear of free-wheel cam, withdraw free-wheel unit and pinion assembly (these two parts can be separated by removing "C" washer ahead of free wheel cam). Remove overdrive sun gear and shift rail assembly as a unit by sliding them off rear of shaft.

Adapter Plate & Sun Gear Mounting: Remove large snap ring from adapter plate, withdraw sun gear cover plate, balk ring blocker assembly, and solenoid pawl.

NOTE—Adapter plate is removed as a unit with transmission mainshaft. Do not disturb unless transmission being disassembled.

REASSEMBLY OF OVERDRIVE: Assemble in reverse order of disassembly directions above. Note the following important points:

Sun Gear Balk Ring, Pawl & Solenoid: After balk ring installed, insert pawl with notch on side downward (Ford), upward (Lincoln & Mercury—on Mercury, interlock plunger engages this notch), position cover plate with tongue over pawl, install large snap ring (this ring furnished in three thicknesses for selective fitting). When installing solenoid (after assembly completed), insert plunger stem with solenoid rotated clockwise 55° (85° on Convertible & Station Wagon) from mounted position to align plunger flats with pawl slot, then rotate solenoid counter-clockwise until mounting screw holes aligned. This will engage plunger in pawl.

Free-wheel Assembly: If free-wheel roller retainer and springs removed from cam, first note position of springs and replace in exact same positions. Springs must place tension on cam so that it is normally rotated counter-clockwise in retainer (viewed from rear) with rollers on "high" ends of cam ramps (outward or engaged position).

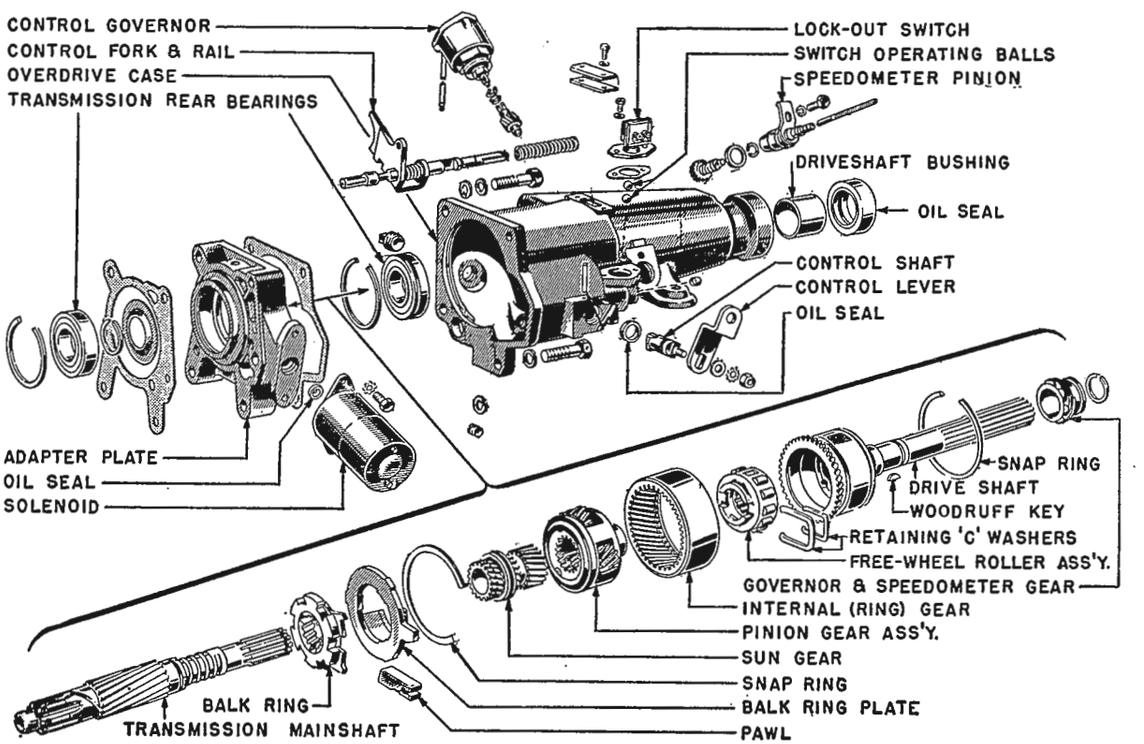
Overdrive Pinion & Free-wheel Assemblies: With these parts installed and retaining clips in place, insert free-wheel rollers in retainer and use rubber band to hold them in place while mainshaft being installed.

Overdrive Mainshaft: Bearing should be installed on shaft with snap ring groove toward front (Ford & Mercury), toward rear (Lincoln), speedometer and governor drive gear must be keyed on shaft and placed with long shoulder on gear toward bearing (Ford & Mercury only—gear installed separately on Lincoln). Snap ring behind gear (directly behind bearing on Lincoln) must be tight fit and prevent all endplay in shaft. This snap ring furnished in four thicknesses for selective fit. When installing shaft over free-wheel cam & roller assembly, rotate shaft counter-clockwise to move rollers to low or disengaged position.

Overdrive Case & Control Mechanism: Install bearing outer snap ring in groove in case with lugs on ring toward slot in housing and expand ring with pliers inserted through slot while case is being pushed on over mainshaft. Insert control shaft in case before case installed on shaft but do not install shaft lock-pin until after assembly completed and cam on shaft engaged in slot in shift rail. Install new oil seal on control shaft and position control lever upward (Ford & Lincoln), downward (Mercury).

OVERDRIVE CONTROL: *See Warner Type R10 Overdrive Control on Pg. 2662.*

TRANSMISSION DISASSEMBLY & REASSEMBLY: *See Ford-Lincoln-Mercury Transmission article.*



FORD & MERCURY WARNER OVERDRIVE (LINCOLN SIMILAR)
►FORD CONVERTIBLE & STATION WAGON HAVE OFFSET MOUNTED SOLENOID

1939-40 HUDSON

Hudson 6 & 8, All Models (1939-40)

►**OVERDRIVE TRANSMISSION NOTE:** Warner Overdrive unit, Model AS13-R6, with electrical 'kick-down' control optional on all 1940 models (used with Hudson transmission). *See Warner Type R6 & R7 Overdrive for complete data on this unit.*

►**ELECTRIC HAND NOTE:** Transmission is same as Std. type except for shifter mechanism and mounting of Electric Hand units on transmission case (Power Unit, Gear Abutment Shift Rail Switch, Clutch Pedal Circuit Breaker). See article on Electric Hand for servicing and adjustment of these units. Transmission serviced in same manner as standard model below.

Handy Shift (1939-40). Transmission case cover modified to include a selector plate (sliding on two guide pins in cover) and actuated by the selector cable to shift the gear engagement shift finger back and forth between the low-reverse and second-high shifter forks at neutral, and a gear engagement lever to which the shift finger is linked. See separate article for Handy-Shift Transmission Control

Hudson '112' Model. Shifter rail lock bars not used on Model 89 (1938). Single lock bar used for Second-High only on Models 90, 98 (1939).

DESCRIPTION: Constant-mesh, helical gear (2nd. & High), sliding spur gear (low & reverse). Main drive gear and clutch shaft mounted on ball bearing. Mainshaft mounted on needle bearings at forward end, ball bearing at rear end. Mainshaft end thrust taken by a ball thrust bearing at the forward end of the shaft. Second speed gear mounted on the main drive gear clutch hub and positioned by thrust washer at each end. Low speed gear is fixed on mainshaft by a lock ring (this gear does not move, low engaged by shifting gear on countershaft). Counter gears splined to countershaft which revolves in bushings in bearing cap at each end of transmission case. Reverse idler assembly consists of stationary gear mounted on bushings on stationary shaft and sliding gear splined to stationary gear sleeve (this gear shifted in conjunction with low speed sliding gear to engage reverse). Second and high speeds engaged by sliding clutch sleeve splined to mainshaft which engages main drive gear or second speed gear clutch teeth (within second speed gear assembly).

1940 Type:—Standard transmission design changed from previous type and transmission modified for Overdrive application as follows:

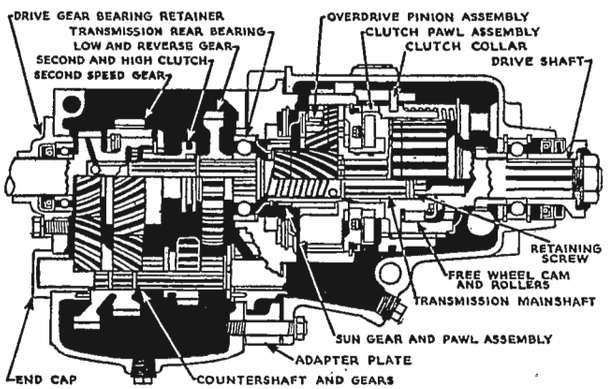
Standard Transmission—New type low and reverse gears used (gears have thicker case hardening and longer life). Air vent now located on transmission case cover (vent is larger and has loose fitting cap).

Overdrive Transmission—For overdrive, regular transmission is modified as follows: New retainer used on mainshaft low-and-reverse gear consisting of conical shaped pressed steel cap fitted over lock ring and pressed into place in groove in gear. New countershaft rear bearing cap, reverse gear cap, main shaft shift sleeve, and low-reverse shift rail used. Transmission case is heavier and oil tube is assembled in rear wall of case to convey oil to mainshaft bearing.

REMOVAL OF TRANSMISSION: *See "Transmission" on car model page.*

DISASSEMBLY: First remove transmission cover and shift lever assembly. Disconnect shift rail lock bar links, remove links and lock bars. Remove clutch housing (if taken off car as assembly with transmission). Use puller J-820 and remove universal joint flange. Remove speedometer drive gear housing and gear. Remove lock ball spring caps (on shifter rail lock brackets), take out lock ball springs, balls, plungers, remove brackets (do not lose shims). Take out shifter lock screws and remove shifter rails and forks. Remove three capscrews in main drive gear bearing retainer in front of case, remove retainer (tap with soft hammer if necessary). Drive low and reverse gear on mainshaft back slightly (rear bearing will move with gear) to expose locking ring, use special drift (Tool Number J-786) to remove the locking ring. Use special puller Tool J-352 (with J-788 adapter for 1940 cars) to remove mainshaft and rear bearing through rear of case, lift low speed gear and clutch sleeve out through top of case, remove main drive gear and second speed gear assembly out through top of case.

Reverse Gear Removal (1936-40). Take out two capscrews in reverse shaft cap on rear of case, remove cap and shaft (shaft pinned in cap). Lift out gear assembly.



Counter Gear Removal. Take out capscrews in rear bearing cap, remove bearing cap, spacer and thrust washer (do not lose shims under bearing cap flange). Use special drift J-786, insert beveled edge between countershaft drive and second gears (at front of case), separate gears, forcing countershaft back until drive gear slips off splines at forward end of shaft, remove lock ring from shaft in front of second speed gear, turn gear so that splines butt against shaft splines, insert drift through rear bearing hole in case, drive second speed driving gear forward on shaft (do not drive gear entirely off shaft). Move countershaft to one side, move low and reverse shifter lever to neutral position. Hold countershaft gears together and remove countershaft from case at the rear. Remove low and reverse intermediate shift lever stud and take out lever. Take out small Allen setscrew on right hand side of case, drive low and reverse shifter fork shaft out of case. Remove cotter pin and castellated nut on bottom of case, take out reverse gear shifter lever fulcrum, pickup lever, shifter lever, shifter, pickup plunger and plunger spring.

Main Drive Gear, Second Speed Gear & Clutch Shaft Bearing:—Mainshaft front bearing loose in main drive gear and can be lifted out (26 needle rollers for main bearing, 7 balls for thrust bearing), after mainshaft has been removed. To disassemble second speed gear, insert one jaw of lock ring remover J-449 (1939 and previous models), new tool J-448-1 (1940) through milled opening in gear to grip lock ring, place opposite jaw just above lock ring. Compress lock ring and lift one side out of groove, use blunt punch to tap other side out. Remove second speed gear and thrust washers. Use bearing puller J-782 to remove clutch shaft bearing from shaft, tool J-779 to re-install bearing. When replacing needle roller retaining ring use tool J-780. Second speed gear bushing (steel-backed, babbitt-lined) diamond bored and gear should be replaced if clearance excessive. Shaft clearance .0005". Endplay .003-.011". When installing this gear, place the bakelite thrust washer on first, install gear, then install outer thrust washer with babbitt face in, install retainer with gap in ring ¼ turn away from second speed gear slots, use tool J-448-5 to seat snap ring in groove. Use cup grease to hold mainshaft thrust balls and rollers until mainshaft is entered.

Mainshaft & Low Speed Gear:—To install, assemble bearing loosely on rear of shaft, install low speed gear and sliding clutch (collar to rear) on shaft inside case, place low speed gear locking ring in groove using cup grease to hold parts in place, hold shaft firmly against thrust bearing balls, use tool J-779 to drive bearing forward on shaft (this will drive gear in place against lock ring). Install speedometer gear, gear housing (rear bearing retainer), universal joint yoke, cork gasket, washer, and capscrew. Tighten screws securely. When installing main drive gear bearing retainer, install sufficient shims between retainer and transmission so that mainshaft endplay is .008-.012" (check with a dial indicator). NOTE—Make certain that oil seals installed with lip on leather pointing in (toward rear on front seal, toward front on rear seal).

Counter Gear Assembly:—Use tool J-450 to remove old bushings, J-780 to install new bushings and line ream with bearing caps in place in case (expansion plugs removed). Use tool J-781 to install second gear retainers in groove. Install spacer on rear end of countershaft with oil groove toward rear, bronze thrust washer on front end of rear bearing cap. See that cap gasket in good condition, install rear bearing cap and thrust washer placing sufficient shims between rear bearing and case so that countershaft endplay is .005-.009" (check with dial indicator). Shaft clearance in bushings .0005".

Reverse Gear Assembly:—Remove and install bushings in an arbor press or with J-488 hand bushing press. New bushings finished to size and do not require reaming. Clearance should be .003". Install sliding gear on stationary gear sleeve with collar toward front. See that shaft pinned to bearing cap before cap installed on case.

Shifter Rail Lock Bar Adjustment. Use second type with bar stock lock bars to service the first type. When installing lock bar guides, shim between guides and case to secure .005" clearance between lock bars and outer ends of plungers. Adjust links so that bar is drawn down sufficiently to release plunger (bar slot aligned with plunger) with clutch pedal depressed one half.

Gearshift Mechanism (1939-40):—See separate Hudson Handy Shift Transmission Control article for adjustment directions when transmission installed

REASSEMBLY: Reverse the disassembly procedure in installing all units in transmission case.

HUDSON 1941-47

Hudson 6 & 8, All Models (1941 to 1947)

►**Overdrive Transmission Note**—Overdrive Transmission is optional on all models. Overdrive unit is Warner Type AS1-R9B and is used in conjunction with a Hudson transmission for which data is given below. *See Warner Type R9 Overdrive article for complete data on this unit and controls used with it.*

Transmission Controls—Steering column mounted gearshift is standard on all models. *Refer to separate Hudson Transmission Control article for adjustment and servicing data.*

Drive-master Transmission—Optional on all models. Consists of a special automatic gearshift mechanism mounted on the transmission case. Refer to separate Drive-Master article (preceding) for all data on this equipment.

DESCRIPTION: New constant-mesh, synchro-mesh (Second & High), sliding gear (Low & Reverse), all-helical gear type. Main drive gear is integral with clutch shaft and is mounted on ball bearing in front of case. Mainshaft is mounted on roller bearing in main drive gear hub (front), ball bearing in rear of case or in adapter plate on overdrive models (rear). Countergear cluster is mounted on bushings on stationary countershaft with thrust washers at each end. Second speed gear is retained on mainshaft as an assembly with the synchronizer unit by a snap ring installed in a groove in the shaft directly in front of the synchronizer inner clutch sleeve.

Synchronizer Unit — Double-blocker, double-spring type. Synchronizer rings are free in ends of inner clutch sleeve and are actuated by three shifting plates or struts which fit in slots in inner clutch sleeve and engage notches in rings. Struts are centered in outer clutch sleeve by two wire springs (within struts on each side of inner clutch web) and move with outer clutch sleeve to engage with cones on gear hubs for synchronization. Teeth on rings block or prevent gear engagement until synchronization completed. Inner clutch sleeve is stationary on shaft and does not move (retained by second speed gear snap ring in shaft groove.

1942 & Later Models: Transmission design changed from 1941 type (above) as follows:

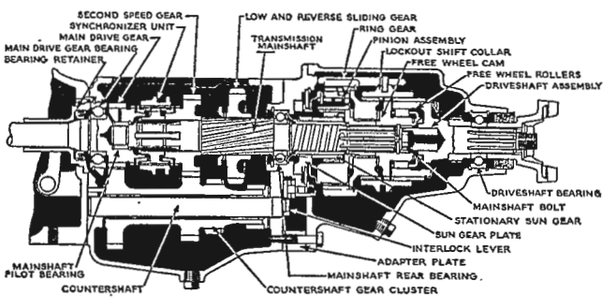
Synchronizer Unit—New larger synchronizing rings, shifter sleeve, shifter sleeve hub, and mainshaft gears are used (these parts must be used together). Shifter struts or plates also increased in height to .270" (were .220").

Second & High Shift Rail Stop—Consists of a new stopscrew installed on left side of case so as to engage milled flat on forward end of shifter rail. Screw provides positive stop for rail when shifted into Second or High Gear (screw must be taken out to remove this shifter rail).

REMOVAL OF TRANSMISSION: *See "Transmission" on car model page.*

OVERDRIVE DISASSEMBLY: On car models with overdrive, overdrive unit can be disassembled and serviced without disturbing transmission providing that adapter plate is not disturbed (must not be allowed to separate from transmission case). *See "Warner Type R9 Overdrive."*

DISASSEMBLY OF TRANSMISSION: On Vacumotive Drive cars unscrew the Governor from housing. Remove transmission cover screws, lift cover off carefully to prevent detent ball spring flying out, tilt transmission case to one side and remove spring and detent ball. Remove front universal joint companion flange nut, lockwasher, plain washer. Use puller J-820 to remove companion flange. Take out screws in speedometer gear housing (rear bearing retainer), remove housing and speedometer gear using care not to damage oil seal in housing. Remove low & reverse shift fork lockscrew and shifter lockscrew, slide low & reverse shift rail out through front of case, remove shift fork and reverse shifter from case. Tilt case and remove interlock plunger from hole in side of case. Remove second & high shift fork lockscrew and lock bolt and washer on left side (1942 on), slide shift rail out, lift fork out of case, tilt case and remove detent ball and spring. Slide mainshaft and gear assembly back so that rear bearing is free of case, tilt front end of shaft up, remove snap ring in shaft directly in front of synchronizer inner clutch sleeve (use special pliers J-1575). Slide synchronizer unit, second speed gear, low speed gear, off shaft and remove through top of case, then withdraw mainshaft and bearing through rear of case. Remove countershaft lockplate screw on rear of case, drive out plate with a drift, drive countershaft out through rear of case using Driver J-1574, remove countergear cluster and thrust washers. Pull main drive gear out through front of case (use driver J-1574 if necessary—gear will be free with clutch housing and bearing retainer removed). Use driver J-1574 inserted through main drive gear bearing hole to drive out reverse idler gear shaft.



REASSEMBLY OF TRANSMISSION: Reverse disassembly directions given above and note following special instructions: Install sliding low speed gear on mainshaft with shift fork flange toward front and make certain that four oil holes in flange groove line up with grooves in shaft. Install second speed gear with tapered side of hub toward front, install synchronizer unit with tapered side of shift sleeve toward front, select lock ring of correct thickness (furnished .087", .090", .093", .097" thick) so that synchronizer has no appreciable endplay when lock ring installed. See that detent balls and springs correctly installed (low & reverse spring at top is heavier than second & high spring at bottom and springs must not be interchanged). Install second and high shift rail stop screw making certain that lockwasher in place under screw head (stopscrew used on 1942 and later cars only).

CAUTION—If lockwasher not used on stopscrew, screw will bottom on shift rail preventing gear engagement.

Mainshaft & Rear Bearing Assembly:—Use special puller J-1134H to remove bearing from shaft. To install bearing, see that locking ring on bearing is toward rear of shaft, use replacer tool J-1570 to drive bearing in place.

Main Drive Gear & Bearing Assembly:—To remove bearing, remove lock ring in groove in shaft with J1575 pliers, use puller J-1134-H to remove bearing from shaft (bearing will be damaged if driven off). When installing bearing, see that shielded side is toward gear (to rear when installed), use replacer tool J-1570 to drive bearing in place. Use lock ring of correct thickness (furnished in thicknesses of .090", .093", .096") so that lock ring is snug fit in groove and there is no appreciable endplay. Use grease to retain mainshaft bearing rollers in drive gear hub until mainshaft installed. If oil seal in bearing retainer being replaced, use remover J-1576 to tap old seal out, press new seal in place with J-1569 seal replacer tool. Use new gasket when installing retainer on case. NOTE—Retainer locating pin engages hole in clutch housing so that retainer can only be installed with throw-out bearing oil holes lined up properly.

Synchronizer Unit:—If synchronizer unit being dismantled, mark inner and outer clutch sleeves and rings to insure reassembly in same positions. Install struts with open face toward inner clutch sleeve, install springs with hooked end of each spring in same strut with free ends running in opposite directions. See that undercut on inner sleeve points toward rear of transmission and install synchronizer on mainshaft with tapered side of outer sleeve toward front.

IMPORTANT NOTE—Two types of synchronizer rings and sleeves used in production and must not be interchanged. Rings with 110° chamfer on face of teeth are marked '110' on flange face and must be used with 110° clutch sleeves which are marked by groove on outside face. 90° chamfer rings and sleeves not marked. CAUTION—90° parts must not be used with 110° parts.

Countergear Assembly: Countergear bushings can be renewed by using J-1573 puller to remove old bushings, J-1572 replacer to install new bushings, and then reaming bushing with KMO-338 bushing reamer (pilot reamer on guide installed in other end of gear cluster while reaming each bushing). When installing countergears in transmission, coat bronze thrust washers with chassis lubricant, install washers in case so that they engage retaining pins in case, install steel thrust washer between gear cluster and rear thrust washer. See that both countershaft and reverse idler shaft are locked in place by lockplate and that lockplate screw tightened securely.

Shifter Shafts & Levers:—Selector shaft can be removed from within case after taking off nut, washers, and lever on outer end of shaft. Bushing is withdrawn from outside after bushing setscrew has been loosened. When removing shift shaft, first punchmark inner lever and shaft to insure correct reassembly (if position lost, use indexing tool J-1571 to re-install inner lever). Remove nut on outer end of shaft, remove lever. Drive out pin in shaft boss on side of case, remove inner lever, withdraw shaft and felt seal. Install levers in same manner.

REASSEMBLY: Reverse the disassembly procedure in installing all units in transmission case.

1948-51 HUDSON

Hudson 6 & 8, All Models (1948-51)—See Notes

►**OVERDRIVE TRANSMISSION NOTE:** Optl. on all models. Consists of Warner Type R10D Overdrive used with Hudson transmission for which data is given below. ***See Warner Type R10 Overdrive article***

►**DRIVE-MASTER TRANSMISSION NOTE:** Optional on all models. Consists of special automatic gear-shift mechanism used with transmission for which data is given below. ***See Drive-Master article for data on Drive-Master Control.***

►**SUPER-MATIC DRIVE TRANSMISSION NOTE:** Optl. on these models. Transmission data below applies to transmission of Super-Matic Drive.

►**HYDRA-MATIC DRIVE TRANSMISSION NOTE:** Optl. on 1950-51 models (except Pacemaker). ***See "Hydra-Matic Transmission" for data.***

►CHANGES, CAUTIONS, CORRECTIONS

►**SLIPPING OUT OF GEAR CORRECTION (Second & High Shift Rail Production Change):** New type Shift Rail, Hudson No. 303832, and Lock Ball Spring, Hudson No. 303847, should be installed when overhauling transmission to correct slipping out of gear

NOTE—These parts used in production beginning with Serial No. 500-26338.

►**INSTALLATION OF 1951 TYPE OVERDRIVE TRANSMISSION COVER ON 1948-50 CARS (to correct insufficient lubrication of Overdrive):** If insufficient lubrication noted in overdrive case, 1951 type Transmission Case Cover, Hudson No. 305424, should be used to replace original cover. This 1951 type has oil trough located so as to catch maximum oil spray from transmission gears and conducts lubricant to overdrive case opening.

DESCRIPTION: Three-speed, all helical gear type. Constant-mesh, synchro-mesh (Second & High), sliding gear (Low & Reverse). Transmission is similar to design used on previous Hudson models.

OVERDRIVE SERVICING NOTE: On transmissions with Overdrive, overdrive unit can be disassembled and serviced separately without disturbing transmission.
See "Warner R10 Overdrive."

REMOVAL OF TRANSMISSION: ***See "Transmission" on car model page.***

TRANSMISSION DISASSEMBLY: On cars with Governor (for Vacumotive Drive, Drive-Master, or Overdrive Control), remove governor from rear bearing retainer. Remove nut on end of driveshaft, pull universal joint flange. Take out capscrews in transmission cover, lift cover off carefully to prevent loss of shift rail spring (tip cover up on left side, remove spring and lock ball, lift cover off). Take out retaining capscrews and remove rear bearing retainer, slide speedometer drive gear off shaft. Remove 2nd & High shift rail stopscrew on left side of case. Remove lockscrew from Low Speed Shifter Fork and from Low Speed Shifter (use straight blade screwdriver which bottoms in screw slot—do not use taper blade screwdriver), slide shift rail out at front of case, lift out shift fork and shifter. Remove interlock plunger. Remove setscrew from 2nd & High Shift Fork, slide shift rail out through front of case. Remove spring and lock ball from case (tip case up). Take out retaining screw on rear of case, remove lock plate to free countershaft and reverse idler shaft. Drive countershaft out through rear of case, using bronze Driver J-1574, lower countergear cluster to bottom of case. Pull mainshaft rearward by hand until puller can be engaged behind bearing or snap ring (if necessary, re-install universal flange, tap on flange to move shaft). Remove bearing from shaft with Puller J-1134-H. Pull mainshaft

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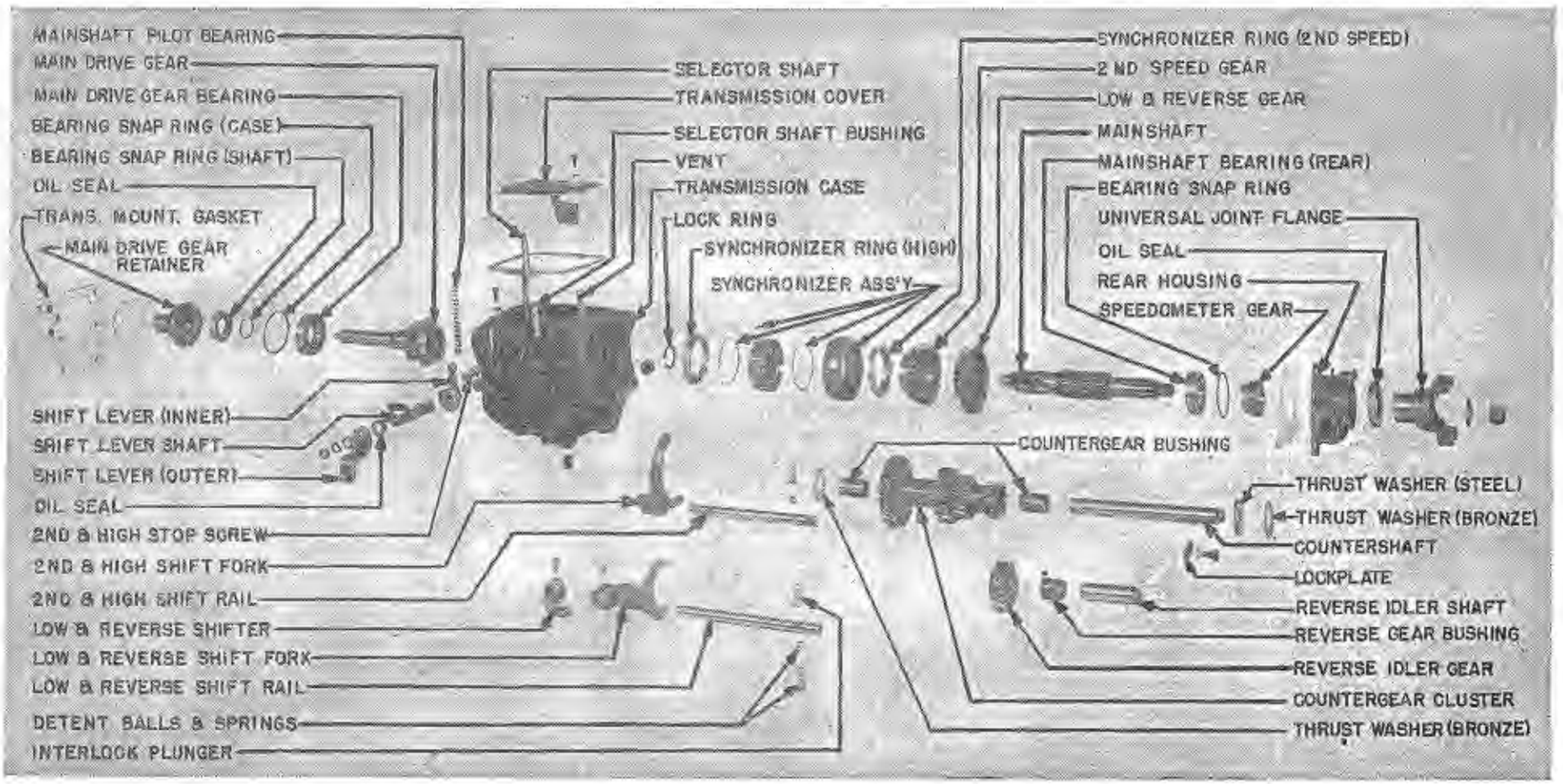


HUDSON 6 & 8 TRANSMISSION (NO OVERDRIVE)

1948-51 HUDSON (Cont.)

to rear until forward end clears pilot bearing in main drive gear, then tilt forward end up, move synchronizer and sliding gear to rear as far as possible, remove mainshaft assembly through top of case. Pull main drive gear forward until bearing retainer snap ring is free, remove snap ring, tap drive gear into case and remove through top of case. Remove shift shaft inner lever, lift countergear cluster and thrustwashers out. Drive out reverse idler shaft (use driver J-1574 inserted through mainshaft bearing hole in front of case), lift reverse idler gear out. Remove nut and washer on upper end of shift selector shaft, lift off lever, take out setscrew in side of shaft, remove shaft from within case, pull bushing straight up and out. Remove nut and washers on outer end of shifter shaft, remove outer lever, drive out tapered lockpin in side of shaft (use pin punch, withdraw shifter shaft and seal. Disassemble all sub-assemblies as follows:

Mainshaft Assembly: Remove sliding gear, take out lock ring in groove ahead of synchronizer hub, slide synchronizer assembly and 2nd speed gear off shaft. When reassembling, make certain that oil holes in gear hub register with shaft spline oil channels (four splines have oil channel at front end). Install 2nd speed gear with the ground tapered hub end toward front of shaft, see that synchronizer struts engage slots in synchronizer rings, use new lock ring in shaft groove and carefully fit ring in groove. Check 2nd speed gear endplay which should be .003-.016".

Synchronizer Assembly: Need not be disassembled (can be removed as a unit by sliding it off front end of mainshaft). To disassemble, lift out synchronizer rings, slide outer sleeve off inner hub, lift out three synchronizer struts or plates and springs. When reassembling, place three struts in position in hub slots, install synchronizer springs with one end of each spring engaging same groove in strut and with springs extending around hub in opposite directions. Install outer sleeve with shifter fork groove toward undercut on hub, and install assembly on mainshaft with this end toward rear of transmission.

Countergear Cluster: Examine bushings for wear and replace if clearance greater than .005". Install new bushings with Replacer J-1572 (position bushings with annular groove nearest end of shaft, draw both bushings in until end .015" beyond thrust face of gears). Ream bushings to .865" using KMO-338 Reamer (pilot reamer in bushing at opposite end of gear and ream each bushing in succession). When installing assembly in case, place thin thrust washer in case at each end (bronze surface out toward gear, washers engaging retaining pins in case), place steel washer on rear face of cluster gear with tongue engaging slot in end of gear. Check endplay which should be .006-.016".

Reverse Idler Gear: Replace bushing if clearance exceeds .005". Install bushing with Replacer J-1572. Ream to inside diameter of .865" using Reamer KMO-338 and pilot. Clearance should be .001-.0025".

Main Drive Gear: To remove bearing, take out lock ring in shaft groove, use Puller J-1134-H. Install bearing with Replacer J-1570, install lock ring in shaft groove but do not install retainer ring in bearing groove until after assembly installed in transmission case.

TRANSMISSION REASSEMBLY: After all sub-assemblies completed, reassemble transmission by reversing disassembly directions except as noted below:

Main Drive Gear Installation: Insert gear and bearing assembly through cover opening in case, push through hole in front of case until retaining ring groove in bearing exposed at front of case, install retainer ring. Install pilot bearing rollers in recess in gear hub (use viscous grease to hold rollers until mainshaft installed).

Mainshaft Assembly Installation: With shaft in place in case, place rear bearing and bearing retainer on end of the shaft, use three special bolts ½" longer than regular capscrews to pull retainer up against housing and push bearing on shaft (draw bolts up evenly). Remove bearing retainer, use regular capscrews when retainer finally installed (after speedometer gear installed).

Countershaft Installation: After mainshaft installed, lift countergear cluster up in case (use care not to dislodge thrustwashers), insert beveled end of countershaft at rear of case, drive countershaft in with a soft hammer (coat last 1½" section with red lead for sealing) making certain that shaft turned so that locking plate can be engaged. Install locking plate to lock countershaft and reverse idler shaft.

Reverse Idler Shaft Installation: Make certain that shaft turned to proper position for lock plate engagement, tap shaft into case, coating outer section with red lead or other sealer, drive shaft into place with a soft hammer. Install locking plate (see Countershaft Installation).

Shifter Shaft: Two types of oil seal used—correct type must be used with each type case (see below). To install shift shaft, lubricate shaft with engine oil, insert shaft in case, lock in place by driving lock pin in hole in case (pin engages groove in shaft). Install rubber sealing washer, outer shift lever, plain washer, shakeproof washer, tighten nut securely. Check by rotating shaft. If more than slight drag noted, check oil seal for interference.

►**Oil Seal Change**—*Two types used. Not interchangeable. Correct type must be used as follows:*

	Shift Shaft Seal	Transmission Case
First Type①	163251	300423③, 300917④
Second Type②	301495	301841③, 301838④

①—(Cars without Overdrive with 15x7.10 Tires)—Before Serial No. 7354 & No. 7498 to 7603 incl. (Cars without Overdrive with 15x7.60 Tires)—Before Serial No. 6324. (Cars with Overdrive)—Before Serial No. 21666 & No. 21910 to 22052 incl.

②—Cars after above serial numbers.

③—Without Overdrive. ④—With Overdrive.

Shifter Rail Lock Balls & Springs: 2nd & High spring and lock ball should be inserted in case first, install 2nd & High shift rail, then insert interlock plunger, install Low & Reverse shift rail, finally insert Low & Reverse lock ball and spring. See spring data below.

►***CAUTION—Different type springs used in each type transmission—correct type spring must be used to insure transmission not jumping out of gear.***

Shift Rail Springs

	Low & Reverse	Second & High
Std. Trans.	9 lbs. (41151)	9 lbs. (41151)
With O.D.	30 lbs. (41236)	19 lbs. (163442)
With HDM	19 lbs. (163442)	19 lbs. (163442)
With O.D. & HDM	30 lbs. (41236)	19 lbs. (163442)

O.D.—Overdrive. **HDM**—Hudson Drive-Master.

HUDSON SUPER-MATIC DRIVE

Pacemaker, Model 500 (1950), 4A (1951) Optl.
Super Six, Model 501 (1950), 5A (1951) Optl.

DESCRIPTION: Super-Matic Drive consists of a three-speed transmission and overdrive unit with automatic shift mechanism and automatic clutch control. With this installation, whenever Super-Matic "On" button is pushed in, and Automatic 4th-Speed Button pushed in, operation is entirely automatic and controlled by the accelerator pedal (shifts up-and-down through 2nd-3rd-4th automatically and dependent on accelerator pedal position and car speed). An ultra-low gear is also provided and is engaged manually when required. *NOTE*—Fourth speed can be locked out when desired by pulling out Automatic 4th-Speed Button (provides automatic 2nd-3rd up-and-down shifts) or entire automatic shifting can be cut out by pressing Super-Matic "Off" button (car is then operated conventionally by using clutch pedal and gearshift lever).

Upshift Speeds

2nd-to-3rd①	Above 14 MPH.
3rd-to-4th①	Above 22 MPH.

Downshift Speeds

4th-to-3rd (Normal)	18 MPH.
4th-to-3rd (Kick-down)	②
3rd-to-2nd	12 MPH.

①—Engaged by releasing accelerator pedal momentarily.

②—At any speed above 18 MPH. by fully depressing accelerator pedal.

DISASSEMBLY & OVERHAUL: Super-Matic Drive units can be serviced separately as follows:

Clutch Control: *See "Hudson Vacumotive Drive" on Page 2106 in Clutch & Controls Section.*

Automatic Shift Control: *See "Hudson Drive-Master" on Page 2622 in this section.*

Transmission: *See "1948-51 Hudson" Transmission on Page 2773 (preceding).*

Overdrive: *See "Warner Type R10" Overdrive on Page 2658 in this section.*

NASH & NASH-LAFAYETTE 1939-40

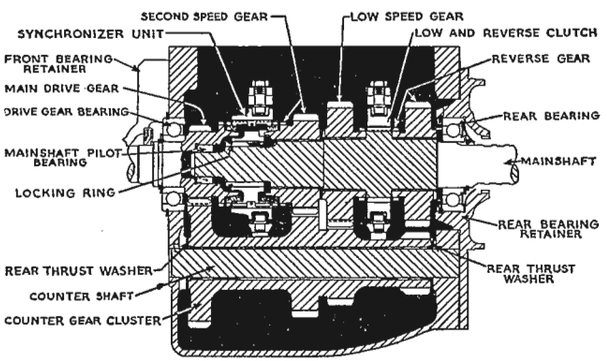
Nash 6 & 8, All Models (1939-40)
Nash-Lafayette, All Models (1939-40)

NOTE:—Steering Column Gear Shift—See separate Nash Transmission Control article.

OVERDRIVE TRANSMISSION NOTE:—1939 Models—Warner Model R6 is optional. Disassembly directions for Overdrive are given below.
See "Warner R6 Overdrive (No Kick-down)."

1940 Models—Warner Model AS12-R6 Overdrive with Electrical 'Kick-down' Control is optional. This type is not same design as used on 1939 cars (similar to 1941 and later types).
See "Warner R6 & R7 Overdrives (With Kick-down)."

DESCRIPTION: Constant-mesh (all gears), synchro-mesh (2nd. & High), all helical gear type. Low & reverse gears are free to revolve on mainshaft (these gears always in mesh with countershaft gears) and are engaged by a sliding clutch sleeve splined on the mainshaft which engages clutch teeth on the gear hubs. Main drive gear (clutch shaft gear) mounted on ballbearing in front end of case. Mainshaft is mounted on pilot roller bearing in drive gear hub (at front), ball bearing in



case (rear) and extends through into overdrive case. Shifter mechanism consists of a yoke on a vertical shaft within the transmission case on the right side which controls the sliding clutch sleeve (rear shaft of low-and-reverse, forward shaft for second-and-high). Detents consist of spring loaded plungers on underside of shifter plate which engage sectors on the shafts. A two-plunger interlock is located in a boss between the two shafts. Adjustment screws which serve as stops for the front (second-and-high) shaft are located in front and right sides of transmission case. A reverse lockout lever for the overdrive unit is located at the rear of the transmission case.

Synchronizing Unit (Second-and-High)—Wire-bound Strut Type Blocking design. Synchronizer rings are loose in ends of inner clutch sleeve and are actuated by struts assembled in slots in inner clutch sleeve and engaging recesses in synchronizer rings. Struts are centralized by locking wire or ring within outer clutch sleeve so that struts move with outer sleeve to engage synchronizer rings during initial movement of sleeve (inner sleeve is stationary on shaft and has no part in synchronizing operation). Teeth on outer rim of synchronizer rings block or prevent gear engagement until synchronization completed when clutch teeth on inner rim of sleeve slide through synchronizer ring teeth to engage teeth on gear hubs.

REMOVAL OF TRANSMISSION: *See "Transmission" on car model page.*

TRANSMISSION DISASSEMBLY NOTE: Overdrive can be removed & disassembled (for work on this unit only **without disturbing transmission assembly** or transmission can be disassembled (for work on transmission only) **without disturbing overdrive assembly** (see disassembly directions below).

OVERDRIVE DISASSEMBLY (without disturbing Transmission): Remove U-joint flange at rear of overdrive case, loosen screws holding overdrive unit on rear of transmission case, move overdrive toward rear and drive shaft toward front (into overdrive case) to prevent free-wheeling unit pulling apart and use extreme care to prevent adapter plate (rear bearing retainer) from moving away from transmission case—**if bearing retainer allowed to move ¼" toward rear, synchronizer will come apart requiring complete dismantling of transmission.** As soon as overdrive has been separated from transmission sufficiently, install one bolt to retain adapter on transmission case, remove overdrive case, pull out reverse release pin. Pull rear shaft off, using rubber band to retain free-wheel rollers, remove retaining screw and washer (in recess in free-wheel cam), remove cam and front thrust washer. Remove clutch and planet gear assembly (do not disassemble unless required—planet gears are split type and must be properly meshed in clutch gear. Sun gear cannot be removed without dismantling transmission.

TRANSMISSION DISASSEMBLY (without disturbing Overdrive): Remove shift levers on top of transmission case, transmission cover and gasket. Install spacer or large nut on each shifter shaft, re-install shaft nuts and washers (this will prevent dis-assembly of shafts and detent and interlock plungers). Straighten locks on fork stud nuts (on top of shaft lugs above forks), remove nuts. Lift both shafts and mounting plate out through top of case as an assembly leaving forks in case. Remove forks being careful not to drop the two fork shoes on each fork in case (remove overdrive oil trough before taking out rear fork). Remove countershaft by removing plug on lower rear face of overdrive case, inserting special SE-568 countershaft pilot and washer retainer tool through this hole and hole in rear end of transmission case and driving countershaft out through front of case (allow tool to remain in gear cluster until shaft re-installed). This will allow the counter gear cluster to drop down in case. Remove overdrive mounting bolts on rear of transmission case, separate adapter plate (rear bearing retainer) from transmission case and withdraw complete overdrive assembly, adapter plate, and mainshaft assembly through rear of case as a unit (use bolt to hold adapter plate and overdrive case together to prevent overdrive coming apart). Disassemble mainshaft units as directed below. Take out front bearing cap mounting screws on front of case, withdraw bearing cap, main drive gear, and bearing assembly through front of case. Lift out counter gear cluster and thrust washers. To remove reverse idler gear, drive shaft out toward rear being careful not to lose key in shaft which engages transmission case.

TRANSMISSION REASSEMBLY: Reverse disassembly directions above and note following data on sub-assemblies:

Mainshaft Assembly:—Parts are assembled on each end of shaft in distinct groups (serviced separately as directed below) as follows: **Rear End**—Reverse Gear, Rear Main Bearing, and Bearing Retainer. **Front End**—Low Speed Gear, Second Speed Gear, and Synchronizer.

Reverse Gear & Rear Main Bearing—To disassemble (with overdrive removed from shaft), free snap ring on front face of retainer at bearing outer race, press shaft and bearing out of retainer toward front (retainer has oil seal or oil shedder in bearing recess and sun gear is mounted on rear face—see note below). Remove snap ring on shaft at rear of bearing, press speedometer gear (plain type transmission only) and bearing off shaft, remove snap ring (this ring holds bearing in retainer and cannot be taken off until after bearing removed from shaft), remove thrust washer and reverse gear. Assemble parts in same order and make certain that one end of bearing snap ring coincides with notch in retainer, use pry bars or screwdrivers to seat snap ring firmly in groove.

Second Speed & Low Speed Gears and Synchronizer Assembly—Entire assembly retained by snap ring on shaft in front of synchronizer unit inner sleeve (1939), locking washer retained by spring loaded plunger in hole in shaft (1940). To disassemble, remove snap ring (1939), use pointed tool to depress plunger so locking washer is free and turn washer so that prongs line up with splines in shaft, withdraw washer and remove all synchronizer unit parts (mark to insure reassembly in same relative positions), thrust washer and key, second speed gear, thrust washer, low speed gear, low-and-reverse clutch sleeve. Reassemble in same manner and note particularly the following points: low speed gear thrust washer lug must be located in gear slot, second speed gear thrust washer must be installed with oil groove toward gear and key installed to retain washer, second speed synchronizer ring must be installed first, then drive synchronizer assembly on shaft (use sleeve SE-589), install snap ring in groove in shaft (1939), install locking washer and turn washer so that prongs engage splines to lock washer in place, see that locking plunger in shaft hole engages washer so that it can not turn.

CAUTION—Synchronizer ring must be turned so notches align with struts in synchronizer sleeve or assembly will be damaged when driven on shaft Synchronizer strut lock ring must be installed with hook on end midway between two struts and engaged between two teeth on outer clutch sleeve (synchronizer will not operate if gap in ring placed at strut so that strut is free to move endwise).

NOTE—Synchronizer assembly will be facilitated if three 2" lengths of .003" shim stock (tapered to ¾" at ends) are inserted directly above struts to retain lock wire in strut notches while spring is compressed to allow assembly of outer clutch sleeve

CONTINUED ON NEXT PAGE

NASH & NASH-LAFAYETTE 1939-40 (Continued)

Mainshaft Installation & Endplay Adjustment—Mainshaft assembly should be installed in transmission with main drive gear (and pilot bearing) in place and counter gear cluster in case but suspended on assembling mandrel (see Counter Gear Assembly below). With high speed gear synchronizing ring in place (struts engaging notches in ring), insert mainshaft through rear of case so that forward end enters pilot bearing in main drive gear. Hold mainshaft so that rear bearing retainer is tight against rear face of case, check endplay of synchronizer bronze clutch ring. Total endplay should be .020". Adjust by installing steel shims between rear bearing retainer and transmission case (1-3 shims normally, more if necessary).

Endplay Adjustment (1940). When installing the rear bearing retainer, install SE-612 gauge between rear face of main drive gear and high speed synchronizer ring, install correct shim thickness between transmission case and rear bearing retainer so that, when mounting screws tightened, gauge clearance will be from .0 to .016" (if gauge tight, add additional shim). CAUTION—Rear bearing retainer must be tight when this check made.

Main Drive Gear & Bearing Assembly:—Bearing retained on shaft by washer and snap ring and can be removed after snap ring has been freed. When assembling drive gear, make certain that oil seal in retainer is in good condition and saturate with engine oil, see that snap ring in place on bearing outer race, assemble in transmission case and install sufficient gaskets between retainer and case so that snap ring held firmly in place without any clearance between retainer and face of case. Mainshaft pilot bearing is retained in gear hub by lock ring.

Counter Gear Assembly:—Install gears in case with thrust washers at each end (washer tongues must engage notches in case above shaft hole) using assembling mandrel SE-563 inserted through front end of case. After mainshaft assembly installed, drive countershaft in through front of case so that mandrel driven out at rear (use wire loop to lift counter gear, if necessary for shaft alignment). Shaft prevented from rotating by setscrew in forward end which engages notch in case.

Reverse Gear:—To assemble, lubricate gear, install with shoulder on gear toward front, drive shaft in from rear with key lined up with notch in case.

Shifter Assembly Installation & Adjustment:—Lubricate fork shoes before installing, make certain that lower ends of vertical shafts engage pivot plugs in bottom of transmission case and that shift fork stud nuts are securely locked after being tightened. Use sealing compound on gasket under shift plate and see that plate is located by two dowels on transmission case (dowel pins must not project above top surface of plate). Adjust as follows:

Shifter Fork Adjustment. When installing shift mechanism mounting plate assembly, adjust shift forks before tightening shift fork nuts as follows: Use SE-612 gear spacing gauge placing narrow section of handle between low speed gear and clutch sleeve. Make certain that shifter shaft in neutral position, tighten rear shift fork nut, bend up lock plate on nut. Use two SE-612 gauges placing large end of one gauge between main drive gear and high speed synchronizer ring, second gauge between second speed gear and second speed synchronizer ring. See that shifter shaft in neutral position, tighten front shift fork nut, bend up lock plate on nut. Adjust Second & High Synchronizer Clutch Stops

Low-and-Reverse Clutch—Install operating lever on upper end of shaft and check operation. With lever in neutral position (detent plunger engaging center notch on sector), outer clutch sleeve should be centered on shaft gear and fork shoes should be free in clutch groove. To adjust, loosen fork stud nut, shift position of fork in relation to lever on shaft. Tighten nut securely and lock with lock plate

Second & High Synchronizer Clutch Stops. Install lever on forward shaft, place lever in neutral position (detent plunger engaging center notch in sector), check to see that outer clutch sleeve centered so that both synchronizer rings free and that play is equal. Adjust in same manner as low-reverse clutch by loosening fork stud nut and shifting fork in relation to shaft. Operate lever to engage second speed and check gear engagement and detent and interlock operation. Detent plunger should engage second speed notch in shaft sector and interlock plunger should be seated fully in notch with low-reverse shaft sector with slight clearance and should prevent operation of this shaft. Adjust by loosening locknut and turning limit adjustment screw on side of transmission case which limits front shaft travel. Engage high speed and check in same manner (adjusted by turning limit adjustment screw on front of case in same manner).

Overdrive lockout (Reverse release)—Lever at rear of case pivots on pivot pin which is mounted on fulcrum stud in rear of case. To check operation, place transmission in reverse gear and overdrive in conventional position. When rear shaft lever is moved, lockout pin should have slight (.005") movement.

OVERDRIVE UNIT

DISASSEMBLY & REASSEMBLY: *See Warner Overdrive data as follows:*

1939—*See Pg. 2642 "Warner R6 Overdrive (No Kickdown)."*

1940—*See Pg. 2649 "Warner R6 & R7 Overdrive."*

ADJUSTMENT:—Manufacturer recommends that no attempt be made to adjust overdrive cut-in speed (pawl adjustment) unless accurate spring scale used to measure pawl spring tension and assure equal and correct adjustment of both pawls. Pawls are adjusted by removing plug on top of overdrive case and turning shaft so that holes in clutch collar and pawl in which adjusting screws located line up. Each screw (two screws—one for each pawl) should be adjusted equally. Turn screws in to raise cut-in point, out to lower cut-in point, being certain that both screws are adjusted equally and turned so that they **do not interfere with the clutch collar.** Cut-in speed should be as follows:

Car Model	Cut-in Speed
Nash & Nash Lafayette ('39)	38-42 MPH.
Nash & Nash-Lafayette ('40)	33 MPH.

NOTE—One pawl adjusting screw has single slot in head, opposite screw has double slot to avoid possibility of adjusting the same screw twice.

NASH "600" & STATESMAN SYNCHRO-MESH

"600", All Series (1946-49)

Statesman, All Series (1950-51)

►CHANGES, CAUTIONS, CORRECTIONS

►**1946-47 TRANSMISSION SHIFT SHAFT & FORK CHANGE (To correct gear disengagement caused by distortion of Fork or Quadrant):** On cars before Serial No. K-140220, check clearance between rear face of synchronizer shift collar and front face of 2nd. speed gear with transmission 2nd. speed gear fully engaged. If clearance less than .028" (use feeler gauge), install new type Shifter Fork and Shaft Assemblies (forged quadrants pressed on steel shafts with larger pivots on forks and larger holes in shafts). New type parts replace original design (quadrants brazed on shafts).

►*NOTE—Only new type parts furnished for service. Install complete unit package (High & Second and Low & Reverse Shafts and Forks).*

►**1949 SYNCHRONIZER PRODUCTION CHANGE:** Beginning with Serial No. K-298081 on 1949 "600," Synchronizer Assy. changed to same type as used on Ambassador Six. *This new synchronizer requires different disassembly procedure (see below).*

►**1950 TRANSMISSION NOISE CORRECTION:** Noise in transmission or overdrive may be due to the following conditions caused by incorrect adjustment of the torque tube trunnion:

(1) Transmission rear bearing snap ring wrong size or incorrectly installed (furnished in four thicknesses and must be firmly seated in groove to control mainshaft endplay).

(2) Above snap ring broken by excessive loading due to incorrect torque tube trunnion adjustment causing propeller shaft to protrude more than ⅛-¼".

(3) Dust shield on propeller shaft scraping on trunnion bracket due to incorrect torque tube trunnion bracket adjustment.

See "Nash Hypoid (with Torque Tube Drive) Rear Axle" in Rear Axle Section for Torque Tube Trunnion adjustment.

OVERDRIVE TRANSMISSION NOTE: These transmissions serviced in same manner as standard type (below) except for Overdrive (Warner R10B). *See "Warner R10 Overdrive."*

DESCRIPTION: Three-speed, all helical gear type with constant-mesh, synchro-mesh (Second & High), sliding gear (Low & Reverse).

Synchronizer Unit (1946-49). Special spring and ball type. Outer clutch sleeve (shifting collar) is centered on inner hub by six poppet balls and springs fitted in holes in hub. Synchronizing rings are loose in ends of sleeve and are driven by the Clutch Ring Driver splined on shaft (installed at rear of hub with notched lugs in recesses in hub which engage prongs on synchronizer rings).

Synchronizer Unit (Beginning 1949 Serial No. K-298081). Double-blocker, double-spring type. Synchronizer rings are free in ends of inner clutch

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NASH SYNCHRO-MESH (Cont.)

sleeve and are actuated by three shifting plates or struts which fit in slots in inner clutch sleeve and engage notches in synchronizer rings. Struts are centered in outer clutch sleeve by two wire springs (within struts on either side of inner clutch web) and move with outer clutch sleeve to engage with cones on gear hubs for synchronization. Teeth on rings block or prevent gear engagement until synchronization completed. Inner clutch sleeve is stationary on mainshaft and does not move (retained with second speed gear by locking washer and plunger on forward end).

REMOVAL OF TRANSMISSION: *See "Transmission" on car model page.*

TRANSMISSION DISASSEMBLY: Remove transmission case cover and gasket. Remove shifter shaft nut, washer, and lever from Low & Reverse shifter shaft, drive lockpin out to free shaft (drive pin up), drive shaft out of case as far as possible (use brass drift on inner end) to provide clearance for gear removal (NOTE—Not necessary to drive out Second & High shifter shaft). Remove capscrews in rear bearing retainer, move retainer, mainshaft and gear assembly to rear until synchronizer unit completely disengaged from shaft, remove low & reverse shifter fork, then withdraw retainer and shaft through rear of case (on overdrive transmissions, lower left stud must be removed to permit complete assembly to be withdrawn). Drive the countershaft lock out to free shaft. Use Countershaft Aligning Tool J-2632 to drive countershaft out through rear of case allowing countergear cluster to drop down on small diameter of aligning tool. Take out capscrews in bearing retainer on front of case, remove retainer, withdraw main drive gear assembly through front of case, lift out front synchronizer ring through top opening of case. Turn synchronizer assembly at right angles and lift it from case (CAUTION—Shifter shoes will drop out as synchronizer removed from fork—remove shoes from case). If reverse idler gear being removed, drive shaft out through rear of case using a long punch (CAUTION—do not damage shaft or gear), lift gear out. Remove forks from shifter shaft quadrants. Remove lever on outer end of Second & High shift shaft, drive out lockpin. Remove both shifter shaft assemblies from within case. Remove Second & High speed finder poppet (plunger & spring) from within case, Low & Reverse speed finder poppet from plug hole at bottom of case. Remove Interlock poppet from boss in case between shifter shaft holes. Lift out countergear cluster and thrustwashers. Dismantle and service sub-assemblies as follows:

Main Drive Gear: Remove snap ring from shaft groove in front of bearing, press bearing off shaft. Check mainshaft pilot bearing rollers in gear recess for wear (jar gear lightly on block of wood, if rollers fall out, install new rollers and make certain that retainer ring installed in recess). Press bearing on shaft with snap ring groove toward front, install ring in this groove (.076-.0785" thick, not variable). Install snap ring in shaft groove making certain that snap ring is snug fit in groove (selective fit—this ring furnished .092", .095", .098" thick).

Mainshaft & Gears: Remove clutch ring driver from front end of shaft, rotate 2nd. speed gear thrust washer until tongues on washer line up with spline grooves, remove washer, slide synchronizer ring, 2nd. speed gear, and low-reverse sliding gear off shaft. Remove snap ring from rear bearing retainer (in front of bearing), tap shaft and bearing out of retainer toward front using a brass drift. To remove bearing, remove snap ring from shaft at rear of speedometer gear, remove gear, lift out gear woodruff key, press bearing off. Inspect all parts for wear.

Mainshaft Rear Bearing—Press bearing on shaft with closed end forward and tight against shoulder on shaft. Install speedometer gear (and woodruff key) install snap ring in shaft groove, selecting ring for snug fit (this ring furnished .087", .090", .093" thick). Install shaft and bearing assembly in rear bearing retainer with bearing seated firmly in retainer recess, install snap ring in retainer groove, selecting ring for snug fit so that shaft has no endplay (furnished .062", .065", .068", .071" thick).

Low-reverse Sliding Gear—Shift collar must be toward rear and gear must slide freely on splines.

Second Speed Gear—Gear synchronizer cone must be forward and gear turn freely on shaft. Push thrust washer on shaft against gear, revolve washer until tongues engage groove in shaft splines so that washer is locked in place (washer will be held in place by clutch ring driver). Check gear endplay with feeler between rear face of gear and shoulder on shaft. Endplay should be .002-.010".

Synchronizer Assembly (1946-49): If these parts to be dismantled, mark the hub and sleeve to insure reassembly in same position, slide sleeve off hub being careful not to lose poppet balls and springs which will fly out of hub holes. When reassembling, use piston ring compressor to retain springs and balls in hub, slide sleeve on hub with chamfered side of sleeve toward long end of hub.

Synchronizer Ring & Driver—Engage synchronizer ring in gear cone (prongs forward), engage Clutch Ring Driver on shaft splines with short lugs toward 2nd. speed gear and in line with notches in gear thrust washer. Turn synchronizer ring so that prongs line up with notches in driver, push driver in place against gear (locks thrustwasher in place).

Synchronizer Assembly (1949 & Later): Hub and sleeve are marked by etched line to insure correct reassembly. If disassembled, install struts with open face toward inner clutch sleeve and with hooked end of each spring wire engaged in the same strut (free end of spring will be between this strut and next strut in a clockwise direction).

Rear Bearing Retainer Mainshaft Bushing & Oil Seal: Bushing and oil seal installed in rear end of retainer extension housing. Oilite bushing can be replaced with oil seal out as follows:

Bushing Replacement—Remove old bushing through rear of housing. Assemble felt oil ring on new bushing, press bushing in housing until shoulder on bushing is ¼" from shoulder in housing.

►*CAUTION*—Felt oil ring must not be compressed.

Oil Seal Installation—Use driver J-1556 to install oil seal in recess at rear of housing.

►*CAUTION*—Seal must be inserted with lip on leather toward front.

TRANSMISSION REASSEMBLY: After all sub-assemblies serviced as above, reassemble transmission by reversing disassembly directions and note the following important points:

Reverse Idler Gear: Beveled side of gear teeth must be forward. Drive the shaft in from rear until lock slot is flush with rear face of case (slot should face countershaft).

►*CAUTION*—Low & Reverse Shifter Shaft must be installed before reverse idler gear installed.

Countergear Cluster: Use heavy lubricant on thrustwashers, insert gear cluster and front thrustwasher in case (lip on washer lined up with slot in case),

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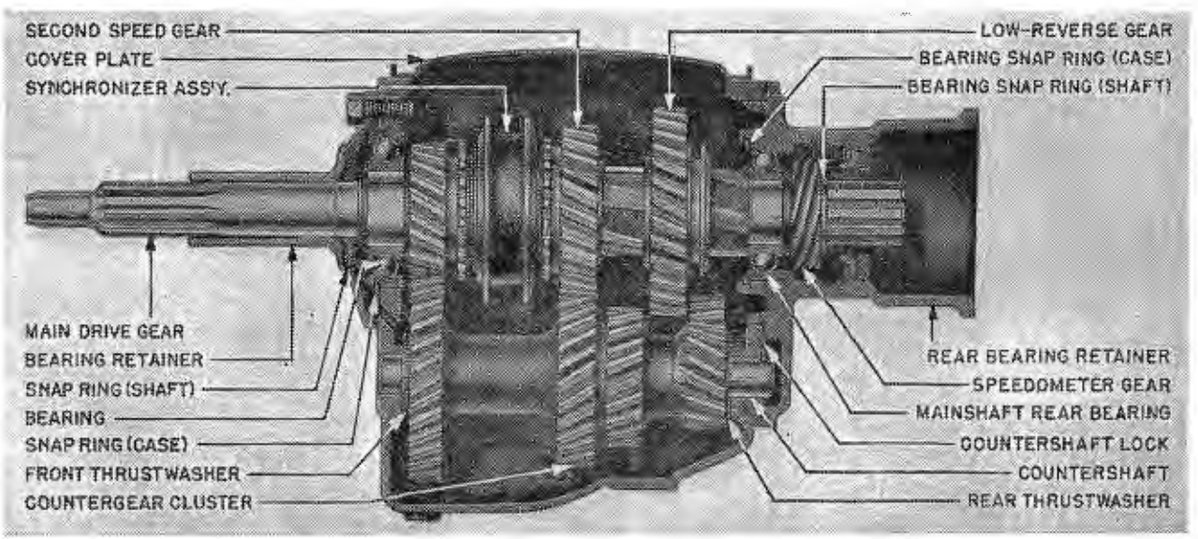


NASH '600" & STATESMAN TRANSMISSION (NO OVERDRIVE)

NASH "600" & STATESMAN (Continued)

install rear thrustwasher through hole in case, insert J-2632 aligning tool to retain parts while remainder of transmission assembled. After all parts installed, tap countershaft in through rear of case (take care not to damage thrustwashers) until lock slot flush with rear face of case, install lock plate in slots in countershaft and reverse idler shaft.

Shifter Shaft Assemblies: Inspect needle bearings in case before installing second-high shifter shaft, replace nedle bearings, if necessary, with special driver. After installing speed finder poppets and springs, and interlock poppet, insert shaft from inside case but do not install lock pins and levers until transmission completely reassembled. Install synchronizer assembly in second-high fork (use heavy grease to retain fork shoes).

Main Shaft & Rear Bearing Retainer: Place standard .010" shim (with gasket on each side) on face of rear bearing retainer, insert assembly through rear of case and work shaft through synchronizer assembly hanging in shift fork, being careful to **line up clutch hub recesses with clutch ring driver prongs.** Line up low & reverse shift fork with collar on low-reverse gear. After main drive gear installed, check mainshaft endplay (synchronizer ring clearance) and adjust as follows:

Mainshaft Endplay Adjustment—Controlled by shim thickness under rear bearing retainer. Check and adjust as directed below. *CAUTION—Each type synchronizer requires special gauge and different setting:*

With 1946-49 First Type Synchronizer—To check synchronizer ring clearance, insert special clearance gauge, Tool J-1542, at each end of synchronizer sleeve while holding rear bearing retainer tight against case. If clearance not equal to gauge thickness (.105"), adjust by increasing or decreasing shim thickness at rear bearing retainer. Rear bearing retainer capscrews can be installed after this adjustment completed. *CAUTION*—Gasket must be installed on each side of this bearing retainer shim.

With 1949 & Later Type Synchronizer—Use special clearance gauge, Tool J-1410 (.075"). Clearance should be .060-.080". Checking and adjusting procedure same as for first type synchroinzer (above).

Main Drive Gear: When installing gear in case, line up synchronizer ring prongs with slots in clutch ring driver. Install bearing retainer with new gasket and line up oil return holes in retainer and case. When tightening capscrews, note whether retainer contacts bearing before contacting case and correct this condition by **installing additional gaskets under retainer.** Main drive gear endplay must not exceed .005" and should preferably be .000".

Shifter Fork Alignment: After assembly completed, shift transmission into Second Gear and make certain that gear fully engaged. Measure clearance between rear face of synchronizer clutch shift collar and front face of second speed gear which must not be less than .028". If less, shifter fork or quadrant has been distorted and should be replaced.

Transmission Cover Plate: Install gasket on case with vent hole to rear (mark FRONT forward), install cover with vent hole forward and see that this vent is clean and open.

1941-49 NASH AMBASSADOR

Ambassador Six, All Series (1941 to 1948)
Ambassador Six, Series 4960 (Early 1949)
Ambassador Eight, All Series (1941-42)

►CHANGES, CAUTIONS, CORRECTIONS

►**1949 TRANSMISSION CHANGE:** This Nash transmission (with Optl. Warner Overdrive) used only on Early 1949 cars. Later cars have Warner Transmission.
See Warner Transmission data for later 1949 cars.

►**1947 TRANSMISSION SHIFTER SHAFT & FORK CHANGE After Serial No. R-444510 (Std. Trans), R-443972 (Overdrive Trans.):** New type heavier Shifter Shafts, Forks, and Sleeves used beginning with above serial numbers. These new parts furnished for service on earlier cars and **entire group of new parts** must be installed as an assembly (cannot be installed singly on earlier cars).

►*IDENTIFICATION NOTE*—New design parts have **forged** quadrants which are pressed on machined steel shafts.

►**1942-47 REPLACEMENT SHIFTER SHAFT & FORK ASSEMBLIES:** New type parts (see Identification Note below) are furnished in group package for installation on models listed below. Previous type parts are not furnished for service and **new type parts must be installed as complete assemblies** (cannot be used singly with previous type parts). This change applies to following cars:

Series 4260, 4280, 4660	All Cars
4760 (No Overdrive)	Before Serial No. R-444510
4760 (With Overdrive)	Before Serial No. R-443972

►*IDENTIFICATION NOTE*—New design parts have **forged** quadrants pressed on machined steel shafts, larger diameter pivots and pivot holes, deeper interlock notches, and two annular grooves in shaft sleeves (sleeves have larger I. D. to fit larger shafts).

►**1947 TRANSMISSION MAIN DRIVE GEAR, BEARING RETAINER & LOCK RING CHANGE (Starting Serial No. R-432468 Std. Trans., R-432167 Overdrive Trans.):** Lock ring in bearing changed from .065" thick to .077" and new type main drive gear and bearing retainer used.

Main Drive Gear—New type gear can be identified by absence of oil hole (first type gear has oil hole drilled in shaft from point in front of bearing to recess in front of mainshaft pilot bearing rollers).

Front Bearing Retainer—New type retainer has lock ring counterbore 3 5/32" in diameter and .064-.067" deep (first type retainer counterbore 3 7/64" diameter and .078" deep).

►*CAUTION—New and previous design parts must not be interchanged and each type must be installed differently (see Transmission Asembly direction).*

OVERDRIVE TRANSMISSION NOTE: These transmissions serviced in same manner as standard type (below) except for Overdrive Unit which is Warner Type R7C (1941-46), Type R10 (1946-48).
See "Warner R6 & R7 Overdrive (With Kick-down)" and "Warner R10 Overdrive."

DESCRIPTION: Three-speed, all helical gear type. Constant-mesh, synchro-mesh (Second & High), sliding gear (Low & Reverse). Main drive gear mounted on ball bearing in front of transmission case (see Production Change above). Mainshaft is mounted on roller bearing in main drive gear **(front), ball bearing in retainer cap on case (rear).** Countergear cluster is mounted on roller bearings on stationary shaft with thrust washers at each end. Second speed gear is retained on mainshaft as an assembly with the synchronizer unit by a splined locking washer retained by a spring-loaded lock plunger installed in the shaft directly in front of the synchronizer inner hub.

Synchronizer Unit — Double-blocker, double-spring type. Synchronizer rings are free in ends of inner clutch sleeve and are actuated by three shifting plates or struts which fit in slots in inner clutch sleeve and engage notches in synchronizer rings. Struts are centered in outer clutch sleeve by two wire springs (within struts on either side of inner clutch web) and move with outer clutch sleeve to engage with cones on gear hubs for synchronization. Teeth on rings block or prevent gear engagement until synchronization completed. Inner clutch sleeve is stationary on mainshaft and does not move (retained with second speed gear by locking washer and plunger on forward end).

Transmission Interlock (1942 On): Consists of a cam lever riveted to a tubular pin which is a slide fit in the hole directly behind the speed finder plunger locating screw so that notches in top of lever engage shift yoke pins on back of yokes. When either yoke moves to engage a gear, the yoke pin engages a cam on the interlock lever so that lever is rocked to lock opposite yoke in neutral position.

REMOVAL OF TRANSMISSION: *See "Transmission" on car model page.*

TRANSMISSION DISASSEMBLY: Remove cover capscrews, lift off cover and baffle, remove mounting capscrew and lift oil trough out. Move both shifter shaft levers away from each other slightly so that speed finder plungers move out of notches in quadrants, tighten speed finder lockscrew (on outside of case between lever shafts) to hold plungers away from quadrants. Mark shift levers and shafts to insure correct reassembly, remove levers, drive shaft lockpins up and out of bosses in case. Use soft drift to drive shifter shafts toward outside of case as far as possible, lift off oil seals, retainers, and shaft sleeves which will be pushed out of case. Remove low-reverse shifter fork, remove interlock, remove second-high shifter fork (work pivot end toward rear as fork slips out of collar). Remove low-reverse shifter shaft (move sliding gear toward rear of case for clearance) and second-high shifter shaft (slide clutch sleeve to rear for clearance, turn shifter shaft so that pivot hole is downward, pass quadrant under synchronizer until end of shaft free from hole in case). Remove capscrew and washer on rear end of mainshaft, pull companion flange (Puller J-1412). Remove capscrews in rear bearing retainer and rotate retainer to expose countershaft hole in rear face of case (on Overdrive Transmissions, merely take out pipe plug at rear of overdrive case). Use Countershaft Aligning Tool J-1415-A to drive countershaft out at front of case so that countergear cluster drops down on small diameter of tool. Remove capscrews and nuts retaining rear bearing retainer cap (or adapter plate on overdrive transmissions), withdraw mainshaft and gears through rear of case as an assembly (CAUTION—On overdrive models, use extreme care that adapter plate does not separate from overdrive case which would require dismantling of overdrive to reassemble freewheel rollers—install one screw to hold adapter

CONTINUED ON NEXT PAGE

1941-49 NASH AMBASSADOR (Continued)

plate and overdrive case together while off transmission). To remove main drive gear, take out screws in bearing retainer on front of case, withdraw gear and bearing as assembly. Lift countergear cluster and thrust washers out of case. To remove reverse idler gear, use long brass drift inserted through front of case to drive shaft out toward rear. Dismantle and service sub-assemblies as follows:

Main Drive Gear: Remove snap ring from shaft, press bearing off in arbor plate using J-1298-N bearing plate. Check mainshaft pilot bearing rollers in recess for wear (jar gear lightly on block of wood, if roller falls out, install new rollers and make certain that retainer ring installed in recess). Press bearing on shaft with snap ring groove toward front, use tool J-1416 to install snap ring in shaft groove making certain ring is snug fit in groove (selective fit—furnished .087", .090", .092", .093", .096" thick). Large snap ring installed in bearing groove should be .065" thick (first type gear with oil hole in shaft), .077" (later type gear without oil hole).

See Production Change Note above for data on this parts change.

Synchronizer & Second Speed Gear:—To dismantle assembly, depress locking plunger under lock ring in front of synchronizer inner clutch sleeve with a sharp pointed tool, revolve lock ring one spline so that it is free and withdraw from shaft, remove synchronizer, bronze thrustwasher, second speed gear, steel thrustwasher. Sliding gear can then be removed from shaft. Install assembly in same manner selecting retainer washer of correct thickness so that second gear endplay is .002-.004" with retainer installed. See that retainer turned so that it is locked in place in mainshaft splines and that locking plunger prevents retainer from turning.

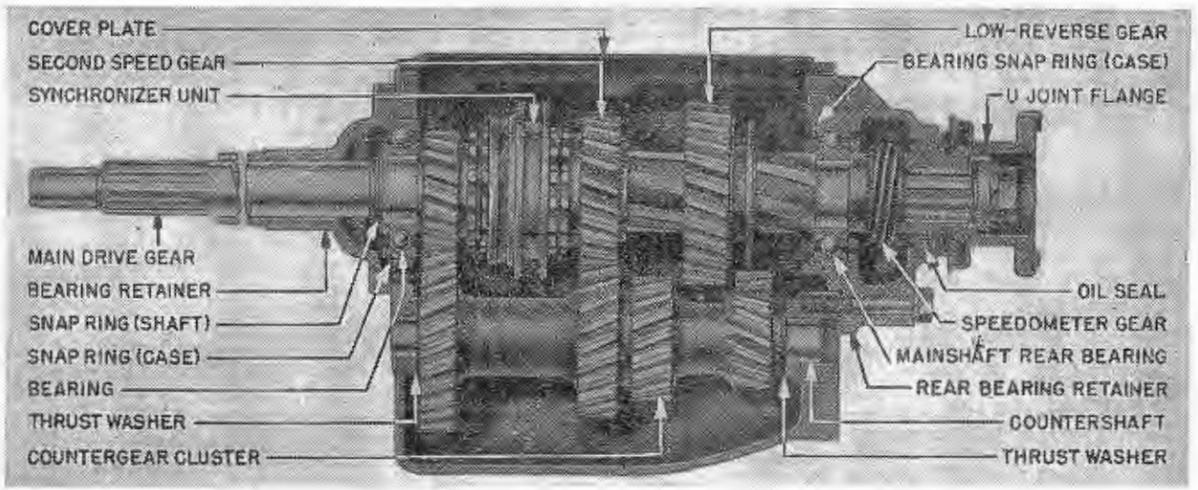
►*CAUTION*—Install second speed gear steel thrustwasher with chamfer toward rear end and tongue in line with notch on spline shaft, install bronze thrustwasher with tongues toward front of shaft and **rotate washer so that tongues engage notches in splines** (see that washer does not slip out of place when installing synchronizer).

Synchronizer Unit—Inner and outer clutch sleeves and rings should be marked before disassembly to insure reassembly in same positions. Install struts with open face toward inner clutch sleeve and hooked end of each spring wire engaged in the same strut (free end of this spring will be between this strut and next strut in clockwise direction).

Mainshaft Rear Bearing: Remove snap ring from recess in rear bearing retainer (in front of bearing), tap shaft and bearing out of retainer toward front using a brass drift. To remove bearing, slide speedometer gear off shaft, press bearing off. Install bearing with closed side forward. On overdrive cars, overdrive unit must be dismantled and snap ring on shaft behind overdrive sun gear removed, then press shaft out (will not disturb sun gear assembly).

Reverse Idler Gear:—Idler gear should be removed by driving shaft out toward rear. When installing idler gear, see that chamfered edge of gear teeth is toward front of case.

Countergear Assembly:—When installing countergear cluster, install thrust washer at each end with tongue in line with slot in case (washers may be held by grease while installing gears. Allow gears to hang down on small diameter of tool J-1415-A while main drive gear and mainshaft are being assembled then push out tool by inserting countershaft at forward end of case. CAUTION—Use care not to damage thrust washers.



NASH AMB. 6 & 8 TRANSMISSION (NO OVERDRIVE)

TRANSMISSION REASSEMBLY: After all sub-assemblies serviced as directed above, reassemble transmission by reversing disassembly directions and note the following important points:

Mainshaft Rear Bearing Retainer Installation: Install same number and thickness of shims (as removed when transmission disassembled) on face of retainer with new gasket on each side of shim pack. Bolt retainer in place and after assembly completed, check and adjust mainshaft endplay as follows:

Mainshaft Endplay—Controlled by thickness of **shims between rear of transmission case and rear main bearing cap or overdrive adapter. With transmission assembled,** install shift collar centering gauge tool J-1410 (.075" thick) between front face of high speed synchronizer ring and rear face of main drive gear, place second gauge similarly between second speed synchronizer ring and second speed gear. Gauges should slip into position freely and will center the synchronizer sleeve. Front gauge should be from a tight fit to .015" clearance (corresponding to .000-.015" endplay). Adjust by adding or removing shims from between rear bearing retainer and face of transmission case (above).

Main Drive Gear & Bearing Retainer Installation:

►*CAUTION—Make certain that correct type parts used together (see Production Change Note above).* Check thickness of snap ring in bearing groove (.065" thick for first type gear with oil hole in shaft, .077" thick for later type gear without oil hole), and make certain that correct type bearing retainer used for each type gear. Install main drive gear in front end of case, install each type bearing retainer exactly as follows:

First Type Retainer (with .078" deep lock ring counterbore)—This type retainer must be fitted when installed on case (inner face of counterbore contacts front face of bearing and forces lock ring against case). Press retainer firmly in place against bearing, use feeler gauge to measure clearance between face of retainer and transmission case, **install sufficient gasket thickness at this point to take up clearance** (gaskets furnished in various thicknesses). With retainer bolted in place, drive gear endplay must not exceed .015" (.000" preferred).

Later Type Retainer (with .064-.067" deep lock ring counterbore)—With this type retainer, lock ring is clamped between counterbore and face of transmission case. Use a new gasket under the retainer and make certain that oil return hole is at bottom with retainer installed on case. Drive gear endplay must not exceed .015" (.000" preferred).

Shifter Shafts: When installing shifter shaft forks, see that low and reverse fork installed with longer segment at top. Cork oil seals and retainers are installed on outer ends of shafts and shaft bushing retaining pins should be installed from the top.

NOTE—Use tool J-2633 to install oil seals.

Speed Finder Locating Screw—Located on side of transmission case between shifter shafts. Need not be disturbed to remove detent plungers but if removed, screw should be adjusted so that inner end engages flattened portion of plungers to prevent plungers turning but must not cause plungers to bind. Lock adjustment with locknut.

►*CAUTION*—After transmission assembly completed, screw should be backed off just enough so that speed finder plungers operate freely, lock adjustment by tightening locknut.

Transmission Cover: With oil trough installed in case and mounting capscrew tight, install baffle with vent louvre at rear of case, install cover with vent on right side. NOTE—Use gasket on each side of baffle.

PACKARD 6 & 8 SYNCHRO-MESH

Six & Eight, All Models (1939-50)
Super Eight, All Models (1940-50)
Custom Eight, All Models (1940-48)
200 & 300, All Models (1951)

►**ULTRAMATIC DRIVE NOTE**—Automatic transmission optional on above models. *See "Packard Ultramatic Drive (beginning Pg. 2782).*

►**OVERDRIVE NOTE:** *Various Overdrive units used with this transmission as follows:*

1939 Warner Type R6—*See Pg. 2649 "Warner Type R6 & R7 Overdrive."*

1940-48 Warner Type R9—*See Pg. 2654 "Warner Type R9 Overdrive."*

1949-51 Warner Type R11—*See Pg. 2660 "Warner Type R11 Overdrive."*

DESCRIPTION: Constant-mesh, synchro-mesh (2nd. & High), constant-mesh (Low) helical gears, sliding spur gear (Reverse). Second-speed & Low-speed gears are mounted on special double-row ball bearings on mainshaft (furnished as assembly with shaft). Second and high are engeged by synchronizer unit on mainshaft, low speed gear by clutch teeth in sliding reverse gear which engage clutch teeth on low gear hub.

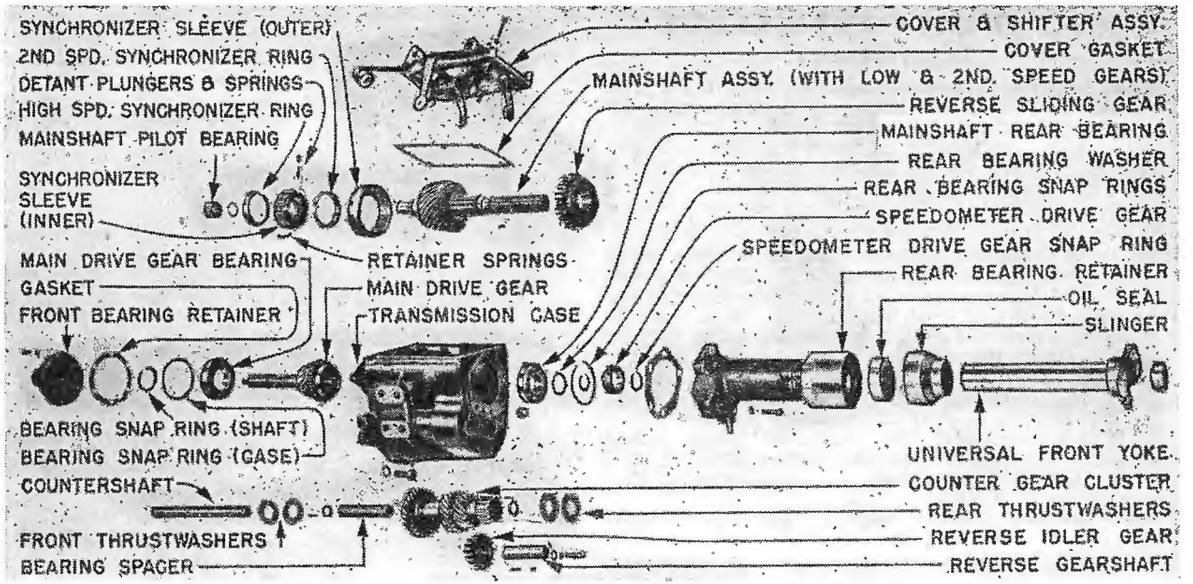
Synchronizer Unit—Special spring-and-plunger type with loose synchronizer rings retained in ends of inner clutch hub by three flat retainer springs. Outer clutch sleeve is centered on inner hub by three spring-loaded detent plungers which engage a groove cut at the center of the outer clutch sleeve.

►**OVERDRIVE TRANSMISSION DISASSEMBLY:** *See Warner Overdrive data for disassembly of overdrive and note following important points:*

1939 Transmission Mainshaft Endplay. The shaft should fit in overdrive adapter plate without perceptible endplay. Endplay controlled by mainshaft rear bearing front snap ring (which engages groove in adapter plate), spacer and rear snap ring behind bearing (this snap ring engages groove in shaft. These snap rings furnished in .003" steps as follows: No. 338472, 3, 4, 5 (Front Snap Ring—thinnest to thickest). No. 338458, 9, 338460, 1 (Rear Snap Ring—Thinnest to thickest).

1939 Overdrive Rear Bearing. Two types used. First type has compressible spacer sleeve on shaft between bearings with bearing pre-load controlled by universal joint flange nut on rear end of shaft. This type bearing assembly should be changed to second type (with bearing adjustment controlled by Belleville type spring washer between bearings) whenever overdrive unit disassembled or bearings removed, by installing Solid Spacer No. 341264, Belleville Spring Washer No. 341266.

CAUTION—On models with this first type bearing, universal joint flange nut must not be loosened which will disturb bearing adjustment. If bearings dismantled or adjustment lost by changing nut position, re-adjust bearings as directed in Warner Overdrive article. NOTE—On later cars with Belleville type washer between bearings, universal joint nut should be kept tight (nut does not control bearing adjustment). These cars may be identified by letter 'M' stamped on side of universal joint flange.



PACKARD 6 & 8 TRANSMISSION

REMOVAL OF TRANSMISSION: *See "Transmission" on car model page.*

DISASSEMBLY OF TRANSMISSION: Take out mounting screws and lift off cover and shifter assembly. Remove nut on rear end of mainshaft at universal joint yoke and remove yoke from shaft (nut not used on later cars where yoke is free on mainshaft splines). Remove rear bearing retainer, take out snap ring and slide speedometer gear off Take out mounting screws and remove front bearing retainer. Drive countershaft out (see Note below), remove main drive gear and bearing through front of case. Move mainshaft assembly to rear until rear bearing free of case, tap bearing off shaft, then remove mainshaft through top of case. Lift counter gear cluster and thrustwashers out through top of case. To remove reverse idler gear, remove retaining capscrew and washers on rear end of shaft, drive shaft out through rear of case (use drift inserted through front of case), lift out reverse gear. Remove two countershaft thrust springs, use small punch to drive out thrust spring plugs.

Countershaft Note—Shaft must be driven out toward front (key in forward end of shaft engages slot in front end of transmission case). Use J-2559 countershaft assembly bar to drive shaft out and leave tool in counter gear cluster to retain bearing rollers until re-installed. **Overdrive Model**—Remove overdrive case drain plug (on rear end of case at bottom) and insert J-2559 tool through this hole to drive countershaft out.

OVERHAUL: Disassemble and overhaul all sub-assemblies as follows:

Synchronizer Unit: To disassemble, press outer sleeve off inner clutch hub by hand (CAUTION—use care not to lose detent plungers and springs which will fly out). Remove three retainer springs, lift out synchronizer rings. When reassembling, use Clamp J-2563 to hold plungers and springs in place, install synchronizer sleeve with wider shoulder of external groove on opposite end from extended hub of inner sleeve.

REASSEMBLY: After overhaul of sub-assemblies:
Synchronizer Travel Adjustment—Check clearance between lug on second-high shifter fork and stop on cover with shift lever in High Gear position. Clearance should be .005" min., .010" max. Adjust by bending lug. CAUTION—If clearance greater than .010", outer clutch sleeve may move too far forward which will allow synchronizer balls and springs to fly out (requiring removing cover & reassembling).

Mainshaft, Low & Second Speed Gear Assembly:—Both low and second speed gears are furnished as an assembly with the mainshaft and should not be removed. These gears are constant-mesh type and are mounted on double row ball bearings on shaft.

Mainshaft Assembly: Install synchronizer on forward end of shaft with wider shoulder of external groove toward second speed gear, then install front bearing spacer on shaft. Install reverse gear on rear end of shaft with shifter groove toward rear or away from low speed gear.

Reverse Idler Gear: Align woodruff key in shaft with slot in case, tap shaft into case until it engages gear, install gear, drive shaft in until key is seated, secure shaft with plain washer, lockwasher, and capscrew.

Countergear Assembly: If roller bearings removed, first install assembly bar J-2559 in gear cluster, in-

CONTINUED ON NEXT PAGE

PACKARD 6 & 8 SYNCHRO-MESH (Continued)

stall bearing spacer, assemble 25 rollers in each end (use grease to retain rollers), install end plate and thrustwasher on each end of gear cluster. Install assembly in bottom of transmission case. **After main drive gear installed,** raise assembly up and insert countershaft through front of case aligning woodruff key with slot in case, drive shaft into place which will push assembly bar out at rear. Install two countershaft thrust springs in openings in case and install thrust spring plugs.

►*CAUTION*—Lips on countershaft thrustwashers must point upward and engage grooves in case.

Main Drive Gear Assembly: Install bearing and retaining ring on drive gear shaft, install snap ring. Install mainshaft pilot bearing in recess in rear end of gear.

Main Drive Gear & Mainshaft Installation: Place mainshaft assembly in case with rear end of shaft extending out through bearing hole, install rear bearing and retaining ring on shaft and tap bearing into place in case. Install main drive gear in case and enter mainshaft in front bearing. Install main drive gear bearing retainer using new gasket and aligning drain passage in cover with hole in case, tighten retainer capscrews. Install rear bearing plain washer, snap ring, speedometer drive gear (CAUTION—see that gear key in place), and gear snap ring.

►**Endplay Note**—Rear bearing and speedometer gear snap rings furnished in various thicknesses and should be selected to eliminate endplay.

Shifter Mechanism:—Yokes on horizontal shafts in cover engage synchronizer clutch sleeve (front shaft), low speed gear clutch and reverse gear (rear shaft) directly without intermediate linkage. Spring-loaded ball type detents are located in bracket on side of cover and engage sectors on shafts. Entire shifter mechanism located in cover and need not be dismantled when cover removed.

Interlock Assembly—If bracket removed, install parts as follows: Place interlock ball spacer and detent ball spring in bracket (interlock spacer toward center, detent ball spring toward outer edge of cover). Place cover on bench with top down, position forks so that center neutral grooves are in line, install bracket (CAUTION—hold detent and interlock balls in position in bracket, pull shoe ends of both forks together and push down on bracket at the same time so that balls engage center grooves. Install bracket retaining screw.

High-Gear Shifter Lever Travel—Clearance between lug on shifter lever and transmission case cover must be correctly set to prevent excessive lever travel which will allow synchronizer poppet balls and springs to jump out in high gear position. check by shifting to second speed position, and then into high, checking clearance between stops on fork and stop pads in cover in each position. With detent ball seated in groove, clearance should be not less than .002". If clearance not .002" or greater, file or scrape stop pads in cover. Clearance must not exceed .010".

PACKARD SENIOR LINE

Twelve, All Models (1939)

DESCRIPTION: Constant-mesh, synchro-mesh gears (second and high), sliding spur gear for reverse (this gear acts as low speed engaging clutch when shifted forward). Main drive gear mounted on ball bearing. Mainshaft mounted on roller bearing (front), ball bearing (rear). Low and second speed gears mounted on double row ball bearings on mainshaft. Counter gear cluster mounted on double row ball bearing (front), roller bearing (rear). Low gear is engaged by shifting reverse gear on mainshaft forward to engage internal clutch teeth on gear with clutch teeth on low speed gear hub. Second and high engaged by sliding clutch sleeve splined on mainshaft which engages clutch teeth on inside of synchronizing cones on gears.

Synchronizing Unit. Consists of synchronizing drums splined on mainshaft which engage synchronizing cones on gears. Drums actuated by synchronizing yoke pivoted in case. Plunger in dashpot on yoke contacts cam on shifter shaft so that yoke is rocked to engage drum and cones when shifter shaft moved to engage gear (escape of oil from dashpot allows plunger to disengage from cam after synchronization completed, yoke then returned to disengaged position by centralizing springs so that drum drawn out of engagement).

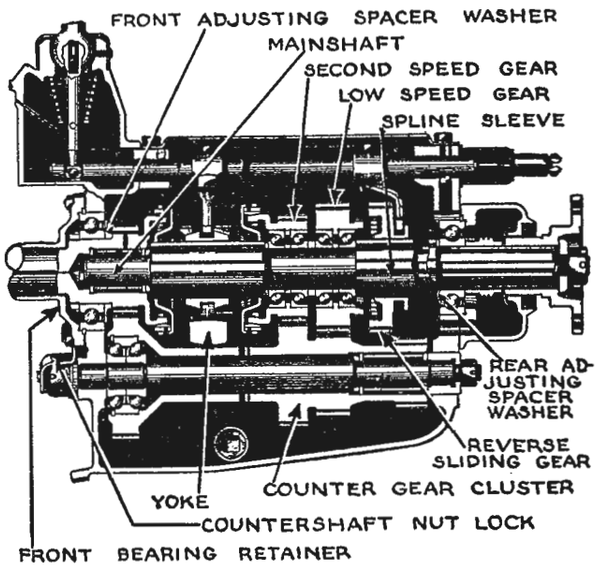
REMOVAL OF TRANSMISSION: *See "Transmission" on car model page.*

DISASSEMBLY: Check synchronizer yoke travel before disassembling transmission (see Yoke Adjustment) and note this figure for use in reassembling transmission.

Disassembly. Remove shift lever and cover, backing switch on rear end of case, shifter shaft and fork assemblies, lock balls and springs. Take off front bearing retainer and countershaft front nut (inside clutch housing). Take off universal joint flange nut, remove flange, take out screws and remove rear bearing retainer. Remove synchronizing yoke lock plates and screws (one on each side of case), and centralizing pin (left side). Remove main drive gear bearing nut. Drive countershaft out toward rear. Remove clutch shaft and main drive gear assembly out toward front. Pull mainshaft assembly to rear until bearing clears case, align slots in sliding clutch sleeve and synchronizing yoke, remove front synchronizing drum, yoke, bronze yoke links, sliding clutch sleeve and rear synchronizing drum through top of case. Move shaft forward and remove reverse sliding gear, spline sleeve (on which reverse gear slides) through top of case. Remove mainshaft and low and second speed gear assembly through top of case. Remove counter gear cluster through top of case. To remove reverse idler gear, take out shaft lockscrew on left side of case, drive shaft out toward rear.

Mainshaft Assembly:—Low and second speed gear bearing adjustment controlled by spacer washers on shaft between inner races of bearings in each gear. These spacers furnished .1875", .1885", .1895" thick. Bearing assemblies retained by reverse sliding gear spline sleeve which acts as spacer when universal flange nut is tightened. Install thrust washer on mainshaft front bearing shoulder with taper face toward rear. Shim on mainshaft between reverse sliding gear spline sleeve and rear bearing (these spacers furnished .0725 to .1105" thick in .002" steps) used to control yoke travel in conjunction with spacer between main drive gear and front bearing furnished .222" to .256" thick in .002" steps.

Synchronizing Yoke Assembly:—Install synchronizing yoke bronze links (drum connection) on each side with relieved side up (latest type has word 'Top' cast in link at this point). See that centralizing screw is engaged between springs in yoke.



PACKARD SENIOR LINE TRANSMISSION

Yoke Travel & Adjustment. To check yoke travel, set up dial indicator so that finger contacts yoke at point adjacent to centralizing screw and measure yoke travel in either direction from center disengaged position. Shift transmission into second and high and note yoke travel in each case back to center. Should be .140" minimum, .160" maximum. This travel will provide correct clearance of .018" between synchronizing drums and cones. Adjust by adding or removing spacers between reverse sliding gear spline shaft and rear bearing on mainshaft, or between main drive gear and bearing at front of case (see Mainshaft Assembly above). Change of .006" in spacer thickness changes yoke travel .040".

Counter Gear Cluster Assembly:—Backlash at 19 and 29 teeth gears should be .003-.004". Install countershaft with mark 'L' on flat at front end toward reverse idler.

REASSEMBLY: Reverse the disassembly procedure.

PACKARD ULTRAMATIC DRIVE

Eight & Super 8, "2300" Series (1949-50)
Custom Eight, "2300" Series (1949-50)
200 & 300 Eight, "2400" Series (1951)
400 Patrician Eight, "2400" Series (1951)

►CHANGES, CAUTIONS, CORRECTIONS

►**STARTING ENGINE BY PUSHING CAR:** If this procedure required for Ultramatic cars, place selector lever in neutral "N" position, turn on ignition. When car has attained speed of 25 MPH., move selector lever to high range "H" position. The car will then crank the engine.

►**TOWING ULTRAMATIC DRIVE CARS:** Cars can be towed with selector lever in Neutral "N" position, **providing Ultramatic Drive unit is not damaged and oil level in unit is normal.** Car should not be towed at speed greater than 30 MPH., and should not be towed for any great distance (less than 300 miles). **If selector lever cannot be placed in Neutral,** or if transmission oil level low, disconnect drive shaft at rear end and securely fasten it up to frame so that it cannot move to the rear (CAUTION—rearward movement will allow front end to slip off transmission mainshaft splines and drop down).

►**CONTROL VALVE LINKAGE PRODUCTION CHANGES:** Following changes made in production require new settings and linkage adjustment procedures as detailed under LINKAGE ADJUSTMENT:

Control Valve Lever & Link Change—First type two-piece adjustable link superseded by one-piece solid link. With first type link, rear land of control valve should be ¾" out of control valve lower body. With second type solid link, rear land of control valve should be 5/16" out of control valve lower body with detent lever in reverse position. *See Control Valve Link Adjustment under Transmission Reassembly.*

Throttle Valve Lever Change—Beginning with Transmission unit No. 106958 (Eight), 6486 (Super & Cust. 8), woodruff key previously used to locate throttle valve outer lever on shaft in transmission case was eliminated to allow lever to be rotated on shaft for adjustment. On earlier transmissions, this key can be removed and discarded if new Throttle Valve Lever Adjusting Gauge PU-334 used to adjust lever. *See Throttle Linkage Adjustment.*

►**REACTOR SHAFT ENDPLAY CHANGE:** Original endplay setting of .018-.022" changed to .010-.015" to provide more running clearance for direct drive clutch driven plate and prevent any tendency of clutch to "hang on." Thrust washers for control of shaft endplay now furnished in .005" steps from .070" to .115" (superseding washers in .010" steps from .060" to .090"). *See Converter reassembly data.*

►**1951 GOVERNOR REMOVAL CAUTION:** Governor cannot be removed from Ultramatic transmission on car as a unit due to small clearance between governor and frame "X" member. Remove governor as follows: Take out governor housing-to-driveshaft retaining screws, remove housing. Then remove adapter by taking out retaining screws and maneuvering adapter out of transmission case. Install adapter and governor housing in same manner. Tighten adapter screws to 7½-8½ ft. lbs. and housing screws to 6-7½ ft. lbs. Pull screws up evenly and check valves in governor housing for free movement after screws tightened.

►**REPLACEMENT OIL COOLER FITTING CAUTION (Early Custom Eight Cars):** Original 90° type elbow fittings not furnished for service (later 45° type, Part No. G444184, furnished for all cars) and following precautions must be observed when replacing flexible hose between oil cooler and intake and return lines on these cars: Turn a new 45° fitting into original 90° elbow at cooler (if necessary to replace oil cooler fitting, solder 45° elbow into cooler tank). Slack off the two forward tubing support brackets, force forward end of tubing back and fix its position so that flexible hose connections are as straight as possible (keep rear tubing brackets tight so that slack taken up by tubing without changing position of rear hose connections), tighten forward tubing support brackets.

DESCRIPTION

Ultramatic Drive is a Torque Converter and Planetary Gear type transmission consisting of the following units:

Torque Converter & Direct Speed Clutch: This assembly is contained in a case mounted on the rear face of the flywheel and consists of the units listed below. Torque converter and direct speed clutch action is automatic and is controlled by the hydraulic system (see Operation—below, and Hydraulic Circuit illustration).

Converter Pump (Driving Member)—Integral with rear section of torque converter case bolted directly on flywheel and positively driven at crankshaft speed. Pump is supported at rear end on hollow shaft carried in babbitted bearing in the bell housing (front oil pump is splined on rear end of shaft and shaft is grooved to provide oil channel into converter).

Turbine (Driven Member)—Two-section type consisting of a First Turbine bolted on a flanged hub which is splined on forward end of converter shaft (direct speed clutch driven member also bolted to this flanged hub), and a Second Turbine bolted to the first turbine with clearance between the two in which the Reactor is located.

Reactor (Stationary Member)—Consists of a set of curved vanes placed between the first and second turbines. Reactor is mounted on a short tubular shaft with an overrunning clutch in the mounting flange at the rear end of the shaft. Reactor is locked or held stationary when unit is operating as a Torque Converter but the overrunning clutch allows the reactor to "free-wheel" or rotate freely at steady car speeds so that the torque converter acts as a fluid coupling except when Direct Drive Clutch locks the entire unit for positive drive.

Direct Speed Clutch—Consists of a hydraulically operated oil-cushioned single plate clutch in forward section of torque converter housing. Clutch driven member is bolted to turbine mounting flange and clutch driving plates are locked in torque converter housing (lugs on plates engage slots in housing), so that the torque converter pump and turbine are positively locked together for positive drive when clutch is engaged. Clutch is engaged hydraulically by admitting oil into housing in front of forward driving plate (plate acts as a hydraulic piston).

Planetary Gear Unit: This assembly is contained in the transmission case directly behind the torque converter and is controlled by the driver through a selector lever directly below the steering wheel. It provides Emergency Low, Reverse, Neutral, and Parking (see Operation below). Operation and control of the transmission is through a hydraulic system for which oil pressure is supplied by two oil pumps built in the transmission (forward oil pump in recess in bell housing and driven by converter pump shaft, rear oil pump in recess at rear of transmission case and driven by output shaft). An oil cooler built in the lower tank of the radiator controls the temperature of the oil. Planetary assembly consists of the following units:

Sun Gears—Consist of two helical gears in tandem on drive (input) shaft with a ball thrust bearing between the gears. Front Sun Gear (Low Range Reaction Gear) is integral with a flange splined in the Low Range Drum so that the gear is locked to the shaft when the clutch is engaged (High Range) and is held stationary to serve as a reaction member for the short planetary pinoins which mesh with it when the low range drum band is applied (Low Range). Rear Sun Gear (Driving Sun Gear) is splined directly on the input shaft and meshes with the long planetary pinions.

Planetary Pinions—Consist of three short large gears and three long smaller gears mounted alternately around the planetary cage and all meshing together. The short pinions mesh with the forward sun gear (Low Range Reaction Gear) and with the Planetary Ring Gear which is integral with the Reverse Drum. The long pinions mesh with the rear sun gear (Driving Sun Gear). Planetary cage is integral with the output shaft.

Low Range Drum & High Range Clutch Assembly—Mounted on input shaft directly in front of planetary pinion cage. Inner clutch member is splined on input shaft and rotates with the shaft. Outer clutch member incorporates the Low Range Drum and front sun gear as well as the clutch engaging hydraulic piston and disengaging spring. Clutch driving plates (with facings) are waved to assist disengagement and spring-controlled oil vents in the hydraulic piston are also uncovered when clutch is disengaged.

Low Range Brake Band & Engaging Mechanism—Band holds Low Range Drum and front sun gear stationary when it is applied by the Low Range Brake Piston acting through a lever and strut engaging one end of the band. Opposite end of band is anchored by adjusting screw on side of case.

Reverse Drum Band & Engaging Mechanism—Same design as Low Range Band (above). Band holds reverse drum and Planetary Ring Gear Stationary when it is applied.

Parking Brake Mechanism: Consists of a gear splined on the transmission output shaft at the rear of the transmission case and a pawl which engages the gear to prevent rotation of the shaft when the selector lever placed in "P" parking position. Pawl is operated by a locking lever actuated by the control valve cross-shaft and lever in the transmission case.

OPERATION

The torque converter assembly automatically provides a torque multiplication ranging from approximately 2 1/3 to 1 (for Starting & Heavy Loads) to

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PACKARD ULTRAMATIC (Cont.)

an equivalent "High" 1 to 1 ratio (for Steady Driving & Light Loads) and is locked out by the Direct Speed Clutch at speeds above 15 MPH. in High Range operation under normal driving conditions (can be unlocked or "kicked down" at car speeds under 50 MPH. at the will of the operator). Planetary Unit is controlled by the operator and provides definite gear ratios (in addition to the varying ratio of the Torque Converter) depending upon the selector lever position. This control is effected through the hydraulic control system (see illustration) by means of oil pressure supplied by the two oil pumps in the transmission case.

LUBRICATION

Check transmission fluid level every 1000 miles and add fluid as required to maintain level at FULL mark on dip stick. Drain and replace fluid at 25000 mile intervals (CAUTION—this 25000 mile interval supersedes original recommendation of 10000 or 15000 mile periods).

►***CAUTION—Fluid must only be checked at normal operating temperatures and within 1 minute after engine has been idling at 800 RPM. for 1 minute with selector lever in Neutral "N" position.***

Checking Fluid Level—With fluid at normal operating temperature, place selector lever in "N" position, idle engine at 800 RPM. for at least 1 minute, check level by removing dip stick from filler hole on left side of transmission (accessible from beneath car—turn cap ½ turn counter-clockwise before withdrawing it). Add fluid as required to bring level up to FULL mark on stick.

►**Transmission Filling Note**—Fluid can be installed through filler tube (from beneath car) if oil gun or pump with flexible hose or curved spout used. If this equipment not available, fold back rear corner of front floor mat, remove filler hole cover from transmission cover in floor, and remove filler hole plug in upper rear end of transmission case. Fluid can be poured in through this opening.

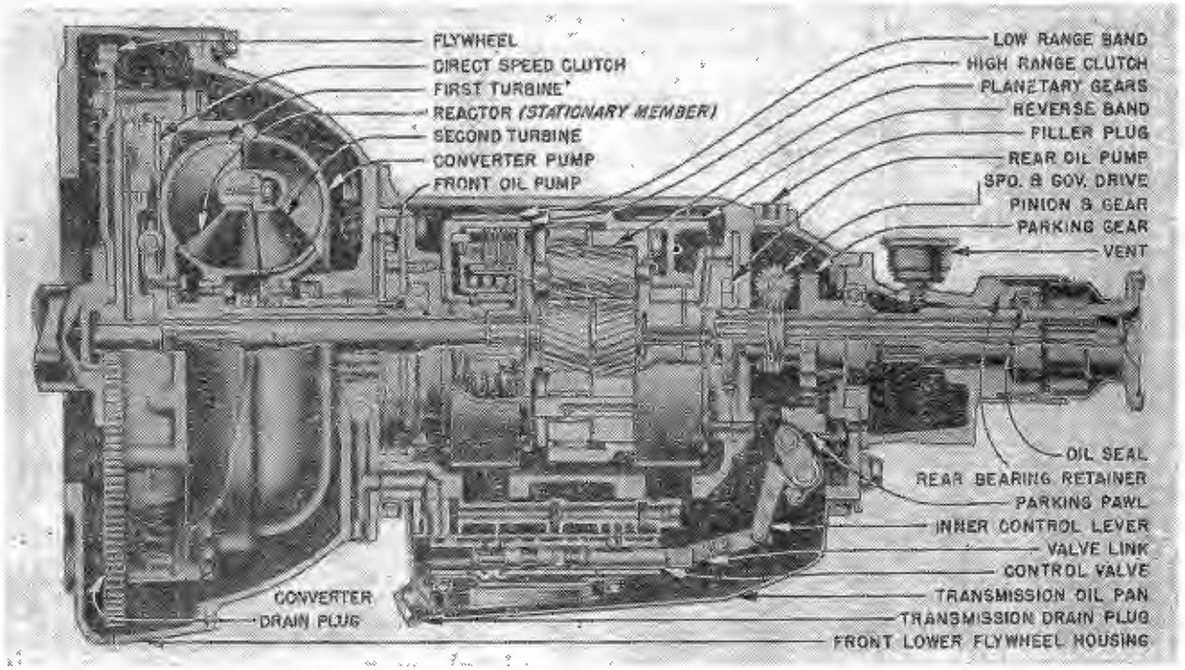
Draining & Replacing Fluid—Remove front lower flywheel housing. Loosen one converter drain plug (to act as a vent), then rotate flywheel 180° to bring second drain plug to lowest point, remove this plug and drain converter case. Remove transmission case drain plug (at forward end of transmission oil pan), drain case. Replace and tighten all drain plugs, replace flywheel housing. Install 7 qts. of fluid through dip stick opening using curved oil gun (or through plug hole in top of case at rear, accessible by removing cover in transmission floor cover). Idle engine at 800 RPM. for at least 2 minutes with selector lever in "N" neutral (to fill converter case). Check fluid level as directed above, add sufficient fluid to bring level up to FULL mark on dip stick (capacity is approximately 12 qts.). Run engine at 800 RPM. for one minute, recheck level.

►***CAUTION—Amount of fluid installed should be determined by dip stick reading rather than actual number of quarts.***

Recommended Fluid—Packard Ultramatic Drive Fluid or any Type "A" Automatic Transmission Fluid which has an AQ-ATF number embossed on container.

LINKAGE ADJUSTMENT

►***ADJUSTMENT CAUTION***—Before adjusting linkage, check the transmission control and throttle linkage for free operation without binding or lost motion due to wear. Warm up engine and transmission. Set engine idle speed at 375 RPM. with choke valve wide open and fast idle inoperative and selector lever in "H" high range. Set hand brake to hold car. Then adjust linkage as follows:



PACKARD ULTRAMATIC DRIVE

Selector Control (All Models): Place selector lever in "L" Low Range position, see that detent plunger engages notch in sector (can be determined by feel). Adjust control rod by loosening locknuts and turning turnbuckle on rod until clearance between the steering column lever stop and the stop on the bracket is .030-.040" (measure with feeler gauge), tighten turnbuckle locknuts. Check adjustment by moving selector lever to other positions. Shifts to Neutral "N", Reverse "R", and Park "P" should be possible without permanent over-travel when contacting the stops.

1949-50 Throttle Linkage ("2300" & "2300-5" Series):

CAUTION—Different checking gauges and special procedures required for some cars as follows:

1) Throttle Cross Shaft-to-Carburetor Rod—Install Checking Gauge PU-333 (Eight), PU-332 (Super 8—see Note below), PU-312 (Custom Eight) over throttle cross shaft and end of carburetor rod. Adjust rod length by loosening locknut and turning the spring-loaded throttle override until forward end of gauge rests on upper milled surface of carburetor throttle body. Tighten locknut and remove gauge. This adjustment will provide correct angle of cross shaft lever.

►**Super 8 Gauge PU-332 Note**—If gauge does not fit properly due to interference between gauge and starter switch on carburetor, grind off inner edge of square end of gauge at 45° angle to distance of ⅛" from corner on each side.

►**Throttle Valve Lever Adjustment Note**—Procedure below is new and when applied to cars before Trans. No. 106958 (Eight), No. 6486 (Super & Cust.), it will be necessary to **remove and discard** the Woodruff key which positioned the throttle valve outer lever on shaft on right side of transmission case. This key is omitted on transmissions after above numbers.

2) Throttle Valve Lever—***CAUTION—First cars must be modified as follows before adjustment can be made:***

Adjustment—Use new Lever Adjusting Gauge No. PU-334 and proceed as follows: Disconnect both front and rear rods from relay lever on right side of transmission bell housing by taking out clevis pin. Move rear rod toward rear of car until throttle valve lever reaches rear limit of travel. Hold lever back against the stop in this position, install gauge over end of rod and relay lever, note whether pin on gauge enters these holes freely. If not, on first transmissions with woodruff key in valve lever shaft (see Note above), remove lever and discard key, replace lever. On all models, tighten lever clampscrew just enough so that lever will rotate with shaft until stop is reached and will then slip on shaft. Rotate lever toward front until stop is reached, **continue to rotate lever toward front ⅛ turn,** then rotate lever toward rear until stop is reached. Check lever position with gauge and continue to rotate lever toward rear until gauge pin enters lever rod hole freely, tighten lever clampscrew to 80 ft. lbs. torque, remove gauge, connect both rods to relay lever. Check throttle cross-shaft to throttle valve rod and adjust as follows:

CONTINUED ON NEXT PAGE

PACKARD ULTRAMATIC (Cont.)

Carburetor Throttle Rod—Adjust throttle cross-shaft to carburetor rod by loosening locknut and turning the spring-loaded throttle over-ride until cross-shaft bellcrank at manifold end of shaft leans forward 13½° at top from perpendicular through the shaft center-line. On Eight and Super Eight models, special gauges available for this adjustment: PU-333 (Eight), PU-332 (Super 8).

3) **Throttle Cross Shaft-to-Throttle Valve Rod**—Disconnect rod at upper (cross shaft) lever end, push rod downward lightly to seat transmission throttle valve plunger against stop. Adjust clevis on rod so that rod is **5/32" short** (pin hole in rod clevis 5/32" short of alignment with pin hole in lever—can be checked with Gauge PU-326). Tighten clevis locknut and connect rod. NOTE—The 5/32" movement of rod necessary to align holes for installation of clevis pin will move throttle valve plunger .050" from its stop.

4) **Relay Lever-to-Cross Shaft Rod**—Depress accelerator pedal until carburetor throttle is just wide open, check clearance between accelerator pedal push rod lever and spring-loaded stop on left side of engine. This clearance should be .050". Adjust by turning adjusting sleeve on relay lever end of rod.

1951 Throttle Linkage ("2400" Series). Adjust linkage in following order:

1) **Throttle Cross Shaft-to-Carburetor Rod**—Install Checking Gauge PU-364 (all models) on milled surfaces on top of cylinder head directly ahead of cross shaft bracket. Adjust cross shaft lever-to-carburetor rod by loosening locknut and turning the spring-loaded throttle override until short bend at rear of rod protrudes through hole in lever and enters hole in gauge. Tighten locknut and remove gauge. This adjustment will provide correct angle of cross shaft lever.

2) **Throttle Valve Lever.** Disconnect relay rod from throttle valve lever on right side at rear of transmission by taking out clevis pin. Loosen lever clampscrew just enough so that lever will rotate with shaft until stop is reached and will then turn on shaft. Rotate lever forward until it is horizontal, then rotate lever in opposite direction toward rear until valve is closed against the throttle valve spring but **without compressing the spring.** Using care not to compress the spring, continue to rotate lever toward rear until piece of 3/16" rod can be inserted through holes in lever and relay rod and when this rod is snug in both holes, tighten lever clampscrew to 80 ft. lbs. torque. Remove the 3/16" rod, connect relay rod to lever with regular clevis pin.

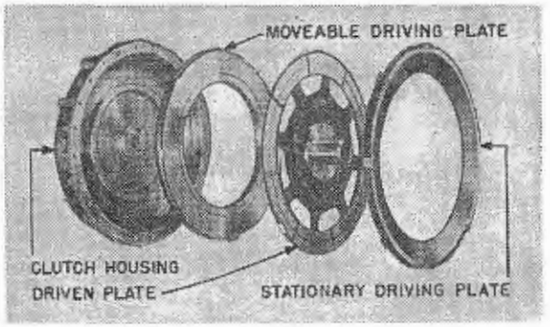
3) **Accelerator Relay Rod-to-Cross Shaft Lever.** Adjust rod length so that clearance between cam on cross shaft lever and kickdown stop plunger on left side of engine is .030-.040" with wide open throttle.

Starter Safety Switch: Mounted on left side of transmission case. Circuit through switch should be completed (so that starter can be operated) with gear-shift selector lever in "N" or "P" position.

BAND ADJUSTMENT

►*ADJUSTMENT NOTE*—Adjusting screw and locknut for each band are located on outside of transmission case—left side (Low Range Band), right side (Reverse Band). Both bands are adjusted alike.

Adjustment—Loosen locknut on band adjusting screw, use Torque Wrench to tighten adjusting screw (clockwise rotation) to 20 ft. lbs. torque, then **back off adjusting screw 1¾ complete turns,** tighten locknut to torque of 25-30 ft. lbs.



ULTRAMATIC DRIVE DIRECT SPEED CLUTCH

TROUBLE SHOOTING

CAR FAILS TO MOVE (At all times or with selector lever in certain Ranges):

1. With Selector Lever in any position (appears to be in Neutral—rear wheels are free).

1) Low oil level in transmission or clogged oil inlet screen. Check oil level. Check front pump pressure (see Testing Hydraulic Units).

2) Front Oil Pump Relief Valve or Pump Selector valve sticking open. Check front pump pressure (see Testing Hydraulic Units).

3) Selector control linkage broken or disconnected.

4) Transmission output shaft broken at planetary unit in transmission case. Check by operating engine with selector lever in High Range and rear wheels jacked up. If engine accelerates and propeller shaft does not turn, broken output shaft is indicated (grating noise will be noted in transmission).

5) Rear axle shaft broken or other broken parts in rear axle (propeller shaft will turn but car will not move).

2. With Selector Lever in any position (Rear Wheels are Locked).

1) Parking gear lever spring broken (allowing pawl to remain engaged in parking gear).

2) Low & Reverse Bands adjusted too tight.

3) Bushing or bearings seized or other broken parts in transmission case.

4) Hand brake not released.

5) Broken parts in Rear Axle causing axle to be locked.

3. With Selector Lever in High Range (operation in Low and Reverse Ranges satisfactory).

1) Low oil level in transmission case.

2) Selector control linkage disconnected or out of adjustment (check by moving lever slightly to either side of "H" detent position).

3) High Range Clutch pressure low (may be caused by worn or sticking clutch piston rings or sticking or inoperative Modulating Valve). Check high range clutch pressure (see Testing Hydraulic Units).

4) High range clutch plates worn or burned.

4. With Selector Lever in Low Range (operation in High and Reverse Ranges satisfactory).

1) Selector control linkage out of adjustment (check by moving lever slightly to either side of "L" detent position).

2) Low Range Band worn, band end broken, or band strut dropped out of position (check Low Band adjustment, this trouble indicated if screw goes in too far).

3) Low Range Apply Piston jammed (check for loose Low Band adjusting screw with engine running and selector lever in "L", this trouble indicated if screw is found to be loose).

4) Low Range Fast Acting Piston Vent closed (check by running engine with selector lever in "L", this trouble indicated if car has tendency to move after several minutes operation).

5) Timing Valve stuck in "High Range" position (car will appear to be in neutral). Check as follows: disconnect carburetor throttle link rod from cross-shaft bellcrank, start and operate engine at 800 RPM., place selector lever in "L" range, depress accelerator pedal to floor to increase modulating pressure (to free timing valve). Reconnect carburetor throttle link rod and check operation in Low Range. If car now operates in Low Range, a sticking timing valve is indicated.

5. With Selector Lever in Reverse Range (operation in Low and High Ranges satisfactory).

1) Selector control linkage out of adjustment (check by moving lever slightly to either side of "R" detent position).

2) Reverse Band worn, band end broken, or band strut dropped out of position (check Reverse Band adjustment, this trouble indicated if screw goes in too far).

3) Reverse Apply Piston jammed (check for loose Reverse Band adjusting screw with engine running and selector lever in "R", this trouble indicated if screw is found to be loose).

EXCESSIVE SLIP WHEN TRANSMISSION OPERATING (At all times or with selector lever in certain Ranges):

1. In all Ranges (selector lever in "H", "L", or "R").

1) Low oil level in transmission case.

2) Selector control linkage out of adjustment.

3) Front Oil Pump Relief Valve or Pump Selector Valve faulty (valve sticking open, worn, or spring broken). Check Front Pump Relief Valve Boost Pressure (see Testing Hydraulic Units).

4) Front Oil Pump defective (check for worn or scored pump rotors).

2. In High "H" Range only (operation satisfactory in Low "L" and Reverse "R").

1) Control Valve Link out of adjustment.

2) High Range Clutch pressure low due to oil leakage in pressure passages, at low range drum bushing, check valve in reactor clutch housing, or at clutch piston rings. Check high range clutch pressure (see Testing Hydraulic Units).

3) High Range Clutch piston stuck in cylinder, piston rings broken or worn.

4) High Range Clutch plates worn, burned, or sticking on their splines.

3. In Low "L" Range only (operation satisfactory in High and Reverse Ranges).

1) Control Valve Link out of adjustment.

2) Timing Valve sticking. Check Low Range Application Pressure (see Testing Hydraulic Units).

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PACKARD ULTRAMATIC (Cont.)

If pressure builds up slowly, this trouble is indicated.

3) Low Range Fast Acting Piston Vent closed (check by running engine with selector lever in "L", this trouble indicated if slippage disappears after several minutes).

4) Low Range Piston sticking or piston seals worn.

5) Low Range Band out of adjustment. Band or drum worn, burned, or scored.

4. In Reverse "R" Range only (operation satisfactory in High and Low Ranges).

1) Control valve link out of adjustment.

2) Reverse piston pressure low due to leakage in reverse hydraulic circuit.

3) Pump Selector Valve Boost Pressure low or lacking. Check Front Pump Relief Valve Boost Pressure (see Testing Hydraulic Units) **in Reverse.** Pressure should be 155 lbs. at 800-1000 RPM. If pressure low, check for obstruction or leak in boost passage.

4) Reverse Fast Acting Piston Vent closed (check by running engine with selector lever in "R", this trouble indicated if slippage disappears after several minutes).

5) Reverse Piston sticking or piston seals worn.

6) Reverse Band out of adjustment. Band or drum worn, burned, or scored.

EXCESSIVE DRAG WHEN TRANSMISSION OPERATING:

1. In High "H" Range or Reverse (operation satisfactory in Low "L").

1) Low Range Band adjusted too tight, low range piston jammed in "on" position, or band strut out of position. Check by loosening low range band and operating car in High "H" Range.

2) Timing Valve stuck in low range position (check by operating car below 15 MPH. in Low range, and shift into High range. If drag noted in High range, a stuck timing valve is indicated).

2. In High "H" Range and Low "L" Range (operation satisfactory in Reverse).

1) Reverse Band adjusted too tight, reverse piston jammed in "on" position, or band strut out of position. Check by loosening reverse band and operating car in reverse.

CAR CREEPS WHEN STANDING WITH ENGINE RUNNING:

1. With selector lever in Neutral "N".

1) Control valve link out of adjustment.

2) Low Range Band adjusted too tight.

3) High Range Clutch Pressure Line Vent stuck (ball check in reactor clutch housing). Creeping generally occurs only when engine speeded up.

4) High Range Clutch Plates sticking or binding on their splines.

2. With selector lever in High "H" Range (at Idle Speed).

1) Engine idling too fast. Set engine idle speed at 375 RPM. (hot or slow idle), 800 RPM. (fast idle).

3. With selector lever in Reverse "R" (creeps forward), or in Low "L" Range (creeps backward).

1) Control valve link out of adjustment.

EXCESSIVE LAG OR DELAY IN SHIFTING:

1. Low Range-to-High Range Shift Lag.

1) Timing Valve sticking or obstruction in metering passage at rear end of timing valve (causes slow release of low band so that band acts as a brake). Make pressure test (see Testing Hydraulic Units) and check time delay between high range engagement and low range release.

2) Low Range Piston sticking in "on" position. Install new seals after freeing piston.

3) Low Range Fast Acting Piston Vent Valve stuck (preventing dumping pressure as soon as pressure is cut off).

2. High Range-to-Low Range Shift Delayed.

See (1), (2), (3) under low-to-high shift lag above.

4) Low Range Band out of adjustment.

SHIFTS ARE SEVERE OR ROUGH:

1. Low Range-to-High Range Shift Severe at Light Throttle only (normal with greater throttle opening).

1) Throttle Valve Linkage out of adjustment (see Linkage Adjustment).

2) Throttle Valve sticking in bore in valve body.

2. Low Range-to-High Range Shift Severe regardless of throttle position.

1) Throttle valve linkage out of adjustment (see Linkage Adjustment).

2) Throttle Valve sticking open or Modulating Valve defective. Check throttle valve pressure (see Testing Hydraulic Units).

3) Low Range Band out of adjustment.

4) High Range Clutch plates worn, scored, or damaged.

5) Cover at rear end of timing valve in control valve body loose.

3. High Range-to-Low Range Shift Severe.

1) Low Range Band out of adjustment.

2) Timing Valve sticking. Make Low Range Application Pressure test (see Testing Hydraulic Units) and note pressure build-up rate of low range piston.

3) Cover at rear end of timing valve loose.

4) Low Range Band or drum worn, scored, or rough.

CHATTERS WHEN STARTING:

1. When starting in Low "L" or High "H" Range.

1) Low Range Band out of adjustment (dragging band will cause High Range chatter).

2) Reverse Band out of adjustment and dragging.

3) Low Range Band or Drum worn, scored, or rough.

4) High Range Clutch plates worn, scored, burned, or sticking. Clutch Piston sticking.

2. When starting in Reverse "R".

1) Reverse Band out of adjustment.

2) Low Range Band dragging.

3) Reverse Band or Drum worn, scored, or rough.

4) Reverse Drum Bushing or Thrustwasher worn or scored.

5) High Range Clutch plates worn, scored, burned, or sticking. Clutch Piston sticking.

TRANSMISSION "CLUNKS" WHEN CAR STOPPED:

1. Direct Drive Clutch Disengagement Noisy.

1) Direct Drive Shift Valve sticking. Check Direct Drive Clutch Pressure (see Testing Hydraulic Units).

2) Governor Vent Valve sticking or defective. Check Hydraulic Governor Pressure (see Testing Hydraulic Units). Governor pressure should cut off at 11 MPH. or above on deceleration.

3) Direct Drive Clutch Moveable Driving Plate sticking or facing groove too shallow in driven plate facing (facing should have groove .062" wide through the full depth of the facing).

ENGINE STALLS WHEN CAR STOPPED:

1. Direct Drive Clutch fails to disengage.

1) Governor defective. Check Hydraulic Governor pressure (see Testing Hydraulic Units).

2) Direct Drive Shift Valve sticking.

3) Converter Inlet Valve or Converter Relief Valve sticking. Check Converter Inlet Pressure (see Testing Hydraulic Units) and also check converter pressure when operating in direct drive.

4) Direct Drive Clutch Moveable Driving Plate sticking or Driven Plate facings broken or torn.

NO "DIRECT DRIVE" (or Direct Drive operation erratic or noisy):

1. Direct Drive Clutch fails to engage (or engages and disengages erratically).

1) Governor defective, Vent Valve sticking or clogged, Governor Drive Pinion teeth worn or chipped (causing erratic operation of the governor). Check Hydraulic Governor Pressure (see Testing Hydraulic Units).

2) Direct Drive Shift Valve sticking. Check Direct Drive Clutch Pressure (see Testing Hydraulic Units).

3) Direct Drive Clutch Moveable Drive Plate sticking. Install new piston rings after freeing up plate.

NO "KICK-DOWN":

1. Direct Drive Clutch fails to disengage.

1) Throttle Valve Linkage out of adjustment (see Linkage Adjustment).

2) Throttle Valve Piston stuck. Check Throttle Valve Pressure (see Testing Hydraulic Units).

3) Governor defective, or governor pressure too high. Check Hydraulic Governor Pressure (see Testing Hydraulic Units).

4) Direct Drive Shift Valve sticking. Check Direct Drive Clutch Pressure (see Testing Hydraulic Units). Pressure should cut off on kick-down if shift valve operating correctly.

5) Throttle Rod Operating Bellcrank (on bell housing) incorrectly installed or reversed. Check and adjust throttle linkage (see Linkage Adjustment).

OVERHEATING ON HILLS (Converter and Transmission).

1. Insufficient oil flow through Converter and Oil Cooler.

1) Converter Inlet Valve or Relief Valve sticking, oil cooler clogged, or Converter Outlet Valve stuck. Check Converter Inlet Pressure (see Testing Hydraulic Units). If pressure OK. when converter operating, check flow through converter as follows: Disconnect hydraulic line at converter outlet valve, use clean container to catch oil flowing through line. Operate engine at 600 RPM. for 15 seconds. Oil flow should be 1¾ quarts in 15 seconds.

NOISE IN TRANSMISSION OR CONVERTER:

1. Scraping Noise in Converter.

1) Broken Direct Drive Clutch driven plate (will also cause faulty direct drive clutch disengagement).

2) Reactor Shaft Bearings or Thrustwashers worn or broken (allowing converter parts to rub or scrape together).

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PACKARD ULTRAMATIC (Cont.)

2. Rattle in Transmission (in Neutral or High "H" Range).

1) Rough engine performance (noticeable at idle speed).

2) Low Range or Reverse Band Struts rattling due to bands being too loose. Adjust bands.

3. Vibration in Drive Line (at 20 MPH. or higher speeds in Direct Drive).

1) Direct Drive Clutch Driven Plate friction lag incorrect (replace driven plate).

2) Extension Housing Bearing worn, scored, or burned out.

4. Excessive backlash (noticeable when accelerating or decelerating in Direct Drive).

1) Transmission Thrust Bearings and Thrustwashers worn.

2) Drive line or rear axle backlash excessive.

5. Knock or grating noise (in Neutral, Low Range, or Reverse).

1) Planetary Unit Gears chipped or broken. Pinion roller bearings broken.

6. Whine in Planetary Unit (below 35 MPH.).

1) In Low Range or Reverse—Planetary gears and pinions worn, scored, or burned. Pinion endplay excessive.

2) In Neutral or High Range below 35 MPH. (disappears at higher speeds)—Air leak in front oil pump intake line, front oil pump rotors noisy, oil foaming in transmission.

7. Whine or Hum in transmission (above 30 MPH.).

1) Front Oil Pump Relief Valve stuck (preventing front pump from idling normally). Check Front Pump Regulated Pressure (see Testing Hydraulic Units) at speeds above 30 MPH. If pump does not cut out, free up relief valve.

2) Rear oil pump noisy due to worn or scored pump rotors.

TESTING HYDRAULIC UNITS

►*CAUTION*—Before making following tests, check fluid level in transmission, road test car by driving under conditions simulating heavy traffic and highway operation (frequent stops and starts, low speed, medium speed, and accelerating). If transmission does not operate satisfactorily after engine and transmission thoroughly warmed up, make the hydraulic test outlined below exactly as directed.

NOTE—Hydraulic pressure gauge with 0-100 psi. scale and flexible line 48" long with ⅛" male pipe fitting are required for these tests (except Reverse Application Test for which 0-200 or 0-300 psi. gauge MUST be used. Pressure Test Gauge Set, No. PU-300, provides all gauges needed for these tests.

Front Pump Regulated Pressure: Remove floor mat and inspection cover in floor panel, remove pipe plug on lower left side of transmission bell housing, install ⅛" pipe reducer and connect gauge line, support gauge in front compartment so that it can be read while running engine. Start engine and operate it at 600 RPM. Gauge reading should be 80-90 lbs. If pressure correct, disconnect gauge, remove reducer, replace pipe plug.

If pressures not correct, check the following: Front Pump Relief Valve or Selector Valve sticking or valve spring broken, Pump Check Valve not seating (front pump pressure will be lost through rear pump), Air Leak in pump intake passage, Bore in control valve body at Control Valve, Modulating Valve, or Throttle Valve worn or scored or has excessive clearance allowing pump pressure to be lost, Piston Seals in control valve upper body worn or leaking allowing pump pressure to be lost at release side of low or reverse piston.

►**Gauge Fitting Note**—Pipe plug (above) is ¼" (first cars), ⅜" (later cars), and the correct ¼" to ⅛" or ⅜" to ⅛" reducer must be used to connect gauge.

High Range Clutch Pressure: Remove ⅛" pipe plug at center of lower rear end of transmission bell housing (just to right of front pump outlet passage plug), connect gauge at this point. Test car on road with gearshift lever in "H" High Range. Pressure should be approximately 35-43 lbs. (throttle closed), and approximately 85 lbs. with throttle wide open. Repeat test with gearshift lever in Low Range, then shift to High Range and again repeat test. If pressures correct, disconnect gauge and replace plug.

If pressures not correct, check the following: Throttle Valve Linkage out of adjustment, Throttle Valve or Modulating Valve sticking, Ball Check Valve in high range pressure passage (in reactor housing) sticking, High Range Clutch Piston Rings worn or leaking, Low Range Drum Bushing worn or scored.

Direct Drive Clutch Pressure: Remove ⅛" pipe plug just to right of center on lower rear end of transmission bell housing (just to right of high range passage plug above), connect gauge at this point. Test car on road with gearshift lever in High Range. Accelerate car slowly with light throttle opening. At speed of 15 to 18 MPH., with light engine load and steady driving, clutch should engage and gauge reading should be approximately 33-41 lbs. at this point. With full throttle, clutch should engage at approximately 56 MPH. and gauge reading should be approximately 85 lbs. If pressure correct, disconnect gauge and replace plug.

If pressures not correct, check the following: Throttle Valve Linkage out of adjustment, Throttle Valve or Modulating Valve sticking, Direct Drive Clutch Piston Rings worn or leaking, Input Shaft Pilot Bushings worn, Reactor Shaft and Reactor Over-running Clutch Housing Bushings worn.

Front Oil Pump Relief Valve Boost Pressure: Remove ⅛" pipe plug, at lower right rear end of transmission bell housing, connect gauge at this point. Start engine and run at 600-1000 RPM. Gauge reading should be 65-75 lbs. If pressure correct, disconnect gauge and replace plug.

If pressures not correct, check the following: Front Pump Relief Valve or Pump Selector Valve sticking or valve spring broken.

Hydraulic Governor Pressure: Remove ⅛" pipe plug at right rear end of transmission case (just to rear of governor housing), connect gauge at this point. Test car on road at speeds above 15 MPH. Gauge reading should be in direct proportion to car speed and range from 31 lbs. at 15 MPH. to 65 lbs. at 56 MPH. If pressures correct in proportion to car speed, disconnect gauge and replace plug.

If pressures not correct, check the following: Governor Valve or Vent Valve sticking, Governor Housing loose on shaft (attached by two capscrews), Valves or Valve Support worn.

Converter Inlet Pressure: Remove the ⅛" pipe plug at upper left side of bell housing, connect gauge at this point. Start engine and operate it at 600 RPM. Gauge reading should be 65-80 lbs. If pressure correct, disconnect gauge and replace plug.

If pressures not correct, check the following: Converter Pump Shaft Bushings (in bell housing) worn or clearance excessive. Converter inlet valve sticking or defective (if pressure exceeds 22 lbs. when operating in direct drive, sticking valve is indicated and may be accompanied by slipping direct drive clutch).

►*CAUTION FOR MAKING FOLLOWING TESTS: Gauge must be connected within transmission case as follows:* Drain oil from case, remove oil pan, insert flexible gauge line through oil filler opening on left side of case, connect gauge at correct plug hole for each test, re-install oil pan, fill transmission case with fluid so that car can be operated. After tests completed, pan must be removed to disconnect gauge.

►*NOTE—Following three tests can be made at one time if three gauges used.*

Throttle Valve Pressure: See Caution above. Remove ⅛" pipe plug from throttle valve body (right side of control valve lower body in transmission case), connect gauge at this plug hole. Test car on road at various throttle openings. Gauge reading should be in direct proportion to throttle opening and should range from 24-28 lbs. at closed throttle to 55-63 lbs. at full or wide open throttle. If pressures correct and in proportion to throttle opening, disconnect gauge and replace plug.

If pressures not correct, check the following: Throttle Valve Linkage out of adjustment, Throttle Valve sticking.

Low Range Application Pressure: See Caution above. Remove ⅛" pipe plug from low range cylinder body (right front end of control valve upper body in transmission case), connect gauge at this plug hole. Test car on road under heavy traffic conditions (frequent stops, starts in Low Range, acceleration, and shifts to High Range). Gauge reading should be approximately 35-45 lbs. when low band application starts at light throttle and 80-90 lbs. at full throttle. If pressures correct, disconnect gauge and replace pipe plug.

If pressures not correct, check the following: Leaks in low range pressure passages (entire passage from timing valve to low range cylinder body), Loose Range Cylinder Body, Low Range Piston Rings worn or leaking.

Reverse Application Pressure: *CAUTION—0 to 200 psi. gauge required for this test.* See gauge connecting Caution above. Remove ⅛" pipe plug from reverse cylinder body (at left rear end of control valve upper body), connect gauge at this plug hole. Test car on road by making frequent stops and engaging Reverse in normal manner. Gauge reading should be 160-180 lbs. with gearshift lever in Reverse and car moving backward with engine speed of 1500 RPM. If pressure correct, disconnect gauge, replace plug.

If pressures not correct, check the following: Leak in reverse pressure passages (entire pressure system from control valve to reverse cylinder), Loose Reverse Cylinder Body or Upper & Lower Valve Bodies, Reverse Piston Rings worn or leaking, Pump Selector Valve sticking (see Note).

►**Pump Selector Valve Sticking Note**—Check for sticking valve by checking Front Pump Relief Valve Boost Pressure (see above) in Reverse at 1500 RPM.

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PACKARD ULTRAMATIC (Cont.)

Boost pressure should be 135-165 lbs. and low boost pressure indicates that pump selector valve is at fault.

►*If above tests indicate that transmission not operating satisfactorily, see Disassembly data.*

REMOVAL FROM CAR

Transmission and Converter are removed as an assembly as follows:

1) Place control lever in "N" neutral position, remove front seat cushion, install covers on front seat back and door trim panels, remove front floor mat and floor transmission inspection cover.

2) Raise both ends of car and support it securely at all four wheels.

3) Remove lower flywheel housing and drain both Torque Converter and Transmission case (see draining data under "Lubrication" above).

4) Disconnect gear selector linkage and transmission throttle linkage, oil cooler lines, speedometer cable, and starter safety switch leads.

5) Disconnect propeller shaft at front and rear universal joints, remove propeller shaft assembly.

6) Support rear end of engine with a hydraulic jack placed under rear end of oil pan (CAUTION—use block of wood on jack to prevent damage to oil pan). or use auxiliary support beam (hung under frame side rails with engine support studs located on each side to rear of oil pan flange). Raise engine and transmission just enough to remove load from engine rear mounting as follows:

1949-50—Disconnect and remove engine rear support channel and bracket assembly, remove transmission steady rest and insulator, remove both support insulators from transmission case by taking out attaching screws in mounting bosses on case.

1951—Remove nuts on insulator studs (on lower face of support cross-member), remove engine support cross-member by taking out attaching screws in frame X-member.

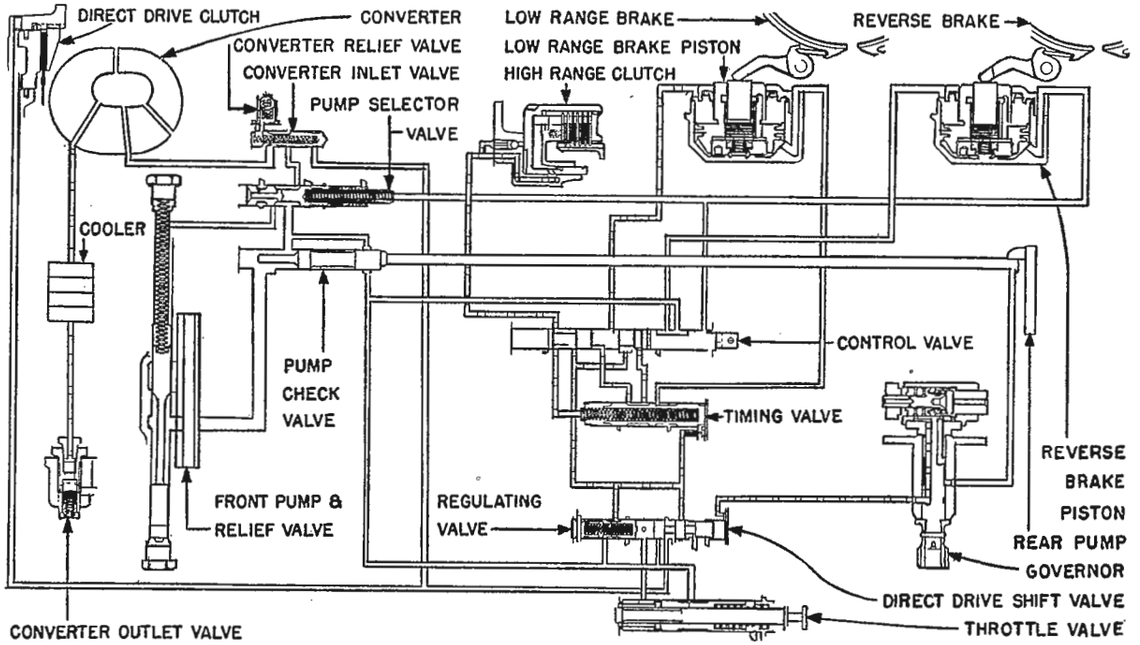
7) Lower the engine and transmission assembly until universal joint flange almost rests on lower face of frame X-member, remove the two extreme upper bell housing-to-upper flywheel housing screws, then raise engine and transmission to normal position.

8) Place transmission lift under transmission or use special hoist (see Note), make certain that lift adapter fits properly around transmission oil pan. Take up transmission weight on lift or hoist.

►**Transmission Hoist Note**—If the special hoist is used, install special lift bracket on transmission case or use sling around case, install lifting hoist over opening in floor panel, connect hoist cable to bracket or sling, take up transmission weight with hoist by tightening hoist cable until it is just taut.

9) Mark flywheel and converter housing to insure re-installation in same relative positions, remove flywheel-to-direct drive clutch housing bolts, tap clutch housing to loosen it from flywheel and slide converter to the rear.

10) Remove transmission bell housing-to-flywheel housing bolts. Secure converter to transmission bell housing to prevent it falling out during transmission removal. Slide transmission to rear until clutch housing is clear of flywheel.



ULTRAMATIC DRIVE HYDRAULIC CIRCUITS

11) Lower the transmission and at the same time tilt the front end down until the transmission bell housing is clear of the flywheel and housing, then move transmission forward until universal joint flange clears frame X-member, lower transmission to the floor.

12) Remove converter assembly from transmission.

OVERHAUL—TORQUE CONVERTER

►*TRANSMISSION OVERHAUL NOTE*—Converter and transmission are disassembled and serviced separately as follows:

►*CAUTION—Check Reactor Shaft Endplay before disassembling converter to determine if new Thrust Washer needed for reassembly.*

Reactor Shaft Endplay Check: With converter on bench, pump end up, mount dial indicator on pump (use special clamp PU-306) with pointer contacting end of reactor shaft, measure reactor shaft endplay. Should be .010-.015" (CAUTION—this supersedes original specification of .018-.022"). This endplay adjusted by installing thrustwasher of correct thickness between reactor and front turbine when reassembling converter.

Disassembly: Take out all converter pump-to-clutch housing capscrews (CAUTION—these are special capscrews and must not be interchanged with others of same size). Loosen pump by tapping with plastic hammer, slip off the converter pump and thrust spacer. Bend back turbine capscrew lock tabs, remove capscrews mounting second turbine on first turbine, loosen second turbine by tapping it with plastic hammer and lift off. Remove reactor, shaft, and ball thrust bearing. Remove capscrews mounting first turbine on direct speed clutch driven plate hub, lift turbine out, remove thrustwasher which seats in turbine flange hole (NOTE—this is the selective thickness washer which controls reactor endplay). Remove direct clutch stationary driving plate (take out lock ring), lift out clutch driven plate and front thrustwasher. Remove the clutch moveable driving plate and piston by inverting the housing and bumping it on the bench. *NOTE*—On first cars, plate can be removed by threading ¼" capscrews in puller holes in plate and lifting plate out.

►*CAUTION—Use care not to damage piston rings located on inner diameter of clutch housing and on outer diameter of piston.*

Cleaning & Inspection: Wash all parts in clear gasoline or kerosene and dry with compressed air. Inspect all contact and mounting surfaces for nicks, burrs, distortion, warping, or low spots. Inspect all bolts and capscrews for worn threads, see that bolt holes not worn or cracked. Inspect machined area around vanes, torus ring, and turbine hub for indications of wear or rubbing condition indicating worn bearings or thrust plates. Check clutch driven plate for worn facings, loose springs, worn splines or worn thrust bearing. Inspect clutch movable plate and piston rings. Check ring gap with feeler gauge (gap should be .003-.012" when installed in housing). Inspect all bearing surfaces for wear, pits, and scores. Clean and inspect oil passage leading from input shaft bearing to direct drive clutch piston.

Reassembly: Use all new gaskets. Install direct drive clutch piston in housing making certain that rings are free in grooves and centered, and that driving splines do not bind. Install the front thrustwashers, clutch driven plate, and stationary driving plate. Install first turbine using new lock plate under

CONTINUED ON NEXT PAGE

PACKARD ULTRAMATIC (Cont.)

mounting capscrews and tighten screws to 25-30 ft. lbs. Install thrustwasher of correct thickness for desired endplay of .010-.015" (correct in accordance with endplay figure as measured before disassembly and see also Reactor Shaft Thrustwasher Note below), using cup grease to hold washer in place (CAUTION—ears on washer must engage recesses in turbine hub). Install reactor and shaft. Install second turbine using new lock plates under mounting capscrews and tighten screws to 12-15 ft. lbs. Install converter pump **temporarily without gasket,** measure clearance, correct as required and mark pump and clutch housing to insure final assembly in best position, **then remove the pump.** Install ball thrust bearing on the reactor shaft using cup grease to hold bearing in place. Install bearing spacer in forward end of pump shaft. Use new gasket and install converter pump **lining up marks on pump and housing,** install all pump attaching capscrews and tighten evenly to 25-30 ft. lbs. Check assembly for free rotation by spinning the clutch driven plate using a dummy input shaft. Plate must be free of any drag.

►***CAUTION—Make certain that all capscrews locked by turning lock plate tabs up against screw heads.***

►**Reactor Shaft Thrustwasher Note**—This washer **furnished in .005" thickness steps from .070" to .115".** (Part Nos. 423190 to 423199 inclusive).

►**Converter Pump & Clutch Housing Clearance Check:** With converter pump installed on clutch housing **without the gasket,** measure clearance between pump mounting flange face and face of clutch housing around entire circumference with a feeler gauge. Clearance must be .007" or less and uniform within .002" all around the flange. If clearance varies more than .002", rotate cover ¼ turn and recheck clearance. When a point is found where clearance is within these limits, mark both the pump and clutch housing with a centerpunch on the edge of the flange **between the bolt hole bosses** (CAUTION—use only a centerpunch or paint for marking—DO NOT use a chisel, and use great care not to mar the bolt hole bosses). If no position can be found where clearance is uniform and within limits, clearance can be reduced on the high side by carefully dressing down pump shoulder with a mill file. If clearance is uniform but greater than .007", dress the pump shoulder down carefully around entire circumference.

DISASSEMBLY—TRANSMISSION

Disassembly: Remove oil pan and gasket. Install hold-down tool PU-308 on Low and Reverse band levers (will prevent band struts dropping when the valve assembly is removed), then remove the oil screen. Disconnect control valve link, remove the control valve lower body, separator, and upper body as an assembly (this assembly need not be disassembled further unless required). Take out 8 capscrews and remove bell housing and gasket. Loosen low range band adjusting screw, remove high range clutch assembly, remove front sun gear thrust bearing. Remove the hold-down fixture from low range band lever (CAUTION—use care that struts do not drop down in case), remove low range band struts, then remove low range band. Remove governor cover on right side of case, take out governor adapter attaching screws, remove governor assembly. Remove speedometer drive pinion and retainer. Take out rear bearing retainer capscrews, remove retainer (on 1949-50 cars, retainer will pull off of output shaft; on 1951 cars, retainer or extension housing will come off as a unit with the extension shaft, extension shaft bearing, and universal joint yoke). Remove converter outlet valve. Remove parking gear (take out snap ring first on 1949-50 cars). Remove speedometer gear and spacers (note position of spacers to insure correct re-installation—spacer with grooved face at rear). Remove entire planetary unit and output shaft assembly through front end of transmission case. Loosen reverse band adjusting screw, lift out reverse drum and planetary ring gear. Remove hold-down fixture from reverse band lever, lift out reverse band struts, remove reverse band. Take out attaching capscrews and remove rear oil pump from recess in rear of case. This completes routine removal of units from case (see Transmission Case data under Overhaul if case is to be stripped). For further disassembly and overhaul of units, proceed as follows:

OVERHAUL
(ALL TRANSMISSION UNITS)

After disassembling transmission (above), the various units can be disassembled for inspection and overhaul as follows:

►***DISASSEMBLY CAUTION—Cleanliness is extremely important when disassembling and overhauling transmission. Make certain that workbench, tools, parts containers, and cleaning solvent are CLEAN.***

Planetary Unit—Remove capscrews attaching forward and rear halves of planetary cage, remove forward half of cage by tapping it sharply with a plastic hammer. Move short planetary pinion shaft to rear and remove locking woodruff key. Remove the three short planetary pinions, shafts, thrust washers, and roller bearings as an assembly. Remove rear (driving) sun gear and thrust washer. Move long planetary pinion shaft to rear and remove locking woodruff key. Then remove the long planetary pinions, shafts, thrust washers, and roller bearings as an assembly. *NOTE*—Pinions can be disassembled by removing thrustwasher from each end and withdrawing bearing rollers, spacer, and shaft from within the pinion.

High Range Clutch—Remove large snap ring from low range drum, remove low range reaction sun gear and flange from drum. Remove clutch hub and input shaft, and clutch plates. Use tool PU-304 to compress clutch piston return spring, remove retaining snap ring, relieve spring tension, remove spring and seat. Dislodge and remove clutch piston by bumping low range drum on a wooden block (piston side down). Remove outer piston ring from the piston and inner piston ring from inner hub of low range drum. Remove snap ring on input shaft at rear of clutch hub, remove clutch hub from shaft.

Bell Housing—Take out eight capscrews, remove the front oil pump and the reactor overrunning clutch housing assembly (CAUTION—do not disassemble the overrunning clutch). Remove front pump relief valve and spring, and oil pressure passage plugs (threaded plugs).

Front Oil Pump—Take out two screws retaining pump on reactor overrunning clutch housing. Remove front cover plate, pump body, and rotors. Separate pump body and rotors, separate pump rear plate from reactor housing.

Rear Oil Pump—Remove cover plate, lift out inner and outer rotors (CAUTION—Keep these rotors separate from front pump parts, rear pump rotors are smaller and are not interchangeable).

Reactor Overrunning Clutch—Do not disassemble this unit (replace if worn or inoperative). See Inspection data.

Control Valve—CAUTION—use extreme care to keep working area and all parts CLEAN when working on control valve assembly. Separate lower valve body, separator, and upper valve body (CAUTION—do not clamp valve body or parts in a vise which may mar contact surfaces or crack body). Remove throttle valve piston spring seat screws, remove the throttle valve, piston, spacer, spring, and seat. Remove control valve and link using slight twisting motion. Remove plate at rear end of timing valve bore, remove timing valve and spring. Remove plate at rear end of direct drive shift valve bore, remove shift valve piston. Remove pins at the forward end and at the center of the modulating valve bore, remove modulating valve, guide, and direct drive shift valve. Remove low range and reverse cylinder bodies, and pistons from the upper valve body. Remove plate at forward end of upper valve body, remove pump check valve, pump selector valve, converter inlet valve, converter relief valve, and valve springs.

Hydraulic Governor—Take out two capscrews attaching governor housing to drive shaft flange, separate housing from flange. Check governor driveshaft-to-adapter endplay which should be .010-.018" and side clearance which should be .0005-.002". If clearances not correct, disassemble driveshaft by driving out pin in driving gear, press gear off, remove shaft from adapter. Check governor valves for free operation by pressing valve in to inner limit of travel and noting whether spring pushes it out to outer limit of travel without drag when released, pull vent valve flyweight and valve to outer limit of travel and noting whether spring returns these parts to inner limit of travel without drag when released. If valves stick or excessive looseness noted, disassemble valves as follows: Pull vent valve to outer limit of travel, remove small snap ring, remove flyweight. Remove valve support snap ring, remove valve support, outlet valve and springs, lift governor valve out through vent valve support opening.

Transmission Case—If case being stripped for cleaning or replacement, remove starter safety switch and selector detent. Loosen lockscrew on selector detent sector and remove lockscrew from control valve inner lever, then slip control valve outer lever and cross-shaft from the case (CAUTION—use care not to damage oil seal), lift out detent sector, inner lever, and parking lock operating lever. Low Range and Reverse Band Levers can be removed by driving out lever pivot pins and lifting out the levers, then remove pivot pin and lift out parking gear pawl and lever.

Extension Housing: ***CAUTION—Different type housing and bearing assembly with extension shaft used on 1951 models.***

1949-50 Bearing Retainer & Extension Housing: Retainer has oil seal at rear end which can be replaced by pulling old seal with a seal puller and driving new seal in place.

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PACKARD ULTRAMATIC (Cont.)

1951 Extension Housing: To disassemble, clamp extension housing in vise, remove universal joint flange nut, pull flange, tap rear end of shaft with soft hammer to free shaft from ball bearing and remove shaft through front end of housing. Remove oil seal using a seal puller or drive seal out with a drift inserted through forward end of housing. Remove snap ring at rear of ball bearing, press bearing out of housing toward rear. If babbitt bearing in forward end of housing requires replacement, remove old bearing with puller PU-335 (used with adapter PU-357). Press new bearing in place with tool PU-357.

Cleaning: Clean all transmission parts (except the ball bearing) in solvent cleaner such as clear gasoline or naptha. Wash all valve parts in separate container. Dry all parts with clean compressed air. Blow out all oil passages with compressed air (CAUTION—do not use wire or drills to clean out passages and ports which would damage metering openings and change calibrations).

Inspection: Inspect all parts for wear and defects with special attention to the following:

Gears—Inspect teeth for wear, scores, nicks, burrs, pits, and chipped teeth. Inspect bearing surfaces and splines for wear and scoring.

Bearings & Thrust Washers—Check for roughness, flat spots, pits, and scores. Check bearings for excessive looseness due to wear. See Reassembly data for selection of thrust washers for correct clearances or endplay.

Drums & Bands—Check for wear, scoring, nicks, or out-of-round. Check low range drum clutch plate splines and inner hub surfaces.

Pistons & Rings—Inspect pistons and rings for wear, scores, nicks, and burrs. Check ring gap of all piston rings with rings in full contact with cylinder walls. Rings can be filed if gaps too small.

Piston Ring Gaps

High Range Inner Ring	.007-.015"
High Range Outer Ring	.010-.020"
Direct Drive Rings (Inner & Outer)	①.002-.016"

①—.012" or less preferred.

Valve Body & Valves—Check all valve body bores for wear with plug gauges PU-324. Check mating surfaces of lower body, separator plate, and upper body for evidence of oil leakage caused by low spots or unevenness (lap on a surface plate using 400A wet or dry sandpaper and kerosene). Valves should be free from scores, must not bind, or be excessively loose (valves should move through entire travel in bore of own weight).

High Range Clutch—Check for correct 10-plate or 12-plate clutch type (see Note below). Inspect clutch plates for wear, scores, nicks, burrs, and for correct "wave."

►**Clutch Assembly Note**—Two types used which must not be interchanged except as follows:

No. 423085 (10-Plate)—Can be identified by star. This clutch must not be used in place of 12-plate clutch but the 12-plate type can be used to replace the 10-plate clutch.

No. 421893 (12-Plate)—Not marked. This clutch must be used on Models 2302, 2306, 2322, 2332, 2333, 2402, 2406, and 2413.

Reactor Overrunning Clutch—Inspect condition of sprags and clutch races (slip circular coil spring from front end of sprags and withdraw one sprag with long-nosed pliers to make this inspection). If worn, pitted, or brinelled, install new assembly.

Reassembly of Parts: Reassemble all sub-assemblies by reversing disassembly directions and note following important details:

►***OIL SEAL & GASKET CAUTION***—Use all new seals and gaskets. **Do not open** gasket envelope until ready to install (gaskets will absorb moisture and expand so they will not fit). If gaskets have absorbed moisture, dry them out in an electric oven at 175-200°F. (do not use gas oven which emits moisture from combustion).

Transmission Case—Install following parts in case before installing sub-assemblies: Parking gear lever, pawl, and linkage; low range band lever and pivot pin; reverse band lever and pivot pin. Install throttle valve operating cross-shaft seal in case, then install throttle valve inner operating lever and shaft, woodruff key and outer lever, lock lever with clamp bolt. Install new control valve operating cross-shaft seal in case, then install cross-shaft, (CAUTION—work shaft through oil seal carefully so that seal not damaged). Install selector detent sector, control valve inner lever, and parking lever spring-loaded cam. Lock inner operating lever in place with lockscrew and nut. Install selector detent. Install starter safety switch. Install converter outlet valve.

Hydraulic Governor—If new shaft being installed, insert shaft and flange in adapter, press on driving gear until endplay between gear and adapter is .010-.018", drill ⅛" hole in shaft and press in new pin to retain gear. After all parts installed, see that valves operate freely (see disassembly check). Make certain housing seats firmly and evenly on drive shaft flange, tighten the two attaching screws evenly to 6 ft. lbs.

Control Valve Assembly—Install converter inlet valve and spring, pump selector valve and spring, and pump check valve in forward end of upper valve body; install retaining plate and screws. Install direct drive clutch shift valve through the rear end of bore in lower valve body, install stop pin at center of bore; install modulating valve and guide, install retaining pin, install direct drive shift valve piston at rear of bore, install retaining plate and screws. Install timing valve and spring, install retaining plate and screws. Install control valve and link (use slight twisting motion). Install throttle valve, piston, spacer, spring and seat, tighten seat attaching screws evenly. Assemble upper and lower valve bodies and separator plate (CAUTION—make certain correct length screws installed in each position), tighten all screws to 6 ft. lbs. torque. Install the low range and reverse piston upper seals and retaining rings, assemble fast-acting pistons, seats and retainers in the low range and reverse pistons and install seals on both pistons, then install these assemblies in cylinder body (CAUTION—moisten seals with Ultramatic fluid). Assemble pistons and cylinder bodies on control valve upper body (CAUTION—see that piston does not damage upper seal) using round-headed Phillips screws.

►***NOTE***—All valves not spring-loaded should move within control valve body of own weight.

Reactor Overrunning Clutch—***See Bushing production change & replacement bushing note.*** If clutch disassembled, install in following order: Hold inner race facing the front face, install the sprags with curved side at top toward left, and curved side at bottom toward right (use rubber band to hold them in place) and see that sprags lean counter-clockwise or toward left at top. Install coil spreader spring at each end of sprags. Install assembly in housing allowing housing to slip off rubber band (CAUTION—make certain that spreader springs remain in place). Check for correct assembly by making certain that inner race will rotate in clockwise direction (viewed from front) but locks when turned in counter-clockwise direction.

►**Reaction Clutch Housing Bushing Note**—***Three types of Housing & Bushing Assemblies have been used as follows:***

(1) No. 421641 with non-replaceable thin wall bushings. This type was superseded by No. 423220.

(2) No. 423220 with both non-replaceable thin-wall bushings (housing bore less than 1.250"), and replaceable thick-wall bushings (housing bore 1.250"). Thick-wall bushings furnished under Part No. 410989 and can be replaced with bushing tools. This 423220 housing sueprseded by No. 410986.

(3) No. 410986 with replaceable thick-wall bushings. Bushings are No. 410989 (same as second type housing) and can be replaced with bushing tools.

Front Oil Pump—Assemble pump rear plate on the reactor overrunning clutch housing (journal end of reactor cluch housing down), install pump body in correct position on rear plate (CAUTION—make certain all oil passages are aligned), install outer and inner rotors in pump body (CAUTION—make certain that centering ring in place and that inner groove in inner rotor is DOWN). Check rotors for correct assembly (rotors should mesh at the bottom), install pump front plate (CAUTION—align oil passages), use two reactor clutch housing capscrews to hold parts in alignment, install two pump attaching screws and tighten evenly to 8-9 ft. lbs.

Rear Oil Pump—Install outer and inner rotors in pump body (output shaft will line up inner rotor), install rear plate, install two attaching screws and tighten evenly to 8-9 ft. lbs.

Bell Housing—***CAUTION***—Do not tip assembly down after overrunning clutch installed (will allow assembly to fall out). Install front pump relief valve and check for free operation in valve bore, then install valve retaining plug, valve spring, and plug. Install front oil pump and reactor overrunning clutch assembly (CAUTION—make certain that oil passages line up), install eight attaching screws and tighten evenly to 15-18 ft. lbs. Install oil passage plugs and tighten securely, install new converter pump shaft seal in housing.

High Range Clutch—***See the Bushing Production Change & Replacement Bushing Note below.*** Install outer piston ring on piston and inner ring on drum journal and centralize inner ring on hub, use ring compressor PU-314 to guide outer ring and install high range clutch piston in cylinder of low range drum. Install clutch release spring with one end seating in piston. Use tool PU-304 to compress the spring, install spring retainer and snap ring. Coat clutch hub thrustwasher with cup grease before installing, install snap ring on input shaft ahead of clutch hub, then install clutch hub, thrust washer, and rear snap ring. Install clutch hub and input

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PACKARD ULTRAMATIC (Cont.)

shaft in low range drum. Install clutch plates (start with steel plate, install driving and driven plates alternately). Install front sun gear and flange, and retaining snap ring (CAUTION—make sure snap ring seated in groove).

►**High Range Clutch Housing Note**—*Two types of Housing and Bushing Assemblies (requiring different Clutch Piston Inner Ring) have been used as follows:*
(1) No. 421638 Housing Assembly (with non-replaceable thin-wall bushings) used with Piston Inner Ring No. 421072. If bushing wear excessive, replace above parts with Kit No. 410987 (consists of second type Housing No. 423366 and later design Piston Ring No. 423367).
(2) No. 423366 Housing Assembly (with replaceable thick-wall bushings) used **with new No. 423367 Clutch Piston Inner Ring** (this ring can also be used with first type housing but first No. 421072 ring must not be used with the second type housing). This housing has bushing bore of 2.000" ± .0005" (.062" larger than first type). Replacement bushings are furnished (No. 410990) and can be installed with regular bushing tools.

Planetary Unit—Assemble each planetary pinion with spacer, roller bearings, and thrust washers on its shaft (spacer at center, 19 rollers and thrust washer at each end—use clean cup grease to hold rollers and thrust washers in place). Hold output shaft horizontal, install long planetary pinion assemblies in planetary cage **with chamfered end of each pinion to the front,** push shafts far enough in to insert woodruff key, then push shafts forward so that they are locked by keys. Install rear thrust washer in cage (hold in place with clean cup grease) and then install rear sun gear (CAUTION—see that thrustwasher seats in cage). Install short planetary pinion assemblies **with chamfered end to front** and lock shafts with woodruff keys in same manner as long pinions. Make certain that all thrustwashers are in place, then install front half of planetary cage (CAUTION—line up marks on both halves). Tighten attaching capscrews to 25-30 ft. lbs. (large screws), 15-18 ft. lbs. (small screws), lock all screws by bending up tabs on lock plate.

Extension Housing & Shaft (1951): Press rear ball bearing in rear end of housing, install bearing snap ring, press rear oil seal in, install extension shaft in housing making certain that shaft pressed in until shoulder on shaft is against bearing inner race. Install universal joint flange, washer, and nut. Tighten nut securely to 90 ft. lbs. torque. Lubricate parking gear hub with film of Ultramatic Drive Fluid, install parking gear in forward end of housing temporarily **with thrust spring omitted** (necessary for measurement of endplay to determine correct thrustwasher thickness between high range clutch housing and reactor clutch housing).

►*CAUTION—Parking Gear Thrust Spring must be installed during final assembly (after endplay adjustment completed).*

REASSEMBLY—TRANSMISSION (AFTER OVERHAUL OF UNITS)

Reassembly of Transmission—Install parts by reversing order of disassembly and note following important instructions:

Rear Oil Pump—Install rear oil pump in case, see that all oil passages line up, tighten capscrews evenly to 15-18 ft. lbs.

Planetary Unit Installation—Coat reverse drum thrust washer with cup grease and place it on rear oil pump body journal. Install reverse band and struts, install band lever holding fixture PU-308 to retain these parts. Install reverse drum using care not to score the drum bushing. Install new seal ring on output shaft and lubricate seal and shaft with Ultramatic Drive Fluid. Install the planetary unit through the front of the case using care not to score the drum bushing (CAUTION—make certain that seal ring enters front bore of rear pump body and that planetary unit is all the way back against the reverse drum thrust surface). Install speedometer driving gear parts (see note below for production changes). Install rear bearing retainer (1949-50) or rear housing assembly (1951—parking gear thrust spring must be **omitted**) with new gasket, tighten attaching capscrews evenly to 12-15 ft. lbs. (1949-50), 15-18 ft. lbs. (1951). Install hydraulic governor and tighten attaching screws in governor adapter to 8-9 ft. lbs., then install governor cover with new gasket and tighten cover screws to 8-9 ft. lbs. Install speedometer drive pinion and retainer.

►**Speedometer Drive Gear Assembly Note**—*Different type assemblies (gear, spacers, washers, etc.,) used which must be correctly installed as follows:*
(1949-50)—Install parts on rear end of output shaft in following order: Speedometer driving gear spacer, speedometer driving gear, parking gear spacer, parking gear, output shaft rear bearing, parking gear snap ring.
(1951)—Install parts on rear end of output shaft in following order: Speedometer driving gear sleeve, spring, spacer (smooth face against gear), speedometer driving gear, rear spacer (grooved face against gear).

High Range Clutch Installation (& Endplay Adjustment)—Install low range band, and driving sun gear front thrust ball bearing (use cup grease to hold bearing in place). Install high range clutch unit through front of case and make certain that it is seated against thrust bearing with sun gear in mesh with planetary pinions. Install low range band struts and install band lever holding fixture PU-308 to retain these parts. Then **check and adjust endplay** as follows:

►*CAUTION—On "2400" series cars, extension shaft and rear housing MUST BE INSTALLED and planetary unit and output shaft must be solidly up against end of extension shaft when following measurements are taken (false reading will be obtained if measured otherwise).*

(1) Mount gauge PU-302 on transmission mounting face of bell housing **with gasket removed,** set gauge to measure distance from milled rear face of bell housing to milled surface at rear face of reactor overrunning clutch housing, lock gauge cylinder in this position.

(2) Invert gauge on front face of transmission case, measure distance from forward face of low range drum thrust surface to milled front face of transmission case. Gauge micrometer reading will indicate endplay which must be adjusted by installing thrustwasher of correct thickness (this washer furnished in .010" steps from .085" to .135" thick).
From the gauge reading (above), select a thrustwasher equal in thickness to the gauge reading (1949-50), .010" less than gauge reading (1951), coat washer with cup grease to hold it in place and install the bell housing on the transmission using a **new gasket** (see gasket caution below). Install all attaching capscrews and tighten evenly to 55-60 ft. lbs. On 1951 transmissions, remove rear housing, **install parking gear thrust spring** on end of extension shaft (to rear of parking gear), re-install rear housing and tighten attaching screws to 15-18 ft.lbs.

►*BELL HOUSING GASKET CAUTION*—End clearance is controlled by the thickness of this gasket (in conjunction with thrustwasher) and should be .008-.018" (1949-50), .018-.028" (1951). NEW GASKET and CORRECT THICKNESS THRUSTWASHER must be used when assembling transmission.

Control Valve Assembly—Install control valve assembly (CAUTION—make certain that control valve collar engages valve operating lever), using correct length capscrew in each hole and omitting the two screws which attach the oil screen, tighten screws evenly to 9 ft. lbs. Connect control valve link to inner lever, install the spring lock. Adjust the control valve (see below). **After control valve adjusted,** install oil screen, tighten attaching capscrews to 9 ft. lbs. Remove holding fixture PU-308 from low range and reverse band levers.

Control Valve Link Adjustment (First Type Two-piece Adjustable Link): Place the selector control valve inner lever in Reverse **"R" position** and make certain that detent fully engaged in detent well. Use gauge PU-316 installed on rear land of control valve, adjust link (loosen clamp bolt holding link sections together), so that rear land of valve is ¾" out of control valve lower body. In this position, distance from center of link pin to control valve lower body should be 1.28". Make certain that link clamp bolt is securely tightened.

Control Valve Adjustment (Later Type Solid Link): Place selector control valve inner lever in Reverse "R" position and make certain that detent fully engaged in detent well. Use gauge PU-316B installed on the control valve, loosen detent lever capscrew, position control valve so that distance from face of valve body to shoulder on valve is exactly 5/16", tighten lever clampscrew to 50 ft.lbs. torque. Control lever shaft should have approximately .045" endplay (controlled by detent lever position on shaft). If necessary to adjust endplay, loosen detent lever clampscrew and move lever using care **not to disturb valve setting of 5/16".**

Oil Pan Installation—Use new gasket, tighten attaching capscrews evenly to 10-12 ft. lbs.

Band Adjustment—Adjust both bands. *See Adjustment data.*

INSTALLATION IN CAR

After transmission completely assembled, install converter on transmission input shaft and fasten converter to bell housing to prevent it falling off while transmission being installed. Install transmission and converter assembly by reversing the removal procedure and note the following:

Transmission Pilot Studs—Use two pilot studs in forward face of clutch housing to guide it onto flywheel.

►*CAUTION—Make certain that converter drain plug lined up with opening in flywheel.*

Tightening Torques—Tighten clutch housing-to-flywheel capscrews to 25-30 ft. lbs. Tighten transmission bell housing-to-flywheel housing capscrews to 25-30 ft. lbs. (CAUTION—bell housing must be held tightly against flywheel housing while tightening these screws).

Filling Transmission—See Lubrication data.

►*CAUTION—Transmission must have at least 7 qts. of fluid before engine is started.*

Adjusting Linkage—See Linkage Adjustment.

STUDEBAKER AUTOMATIC TRANSMISSION

Champion, Model 9G (1950), 10G (1951)
Comm. & Land Cruiser, 17A (1950), H (1951)

►CHANGES, CAUTIONS, CORRECTIONS

►**TRANSMISSION SERIAL NO. NOTE**—Separate Torque Converter Nos. and Transmission Nos. used:

Torque Converter—Stamped on engine side of flywheel adjacent to flywheel ring gear.

Transmission—On metal plate on left side of transmission case below oil level gauge.

►**NEW TORQUE CONVERTER HOUSING INSTALLATION CAUTION**—New housings must be checked for run-out (bore & face) and dowels relocated if bore run-out exceeds .004". *See "INSTALLATION" data below for checking of housing and relocating dowels.*

►**1951 COMMANDER ACCELERATOR LINKAGE CHANGE (Serial No. 8133626 Up):** Following parts changed to provide smoother accelerator operation: Accelerator Bellcrank Lever & Bracket Assembly, Accelerator Bellcrank Lever-to-Transmission Rod, Accelerator Cross-shaft Assembly.

►**GOVERNOR LEVER PRODUCTION CHANGE:** Governor control lever now has **two** holes for accelerator cross-shaft-to-transmission rod ball joint connection. On 1951 transmissions below Serial No. SCO-31007 (with first type **one-hole** lever), new **two-hole** lever No. 529078 **should be installed.**

►*CAUTION—See Linkage Adjustment directions for connection at this lever (rod must be connected in proper hole and all cars not connected alike).*

►**TRANSMISSION OIL PAN PRODUCTION CHANGE:** Beginning Champion Serial No. 20171, Commander No. 45792, oil pan with reinforced flange used. This pan requires ⅛" longer oil pan screws and can be installed on earlier cars if Kit No. 529975 used (includes 14 new longer screws No. 31-0510).

►**STARTING ENGINE BY PUSHING CAR:** Turn ignition key ON, depress and release accelerator pedal once (to set automatic choke), place transmission selector lever in Neutral "N" position. Push car until speed of 15-20 MPH. is reached, then move selector lever to Drive "D" or Low "L" position.

CAUTION—Pushing to start engine recommended rather than towing (car may overtake tow car).

►**TOWING CARS WITH AUTOMATIC TRANSMISSION:** Place transmission selector lever in Neutral "N" position and **do not tow car in excess of 30 MPH.**

►**REPLACEMENT ENGINE CAUTION:** Special replacement engines (Complete or Stripped Assy.) with **special Crankshaft-to-Converter Bolts** furnished for cars with Automatic Transmission. *Engines must not be interchanged between std. Synchro-mesh and Automatic Trans. cars except as follows:*

Champion Engines—Std. Stripped Engine (526685 or 530862) would require changing of Crankshaft and Crankshaft Bolts for use with Automatic Transmission and this is not recommended. Automatic Trans. Stripped Engine (530350 or 530865) can be used with std. synchro-mesh trans. by installing std. Crankshaft-to-Flywheel Bolts No. 194542 (replacing special No. 526851 bolts).

Comm. & Land Cruiser—Std. 1950 Stripped Engine (525852) can be used in emergency with Automatic Transmission by removing portion of engine front plate, and installing special Crankshaft-to-Converter Bolts No. 526851 (replacing std. Crankshaft-to-Flywheel Bolts).

►*CAUTION—Special Crankshaft-to-Converter Bolts No. 526851 must always be used for mounting of automatic transmission Converter on flywheel (converter will be damaged if regular bolts used).*

DESCRIPTION

Transmission consists of Torque Converter Assembly (torque converter and Direct Speed Clutch) and a planetary type transmission (3-speed and Reverse) which is hydraulically controlled. Transmission has a pawl-and-gear Parking lock mechanism and is fitted with an electrically controlled, solenoid operated "Anti-Creep" device by which the brakes are held on while the car is standing (operative whenever ignition turned on).

►**Champion & Commander Differences:** Transmissions are similar but have following differences:

Torque Converter—11" diameter (Champion), 12" (Comm.). Direct Drive Clutch is also proportionately smaller on Champion. Torque converter cooling air intake has screened opening on left side (Champion), flexible air duct (Comm.).

Transmission Oil Capacity—Approx. 9½ qts. (Champion), 11½ qts. (Comm.). *See Lubrication data.*

Low Band Servo—Single piston type (Champion), double piston type (Comm.).

Planetary Multiple Disc Clutch—Three-disc type (Champion), four-disc type (Comm.).

Extension Housing—Champion governor extension housing does not have direct drive latching mechanism (used on Comm.), and has heavier governor spring. Speedometer pinion has 27 teeth (Champion), 24 teeth (Comm.).

Torque Converter & Direct Speed Clutch: Assembly is mounted in a case which replaces the flywheel used on cars with standard transmission and consists of the units listed below. Torque converter is air-cooled by air drawn in through duct on left side of case (vanes on outer surface of converter case circulate air) and discharged through louvres on bottom of housing. Torque converter and direct speed clutch action is automatic and controlled by the hydraulic system (see Operation—below, and Hydraulic Circuit illustration).

Converter Impeller (Driving Member)—Integral with rear section of converter case bolted on engine drive plate on end of crankshaft. Impeller is supported at rear end by sleeve extending through bushing in forward end of front oil pump housing (behind oil seal). This sleeve engages the inner gear of the front oil pump and drives the pump. Impeller rotates at engine speed.

Turbine (Driven Member)—In converter case directly in front of impeller and driven by oil flow from the impeller. Turbine hub is splined on tubular driveshaft which is integral with the front planetary ring gear so that power is transmitted to this unit when the converter is operating.

Stator (Stationary Member)—Consists of a set of curved vanes placed between the inner ends of the turbine and impeller vanes. Stator is mounted on a free-wheeling unit which is mounted on a stationary shaft carried in the front retainer of the transmission case. Stator is locked or held stationary when unit is operating as a torque converter and acts to "boost" the oil returned to the impeller thus supplying the torque multiplication. When turbine speed equals impeller speed, stator rotates freely with the other members (rotation permitted by free-wheel unit) without any torque multiplication.

Direct Drive Clutch—Consists of a hydraulically operated single plate clutch in forward end of torque converter housing. Clutch driven member is splined on forward end of transmission mainshaft and clutch driving plates are locked in converter housing (plates engage dowels and studs in housing) so that the transmission mainshaft is driven directly by the crankshaft when the clutch is engaged, thus locking out the torque converter. Clutch is engaged hydraulically by oil under pressure in chamber in front of forward pressure plate (oil enters and leaves this chamber through oil channel in hollow mainshaft).

Planetary Transmission: Consists of planetary gear sets, bands, and servo mechanisms, multiple disc clutch, free-wheeling units, governor, oil pumps, and control valves located in transmission case.

Front Planetary Unit & Clutch—Gears are conventional (inner sun gear, planetary pinion assy. and outer ring gear) with outer ring gear driven by torque converter turbine, planetary pinion assembly driving rear planetary ring gear, and sun gear controlled by Low Band and Multiple Disc Clutch. Sun gear is held stationary by the Low Band (in Low position) so that power is transmitted through the gears, or is locked to the planetary pinion assembly by the multiple disc clutch (in Intermediate and Direct positions) so that the entire planetary unit revolves as an assembly to transmit power directly without gear reduction. In reverse position, the planetary pinion assembly is held stationary by the Reverse Band and power is transmitted through the gears and in a reverse direction.

Rear Planetary Unit—Gears are conventional (inner sun gear, planetary pinion assy. and outer ring gear) with outer ring gear driven by front unit planetary pinion assembly, planetary pinion assembly driving transmission mainshaft (pinion plate splined on shaft), and sun gear controlled by the Low Band or Forward Band through free-wheel units on the gear hub. Sun gear is held stationary by the Forward Band in all forward speeds (Low, Intermediate, and Direct positions) so that power is transmitted through the gears with these modifications: In Intermediate position, the forward free-wheel unit permits the front planetary unit (which is locked out) to over-run the rear planetary sun gear (which is held stationary). In Direct drive position, gears are by-passed by the engagement of the Direct Speed Clutch and the sun gear turns freely with the other gears although the Forward Band is applied (this rotation permitted by the rear free-wheel unit in the forward band drum hub). In Reverse position, the sun gear is driven by the front planetary unit and the ring gear is held stationary by the Reverse Band (along with the front planetary pinion assy.) so that power is transmitted through the planetary pinion assembly.

Parking Brake Mechanism—Consists of a pawl controlled by the transmission selector lever which engages a gear on the rear end of the transmission mainshaft and locks the shaft when selector lever is placed in Parking "P" position. An interlock piston (see illustration) operating from oil pressure supplied by the rear oil pump prevents engagement of the pawl if car is moving forward at speed

CONTINUED ON NEXT PAGE

STUDEBAKER AUTOMATIC TRANSMISSION (Cont.)

greater than 3-5 MPH. to prevent accidental engagement of the parking lock.

Anti-Creep System—Consists of a solenoid controlled valve in the hydraulic brake line to the rear wheels which is controlled by the Pressure Switch in the transmission and an Idle Adjustment Screw switch on the carburetor (replaces regular throttle stop-screw) or on accelerator cross shaft bracket. *See "ANTI-CREEP" in Brake Section for data.*

Oil Pumps: Two pumps used to provide oil pressure for hydraulic controls, oil supply for torque converter, and transmission lubrication:

Front Pump—External-internal gear type, in front of transmission case and driven by the engine. Pump starts to operate as soon as engine started and supplies oil to torque converter and for transmission lubrication. Also supplies oil pressure for hydraulic controls during Idling, Low Speed, and Reverse operation. Pump pressure is controlled by Front Pump Relief Valve.

Rear Pump—Mounted externally on right side of transmission extension housing and driven from same cross-shaft as governor. Pump is driven from the propeller shaft and operates whenever rear wheels are turning. Supplies oil pressure for transmission operation when pushing car to start engine, and at higher car speeds (when rear pump takes over, rear pump relief valve by-passes front pump output to oil pan so that front pump idles).

Hydraulic Controls: Consist of a governor in the transmission extension housing, and a valve assembly contained in the Valve Block mounted on lower face of transmission case within oil pan.

Governor—Fly-ball type. Actuates governor valve to control Direct Speed Clutch operation. A governor lever is linked to the accelerator linkage so that governor action can be overridden for "kick-down" to intermediate gear, or upshift to Direct speed delayed by the operator.

Front Pump Relief Valve—Regulates front pump pressure at 80 lbs. for all forward driving ranges (P, N, D, L) and boosts pump pressure to 200 lbs. for reverse (R) operation.

Rear Pump Relief Valve—Regulates rear pump pressure at 80 lbs. Also by-passes front pump output to oil pan (so that front pump idles) when rear pressure sufficient to operate transmission.

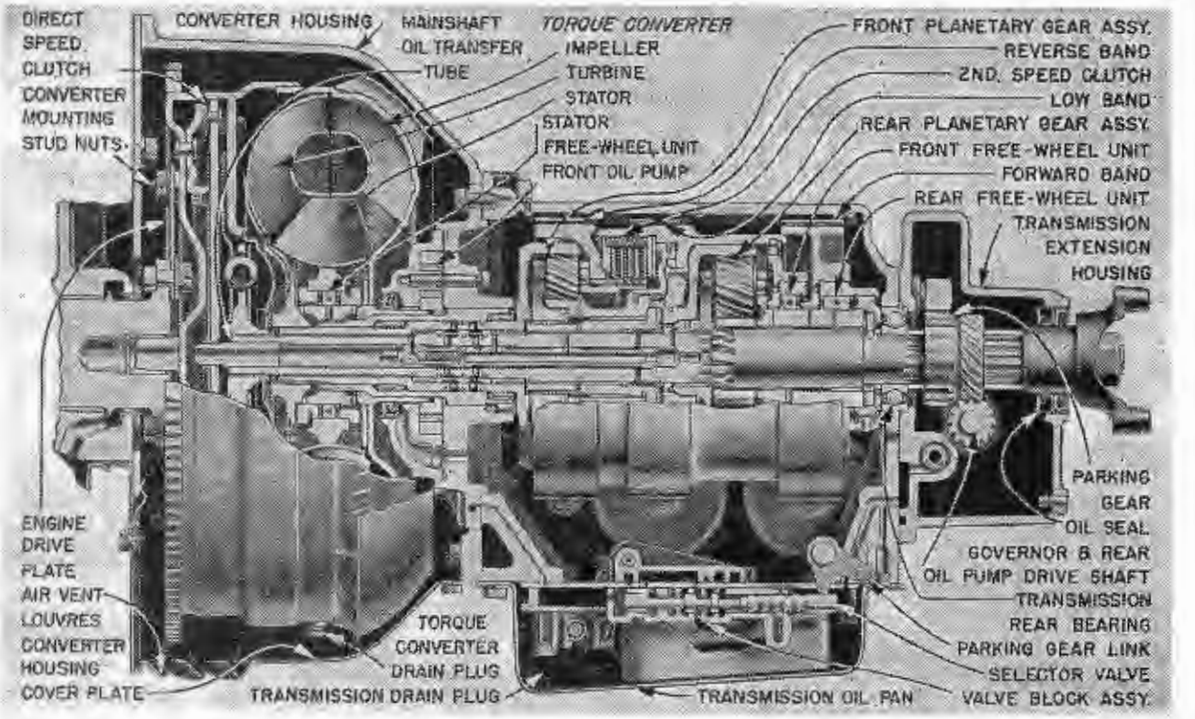
Converter Valve—Supplies oil to converter assembly at pressure of 27 lbs. to maintain oil level.

Selector Valve—Linked to transmission selector lever on steering column and controls oil pressure supply to servo mechanisms, multiple disc clutch, and direct drive clutch as required for operation in each range (P, N, D, L, R depending on selector lever position).

Reverse Shuttle Valve—Provides for smooth engagement of reverse band.

Reverse Interlock Valve—Prevents application of reverse band when car is moving forward.

Parking Interlock Piston—Blocks engagement of parking gear pawl when car is moving forward and prevents accidental engagement of parking lock.



STUDEBAKER AUTOMATIC TRANSMISSION SECTIONAL VIEW

OPERATION

Torque Converter Assembly automatically provides a torque multiplication ranging from 2.16-1 (maximum when turbine stationary and impeller turning at 1450 RPM. or normal stall speed) to 1-1 (when turbine and impeller speeds approximately equal. At car speed of 18 MPH. (depending on throttle position—see table), engagement of Direct Speed Clutch locks out the torque converter completely. The planetary transmission is controlled by the operator and provides the following gear ratios:

Neutral "N" Position—All bands and clutches are released so that no power is transmitted through transmission. Car can be moved freely if brakes not applied (will be held on by Anti-creep after they have once been applied but can be released by turning ignition off or by opening the throttle).

Low "L" Position (used primarily for extra power on steep grades, engine braking when descending grades, fast acceleration from standing start, or "rocking" car out of sand or snow). The Low and Forward bands are applied and power is transmitted through both planetary gear sets in tandem providing a total ratio of approximately 4.6-1 (converter torque multiplication of approximately 2-1 plus gear reduction of 2.3-1).

►*OPERATION CAUTION*—When Low used for engine braking on grades, **car speed should be brought below 40 MPH.** before moving selector lever to "L" position. When Low used for fast starts, selector lever should be moved to "D" position **before reaching car speed of 40 MPH. and without releasing accelerator.**

Drive "D" Position—Provides two ratios depending on car speed and throttle position as follows: **Intermediate**—*See Shift Speed Table for effective car speeds.* Forward Band & Multiple Disc Clutch applied so that forward planetary gear set is locked out and power is transmitted through rear planetary gear set providing a total ratio of approximately 2.9-1 (converter torque multiplication of approximately 2-1 plus gear reduction of 1.4-1). **Direct**—*See Shift Speed Table for effective car speeds.* The Direct Speed Clutch engages and this locks out the Torque Converter and also the Planetary Gear unit to provide positive drive of 1-1 ratio.

Direct-to-Intermediate Downshift—At car speeds below 55 MPH. (Champion), 50 MPH. (Comm.), the transmission can be "kicked down" from Direct to Intermediate for additional power for hill climbing or passing by fully depressing accelerator pedal. Transmission will remain in Intermediate until throttle released momentarily or lock-out speed of 65 MPH. (Champ.), 58 MPH. (Comm.) reached.

►**Champion Note**—Transmission can be downshifted as above in the 18 MPH.-to-30 MPH. range as desired by a greater than normal accelerator pedal pressure.

Reverse "R" Position—Reverse band is applied in two stages ("boosted" oil pressure of 200 lbs. on servo inner piston applies band, shuttle valve then directs oil pressure to servo outer piston also to assist band in absorbing the high reaction torque). Power is transmitted through both planetary units

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STUDEBAKER AUTOMATIC TRANSMISSION (Cont.)

in tandem to provide reverse rotation and a total ratio of approximately 4-1 (converter torque multiplication of 2-1 plus gear reduction of 2-1).

Parking "P" Position—Similar to neutral position (all bands and clutches released) and in addition the parking pawl (linked to selector lever) is engaged in parking gear on rear end of mainshaft so that propeller shaft and rear wheels locked.

Car Shifting Speed Table

Upshift (Intermediate-to-Direct)

	Normal — Throttle — Wide-Open
Champion	22 MPH.....65 MPH. max.
Commander	18 MPH.....58 MPH. max.

Downshift (Direct-to-Intermediate)

Champion	18 MPH.....①below 55 MPH.
Commander	12 MPH.....①below 50 MPH.

①—Forced "kick-down" downshift.

LUBRICATION

Check transmission oil level every 1000 miles and add oil as required to maintain level at "FULL" mark on dip-stick. Drain and replace oil at 15000 mile intervals or once a year.

Checking Oil Level—Oil must be warm (set parking brake, place selector lever in "L" position, idle engine until normal operating temperature reached). Remove inspection hole cover in front floor carpet over transmission case, clean all dirt from around inspection hole, check oil level with dip-stick gauge. **With engine idling and selector lever in "L" position,** add oil, as required, to bring level up to "FULL" on dipstick (1 pint between "Low" and "Full").

►***CAUTION—Do not fill above FULL mark.***

Recommended Oil—Use only **premium type 10W engine oil** (or premium type SAE 10-10W engine oil). Special fluids are not required.

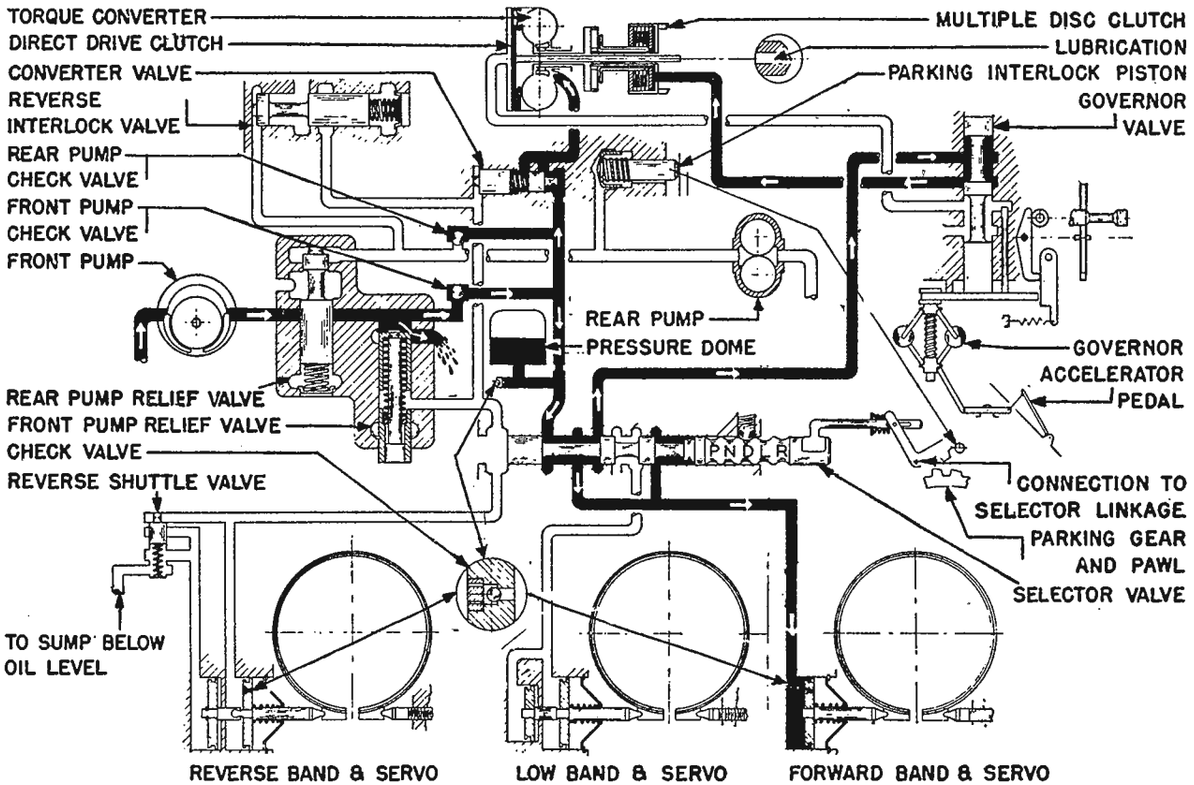
Draining & Refilling—Oil must be warm (set parking brake, place selector lever in "L" position, idle engine until normal operating temperature reached). Stop engine, remove inspection hole cover in front floor carpet, clean all dirt from around inspection hole, remove oil level gauge dipstick. Drain transmission oil pan by removing drain plug at left front corner of pan. Remove converter housing lower cover plate, turn converter until drain plug down, drain converter by taking out this plug (draining facilitated by removing converter pressure take-off plug on left side of transmission case). Re-install all drain plugs, install converter housing cover plate. Install 5 quarts oil (Champion), 6 quarts of oil (Commander), through the dipstick hole on top of transmission case. Start engine and allow it to idle for approximately 1 minute with selector lever in "L" position to fill converter housing, then add three additional quarts of oil, finally check oil level **with engine idling and selector lever in "L" position,** add oil to bring level up to FULL mark on dipstick.

►***CAUTION—Capacity is approx. 9½ qts. (Champion), 11½ qts. (Comm.) but actual amount installed should be determined by oil level reading on dipstick.***

Oil Pan & Oil Screen Removal & Installation: Drain transmission case (see above).

Removal & Cleaning—Remove parking brake bellcrank from crossmember under transmission case (not necessary on Champion). Remove all oil pan capscrews, remove oil pan. Remove spring clip holding oil screen in screen housing on bottom of valve block assembly, remove screen and clean with compressed air.

Installation—Install oil screen in housing and see that spring clip installed properly to hold screen in place. Use a **new pan gasket but DO NOT use any type of sealing compound when installing pan** (heavy mineral grease or Lubriplate may be used to hold gasket in place). Tighten all oil pan mounting screws to 10-13 ft.lbs. Install parking brake bellcrank.



AUTOMATIC TRANSMISSION HYDRAULIC CIRCUITS—INTERMEDIATE DRIVE POSITION

LINKAGE ADJUSTMENT

LINKAGE ADJUSTMENT: ***CAUTION—All models not adjustable alike and 1951 Commander linkage change requires new adjustment procedure on these cars.***

Accelerator Linkage (Champion): Make certain that engine idle speed set to 500-550 RPM. (warm engine with choke valve open and fast idle inoperative).

1) Disconnect accelerator cross shaft-to-bellcrank rod by removing clevis pin at cross shaft end of rod. Disconnect wire at Anti-creep Switch on cross shaft bracket.

2) Hold contact plate on cross shaft lever firmly against end of Anti-creep Switch, measure distance between contact plate and cross shaft bracket. If this measurement not ¼", adjust switch by loosening locknut and turning switch in or out of bracket, tighten locknut after correct ¼" clearance secured. ***NOTE***—If ¼" clearance cannot be secured by adjusting switch, disconnect accelerator cross shaft-to-transmission rod at transmission end and check push rod and cross shaft for interference. ***Do not bend contact plate or cross shaft bracket to secure correct switch setting.***

3) Connect accelerator cross shaft-to-bellcrank rod by installing clevis pin but **do not** install cotter pin at this time. Make certain that carburetor throttle valve in fully closed position (stopscrew on low end of fast idle cam and choke valve wide open).

4) With accelerator control fully released, and carburetor throttle in fully closed slow idle position, check position of spring-loaded swivel on accelerator bellcrank end of carbureor throttle rod. Swivel should be close to **but not touching** the swivel sleeve on the carburetor side of the rod. If swivel position not correct, disconnect accelerator cross shaft-to-bellcrank rod by removing clevis pin, loosen locknut on bellcrank rod clevis, adjust clevis on rod until carburetor rod swivel position is correct, tighten clevis locknut, connect bellcrank rod and install clevis cotter pin.

5) Place selector lever in Park "P" position. Set Adjusting Tool J-4391 at maximum length, hook one end of tool over cross shaft lever to which the

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STUDEBAKER AUTOMATIC TRANSMISSION (Cont.)

transmission rod is connected, hook opposite end of tool over upper right rear corner of battery box (this will rotate lever and partially open carburetor throttle). Shorten tool length by turning the turnbuckle until carburetor throttle valve is just wide open (at this point further movement will compress spring on throttle rod without changing throttle position). Leave tool in place to hold throttle linkage in this position while making adjustments (6).

6) Disconnect accelerator cross shaft-to-transmission rod at ball joint on governor control lever at transmission case. Move governor control lever forward or clockwise until detent resistance is felt. Adjust rod length by loosening locknut and turning ball joint on rod end until rod can be connected to OUTER hole in lever without disturbing lever position (this is full throttle position). Connect rod. Remove adjusting tool from cross-shaft lever.

►*CAUTION—Governor lever has two holes and rod must be connected at OUTER hole. See Governor Lever Production Change Note for data on this new two-hole lever.*

7) Check entire linkage adjustment as follows: Depress accelerator pedal fully (CAUTION—floor mat must be in place), hold pedal in this position. Disconnect rod at governor control lever on transmission, see that lever is in extreme forward position. Without connecting rod, fully release accelerator pedal, position governor lever in line with rod ball joint and make certain that governor lever has at least ¼" free travel in forward direction from this point before spring pressure is felt. If this adjustment correct, connect rod to governor lever. If adjustment not correct (governor lever does not have full forward travel, or proper free travel), recheck entire linkage adjustment. If this does not correct trouble, check linkage for binding, distortion, or interference.

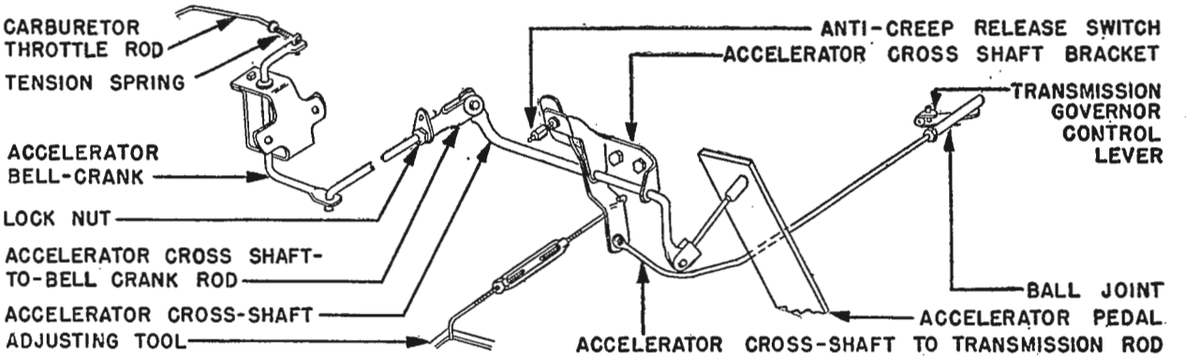
Accelerator Linkage (1950 Commander): See that engine idle speed set to 500-550 RPM. (Warm engine with choke valve wide open and fast idle inoperative). Then proceed as follows:

1) Hook one end of adjusting tool J4391 on lower end of accelerator pedal pushrod, other end over lower right rear corner of battery box (see illustration). Adjust tool length by turning turnbuckle until carburetor throttle valve is just wide open (additional shortening of tool will cause compression of tension spring on bellcrank-to-carburetor throttle rod **which is not desired).**

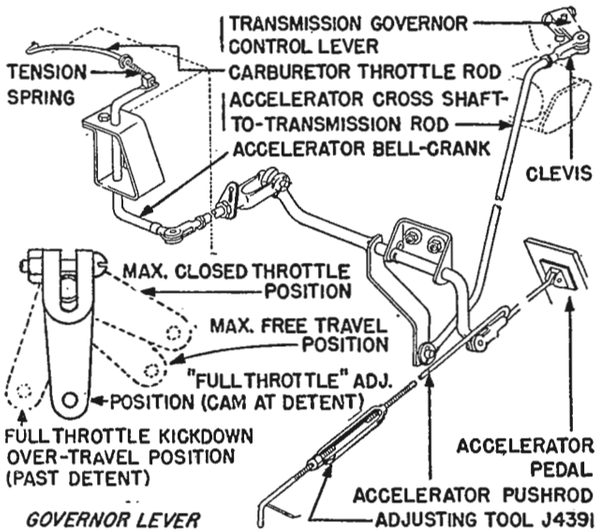
2) With linkage positioned as above, disconnect control rod at governor lever on transmission case by taking out clevis pin, move governor control lever forward or clockwise until detent resistance is felt (see illustration). Adjust rod length by turning clevis until clevis pin slips freely through hole in clevis and **outer hole** in lever. Install clevis pin but do not install cotter pin until final check completed.

►*CAUTION—Governor lever has two holes and rod must be connected at OUTER hole. See Governor Lever Production Change Note for data on this new two-hole lever.*

3) Remove adjusting tool from accelerator pushrod. With floor mat in place, fully depress accelerator pedal and hold pedal in this position. Remove clevis pin from governor control lever, make certain that lever is at forward end of travel. If it is not, see (5).



1950-51 CHAMPION ACCELERATOR LINKAGE



1950 COMMANDER ACCELERATOR LINKAGE

4) Release accelerator pedal. Remove clevis pin from governor control lever, make certain that lever has at least ¼" free travel in forward direction before spring pressure is felt. If it does not, see (5).

5) If governor lever does not have full forward travel (3 above), or if free travel is not correct (4 above), recheck entire linkage adjustment, check for binding, interference, or distortion in linkage. After correcting any trouble, **install clevis pin and cotter pin.**

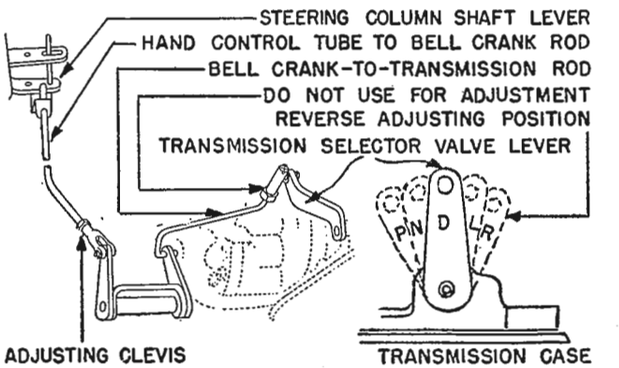
Accelerator Linkage (1951 Commander):

CAUTION—New linkage used beginning Serial No. 8133626 (requires different connection for rod at Governor Control Lever). See step 6.

1) Make certain that engine idle speed set to 500-550 RPM (warm engine with choke valve wide open and fast idle inoperative).

2) Loosen Anti-Creep Release Switch locknut (on cross-shaft bracket), disconnect wire at switch, back off switch several turns for clearance.

3) See that accelerator is in fully released position



SELECTOR (HAND CONTROL) LINKAGE

and throttle stopscrew on low step of fast idle cam. Check clearance between end of cross shaft-to-carburetor rod and firewall (between end of rod and reinforcing rib on firewall). Clearance must be ⅛" minimum ¼" maximum. Adjust by loosening locknut at carburetor lever trunnion and adjusting rod.

4) Use special tool hooked over accelerator pedal shaft and into hole in cowl flange directly above wiring harness to hold carburetor throttle valve in wide open position (this tool must be made up in shop) or hold accelerator linkage in this wide open position as follows: Disconnect accelerator pullback springs, place sufficient weight on accelerator pedal to fully open carburetor throttle valve but **make certain over-travel spring on cross-shaft-to-carburetor rod not compressed** (swivel sleeve on rod should just start to move away from washer).

5) Disconnect accelerator cross shaft-to-transmission rod ball joint from governor lever on tranmsission case. Examine Governor Lever on transmission case to make certain it is latest two-hole type (See Governor Lever Production Change Note) and install this new lever on transmissions prior to Serial No. SCO-31007.

6) Move governor lever forward (clockwise) until resistance of detent is felt, check rod adjustment. Ball joint stud should slip easily into proper hole in lever (CAUTION—see **different setting** for earlier and later cars below). Adjust rod, as necessary, by

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STUDEBAKER AUTOMATIC TRANSMISSION (Cont.)

loosening locknut and turning ball joint on rod. Tighten locknut securely and connect rod but **do not install ball joint stud nut at this time.**

Governor Lever Connection

Cars before Serial No. 8133626 (first type accelerator linkage)—INNER hole.

Cars beginning Serial No. 8133626 (Revised accelerator linkage)—OUTER hole.

7) Release accelerator pedal (remove tool or weight from pedal and connect pull back springs).

Check linkage operation as follows:

8) See that floor mat in place, depress accelerator fully (kick-down position) and hold pedal in this position. Slip ball joint stud out of governor lever on transmission, see that lever is at **end of forward travel.** Reconnect ball joint.

9) Release accelerator pedal. Slip ball joint stud out of governor lever, see that lever has at least ¼" free travel in forward direction before spring pressure felt. Reconnect ball joint, install stud nut.

10) If lever does not have full forward travel (8 above) or if free travel not correct (9 above), check entire linkage for binding, distortion or interference, and correct as necessary. If cross shaft-to-transmission rod interferes with car floor pan, remove front splash pan and bend floor pan out of the way—**do not bend linkage** to correct interference. Check all linkage mounting bolts for tightness.

11) Adjust Anti-creep Release Switch by turning switch into bracket until switch plunger just contacts the plate. Install wire, turn on ignition, adjust switch in or out until a click is heard in the solenoid. Tighten switch locknut.

Selector (Hand Control) Linkage: All models adjusted similarly as follows:

1) Place selector lever in Reverse "R" position. Remove clevis pin from bellcrank end of steering column tube-to-bellcrank rod.

2) Measure length of bellcrank lever-to-transmission lever rod. This length must be 7 5/16" (all 1950 cars), 7 9/16" (1951 cars—see note below) measured from center of fixed end at bellcrank (forward) end of rod to center of adjustable joint at transmission (rear) end of rod. Adjust by loosening locknut and turning adjustable joint on rod.

►***1951 SETTING NOTE***—This 7 9/16" setting supersedes earlier specification of 7⅝" on 1951 cars. Tool J-4602 (for 7⅝" setting) can be used to make this adjustment if **ball joint is turned back one full turn** after having been set to 7⅝" with the tool (this will give 7 9/16" setting).

►***CAUTION—After rod length correctly set (above), DO NOT change rod length when making adjustments.***

3) Disconnect steering column tube-to-bellcrank rod by taking out clevis pin at bellcrank, move valve selector lever on transmission case to reverse (extreme rear) position. Adjust length of steering column tube-to-bellcrank rod by turning clevis on bellcrank end of rod until clevis pin enters hole in clevis and bellcrank freely (CAUTION—do not change length of bellcrank-to-transmission lever rod). Do not install clevis pin at this time.

4) Set selector lever on steering column in Parking "P" position, move valve selector lever on transmission case to park (extreme forward) position and check to see that parking pawl engaged (propeller shaft should be locked). Check adjustment by slipping clevis pin through clevis at rear end of steering column tube-to-bellcrank rod and bellcrank. If pin enters both holes freely, connect rod. If not, readjust as follows:

5) If adjustment not correct in parking position (4 above) after having been correctly set in reverse position (3 above), readjust rod by turning clevis **not more than ½ turn** in either direction for best possible compromise in both reverse and park position. If satisfactory setting not possible within these limits, check entire linkage for wear, looseness, or distortion.

ANTI-CREEP ADJUSTMENT: For adjustments other than Release Switch (part of linkage adjustment above), ***see "Anti-Creep" in Brake Section.***

BAND ADJUSTMENT

BAND ADJUSTMENT: Check and adjust all bands (Forward, Low, Reverse) in same manner using Band Adjusting Tool J4285 (plug gauge) to check the band setting before making adjustments.

Checking Bands—Remove capscrew and copper gasket from pressure take-off hole in servo mechanism of band being checked (see illustration). Insert tool J4285 into the pressure take-off hole as far as it will go and exert slight pressure to start tool threads in hole (see Caution below if threads do not start readily), screw tool into the hole until tool shoulder rests against transmission case noting that indicator plug in tool handle moves outward as tool is turned in (if plug reaches a position flush with tool handle BEFORE tool turned in fully, see Caution below). Indicator should be FLUSH with end of tool handle when tool fully installed if bands correctly adjusted. If not, adjust bands as directed below.

►***CAUTION***—If tool threads cannot be readily engaged in the Forward Band Servo pressure take-off hole, or if indicator plug reaches a position flush with tool handle before adjusting tool fully screwed into transmission case, **BACK OFF band adjusting screw on opposite side of case 2 turns** before screwing tool fully into position. This is an indication that the band adjustment was too tight and tool will be damaged if indicator plug forced out beyond end of tool handle.

Adjusting Bands—With adjusting tool in place to check band setting (above), loosen locknut on band adjusting screw (see illustration), turn adjusting screw in until indicator plug in adjusting tool handle is just **flush** with end of handle, tighten locknut being careful that adjusting screw does not turn. Remove adjusting tool and replace capscrew using **new copper gasket** under screw head.

►***CAUTION—Do not use any type of sealing compound on this capscrew.***

TESTING HYDRAULIC UNITS

If transmission operation not satisfactory, check operation of oil pumps and control units by testing hydraulic control pressures.

Testing Tool Note—Pressure gauge and fittings for connecting gauge at various points on transmission are required for these tests. This equipment furnished as Tool No. J4270 (gauge & fittings).

►***TESTING CAUTION***—When making following tests, DO NOT run engine at speed greater than idle for more than 30 seconds with selector lever in "D," "L" or "R" and rear wheels stationary (will cause overheating of engine). DO NOT use white lead or any type of sealing compound when replacing pipe plugs.

Front Oil Pump Pressure: With engine stopped, remove Allen-head pipe plug in oil pan flange on front of transmission case, install pressure gauge fitting and connect gauge at this point. Connect electric tachometer to engine. Place selector lever in "P" or "N" position, start engine and bring speed up to 1000 RPM. At this speed gauge reading should be 60 lbs. minimum. Stop engine, disconnect gauge and replace pipe plug, tighten plug to 15-18 ft. lbs.

►***CAUTION—Do not use white lead or any type of sealing compound on these plugs.***

Forward Band Servo Pressure: With engine stopped, remove capscrew and copper washer from forward band servo coverplate (see illustration). Install pressure gauge fitting and connect gauge at this point. Connect electric tachometer to engine. With engine running, apply foot brake and hand brake firmly to hold car, move selector lever to "D" position. Gradually increase engine speed to 1000 RPM. At this speed gauge reading should be 60 lbs. minimum. Stop engine, disconnect gauge, replace capscrew using **new** copper washer, tighten screw to 28-33 ft. lbs.

►*See TESTING CAUTION above.*

Reverse Band Servo Pressure: With engine stopped, disconnect bellcrank-to-transmission selector valve lever rod at bellcrank, move selector valve lever on transmission to reverse "R" position. Remove capscrew and copper washer from reverse band servo cover (see illustration), install pressure gauge fitting and connect gauge at this point. Connect electric tachometer to engine. Apply foot brake and hand brake firmly to hold car **before starting engine.** Start engine and increase speed to 1000 RPM. At this speed gauge reading should be 160 lbs. minimum. Stop engine, disconnect gauge, replace capscrew using **new** copper gasket, tighten screw to 28-33 ft. lbs.

►*See TESTING CAUTION above.*

Low Band Servo Pressure: With engine stopped, remove capscrew and copper gasket from low band servo cover (see illustration), install pressure gauge fitting and connect gauge at this point. Connect electric tachometer to engine. With engine running, apply foot brake and hand brake firmly to hold car, move selector lever to "L" position. Increase engine speed to 1000 RPM. At this speed gauge reading should be 60 lbs. minimum. Stop engine, disconnect gauge, replace capscrew using **new** copper gasket, tighten screw to 28-33 ft. lbs.

►*See TESTING CAUTION above.*

Multiple Disc Clutch Pressure: With engine stopped, remove ⅛" pipe plug from mounting flange on rear face of extension housing on transmission case, install pressure gauge fitting and connect gauge at this point. Connect electric tachometer to engine. With engine running, apply foot brake and hand brake firmly to hold car, move selector lever to "D" position. Increase engine speed to 1000 RPM. At this speed, gauge reading should be 60 lbs. minimum. Stop engine, disconnect gauge, replace pipe plug, tighten plug to 15-18 ft. lbs.

►*See TESTING CAUTION above.*

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STUDEBAKER AUTOMATIC TRANSMISSION (Cont.)

Torque Converter Pressure: With engine stopped, remove ¼" pipe plug at torque converter pressure take-off point (see illustration), install pressure gauge fitting and connect gauge at this point (NOTE—selector valve lever rod may be disconnected for ease in making this connection). Connect electric tachometer to engine. Place selector valve lever in neutral "N" position. Run engine at 1000 RPM. At this speed, gauge reading should be 25-35 lbs. For further check, jack up rear wheels securely so they are free to rotate, place selector lever in drive "D" position, run engine at 1500 RPM. At this speed, gauge reading should likewise be 25-35 lbs. Stop engine, disconnect gauge, replace pipe plug, tighten plug to 6-7 ft. lbs.

►***CAUTION—Do not use white lead or any type of sealing compound on these plugs.***

Direct Drive Clutch Pressure: With engine stopped, remove Allen-head pipe plug in oil pan flange on rear of transmission case, install pressure gauge fitting and connect gauge at this point. Connect electric tachometer to engine. Block up rear end of car securely so that wheels are free to rotate. Run engine at idle speed, place selector lever in "D" position. Gauge reading should be 0 lbs. Increase engine speed to 1500 RPM. while watching the gauge. At approximately 1200 RPM., gauge should indicate rapid pressure rise (shift to direct drive) and gauge reading should then be 60 lbs. minimum. Decrease engine speed and again watch gauge. When speedometer indicates 10-12 MPH., gauge reading should drop to 0 (downshift to intermediate drive). Stop engine, disconnect gauge, replace pipe plug, tighten plug to 15-18 ft. lbs.

►***CAUTION—Do not use white lead or any type of sealing compound on these plugs.***

Rear Pump Pressure: With engine stopped, disconnect leads at Anti-creep Pressure Switch on rear of transmission, remove switch. Install pressure, gauge fitting and connect gauge at this point. Run engine with brakes set to hold rear wheels stationary. Gauge reading should be 0 lbs. with rear wheels not turning. Block up rear of car securely so that rear wheels are free to rotate. With engine idling, place selector lever in drive "D" position, increase engine speed while watching gauge. Pump pressure should build up steadily as indicated by increasing gauge reading, and should be 60 lbs. minimum at 20 MPH. Stop engine, disconnect gauge, re-install Anti-creep pressure switch and connect wiring.

►***CAUTION—Do not use white lead or any type of sealing compound when installing pressure switch.***

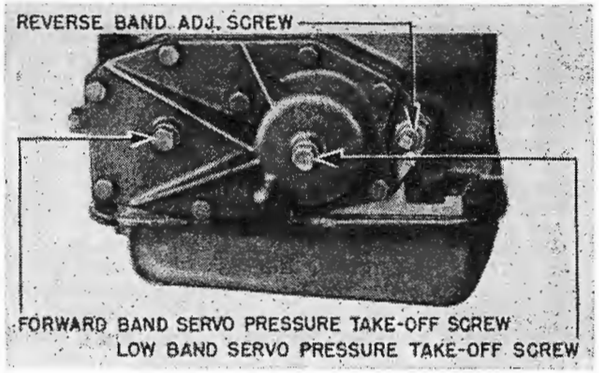
REMOVAL FROM CAR

►***CAUTION—Transmission Assembly and Torque Converter Assembly are removed SEPARATELY as follows:***

TRANSMISSION REMOVAL:

1) Drain oil from transmission case and torque converter housing. See LUBRICATION data.

2) Disconnect propeller shaft at front and rear ends by taking out bearing cup U-bolts (CAUTION—wire bearing cups in place to prevent them dropping off), and removing nuts from center bearing support-to-crossmember studs. Move entire propeller shaft assembly to the rear and out of the way.



LEFT SIDE OF TRANSMISSION CHECKING & ADJUSTMENT POINTS

3) On Champion, disconnect parking brake, cable clevis at parking brake bellcrank. On Commander, disconnect parking brake forward cable from bellcrank on cross member, disconnect bellcrank bracket by taking out mounting bolts, move bellcrank and cable assembly to rear and fasten up out of the way.

4) Disconnect transmission control rods by taking out clevis pins at selector valve lever and governor control lever on transmission case.

5) Remove speedometer cable and pinion assembly from transmission. Disconnect Anti-creep cables from solenoid switch on rear of transmission, free Anti-creep harness from clip on transmission case.

6) Remove converter housing lower cover plate. Remove nuts from two lower transmission case-to-converter housing studs (accessible from within converter housing with cover off).

7) Place transmission lift with adapter in position under transmission case (see NOTE). Do not disturb adapter adjustment knobs after saddle-to-transmission oil pan flange alignment has once been set.

Lift & Adapter Note—Two types available: Model 63 (Lift Type Hoist J4385 & Adapter J4287), and Model 27 (Floor Type Hoist J3389 & Adapter J4287). This tool essential to maintain transmission alignment during removal and installation and to handle transmission weight of approximately 220 lbs.

8) Take out two upper transmission case-to-converter housing capscrews, install Pilot Studs No. J4284 in these holes.

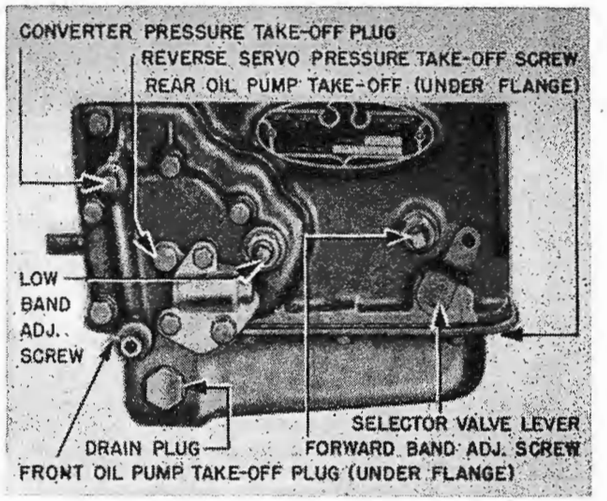
9) Slide transmission assembly to rear out of converter housing and torque converter, then lower transmission and remove from beneath car.

NOTE—If main shaft oil transfer tube (in forward end of transmission mainshaft) does not come out with transmission, remove tube from converter using a long-nosed pliers.

TORQUE CONVERTER REMOVAL (After transmission removed from car):

1) Take out starter mounting screws and pull starter forward until free of engine rear plate. Drain radiator sufficiently to remove upper radiator hose.

2) Disconnect converter housing air intake hose by loosening hose clamp at frame side rail and pulling hose free of clamp. Disconnect engine exhaust pipe at manifold, loosen bolts and nuts from clamp holding exhaust pipe to converter housing bracket.



RIGHT SIDE OF TRANSMISSION

3) Disconnect steering column tube-to-bellcrank rod by taking out clevis pin at bellcrank, disconnect both pull-back springs. Disconnect parking brake conduit from conduit hook on crossmember.

4) Place engine support saddle (see Note) under engine approximately 3-5" forward of engine rear plate, support engine weight with hydraulic jack under support saddle (hydraulic jack should be used to permit engine lowering for converter removal.

Support Saddle Note—Saddle can be made up from iron or wood block capable of supporting 600 lbs. Dimensions for wood saddle made from 4" thick plank: Width 14½", Height 9¼" at front edge, 8¾" at rear (top surface should slant down ½" from front to rear). Center cut-out 9" wide and 7" high (so that saddle clears oil pan and weight is carried on oil pan flanges).

5) Raise engine so that weight carried on support saddle (above). Disconnect fender-to-crossmember brace, take out crossmember mounting bolts, remove engine mounting-to-crossmember bolt nuts and remove crossmember (leave engine mountings attached to converter housing).

6) Lower rear end of engine approximately 3" to provide clearance for converter housing removal.

►***CAUTION***—Do not allow oil pan to strike steering bellcrank and tie rod ends. If additional clearance required, loosen nuts holding bellcrank to engine front crossmember, drop bellcrank down.

7) Remove small filler plate on engine rear plate. Take out all converter housing-to-engine rear plate capscrews. Remove converter housing from dowels.

►***CAUTION—Use care not to damage or distort dowels or converter blower.***

8) Remove nuts and plain washers from converter mounting studs (on front of engine drive plate, accessible through filler plate cut-out in engine rear plate). Lift converter assembly out.

CONTINUED ON NEXT PAGE

STUDEBAKER AUTOMATIC TRANSMISSION (Cont.)

INSTALLATION IN CAR

►*NEW ENGINE CAUTION:* If new engine installed in car, make certain that engine has special flywheel bolts, No. 526851, required for use with Torque Converter. **Use of any other bolts will damage Torque Converter.** ***See "Replacement Engine" data in Studebaker Special Data.***

►**NEW TORQUE CONVERTER HOUSING INSTALLATION:** If new housing installed, bore and face run-out must be checked and corrected BEFORE torque converter assembly installed. Install the housing on the dowels in the flywheel housing and tighten all mounting bolts and capscrews. Use Clutch Aligning Gauge J-2045 installed in end of crankshaft to mount a dial indicator, check and correct run-out as follows:

Bore Run-out—Revolve crankshaft slowly and check total run-out. If run-out exceeds .004", housing must be repositioned and dowels relocated as follows: Remove housing, remove dowel pins, re-install housing and tighten mounting bolts just enough to hold housing in position. Recheck bore run-out and use a lead hammer to shift housing, as required until run-out is less than .004", then tighten all mounting bolts and capscrews securely to hold this position and make final run-out check. If run-out within limits, drill a new dowel hole through the thin section of the flange near each production dowel hole using a 11/32" drill and then reaming holes to .376-.377". Install service dowels in these holes.

NOTE—Above instructions supersede earlier dowel installation data on Champion & Commander H Models.

Face Run-out—With housing installed on dowels and all mounting bolts and capscrews securely tightened, use Clutch Aligning Gauge J-2045 to mount dial indicator, check face run-out at a 4¼" radius throughout entire revolution of the crankshaft. If total indicated run-out exceeds .006", replace housing.

Torque Tightening—Tighten converter housing-to-engine bolt nuts and capscrews to 28-32 ft. lbs.

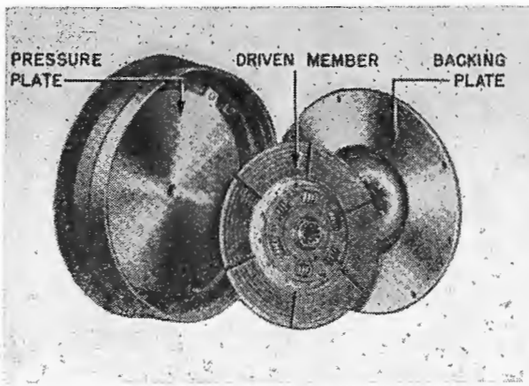
TORQUE CONVERTER INSTALLATION:

1) Align one of the two "o" marks on front face of converter assembly with "o" mark on engine drive plate, install converter on drive plate and install washers and nuts on mounting studs loosely.

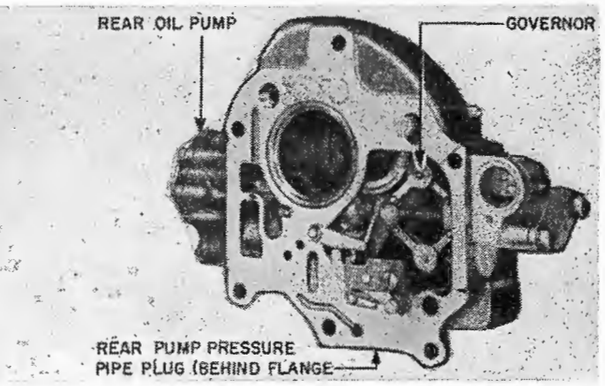
►***CAUTION—Do not securely tighten nuts until step (3).***

2) Thoroughly clean mating surfaces of engine rear plate and converter housing, install converter housing (CAUTION—make certain that housing engages dowels and that dowels and converter blower are not damaged). Install top three housing-to-rear plate capscrews, then raise engine and install remaining housing capscrews, tighten all screws to 28-32 ft. lbs.

3) Position Converter Aligning Flange J4286 in bore of converter housing and over pump drive fingers on torque converter assembly, install two top trans-



DIRECT SPEED CLUTCH



TRANSMISSION EXTENSION HOUSING

mission mounting capscrews to hold aligning flange in place. Rotate torque converter assembly through two complete revolutions to center assembly, then tighten all converter-to-drive plate nuts to 23-28 ft. lbs. (work through filler plate cut-out in engine rear plate). Install filler plate. Remove aligning flange.

4) Install crossmember on frame, lower engine and install nuts on rear engine mountings, connect fender braces.

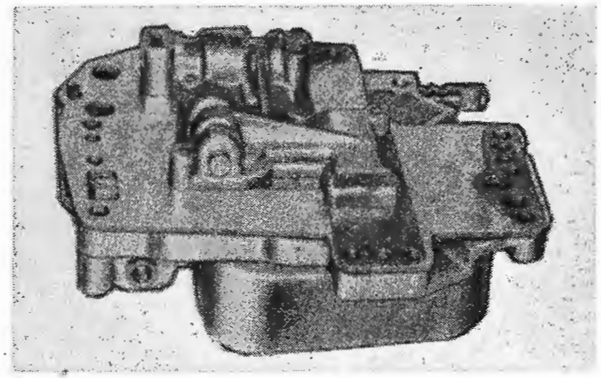
5) Connect parking brake conduit to hook on crossmember. Connect steering column tube-to-bellcrank rod, install two pull-back springs. Connect exhaust pipe at engine manifold, tighten exhaust pipe-to-converter housing bracket bolts and nuts. Install converter housing air intake hose in clamp at frame side rail, tighten clamp screws. Connect upper radiator hose and re-install starter.

TRANSMISSION INSTALLATION (After Torque Converter installed):

►***CAUTION—Splines on transmission shafts must be aligned with splines in Torque Converter as follows BEFORE attempting to install transmission.***

1) Allgn splines on transmission shafts with Spline Alignment Fixture J4283. Loosen fixture thumbscrew, install fixture over shaft splines on front end of transmission case inserting fixture into transmission as far as possible and aligning positioning arm sector with one of lower transmission mounting studs, move arm and shaft (turn universal joint companion flange) until positioning pin slips easily over mounting stud, tighten thumbscrew to lock positioning arm in place on sector. Remove fixture from transmission case carefully and **without moving shaft splines out of position.** Install oil transfer tube in end of mainshaft.

2) Align splines in Torque Converter Assembly by installing alignment fixture (after positioning arm has been set in (1) above), working the fixture into the converter until all splines are lined up on the fixture. Rotate torque converter members and spline alignment fixture until positioning pin slips easily into transmission mounting stud hole **corresponding to same lower transmission case stud on which**



VALVE BLOCK ASSEMBLY

fixture was aligned in (1) above. Remove fixture carefully and **without moving splines out of position.**

3) Install two Transmission Pilot Studs J4284 in upper transmission mounting screw holes in converter housing. Raise transmission assembly to correct height and angle (on special hoist), carefully slide transmission into place using pilot studs as a guide and using care not to disturb spline alignment (CAUTION—do not disturb universal joint companion flange position).

4) Remove pilot studs and install two upper mounting capscrews, install nuts on lower mounting studs, tighten all screws and nuts to 23-28 ft. lbs.

5) Install Anti-creep wiring harness and connect wires to Pressure Switch on transmission. Install speedometer pinion and cable assembly. Install parking brake bellcrank on crossmember and connect parking brake cable. Install propeller shaft, connect front and rear universal joints and center bearing support stud nuts.

6) Install transmission control rods (selector valve lever rod and governor control lever rod) and adjust linkage. ***See LINKAGE ADJUSTMENT data.***

7) Fill transmission with oil—***see LUBRICATION***—and check operation.