ELECTRICAL EQUIPMENT SECTION

The Equipment pages comprise wiring diagrams, performance and adjustment data and trouble shooting instructions on the important Magnetos, special devices and complete electrical systems that have been adapted for automobile use.

Often special equipment is found on cars which was not factory installed. Such Equipment is fully covered in this section so that no trouble will be experienced in Service work.

New Equipment pages will be issued in every supplement. File them in the order of the page numbers at the end of this section.

AUTO-LITE GENERATORS—Continued:

AUTO-LITE GENERATORS—Continued:

AUTO-LITE STARTERS:

DE JON GENERATORS:

DE JON STARTERS:

DELCO-REMY DISTRIBUTORS:

DELCO-REMY DISTRIBUTORS—Continued:

DELCO-REMY GENERATORS—Continued:

DELCO-REMY GENERATORS—Continued:

DELCO-REMY STARTERS:

AID 'FINGER TIP' CONTROL

DESCRIPTION:—Finger Tip Control consists of a switch mounted on a bracket at the base of the steering gear operated by a single button located in the center of the steering wheel which is connected to the switch by a single tube running through the steering column. The horn is sounded in the usual manner by depressing the button. Pulling up on the button closes the starting switch and permits the starter to crank the engine. Rotating the button, which is notched for ease in grasping, controls the lights. The several positions of the button control the various lighting circuits, such as 'Bright', 'Dim' and 'Park'. The lighting switch, starter switch and horn switch are thus combined in one unit with centralized control.

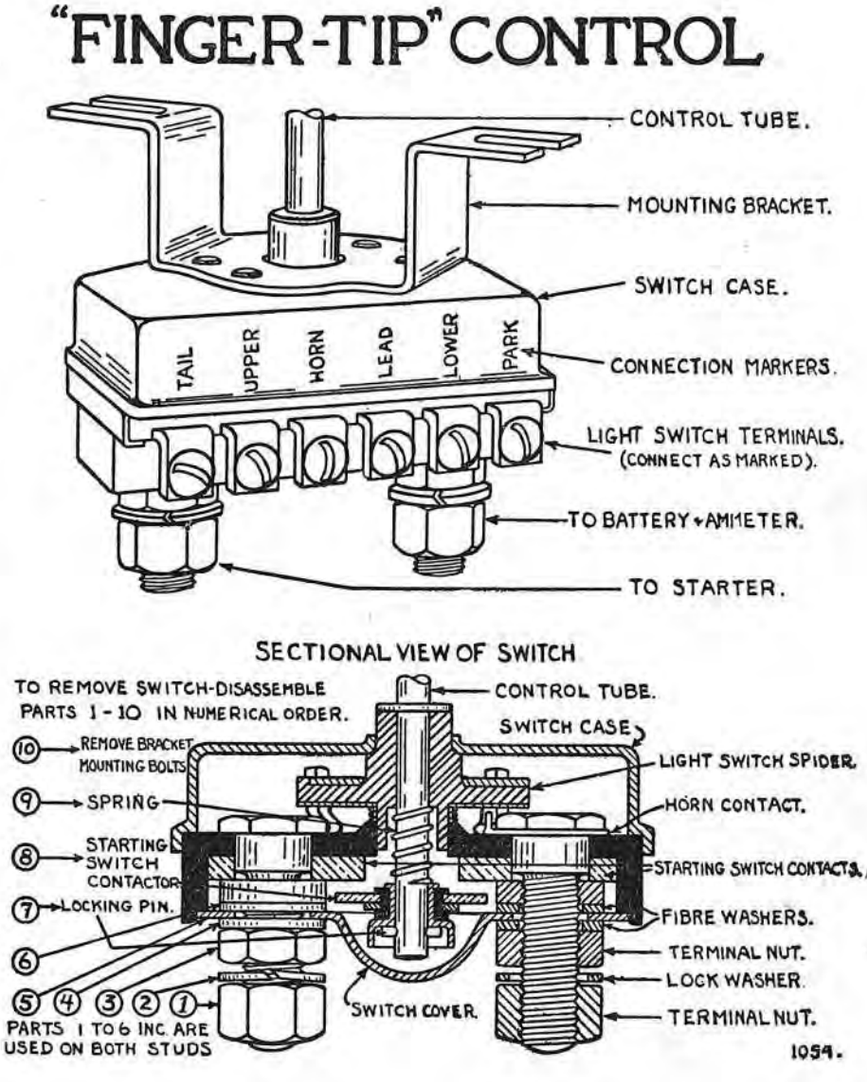
OPERATION:—The construction of the switch is illustrated in the Sectional View adjoining. The two large terminals on the base of the switch are the starting switch terminals. The right hand terminal is connected to the battery and a lead is taken from this terminal for lighting. The lighting lead is connected through the ammeter to the lighting switch terminal marked 'Lead'. The left hand starting switch terminal is connected to the starting motor. Both connections are made with regular starting cable, at least No. 1 flexible braided cable. The two terminals consist of studs mounted in the insulating block which forms the switch body. Each stud has mounted on it a copper block which forms the starter switch contact. The contactor mounted on the end of the steering column tube is directly under the two contacts. When the button on the steering wheel is pulled up this contactor is pulled up and connects the two contacts completing the starting circuit. The spring directly above the contactor on the control tube end shaft breaks the circuit when the button is released and returns the contactor to the 'Off' position. The horn contact is mounted on the upper end of the stud forming the starting terminal which is connected to the battery. When the button on the steering wheel is depressed a connection is made between the contact and the terminal on the lighting switch marked 'Horn', completing the horn circuit. The lighting switch spider is mounted in the upper part of the switch case on the control tube and turns with the movement of the button on the steering wheel.

SERVICING:—It is not practical to disassemble the switch further than is necessary to remove it from the steering gear mounting and the manufacturer recommends that no service work be attempted. Test circuits through the switch with a lamp and test points and when it is determined that the switch is defective the entire unit should be replaced. To remove switch from the car, follow the directions in the following paragraph:

REMOVAL:—To remove the switch from the car, first remove nuts and lock washers from the two starting switch terminals. Take off cables and remove the lock nut and fiber washer from each stud. The switch cover plate and the fiber washer on each stud inside the cover plate can then be removed. Then push up starter switch contactor until the pin under the contactor in the control tube end shaft is visible. Remove the pin and take off the contactor and spring on the shaft. Then take out the cap screws or bolts in the bracket above the switch mounting the switch on the steering gear housing. Pull the switch straight down to clear control tube and lift from place. In mounting switch be very careful to replace the washers both inside and outside the cover plate on each stud. This is very necessary to prevent grounding the battery.

SERVICE PARTS OBTAINABLE
(Aid Mfg. Co., 2625 Stewart Ave., Chicago, Illinois)

Part No.	Description
311	Complete Switch Assembly (Willys Knight and Whippet Type).
54	Switch Assembly, less Parts listed below:
5	Insulating Washer (4 used).
23	Switch Cover Plate (1 used).
29	Stud Lock Washer (2 used).
31	Contact Bar Pin (1 used).
34	Contact Bar Spring (1 used).
38	Stud Nut (4 used).
50	Contact Bar Assembly (1 used) (Contactor).
56	Switch Tube End Lower Shaft.



FINGER TIP CONTROL

PINES TYPE

DESCRIPTION:—The Pines Type 'Finger Tip Control' consists of a starting switch, lighting switch, and horn button combined in a single unit which is designed to be mounted at the lower end of the steering column and controlled by a button on the steering wheel. The starting switch is operated by lifting the button slightly, the horn circuit is closed by depressing the button, and the various lighting circuits are completed by rotating the button. There is no electrical connection between the starting switch unit and the lighting and horn control unit, which permits an ammeter to be placed in circuit to show the discharge current. The two terminals on the side of the unit are the starting switch terminals and one terminal should be connected to the car battery. The lead for the generating and lighting circuits should be taken from this terminal. The other starting switch terminal should be connected directly to the starting motor. The six lighting switch terminals are grouped on the front of the switch. These terminals should be connected as follows (left to right facing the bottom of the switch):

1. Headlight (High Beam—lower filament).
2. Lead—Connect to ammeter through fuse or circuit breaker.
3. Tail—Tail light. On some cars, the dash light is taken off also.
4. Park—Parking bulbs, fender lights or side lights.
5. Horn—This is the horn feed lead. The other horn terminal is grounded.
6. Headlight (Low or depressed beam—upper filament).

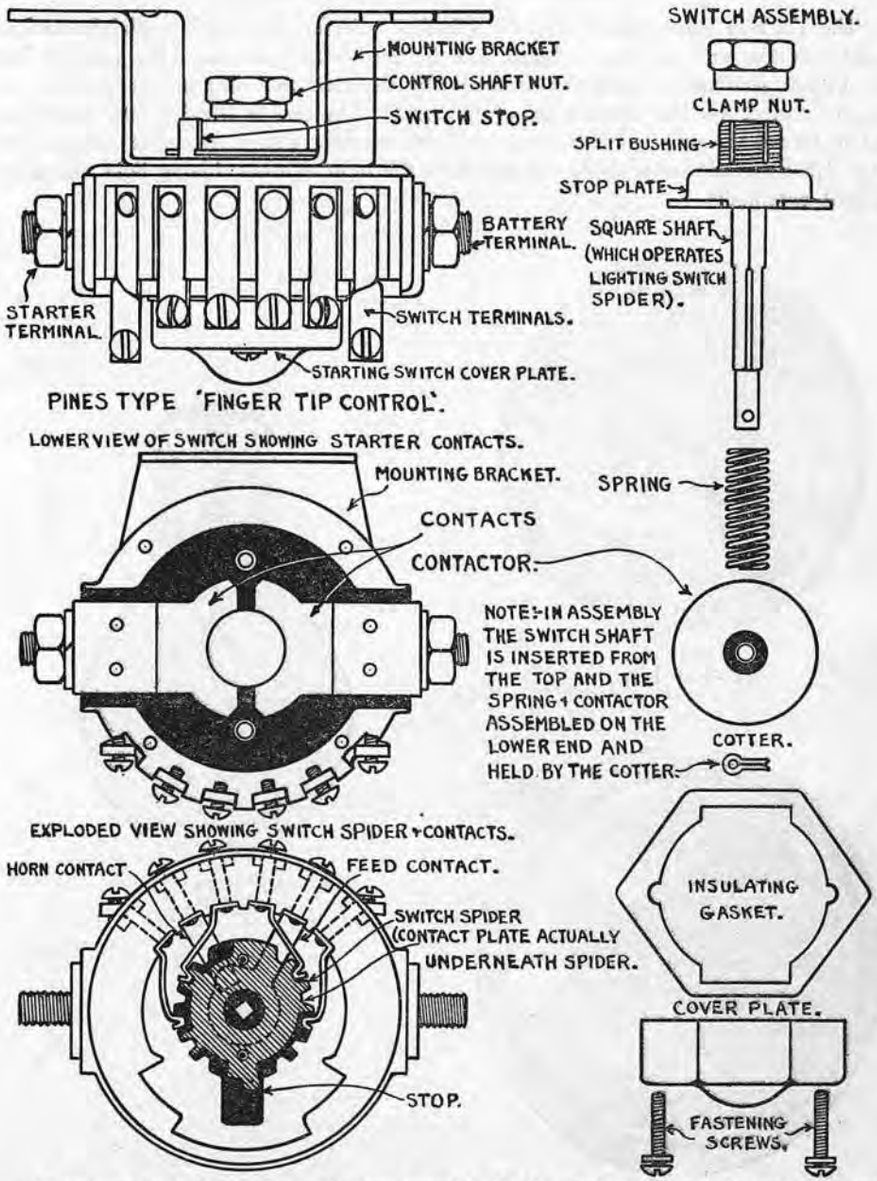
The lighting switch terminals terminate in switch fingers within the switch housing (see exploded view of switch). These switch fingers rest on the notched edge of the switch spider which carries a contact plate on its lower surface. This contact plate bears against the circular plate connected to the 'Lead' terminal and is kept in contact with it by a spring under the plate. The horn terminal contact is directly under this contact plate and they are brought together whenever the control shaft is pushed downward.

The switch control shaft extends through the switch housing to the starting switch housing on the lower end of the switch. The starting switch terminals terminate in two semi-circular copper contacts. A circular contactor is mounted on the lower end of the control shaft below these contacts and is normally separated from them by a spring on the control shaft above the contactor. When the control button is lifted up, this spring is compressed by the upward movement of the control shaft and the contactor completes the circuit between the two starting switch contacts. The contactor is insulated from the control shaft.

MOUNTING:—The switch is fitted with a universal mounting bracket so that it can be mounted on the steering column or on the chassis frame at the lower end of the column. The control shaft upper end is fitted with a slotted bushing and lock nut and grips the control tube in the steering column when the lock nut is tightened. To remove the switch, first disconnect battery cable and tape to prevent short-circuits. Then disconnect starter cable and all lighting lines. Loosen the lock nut on the upper end of the control shaft. Then take out bolts or screws in mounting bracket. The switch can be removed by pulling it straight downward until the control tube slips out of the control shaft bushing.

SERVICING:—The starting switch contacts can be examined by taking off the lower cover plate. To remove cover plate, take out the two screws and lift off the plate and insulating gasket. The contactor on the control shaft can be removed by taking out the cotter pin in the lower end of the shaft. The spring, which will come off with the contactor, must be replaced when the switch is reassembled. If the control shaft is removed, it must be replaced so that the slot in the stop plate is against the stop when the lug on the switch spider is against the stop on the switch body. To secure this result, insert the control shaft and turn the switch spider as far as possible in one direction. Then remove shaft and assemble so that the stop on the top of the switch body prevents the shaft from turning any further in that direction.

The cover plate over the lighting switch spider is riveted in place and it is not practical to attempt any repairs to the lighting switch unit. If tests through the lighting switch with a voltmeter or lamp and test points indicate that the lighting switch is defective, it should be replaced with a new unit.



TILT RAY HEADLAMPS

Cover one headlamp to obscure the light beam. The best driving beam is obtained when there is a high intensity near the top of the beam. Turn the focus adjustment screw in the back of the uncovered lamp until the beam having a high intensity at the top and a sharp upper outline is as narrow as possible measured from top to bottom. Then by loosening the bracket adjusting bolt, aim the lamp so that the top of the beam coincides with the horizontal line on the vertical surface, and is equally divided by the vertical line directly ahead of the headlamp center. Tighten the bracket bolt securely. The correct adjustment for the right headlamp will look like Figure 6. Repeat operations with the other lamp and the headlamps will be adjusted properly.

No further adjustments for the lower beams are needed.

One point that should be kept in mind is that the top of the beam should cut off as sharply as possible, and results frequently can be improved by turning the bulb over in the socket when the beam is not satisfactory with the bulb as first installed.

This equipment is designed to operate with Mazda No. 1110 lamps illustrated by figure 2.

Care should be taken when replacing a lens, to engage the lug which anchors the lens in the lens notch to prevent rotation and also to insure the flutes being vertical. Both the reflector and lens are notched and also marked "TOP" so that they can be mounted only in the correct position. Tilt Ray and Tilt Beam headlamps are equipped with the standard S.A.E. headlamp mounting or its equivalent.

No portion of main beam should rise higher at twenty-five feet than the level of the centers of the lamps when car is loaded.

Tilt Ray headlamps are approved by the various State Lighting Commissions and manufactured under the patents controlled by and pending to the Guide Motor Lamp Manufacturing Company, Cleveland, Ohio.

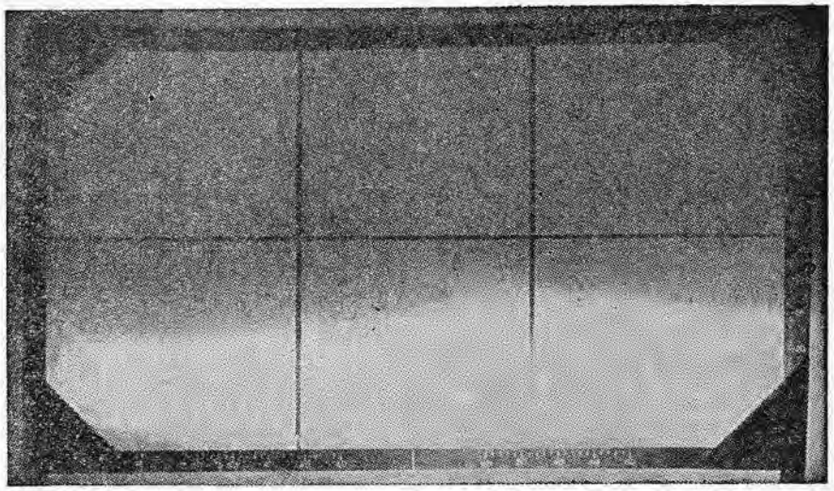


Figure 7.
Lower Beam of Tilt Ray Headlamp shown in Figure 6.

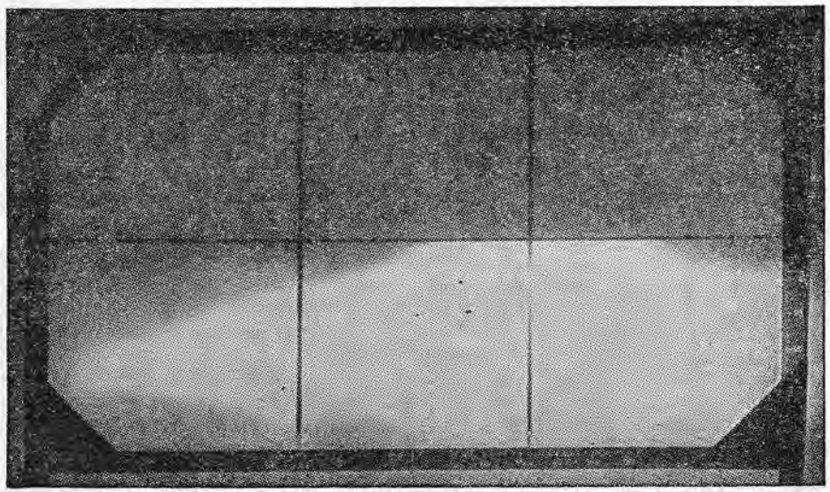


Figure 6.
Upper beam of right hand Tilt Ray Headlamp correctly focused and aimed.

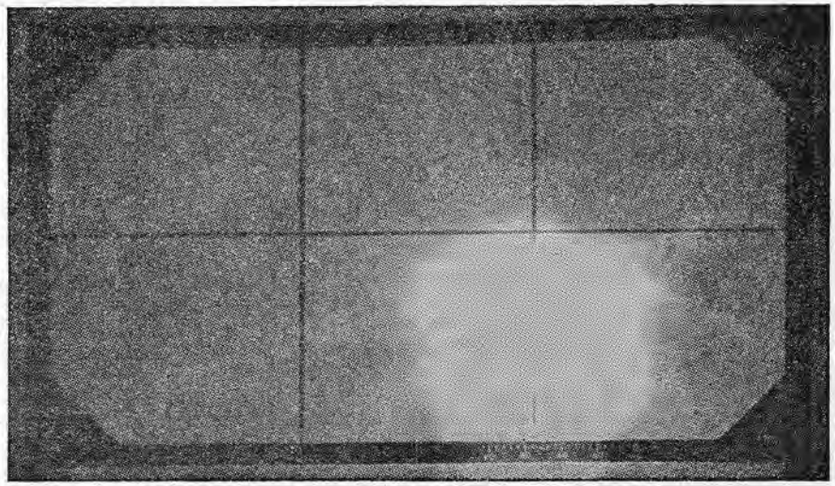


Figure 8.
Upper Beam from Tilt Ray Headlamp without lens.

which holds the terminal plug in position also grounds the three cables and for this reason the screw must always be in place. The speaker can be removed from its mounting on the set and mounted on the roof of the car, which will improve the tone. A special mounting bracket and extension cord is provided for this purpose.

ADJUSTMENT AND TESTING ON THE CAR:—When the radio set is first installed, tune in a station between '30' and '50 on the dial. Reduce the volume until the station can be heard only faintly. Insert the special Bosch service wrench, Part No. 387, in the opening at left of the set near the capacitor cable connector and adjust for maximum volume by turning the wrench back and forth until the best position is found. This setting should be checked if the capacitor plate mounting or location is changed.

Low 'B' Battery Voltage, or No Voltage. No battery voltage indicates an open circuit either at the 'B' battery terminals or in the cable. This can be tested by a 'continuity' test, using a 'C' battery in series with a voltmeter and two test points which are placed on the ends of the battery lead. If the lead is not open, the voltmeter will indicate the total voltage of the 'C' battery. The voltage between the brown and blue battery leads should be 90 volts and between the green and blue leads 180 volts. Test with a voltmeter. If the voltage is below 70 and 140 volts, the 'B' batteries should be tested individually and any battery with a voltage lower than 35 volts should be replaced.

Low 'A' Battery Voltage. Ordinarily whenever the voltage of the car is high enough to operate the car satisfactorily it will be sufficient for operation of the radio set. It is possible, however, that the 'A' battery connections may be faulty or the leads open-circuited and these should be examined.

Capacitor Plate Disconnected or Grounded. Examine the capacitor plate lead and terminal on the plate. Make sure that the grounded shielding on the lead does not touch the plate.

Defective Tubes. The tubes should be tested with a tube tester. If the tube tester is not available, replace the suspected tube with a new tube and see if the operation of the set is satisfactory.

Defective Speaker. Check the speaker by connecting it to another set or touch the speaker terminals to the terminals of a 'C' battery momentarily. A click indicates that the speaker is not open-circuited. The speaker has a balanced armature mounted between laminated pole pieces. The armature must be correctly centered so that it does not touch the pole pieces. The position of the armature is adjusted by using thickness gauges .009 inch thick to center the armature while the mounting screws are tightened.

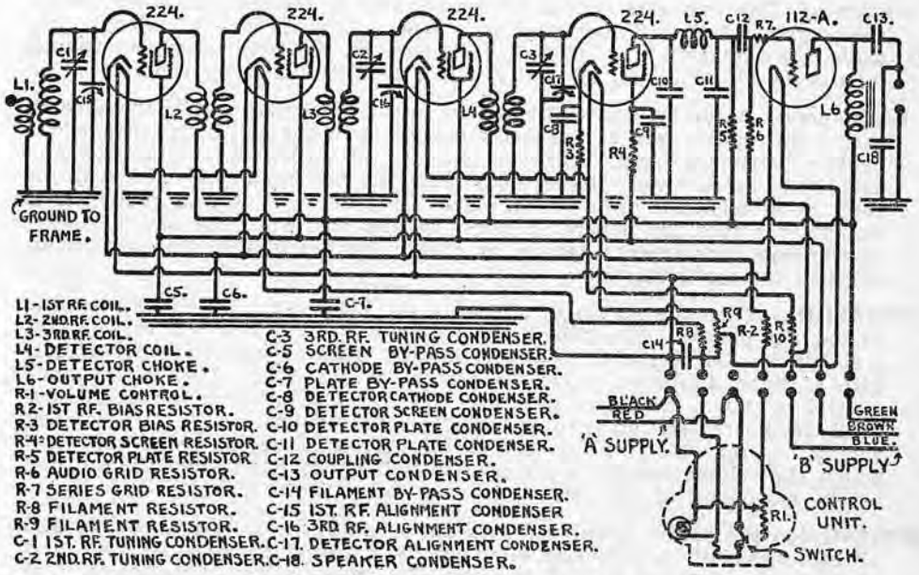
Ignition Interference. This will be particularly noticeable when the engine is idling. Examine the interference suppressors and see that they are mounted on each spark plug and on the center terminal of the distributor head.

Defective Set Chassis. The chassis of the radio set can only be satisfactorily tested by a systematic 'General Test'. A Set Analyzer should be used for this purpose. The analyzer is designed to completely test the set at the tube sockets and is much more thorough and accurate than any other testing methods. However if an analyzer is not available the set can be tested with a voltmeter having scales reading 0-8 volts and 0-200 volts. The voltmeter should be connected to leads ending in test prods which can be inserted in the tube sockets after the tube has been removed. Complete directions for a General Test follow.

TESTING:—The voltmeter should be used to test the tube voltages of the radio-frequency tubes. Filament voltage tests are made from filament to filament terminals, using the low scale on the voltmeter. No reading indicates an open tube, open filament resistor, or an open circuit in the filament wiring. Plate voltages are measured between the plate and cathode terminals, using the high scale of the voltmeter. No reading indicates an open primary on one of the radio-frequency coils, defective wiring or an open connection in the cathode wiring. Screen voltages are measured between the screen and the cathode terminals with the high voltage scale of the voltmeter. No reading indicates an open circuit in the screen or cathode wiring. Grid voltages are measured between the grid terminal (on top of the tube on the Type 224 screen-grid tubes) and the cathode with the low voltage scale of the voltmeter. No reading indicates an open volume control or open radio-frequency bias-register or an open circuit in the cathode wiring.

In testing the detector, the plate voltage registered on the voltmeter will not be the true voltage but will indicate that the circuit is not open. No reading may indicate an open circuit in the cathode wiring. In testing the screen circuit the voltmeter readings may vary due to the voltage drop across the detector screen resistor. No reading may indicate an open circuit in the cathode wiring. In testing the grid circuit, no reading an open secondary winding in the detector coil, defective wiring or an open circuit in the cathode wiring. An open circuit in the cathode wiring may be caused by the detector bias resistor. The detector filament is in series with the third radio-frequency tube. In testing the filament no reading may indicate an open radio-frequency tube, poor socket contact or open filament resistor or wiring.

In testing the audio-frequency tube, no reading in the filament test indicates an open filament resistor, or defective wiring. In the plate circuit test, no reading indicates an open output choke. In the grid test, the high resistance of the series grid resistor will prevent more than a slight movement of the voltmeter pointer.



Tube Socket Voltages for Testing

Stage	Tube Type	Filament	Plate	Screen	Grid
1st Radio-frequency	224	2.0	170	75	3.5
2nd "	224	2.0	170	75	3.5
3rd "	224	2.0	170	75	3.5
Detector	224	2.0	50	15	1.0
Audio-frequency	112-A	4.8	165		0.1

In making all tests great care must be used in selecting the correct scale of the voltmeter since the voltage across some terminals is as high as 170-180 volts. This will damage the voltmeter if the low voltage scale is used.

DELCO RADIO

REMOVAL OF SET:—To remove the radio set from the car for bench testing, first disconnect the 'B' batteries at the battery box. This is very important as it will prevent any damage to the tubes when the battery leads are being disconnected at the terminal block. There is also danger of shock, as the line voltage across the 'B' batteries is 180 volts. Then disconnect the aerial lead wire. Disconnect the tuning control by loosening the nut at the end of the control conduit at the set. Disconnect the leads on the terminal block on the loud speaker. Remove the ignition lock (Dual Lock) on the instrument board on Cadillac and La Salle cars. Then remove the plates on the bottom of the mounting brackets and lift the set from place.

TESTING (On the Bench):—Accurate testing requires the use of a test 'Analyzer' or a specially designed test panel. The Jewell Set Analyzer, Pattern No. 134, is recommended by a car manufacturer using this type radio. With the set analyzer, tests are made by removing one tube at a time, inserting cable plug of the analyzer in the tube socket and inserting the tube in the socket of the analyzer. The volume control should be turned to the extreme loud position. Test readings should correspond to the following table:

Position	Tube Type	Filament Volts	Plate Volts	Control Grid Volts	Screen Volts	Plate MA Current
1. RF.	224	1.8	135	3.25	110	2.4
2. R.F.	224	1.8	80	00	50	1.8
Detector	224	2.0	25	10.0	15	2.2
1. A.F.	227	1.8	40	.4	.2	
2. A.F.	212-A	4.0	140	.4	.4	

This set can be tested for grounds with a 25 watt, 110 volt test line. All external connections should be disconnected in making this test. In checking the operation of the set, it should be kept in mind that the two radio-frequency tubes and the detector tube on the first set are connected in series, and that the two radio-frequency tubes in the second type set are in series, while the detector tube is in series with the first audio-frequency tube. If one of these tubes is burned out, neither tube will heat up when the set is turned on. Whenever a tube is suspected, the tube socket should be examined to see that the contact springs are touching tthe tube prongs. If the reception is apparently satisfactory but weak, it may indicate faulty radio-frequency tubes.

TIMING CHAINS

Three types of timing chans will be found. These are (1) center guide, (2) side guide, and (3) duplex chains designed to engage either side of the pinions or sprockets. See Illustrations. Center guide and duplex chains are more commonly used. Various types of installation are:

Camshaft Drive Without Adjustment. This is a two sprocket short center drive where the camshaft is driven from the crankshaft by chain and the water pump, fan and accessories are driven by some other means, usually by belt from a pulley on the end of the crankshaft. Chains of this type are usually installed endless with the camshaft sprocket off the camshaft. The sprocket is then bolted in place by cap screws threaded through the sprocket into holes in the camshaft flange. On the new Marquette equipped with this type chain, the camshaft sprocket is a press fit while the crankshaft sprocket is a push fit. The chain is removed by pulling the entire camshaft assembly and chain forward until the crankshaft sprocket slips off the end of the crankshaft. There is no adjustment on this type chain and ordinarily the wear will not be sufficient to remove a chain link. The chain must be replaced. On a few installations means of adjustment have been provided.

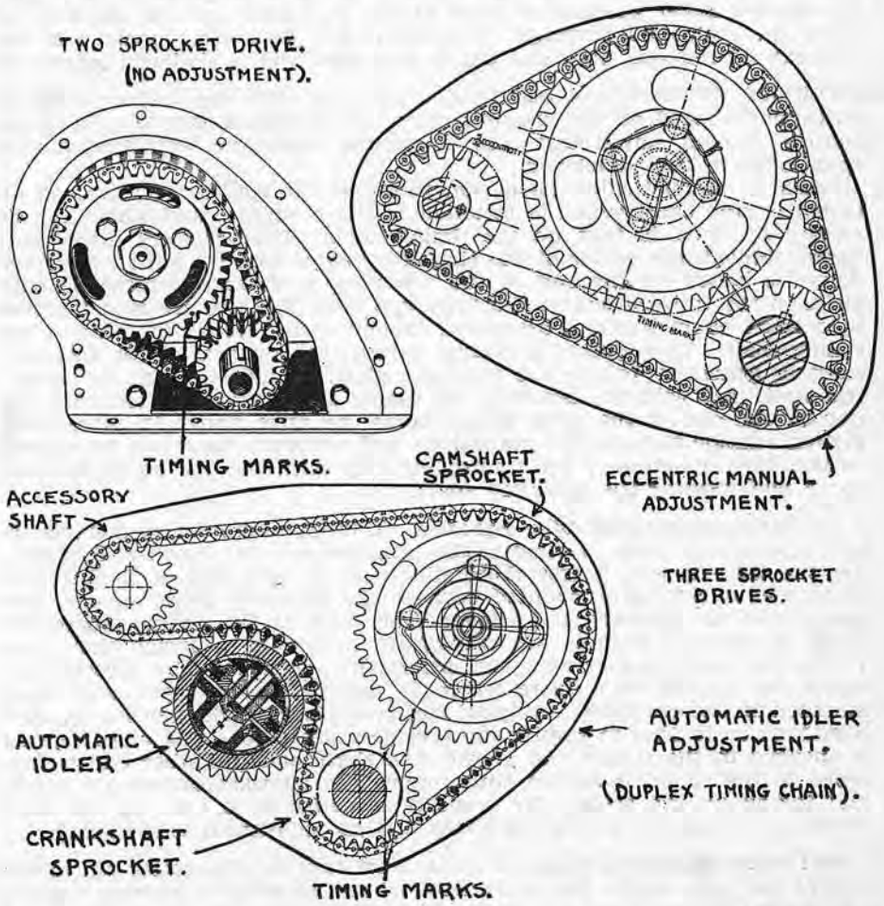
Manual Adjustment. This type drive usually consists of camshaft sprocket and accessory sprocket (generator, water pump, etc.) so placed that the chain passes over all three sprockets in a triangular shape. The chain must be adjusted to take up slack resulting from wear at definite intervals, usually at the end of the first 500 miles and approximately every 2000 miles afterward. The common methods of chain adjustment are:

1. Shifting of Generator. This is by far the most common installation. The generator is flange mounted and provision is made for shifting the generator and generator drive sprocket away from the engine. This is done by slotting the upper flange mounting holes and in some cases providing a set screw and lock nut in the edge of the flange which bears against the flange mounting screw holds the generator in position. The chain is adjusted by loosening the flange mounting screws and turning up the adjustment screw or pulling the generator away from the engine (the lower screw serving as a pivot) until the chain begins to hum with the engine running. The generator is then slacked up until the noise disappears and the screws tightened. With the proper adjustment the chain will run noiselessly. This adjustment will permit approximately ½ inch up and down play in the chain on the longest side (between the camshaft sprocket and the generator sprocket), which is correct. In some instances sufficient movement of the generator is provided to take up all play developed in the life of the chain (½-⅝ inch). In other installations where the adjustment provided is only approximately 5/16 inch, it will be necessary to remove the hunting link in the chain when the maximum position has been reached and then return the generator to its original position. A second set of adjustments can then be made. In any case not more than one link (the hunting link) should be removed from the chain and a hunting link should never be connected in an old chain. The chain adjustment is usually sufficient to take up all allowable wear before the chain teeth spread to such an extent that they will not mesh satisfactorily in the sprocket teeth and when this occurs a replacement chain should be installed.

On ordinary installations of this type the sprocket is bolted directly on the generator shaft and it will be necessary to remove the chain case cover and remove the chain or to take off the nut on the generator shaft and pull the sprocket before the generator can be taken off the engine. A variation of this type drive which is being used extensively has the sprocket mounted on a sleeve which is mounted independently of the generator. The generator is driven through a short shaft carried within the sprocket sleeve and driven by a tongue engaged in the face of the sprocket.

2. Eccentric Mounting of the Accessory Sprocket. On this type of drive the accessory drive sprocket is mounted on an eccentric bushing and provision is made for rotating the bushing thus moving the sprocket outward and tightening the chain. The accessory drive is taken through tongue and slot on the face of the sprocket to the shaft on which the eccentric bushing revolves. This shaft drives the accessories. The sprocket is held in place by a thrust bearing on the chain case cover which bears against the face of the sprocket. Drives of this type vary principally in the design of the eccentric bushing mounting. The advantage of this type drive is that the accessory shaft is held to a fixed center which does not change as the chain is adjusted. This eliminates the necessity of flexible couplings in driving the generator or water pump.

Automatic Adjustment. Timing chains with automatic adjustment use an extra idler adjustment sprocket which is designed to automatically take up the slack in the chain. This system is used in most cases with the duplex type chain and the idler sprocket is mounted below the chain between the crankshaft sprocket and the accessory drive sprocket. The idler sprocket is mounted on an eccentric sleeve which is kept under tension by a drive spring. The spring tends to turn the eccentric sleeve, shifting the sprocket center in such a way as to increase the timing chain tension. The timing chain is thus kept at the proper tension throughout the life of the engine and no attention is necessary. This type of drive is being used in increasing numbers and will be found installed on Graham Paige (some models), Stutz, Blackhawk Six, Stearns Knight, Pierce Arrow, etc.



Full details of the different chains, types of construction and assembly, sprocket types and instructions for servicing timing chains and drives will be found on the following pages.

MORSE SILENT TIMING CHAINS

CHAIN TYPES:—Morse Silent Timing Chains are furnished in center guide and duplex types. Three types of joint construction will be found in service. These are Rocker Joint, Bushed Joint, and Oscillating Joint types

1. Rocker Joint. The Rocker Joint link assembly consists of two pins, a ribbed seat pin, and a plain rocker pin. The chain is designed to operate in one direction which is indicated by an arrow stamped on the face of the outside links. The seat pin is the leading pin and is assembled with the rib pointing in the direction of the arrow. This rib engages in a slot cut in the end of the links and prevents the seat pin from turning. The rocker pin is free to oscillate in the link. In assembly the two pins are slipped in place in the link and a retaining washer is slipped over the end of the seat pin. The seat pin is then riveted over the washer. To disassemble the chain, first turn the chain until the link which is to be taken out is directly over one of the sprockets, then split the washers at each end of the link with a cold chisel and push out the pins. The chain can then be removed and the link will fall from place.

2. Bushed Joint. In Bushed Joint construction, the links are held in place by a round pin and two half round bushings. The bushing is held rigidly in the end of the link but is free to turn in the intermediate links, permitting the chain to adapt itself to the sprockets. In assembling the chains the bushings are slipped in place and the outer link assembled with the 'D' shaped end of the pin projecting through the link. The pin is then riveted over the link. To disassemble the chain, turn chain until the hunting link is on the sprocket. Then drive out the pin at each end of the link and take out the pin and bushings. Chains of this type without direction arrows are designed to run in either direction. Certain chains are marked with direction arrows on the outside links. The chain should be assembled so as to run in the direction of the arrow.

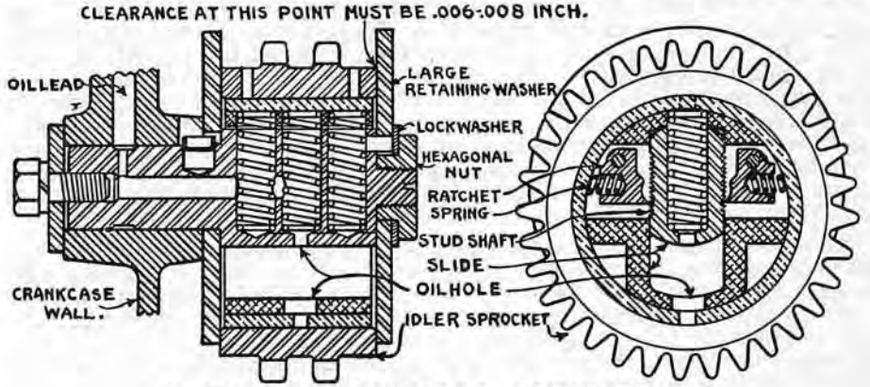
3. Oscillating Joint. The Oscillating Joint consists of an oval pin floating between two bushings. Each bushing engages a rib in the end of the link but is free to turn in the intermediate link. The links are assembled by riveting the end of the pin over a washer on the outside link. To disassemble the chain, split the washer of one pin in a link turned on the face of the sprocket. Push out the pin, remove the bushing and lift the chain from place. This type chain is designed particularly for two sprocket drives.

ADJUSTMENT TYPES:—Morse Chains are used with the various types of adjustment detailed on the preceding page. In addition a special Morse type eccentric manual adjustment drive and automatic adjustment have been developed. Details concerning these types are given below.

1. Eccentric Manual Adjustment. This installation incorporates a special accessory drive sprocket which is carried on an eccentric sleeve. The accessory drive shaft passes through the eccentric shaft on which the sprocket revolves and has a fixed center which is not disturbed when the timing chain is adjusted. The eccentric sleeve is carried in a sleeve in the rear of the timing chain case and extends through to an adjustment clamp arm on the rear face. The adjustment consists of loosening the clamp screw and turning the clamp arm. This revolves the eccentric sleeve within the accessory sprocket, causing the sprocket to move outward thus taking up the chain slack. The full range of adjustment is 180 degrees or 5/16 inch. When this point is reached the hunting link should be removed from the chain and the adjustment clamp returned to its original position.

2. Morse Automatic Adjustment. The Morse Automatic Adjustment consists of an idler sprocket engaging the rear face of a Duplex type timing chain. The idler sprocket revolves on a bushing which is mounted eccentrically on a stationary shaft. Three coil springs in the shaft maintain a constant pressure on the bushing tending to move the sprocket toward the chain and thus take up the chain slack. Two dogs or ratchets are held in engagement with serrations in the sides of the shaft. These provide stops for the adjustment and prevent reverse action. Provision is made for force lubrication. The adjustment range is sufficient to take up all allowable wear in the chain. When the sprocket reaches the point of maximum adjustment the chain should be replaced. Shortening the chain will cause excessive wear on the sprockets since the chain teeth will not mesh properly.

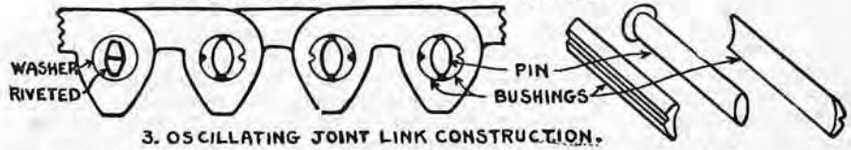
To replace the chain, take off the hexagon nut, lock washer and large retaining washer. This will expose the sprocket mounting on the stud shaft. Insert a small flattened pin in the two slots in the slide adjacent to the shaft. This will release the ratchets. Then press down on the sprocket compressing the springs and insert a hardwood plug in the slide opening



MORSE AUTOMATIC IDLER SPROCKET.

1. ROCKER JOINT LINK CONSTRUCTION TYPES.

2. BUSHED JOINT LINK CONSTRUCTION.



3. OSCILLATING JOINT LINK CONSTRUCTION.

under the stud shaft to hold the sprocket in place. The chain can then be replaced. If it is desired to disassemble the automatic sprocket this can be done after the chain has been removed by sliding the sprocket off and then forcing the bushing outward. After the bushing has been removed the slide can be removed and disassembled. Be careful to save the five springs used in the assembly. In reassembling, the large retaining washer must not be clamped tight against the face of the sprocket. The clearance at this point should be .006-.008 inch.

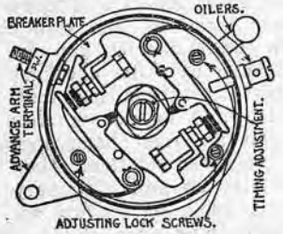
DISTRIBUTORS

SYNCHRONIZATION OF CONTACTS

DELCO

REMOVABLE CAM TYPES

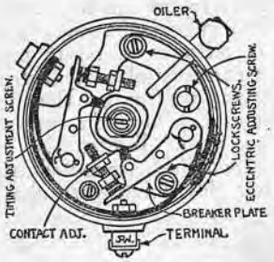
DOUBLE BREAKERS—SYNCHRONOUS OPERATION. Breakers using two sets of contacts operating on a single cam and opening at the same instant must be synchronized, which means both sets of contacts must open at the same instant. If this is not done the breaker contacts opening last will carry all the load and will burn up in service where the contacts are connected in parallel. Where double ignition is used one set of plugs will fire at the wrong time affecting ignition. However, in special cases manufacturers specify certain intervals of time between firing of plugs in double ignition systems and these intervals must be accurately set.



Delco Distributors. Set contact opening at correct figure recommended by manufacturer as given on car data sheets in the National Manual. Contact arm must be on lobe of cam. Turn distributor shaft until one set of contacts begin to separate. Then loosen three lockscrews on mounting plate and shift plate until second set of contacts also begin to separate. Tighten the lockscrews and proceed with the timing.

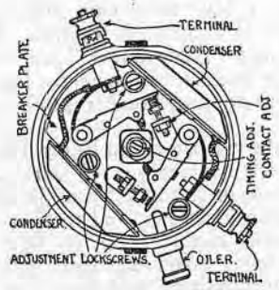
DOUBLE BREAKERS—ALTERNATE OPENING—REMOVABLE CAM. These breakers use two sets of contacts mounted at an angle of 45° and operate on a four sided cam. Contacts open alternately at intervals of 45° corresponding to 90° of crankshaft rotation. This is the correct firing interval for 90° 'V' type engines and eight cylinder 'Line' engines on which these distributors are used. The firing interval must be accurately set or timing of four cylinders will be thrown out. Timing on these breakers is set by loosening taper screw or locknut on breaker cam and shifting cam. For specific car timing directions see car data sheets in National Manual.

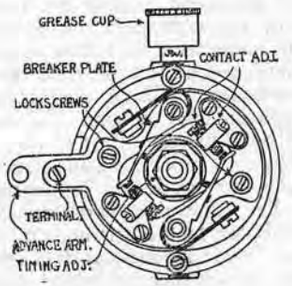
Delco and Remy Distributors. Use Delco-Remy Part No. 822572 to set correct firing interval. First set contact gap to .0225-.0275 inch on Delco breakers and .018-.024 inch on Remy breakers with contact arm on high point of cam. Then loosen taper lockscrew or locknut and remove regular firing cam. Replace with synchronizing tool, placing tool on shaft so that fiber bumper on contact arm mounted on stationary plate is in notch on tool. Loosen three lockscrews on movable plate and turn eccentric adjusting screw until fiber bumper of second contact arm rests in the other notch. Tighten lockscrews and replace regular firing cam. Check contact gap to make certain that it is within limits as given above.

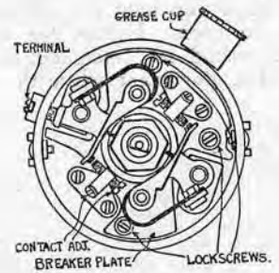


Delco Distributors used on Lincoln and Wills Sainte Claire. These engines are 60° 'V' type eight cylinder engines. The firing impulses occur at intervals of 60° and 120° of crankshaft rotation. Consequently breaker contacts separate at intervals of 30° and 60° corresponding to these 60° and 120° periods. Two breaker arms are mounted on an angle on a four sided cam and open alternately. Ignition timing on these engines is set by loosening taper screw in center of cam and shifting cam until one set of contacts begins to open with piston in firing position.

To set firing intervals use Delco-Remy Part No. 822570. First set contact gap at .0225-.0275 inch with contact arm on lobe of cam. Then loosen taper screw in center of cam and remove cam. Replace with synchronizing tool placing tool on shaft so that fiber bumper of one contact arm rests in notch in tool. Then loosen three lockscrews on plate and shift plate until bumper of second contact arm rests in the other notch of the tool. Then tighten lockscrews. Replace regular firing cam and check contact gap to see that it is within limits given above.







REMY

TYPE 648

Remy Distributors (Series 648—with both sets of contacts on movable plate. Turn distributor shaft until one set of contacts is open with contact arm on lobe of cam. Loosen two lockscrews on mounting plate and shift plate until second contact arm is also on lobe of cam. Tighten lockscrews. Set contact opening .022 inch. Then rotate shaft and check to see that contacts open at the same instant. If they do not, adjust contact opening keeping within limits of .018-.024 inch. Increasing contact gap will make contacts open sooner while decreasing contact gap will make contacts open later.

Remy Distributors (Series 648)—with one set contacts on movable plate and one set stationary. Turn distributor shaft until contact arm mounted on stationary plate is on lobe of cam. Set contact opening at .022 inch. Then loosen three lockscrews and shift plate until second contact arm is also on high point of cam. Tighten lockscrews and set contact opening at .022 inch. Then turn shaft and check contacts to see that they open at the same instant. If they do not, change contact opening by varying contact gap. Increasing the contact gap will make contacts open sooner and decreasing gap will make contacts open later. The contact gap must be kept within the limits of .018-.024 inch.

DISTRIBUTORS

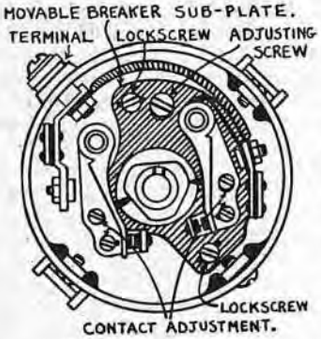
SYNCHRONIZATION OF CONTACTS

DELCO-REMY
TYPES 650, 659

DESCRIPTION:—These types are designed for use on six cylinder engines. They are fitted with two sets of contacts operating on a three sided cam. Contacts open alternately (one set opening an instant before the other set closes) at intervals of 60 degrees which corresponds with the 120 degree firing interval of the engines on which they are designed to be used. The two sets of contacts control the same coil and are connected in parallel in the primary circuit of the ignition system. All these types are identical in principle and are synchronized in the same manner although they differ in constructional details.

CONTACT ADJUSTMENT:—Contacts should be set at .022 inch and must be held within limits of .018-.024 inch at all times. Set contact gap by loosening lock screw on stationary contact mounting plate (located directly behind breaker arm) and turning eccentric adjusting screw until correct gap is secured with breaker arm rubbing block on lobe of cam. This must be done before attempting to synchronize contacts. If the synchronizing operation affects the setting sufficiently to throw the gap outside the limit of .018-.024 inch it must be reset at .022 inch and the synchronization repeated.

SYNCHRONIZATION OF CONTACTS:—A special tool has been developed to synchronize contacts. This is Delco-Remy Part No. 820751. To synchronize contacts, remove distributor head and rotor. Set contact gaps. Then place the synchronizing tool on shaft so that the 'A' side of the spring rests in the slot on the shaft (clockwise distributors) or the 'B' side of the spring rests in the slot (counter-clockwise distributors). Rotate the distributor shaft until the graduations on the leading tool scale approach the slot in the distributor housing. Connect a six volt test lamp in series with the coil primary and turn on the ignition. Continue to turn the shaft until the lamp goes out, indicating that the contacts have opened. Note the scale graduation which is in line with the edge of the slot. Then continue to turn shaft until the same figure on the other scale is opposite the same edge of the slot. This will indicate that the distributor has been turned through 60 degrees and the lamp should go out at this point, indicating that the second set of contacts has opened. If it does not, loosen the lock screws on the movable breaker plate on which this set of contacts is mounted and turn the eccentric adjusting screw until the contacts begin to open. Tighten the lock screws and check the contact opening. It must be within limits of .018-.024 inch. If outside these limits, reset at .022 inch and repeat synchronization. If the slot cannot be used as a reference mark, a mark may be made on the edge of the distributor housing opposite the '0' mark on the scale when the first set of contacts open. The tool is graduated in engine degrees. Contacts must be synchronized within two degrees or one graduation on the tool.

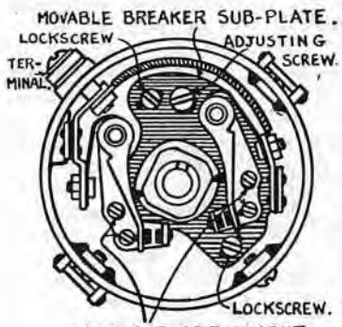


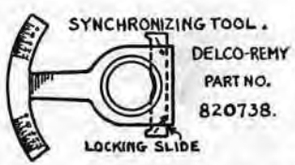
DELCO-REMY
TYPES 651, 652, 657

DESCRIPTION:—These types are designed for use on eight cylinder engines. They are fitted with two sets of contacts on a four sided cam. The contacts open alternately at intervals of 45 degrees corresponding to the 90 degree firing interval of the engines on which they are used. Both sets of contacts control the same coil and they are connected in parallel in the primary circuit of the ignition system. Both contacts must be open to secure a spark at the spark plug. This is accomplished by designing one set of contacts to close immediately after the other set opens. All these types operate on the same principle although they differ in constructional details.

CONTACT ADJUSTMENT:—Contacts should be set at .022 inch and must be held within limits of .018-.024 inch. Set contact gap by loosening lock screw on stationary contact mounting plate (directly behind breaker arm) and turning eccentric adjusting screw until correct gap is secured with breaker arm rubbing block on lobe of cam. Tighten the lock screw. This must be checked before the contacts are synchronized.

SYNCHRONIZATION OF CONTACTS:—A special Delco-Remy synchronizing tool, Part No. 820738, has been developed for this purpose. To synchronize contacts, remove distributor head and rotor and check contact gap. Then place synchronizing tool on shaft and lock it in place by pushing the slide through from the side. The slide is marked with an arrow at each end. One arrow will be visible when the tool is locked on the shaft and the slide should be locked so that the visible arrow points in the direction of distributor rotation. Turn the distributor shaft until the contact set mounted on the base plate begins to open when a six volt test lamp, which should be connected in series in the primary circuit, will go out. Carefully note the reading on the leading scale at a point directly opposite the edge of the terminal plate slot in the distributor housing. Then continue to turn the distributor shaft until the same point on the other scale is opposite the same slot edge on the housing. This will indicate that the shaft has been turned through 45 degrees and the lamp will go out, indicating that the second set of contacts are opening if they are properly synchronized. If the lamp does not go out at this point, loosen the two lock screws on the movable breaker plate and turn the eccentric adjusting screw until the contacts begin to open. Tighten the lock screws and check the contact gap. If outside limits of .018-.024 inch, reset at .022 inch and repeat synchronization.





DISTRIBUTORS

SYNCHRONIZATION OF CONTACTS

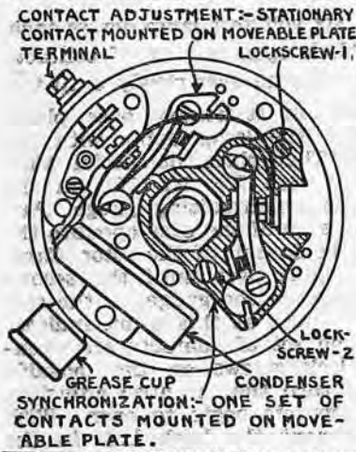
NORTH EAST

PACKARD AND CUNNINGHAM TYPES

DESCRIPTION:—These distributors are designed for eight cylinder engines and have two sets of contacts operating on an eight lobe cam. Contacts must be synchronized so as to open at the same instant in order to distribute the ignition load equally. If one set of contacts opens early, it will have no effect on the timing, which will be determined by the second set of contacts, but this second set will carry all the ignition load and will consequently wear more rapidly than would be the case if the contacts were properly synchronized. Contacts should be synchronized whenever the contacts are resurfaced and synchronization should be checked whenever the ignition timing is checked or set.

CONTACT ADJUSTMENT:—Contact gap should be set at .020 inch. Set contact gap by loosening the lock nut on the stationary contact mounting stud and turning up the stud until the gap is .020 inch with breaker arm rubbing block on lobe of cam. On the new type distributor (new Packard equipment) the stationary contact is carried on a moveable sub-plate. The lock screw on this plate should be loosened and the plate shifted by inserting the point of a screwdriver in the slot in the end of the plate and prying sideways on the screwdriver. Tighten the lock screw after making the adjustment.

SYNCHRONIZATION OF CONTACTS:—First Type. Distributors of this type were constructed with both breaker arms and contact assemblies mounted on a plate which was constructed with .020 inch clearance in the distributor cup. To synchronize contacts, loosen the lock screws on the breaker plate and shift the entire plate within the distributor cup until both contacts open simultaneously.



Second Type. Distributors of this type were constructed with one set of contacts mounted on a movable sub-plate. To synchronize contacts, loosen the two lock screws on the sub-plate, insert the point of a screwdriver in the slot in the plate and pry the plate to one side. Two small pins in the base-plate are designed to be used as fulcrums for the screwdriver. Tighten the lock screws after making the adjustment. The synchronization can be checked as part of the timing operation (see next paragraph.

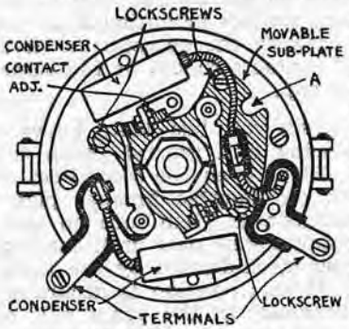
TIMING DISTRIBUTOR TO ENGINE:—The synchronization can be accurately and easily checked while the distributor is being timed to the engine by using one set of contacts at a time. First block open the second set of contacts (mounted on the movable sub-plate) with a piece of cardboard or fiber insulator and proceed with the timing operation, using a test lamp to check the contact opening. Then change the insulator to the first set of contacts and repeat the timing operation except that the distributor advance plate clamping screw should be loosened and the plate shifted until the second set of contacts begin ot open. Check the contact gap after synchronization has been completed.

AUTO-LITE

TYPES IGE AND IGK

CONTACT ADJUSTMENT:—Breaker contact gap when new or with new breaker arms should be .020-.024 inch. After 1000 miles of operation the gap should be set at .018-.020 inch. Set contact gap by loosening lock nut on stationary contact mounting stud and turning up stud until correct gap is secured with breaker arm rubbing block on lobe of cam. Use a feeler gauge and set contacts carefully. It is very important that both contacts have the same gap.

SYNCHRONIZATION OF CONTACTS:—Some means of determining when the contacts open must be used as it is absolutely impossible to determine the break visually with sufficient accuracy. The most satisfactory method is to connect six volt test lamps across each set of contacts so that the lamp will light at the instant the contacts open. To synchronize contacts with test lamps in circuit, turn on ignition and turn engine over slowly until contacts open. If both lamps light at exactly the same instant, the contacts are correctly synchronized. If they do not, loosen the three 'lock screws' on the movable breaker plate and shift the plate until the set of contacts mounted on the plate open at the same instant as the set mounted on the base plate. The breaker plate can be shifted by turning the eccentric adjusting screw 'A' on the first models of this type. The eccentric adjusting screw was later discontinued and distributors are now issued having a slot in the plate at this point. The plate can be shifted by placing the point of a screwdriver in the slot and turning the screwdriver.



AUTO-LITE -TYPE IGE AND TYPE IGK EXCEPT FOR 8 LOBE CAM.

Another method of testing the contact opening is to connect an ammeter in the ignition primary circuit (the two coils are connected in parallel) and noting the ammeter reading. The ammeter should register 8-10 amperes with both sets of contacts closed. If the ammeter reading drops to 4-5 amperes and then to 0 in two steps as the distributor shaft is slowly turned, it is an indication that the contacts must be synchronized. With the proper adjustment, the ammeter should drop from the initial reading of 8-10 amperes to 0 at once.

TIMING DISTRIBUTOR TO ENGINE:—The distributor is timed to the engine in the usual manner by first cranking the engine over until piston No. 1 reaches firing position and then loosening the advance arm clamp bolt and rotating the distributor housing and breaker assembly until the contacts open. Full directions are given on each individual car model page.

TYPE IGK

The Type IGK distributor is synchronized and timed exactly the same as the Type IGE. It is designed for eight cylinder engines and has an eight lobe cam.

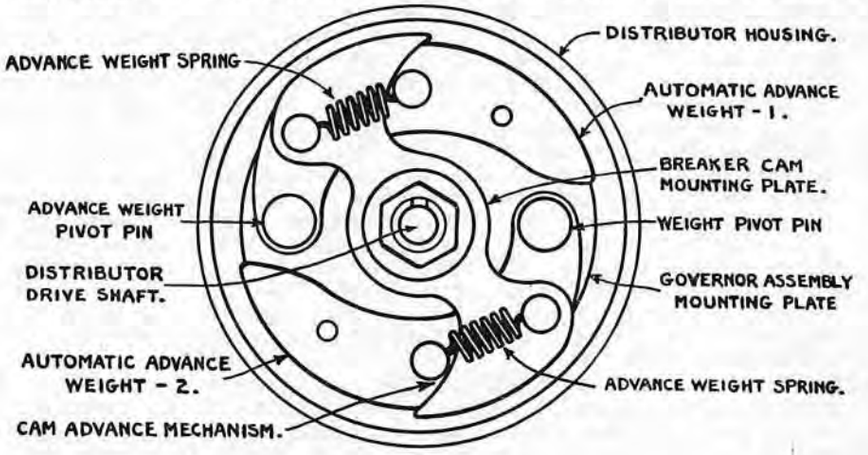
DISTRIBUTOR AUTOMATIC ADVANCE

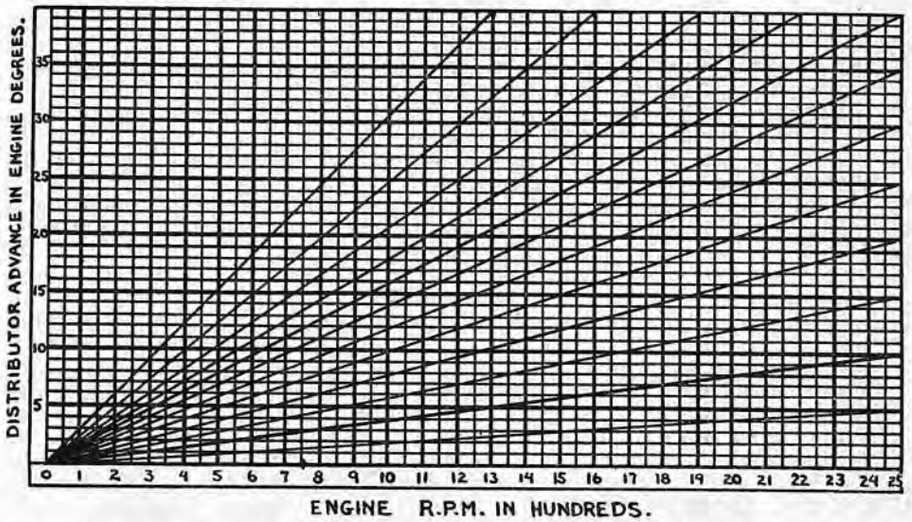
DESCRIPTION:—Practically all distributors are now equipped with automatic advance mechanism, and the tendency at the present time is to reduce the manual advance to a position of minor importance, either by designing the distributor to advance entirely automatically without any provision for manual advance or retard; or to provide only a manual retard with the distributor operating entirely in the full manual position except when the engine is being cranked by hand or is laboring as on a hill or with a heavy load. Automatic advance governor design on distributors used as original equipment is basically the same and consists of mounting the breaker cam on top of the distributor drive shaft but coupling it only indirectly to the shaft through the advance mechanism. The automatic advance governor consists of a weight or several weights (see illustration) pivoted on the advance plate which revolves with the distributor drive shaft. These weights tend to move out from the shaft as the shaft rotates due to the centrifugal force and are coupled to the breaker cam through a cam and lever arrangement so that the cam is rotated with respect to the shaft with the movement of the weights. As the speed of the distributor decreases the weights are pulled back and the cam rotated in the opposite direction by the advance weight springs. The advance mechanism is designed to rotate the cam against the direction of rotation of the shaft as the weights move out, which has the effect of advancing the spark by causing the contacts to open earlier.

AUTOMATIC ADVANCE SETTINGS:—Distributor advance characteristics, that is, the point at which the advance starts with respect to the engine speed and the point at which the maximum advance is reached, are determined by the relative weight and design of the advance weights and the tension of the advance weight springs. The particular characteristics of each model distributor are shown on the individual car data sheets. On every distributor model in service, the advance is designed to be in approximately a straight line from start to finish, that is, the distributor is designed to advance exactly the same amount for each 100 R.P.M. from the point where the automatic advance begins to the point where the maximum advance is reached. The fact that this advance 'curve' is a straight line makes it unnecessary for any other points to be given than the starting point and the finish point in order to test the advance performance. The automatic advance mechanism should start at the point given on the car data sheet, should advance the spark evenly throughout the speed range up to the finish point, where the maximum advance should be reached, and the advance should be constant at all higher speeds.

AUTOMATIC ADVANCE TESTING:—It will be necessary to operate the distributor on the test bench to make tests on the advance mechanism. The distributor should be brought up to the speed at which the automatic advance should begin to operate (it must be kept in mind that the distributor operates at one half engine speed) and the start of the automatic advance checked. The speed should be increased slowly to the point of maximum advance and it should be noted that the spark is advanced uniformly throughout the speed range. A noticeably uneven or erratic action will indicate that the advance mechanism is defective. It should be noted that the maximum advance is reached at the proper speed and that the position of the spark remains constant at all higher speeds. In making this test, if the automatic advance begins early and reaches the maximum figure at a lower R.P.M., the advance weight springs may be broken or weak. A 'spark knock' when the engine speed is decreased, as in ascending a hill, is an indication of weak springs or sticking weights. If the advance begins late, it is an indication of sticking weights. An erratic advance action may indicate worn bearings.

NOTE:—The table shown illustrates automatic advance performance and may be used to determine any number of points in any particular distributor advance curve. The horizontal divisions (from left to right) refer to engine R.P.M. in hundreds. The vertical divisions (reading up the page) refer to distributor advance in terms of engine degrees, as marked. The particular curve for any distributor may be found by marking the beginning point (the lower left hand corner) with the figure at which the automatic advance on the distributor in question should begin to operate and then marking each horizontal division to indicate an additional 100 R.P.M. engine speed. The line which refers to the particular distributor will be that one which crosses the line indicating the maximum engine R.P.M. at a point up the page corresponding to the maximum automatic advance. Every point on that line will then refer to the advance characteristics of the distributor in question. Whenever distributor advance performance and characteristics require additional data, this will be given on the car data sheets.





TIMING GAUGE

FOR USE ON CHRYSLER, DODGE, DE SOTO, AUSTIN

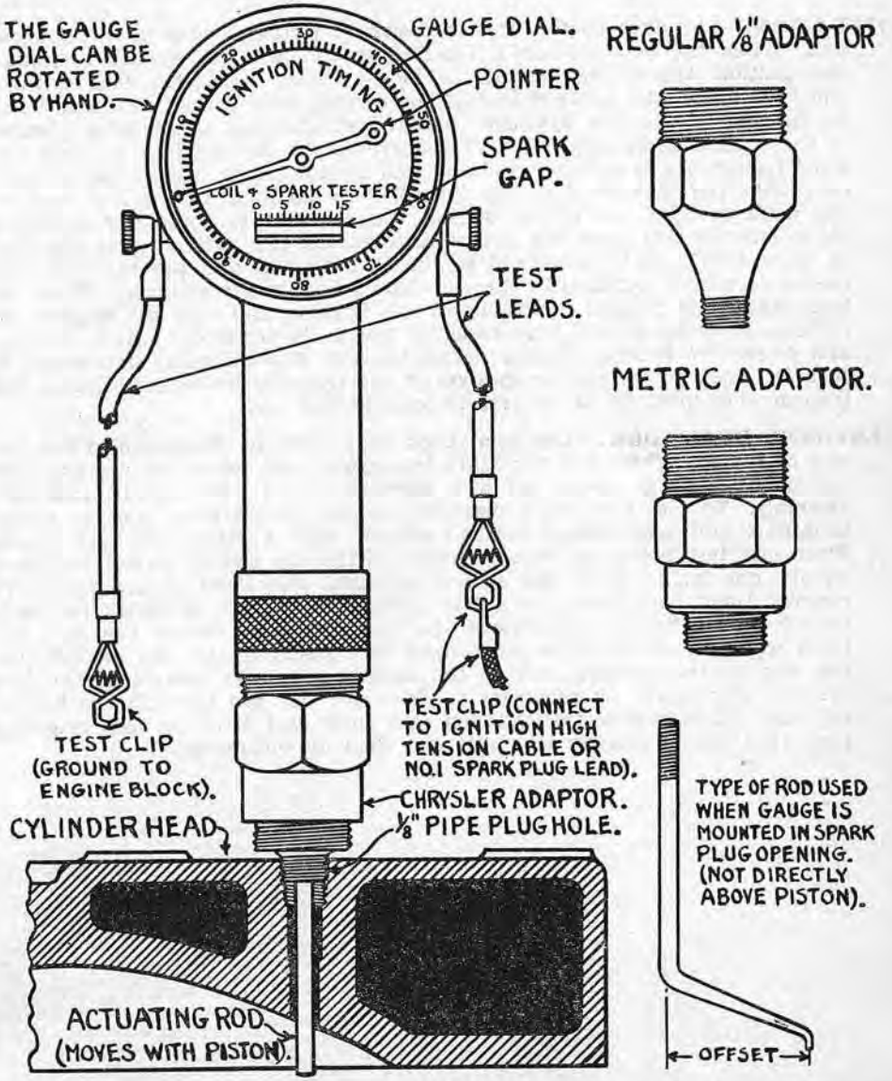
DESCRIPTION:—The timing indicator is a special micrometer gauge with a direct reading dial which is designed to be mounted on the cylinder head to measure the piston travel directly in thousandths of an inch as it approaches and leaves top dead center. It must be used on the car models listed above in setting the ignition as the flywheels on these car models are not marked and the specifications for ignition setting are given by the manufacturer in thousandths of an inch of piston travel for use with the micrometer gauge. The new type gauge is fitted with a visible spark gap so that the opening of the contacts can be checked.

OPERATION:—The operating piston of the gauge is contained in the shaft which is designed to be screwed into the spark plug port in the cylinder head or in the opening in the cylinder head closed normally by a ⅛ inch pipe plug on engines where this plug is provided (the plug will usually be found in the cylinder head directly over No. 6 piston). Special adaptors for use with ⅞ inch S.A.E. spark plug, ½ inch pipe thread, 18 MM. Metric thread and the ⅛ inch pipe plug openings are furnished with the gauge. These adaptors are used in connection with rods which rest on the head of the piston and move with it and thus actuate the gauge piston. Straight rods are used when the gauge is mounted in the ⅛ inch opening directly over the piston and offset rods must be used when the gauge is mounted in the spark plug port which is not directly over the piston head. The gauge is calibrated in thousandths of an inch and one complete revolution of the indicator hand registers .100 inch. The limit of travel of the gauge is six complete revolutions of the indicator or .600 inch and care must be taken when the gauge is used that the rod does not engage the piston more than .6 inch before top dead center.

IGNITION SETTING, USING GAUGE:—In timing the distributor to the engine, first crank the engine over until piston to be used in timing is on compression stroke (see specific car data sheet—the piston used may be No. 1, No. 4 or No. 6). Take out the spark plug or remove the ⅛ inch pipe plug in the cylinder head. Clean the carbon off the cylinder head. This is very important. Assemble the correct adaptor and rod on the gauge and screw the adaptor into the cylinder head. Turn engine over very slowly and see that the gauge indicator does not make more than six revolutions before top dead center. With the piston on top dead center set the gauge dial at zero. Connect the high tension lead from the coil to one of the spark gap terminals on the gauge. Ground the other gauge terminal to the engine and turn on the ignition. The first type gauge used on Chryslers was not equipped with this spark gap and it is necessary to use a test lamp connected in the primary circuit to check contact opening whenever this type gauge is used. Then turn engine over until, with the piston approaching top dead center on compression stroke, the gauge reading indicates the firing position (see car data sheet). If it is desired the gauge dial may be moved from the dead center position a number of calibrations equal to the ignition setting before top dead center, in which case the firing position will be reached when the dial indicates zero. This is likely to be confusing. Then set distributor so that contacts are just opening (at which point a spark will appear in the spark gap on the gauge).

SYNCHRONIZATION OF CONTACTS, USING GAUGE:—The timing gauge can be used to synchronize contacts on distributors using double breakers if it is not desired to use the regular synchronizing tools. To synchronize contacts on a six cylinder engine (distributors with two sets of contacts opening alternately at intervals of 60 degrees corresponding to 120 degrees of crankshaft rotation) after the distributor has been timed to the engine, crank the engine over 180 degrees until the piston again approaches top dead center on the exhaust stroke. Repeat the timing operation by stopping the crankshaft when the gauge reading indicates the firing position and shift the second set of contacts (mounted on the movable sub-plate) until they open, when a spark will be visible in the spark gap. Full details on distributor design and synchronization will be found on 'Distributor' pages.

In synchronizing contacts on eight cylinder engines (with two sets of contacts opening alternately at intervals of 45 degrees corresponding to 90 degrees of crankshaft rotation) it will be necessary to move the timing gauge to the next firing cylinder after the distributor has been timed to the engine and repeating the timing operation except that the disrlbuttor should not be disturbed and the second set of contacts should be adjusted by shifting the movable sub-plate until the spark is seen in the spark gap on the gauge. The spark gap can also be used to test the intensity of the ignition spark by varying the gap.



This gauge is Chrysler tool No. DC-150. It is manufactured by the Joseph Weidenhoff Company of Chicago.

DELCO-REMY ELECTROLOCK

DESCRIPTION:—The Electrolock is an ignition switch mounted on the dash and connected to the distributor housing terminal through an armored steel cable. The breaker lead from the coil is taken through the switch and then to the distributor through this cable which is fastened to the distributor by a special non-removable clip connection. The breaker is grounded through the switch case when the switch is in the 'Off' position. This absolutely prevents tampering with the car when the ignition is locked since it is impossible to wire around the switch.

OPERATION:—The dash switch consists of a tumbler lock cylinder mounted directly in front of a spring in the lock case. The switch contact is mounted on the rear of the lock cylinder. When the key is inserted in the lock and turned to the right as far as possible, the lock is released and the lock cylinder is forced out by the spring closing the switch contacts and breaking the ground connection. The key may then be removed. To turn off the ignition, the lock cylinder is pressed in. This opens the switch, grounds the distributor and locks the ignition. It is only necessary to make certain that the lock cylinder remains in the 'In' position and that the lock has snapped. This feature makes it impossible for the driver to neglect to lock the switch.

TROUBLE SHOOTING:—To test the Electrolock for possible ignition trouble, first disconnect wire on Electrolock case leading to coil. Turn the distributor shaft until contacts open or block open contacts with a piece of cardboard or any insulating substance. Then make the following tests with a lamp and test points:

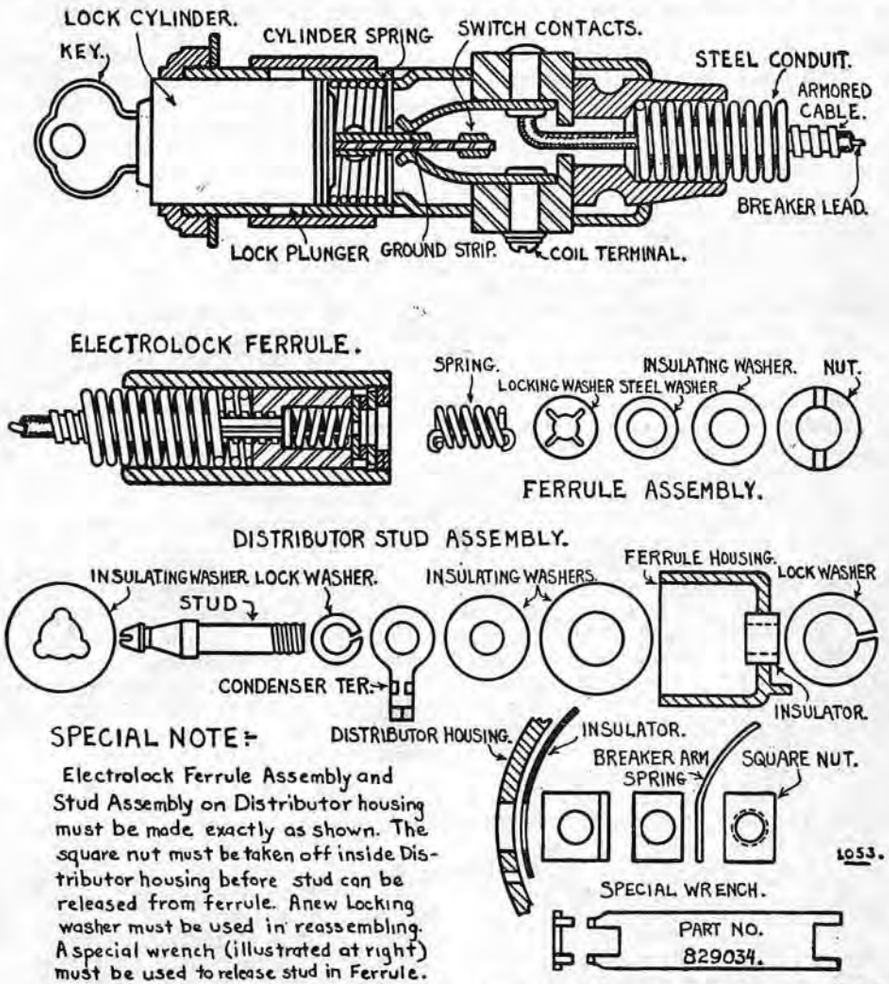
1. Place one test point on the terminal stud inside the distributor housing and place the other test point on the terminal on the side of the Electrolock case from which the coil lead was disconnected. With the switch unlocked the lamp should burn. With the switch locked the lamp should not burn.

2. Place one test point on the distributor terminal stud as in test (1) and place the second test point on the switch case. With the switch locked the lamp should burn. With the switch unlocked the lamp should not burn. If the lamp burns with the switch unlocked the condenser may be shorted or grounded. Disconnect the condenser and repeat the test. If these tests indicate Electrolock is operating satisfactorily, check coil, breaker contacts, distributor, spark plugs and wiring. If tests indicate trouble in Electrolock, disassemble as directed in the following paragraph:

DISASSEMBLY OF ELECTROLOCK:—Remove mounting nut with a spanner wrench and remove switch assembly from dash. Then unlock the switch and depress the plunger in the elongated slot in the side of the case. Then remove the contact assembly and inspect. In reassembling switch make certain that the retainer washer which holds the lock return spring in position does not touch either of the switch contacts. Assemble contact assembly so that the small tang on the side next to the lock cylinder is opposite the terminal screw. The tang fits into a hole in the lock cylinder. If the contact assembly is not replaced correctly the battery will be grounded when the switch is in the 'Off' position.

SERVICING DISTRIBUTOR:—To remove the distributor to the bench for service, remove the Electrolock from the dash and remove distributor from the engine as directed on the car data sheet. Then take entire distributor and Electrolock off the car. To remove Electrolock from the distributor, use special Electrolock wrench Part No. 829034 to remove square nut on terminal stud inside the distributor housing. On the Chevrolet distributor (on which this type Electrolock is standard equipment), it will first be necessary to turn the distributor shaft until advance weight mounting plate studs are 90 degrees from terminal stud, remove the three screws mounting the breaker plate and tilt the breaker plate down on the side nearest the terminal stud. The breaker arm must be slid up on the pin at the same time. Then remove the square nut and pull the Electrolock cable and stud assembly straight out. To remove the stud from the cable, use the special

DELCO-REMY ELECTROLOCK



SPECIAL NOTE:—Electrolock Ferrule Assembly and Stud Assembly on Distributor housing must be made exactly as shown. The square nut must be taken off inside Distributor housing before stud can be released from ferrule. A new locking washer must be used in reassembling. A special wrench (illustrated at right) must be used to release stud in Ferrule.

wrench to loosen the retainer nut in the end of the ferrule. A new locking washer must be used in reassembling. The various parts of the ferrule and stud assembly are illustrated in proper positions. Assemble these parts in order as shown. It will be necessary to remove the Electrolock from the distributor to replace the condenser and it is advisable also in replacing breaker arms.

ELECTROLOCK

TYPE 5-A

DESCRIPTION:—The Electrolock is an ingnition switch mounted on the dash consisting of a lock cylinder in a steel case which is connected to the distributor housing terminal by an armored cable. The breaker lead from the coil is carried inside the cable which is fastened to the breaker terminal by a special design non-removable clip connection. This absolutely prevents tampering with the ignition circuit and prevents the car being started with the ignition turned off since the breaker is grounded through the Electrolock case and through the distributor attachment.

To unlock Electrolock, insert key in lock cylinder and turn ¼ turn to right. The lock cylinder will spring out closing the ignition switch. The key should then be removed since it is not necessary to lock the ignition. To turn off ignition, press lock cylinder in and make certain that it does not spring out again. This will turn off ignition, ground the breaker and lock the Electrolock itself to the car.

The Electrolock is manufactured in two types, the 5-A with one terminal on the side of the case, and the Type 5-B with three terminals on the side of the case.

Connections:—The terminal on the side of the Electrolock case should be connected to the breaker terminal of the ignition coil. The feed for the coil is taken directly off the ammeter or from the relay terminal of the generator. The breaker circuit is completed through the armored cable from the Electrolock to the terminal on the distributor housing.

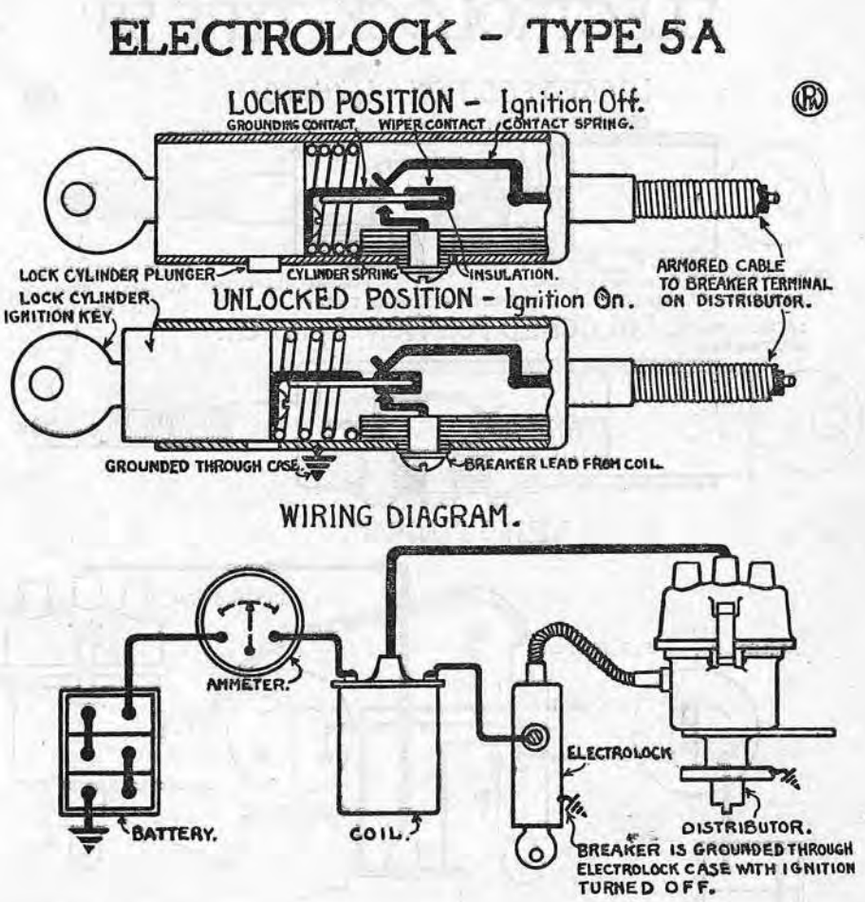
Servicing Distributor:—To remove distributor from car for bench tests or repairs, unlock Electrolock and remove from dash. Remove distributor from engine as directed on the car data sheet. Then remove entire distributor and Electrolock assembly from car.

Trouble Shooting on Car:—Disconnect wire from side of case. Insulate breaker contacts with a piece of cardboard or turn cam until contacts separate. Then make following tests with six volt lamp circuit and test points:

(1) Place one test point on breaker terminal inside distributor and place the other point on the terminal on the side of the Electrolock case. With Electrolock in the unlocked position, the lamp should burn. With Electrolock locked the lamp should not burn.

(2) Place one test point on the breaker terminal inside the distributor. Place the other point on the Electrolock case. With the switch locked the lamp should burn. With the switch unlocked the lamp should not burn. If the lamp burns there is a gound in the Electrolock or the condenser is shorted or grounded. Disconnect the condenser and repeat the test.

If these tests indicate the Electrolock is operating satisfactorily look for ignition trouble in coil, breaker, distributor or spark plugs. If tests indicate trouble in the Electrolock, disassemble as directed in paragraph on 'Servicing Electrolock' under Type 5-B (see next page).



ELECTROLOCK

TYPE 9

TYPE 9-A

DESCRIPTION:—The Type 9 Electrolock differs from the Type 5 in that the lock cylinder does not spring out as the switch is unlocked and has simply a one-quarter turn rotary movement. The key hole in the lock is vertical with the switch locked. To turn on ignition, the key must be inserted and turned to the right. The key may then be removed as the switch locks automatically when the ignition is turned off by turning the lock cylinder back to the vertical position. The Type 9-A Electrolock has one terminal on the side of the case. This should be connected to the ignition coil and the other coil terminal should be connected to a 'hot' terminal of the car wiring circuit ordinarily the discharge side of the ammeter. The Electrolock is coincidental in operation, grounding the coil and breaker through the switch mounting on the instrument board and the cable attachment on the distributor when the switch is turned off. No provision is made for the connection of gasoline gauges or other accessories to be controlled by the ignition switch and if devices of this kind are installed they must be provided with a separate switch, or a Type 9-B Electrolock installed.

To Remove Electrolock from Distributor. The Type 9 Electrolock is fitted with a 'serviceable timer end' and the Electrolock and cable assembly can be removed from the distributor housing and replaced. To remove the snap terminal assembly (distributor housing assembly) from the Electrolock, first remove snap terminal assembly and cable from distributor. Then cut the terminal post to remove the grounding cup and insulating washer. This will expose the timer end nut which is staked in place. Unscrew the nut, using the special spanner wrench designed for this purpose (see illustration). The snap terminal assembly can then be removed with the timer end lock ring attached to the terminal stud. In reassembling a new terminal stud and lock ring must be used. The timer end contact spring assembly on the cable can also be disassembled by using the special wrench to unscrew the nut. In reassembling, replace parts in the same order, making certain that the insulating washers are in place and stake nuts to prevent their working loose in service.

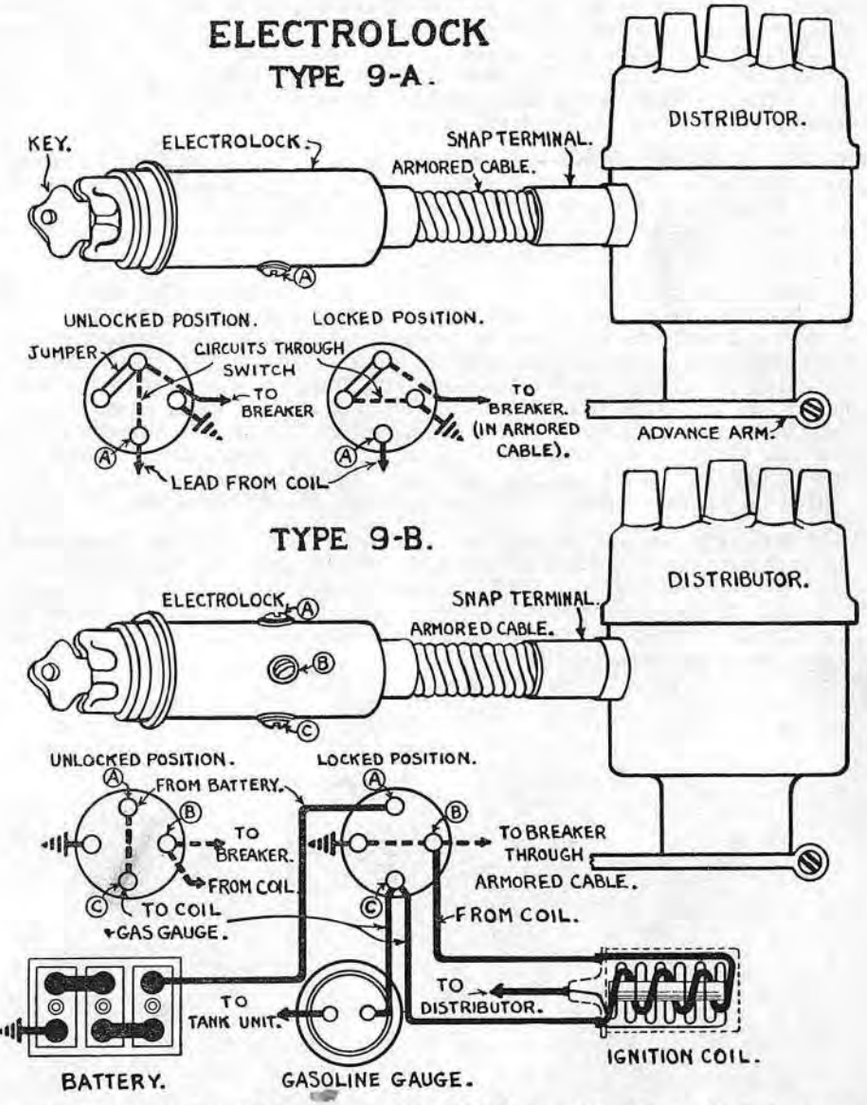
SERVICING ELECTROLOCK:—The Electrolock can be disassembled for inspection and service by turning the lock cylinder to the unlocked position and then removing the small screw in the side of the case. The lock cylinder can then be withdrawn, exposing the switch. Parts are available for replacement and repairs can be made.

Trouble Shooting. Use a lamp and test points to check Electrolock switch circuits. Disconnect wire at terminal on side of case and block open breaker contacts. Place one test point on primary terminal inside breaker case and the other test point on the terminal on the side of the case. The lamp should light with the switch unlocked and should not light with the switch locked. If test lamp indicates switch circuits are not being completed correctly, the lock cylinder should be removed and the switch inspected. With one test point on the primary terminal inside the distributor housing place the second test point on the lock case. The lamp should light with the switch off or locked and should go out when the switch is unlocked.

If the lamp remains lighted with the switch unlocked, the Electrolock is grounded or the condenser is grounded. Disconnect the condenser and repeat the test. If this indicates that the condenser is at fault it should be replaced. If these tests indicate that the Electrolock is all right and ignition trouble continues, check the ignition coil, breaker contacts, distributor, spark plugs and spark plug cables.

TYPE 9-B

DESCRIPTION:—The Type 9-B Electrolock is similar in design to the Type 9-A except that it is provided with three terminals on the side of the case and should be used when gasoline gauges or other accessories are used which must be controlled by the ignition switch. The ignition lead is connected to one terminal on the case and the two coil leads are connected to the other two terminals. The gasoline gauge and other accessories should be connected to the feed terminal of the coil on the case (and never to the breaker lead from the coil). The breaker lead from the coil is completed through the Electrolock armored cable in the usual manner and the coil and breaker are grounded when the switch is locked.



SERVICING DISTRIBUTOR AND ELECTROLOCK:—The Electrolock is removed and serviced in exactly the same manner as the Type 9-A. In making tests with lamp and test points, disconnect wires at Electrolock terminals and use terminal marked 'Coil.' In rewiring ignition circuit make certain that all leads are insulated down to the screw heads to avoid any possibility of short circuit to the case. Never use grease or oil in the lock cylinder. If the tumblers stick a small amount of graphite may be used on them.

SHALER CO-INCIDENTAL LOCK

FIRST TYPE

DESCRIPTION:—The Shaler Ignition Lock consists of tumbler lock switch in a pressed steel case mounted on the dash and a solenoid operated latch mounted in a box on the side of the distributor housing. The two units are connected by a woven cable. When the ignition is turned off at the switch, the ignition coil is grounded and the breaker is grounded at the latch or trap mechanism on the distributor housing by a special ground wire contained in the cable. In addition to the breaker lead, ground wire and coil leads (where the coil leads are taken into the cable at the trap mechanism as on the Durant installation) the cable contains also leads connected to the trap operating solenoid and a live wire or "hot lead" connected to the switch terminal which is connected to the ammeter. The trap leads are dead ended or insulated at the switch end of the cable and the live wire is dead ended at the trap mechanism unless this lead is used for the generator line, as on the Chrysler 52 installation. When gasoline gauges or similar devices are used they are connected to the coil side of the switch or to the switch terminal on the ignition coil.

The theft-proof feature of the lock consists in the fact that the breaker ground can only be relieved by cutting the cable. This short-circuits the live wire and the trap mechanism lead and causes the trap solenoid to permanently ground the breaker. If the cable has been cut or the trap mechanism operated it will be necessary to remove the entire assembly and replace the cable and trap mechanism as directed below.

OPERATION:—Insert the key in the lock on the dash and turn ¼ turn to right. When the car is stopped it is very important that the switch should be locked to prevent the battery discharging through the coil.

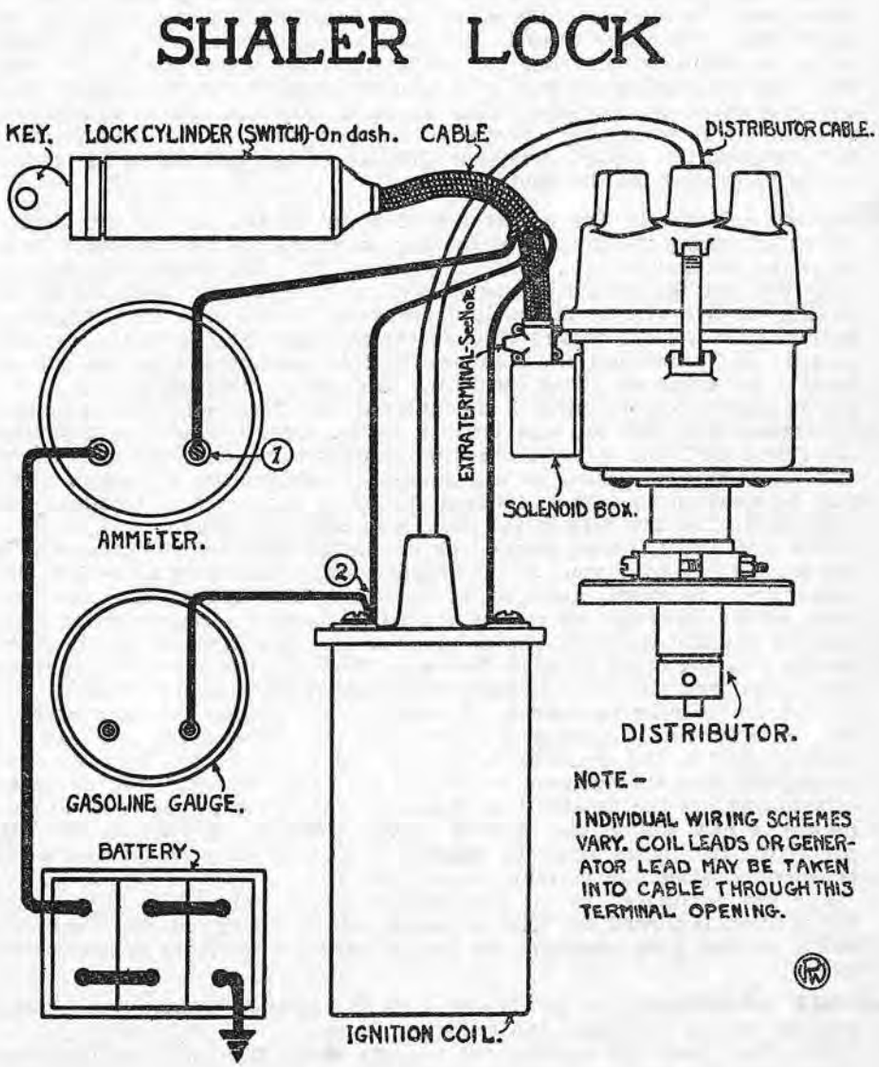
Trouble Shooting:—To test for ignition trouble on the car, disconnect feed wire at ammeter (No. 1 on diagram) and both terminals at coil. Then use regular 6 volt test lamp circuit and test points and make following tests:

(1) Place one test point on feed wire (No. 1) and place the other point on the coil lead from the switch (this is the wire attached to the coil at the terminal from which the gasoline gauge is taken off). The lamp should burn with the switch unlocked and should go out when the switch is locked. If switch is operating satisfactorily make following test for correct operation of solenoid:

(2) Block open the breaker contacts or turn cam until contacts open. Replace all ignition wiring. Replace one test point on breaker terminal inside distributor case and place second test point on switch case on dash. With the switch locked the lamp should burn. With the switch unlocked the lamp should not burn. If test indicates that solenoid is operating satisfactorily and ignition trouble continues, check breaker contacts, coil, spark plugs, and engine timing.

SERVICING LOCK:—If either the lock switch or solenoid are defective they must be replaced. To replace switch, unlock and remove from dash, unsolder wires at terminals and connect new unit. Then make test No. 1 to insure correct operation of the new switch.

To remove solenoid from breaker, take off distributor head, unsolder nut on terminal inside, remove nut, take off breaker arm spring and push stud out through case. In installing new unit make certain that the insulating washers are replaced in proper order so as to insulate stud from case. After testing to make certain that solenoid is operating satisfactorily, resolder nut, being careful not to use too much heat as this will draw out temper of breaker arm spring.



AC FUEL PUMP

DESCRIPTION:—The AC Fuel Pump is a mechanically operated gasoline pump. The pump is mounted on the side of the engine block and is driven through a rocker arm by an eccentric cam on the camshaft. It supplies gasoline at a positive pressure directly to the float chamber of the carburetor. The gasoline flow is controlled entirely by the needle valve in the carburetor float chamber and by the speed of the car so that the operation of the pump is entirely automatic.

Two types of the pump, Series A and B, have been developed and are in use as standard equipment on 1929 car models. The principle of operation of the two types is similar although they differ in constructional details as shown in the illustrations.

OPERATION:—The shaft (G) which supplies power to operate the pump is ordinarily the camshaft of the engine. When the camshaft is rotated, the eccentric cam (H) causes the rocker arm (D) to move backward and forward. The movement of the rocker arm which is pivoted at (E) pulls down the pull rod (F) together with the pump diaphragm (A) which is bolted on the upper end of the pull rod between the cup shaped metal discs (B). This creates a vacuum in the pump chamber (M) which causes gasoline from the fuel tank at the rear of the car to enter the pump through the inlet (J) into the sediment bowl (K) through the filter screens (L) and the inlet valve (N) and fill the pump chamber. As the eccentric completes a revolution the rocker arm ceases to pull on the pull rod and the driving spring (C) forces the pull rod and diaphragm upward. This closes the inlet valve and opens the pressure valve (O) causing the gasoline to flow through the outlet (P) to the carburetor float chamber. When the carburetor bowl is filled and the float needle valve closes, the pressure of the gasoline backed up in the pump chamber is sufficient to hold the driving spring (C) compressed, holding the pull rod and diaphragm in its lowest position. The movement of the rocker arm which continues as long as the engine is running is absorbed by the linkage (T) in the Series A Pump and by the break or cam action of the rocker arm (R) which is made in two pieces on the Series B Model. The pump thus remains inoperative until sufficient gasoline has been used from the carburetor float chamber to allow the driving spring to force the pull rod upward again when the pump resumes operation. This spring (S) is used merely to keep the rocker arm in contact with the eccentric to eliminate noise and to take up the free motion of the linkage and rocker arm break.

TROUBLE SHOOTING:—Check faulty gasoline feed to engine which may be caused by defective pump, from the following table:

Insufficient fuel is delivered at carburetor starving engine and causing it to stop or lack power.

1. Leaky tubing or connections allowing gasoline to be lost or permitting air to be drawn in the system. Check gas line and connections and watch sediment bowl for air bubbles.
2. Bent or kinked tubing. This will obstruct gas line and prevent gasoline reaching pump.
3. Sediment bowl loose. This will destroy pump vacuum and interfere with pump action. Tighten the thumb nut under the bowl and examine cork gasket to make sure that it is in place and lies flat around upper rim of sediment bowl.
4. Dirty screen. This will obstruct gasoline flow. Remove sediment bowl, take out and clean screen.
5. Loose valve plug. This will destroy pump vacuum or cause gasoline leak. Examine plug gasket and tighten plug.
6. Defective valves. Remove valve plugs and valves. Wash valves in gasoline and examine. If warped or damaged, replace. Examine valve seat. Replace valves, making certain that spring is around lower end of valve plug and that valve is placed with polished side down. Use new cap gaskets if necessary.

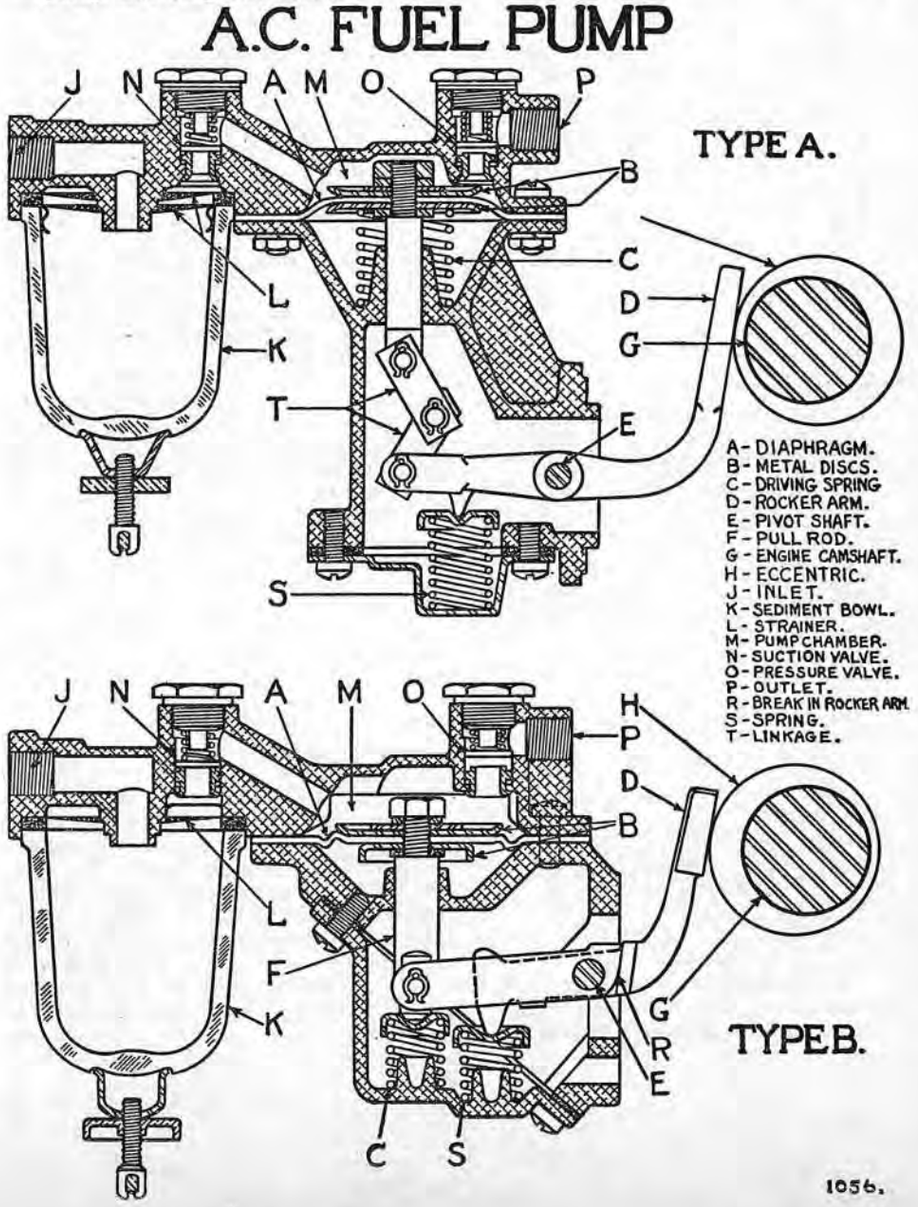
Gasoline leaks around Diaphragm.

Tighten the cover screws alternately and evenly. Do not disassemble pump body.

Carburetor Floods.

Check float needle valve for correct seating. Check float level.

SERVICING:—The AC Spark Plug Company, who manufacture these pumps, recommend that no attempt be made to disassemble the pump other than as described above as special jigs and fixtures are necessary to properly align parts to insure correct operation of the pump. The pump should be returned to them or to their service representatives whenever major repairs or adjustments are necessary. In ordinary installations these pumps are oiled by splash from the crankcase and no service adjustments are necessary other than to remove and clean the sediment bowl and filter screens occasionally. There are two screens on the Series A pump, one above and one below the cork gasket above the glass sediment bowl. The Series B pump has only one screen.

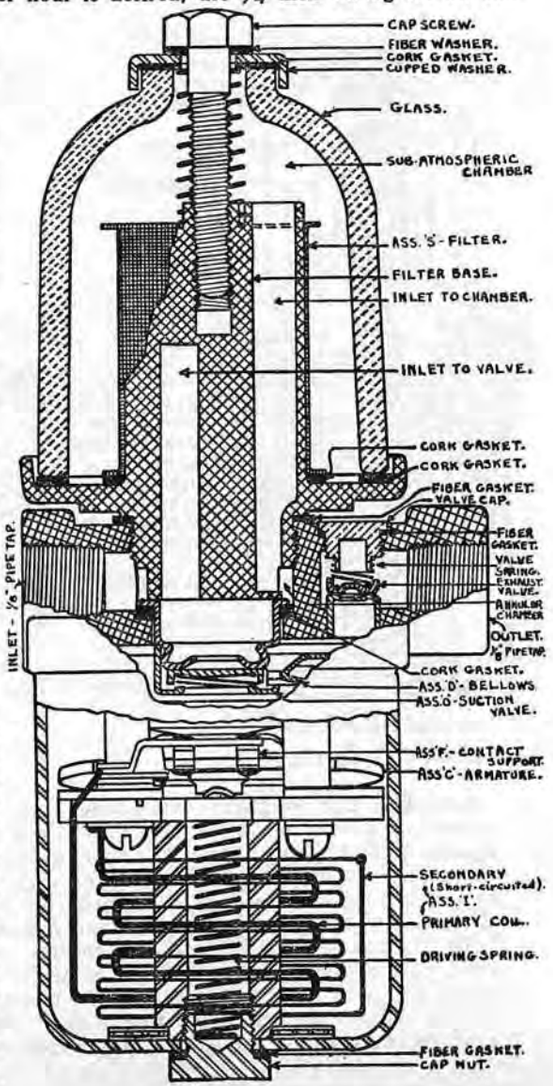


AUTOPULSE

SECOND TYPE

DESCRIPTION:—The Autopulse consists of a bellows pump operated by a new de-design electric motor. The bellows are made of metal with reinforced and soldered flanges and it is claimed they will outlast the ordinary life of an automobile engine. No lubrication or service adjustments are necessary.

INSTALLATION:—The pump should be mounted as near the carburetor as is practical and approximately on the same level. Wherever possible mount the pump directly on the carburetor bowl. Both suction and delivery lines of the pump are tapped with 1/8 standard pipe thread and suitable fittings are provided for mounting. For mounting on chassis or engine special brackets 266 (for horizontal mounting), or 267 (for vertical mounting) are provided. A special rubber insulated bracket is supplied for mounting on wooden dash to eliminate sound. For single until mounting where less than 5 gallons per hour is desired, use 1/4 inch tubing for all connections. If full capacity is desired, use 5/16 inch tubing. For Duplex or two unit installation, use 1/8 or 1/4 inch pipe thread manifolds. On Triplex or Quad installations, use two 5/16 inch tubes or one 3/8 inch tube with 1/4 inch pipe thread manifolds. On Quintette or Sextette installations, use two 3/8 inch tubes with 1/4 inch pipe thread manifolds. On multiple installations each unit operates independently and is connected in parallel with the others. Connect the flexible lead to the ignition terminal on the switch or to the switch terminal on the ignition coil. The pump is grounded through the shell. On two wire systems or where pump is mounted on insulated base, the mounting bracket must be connected to the battery or grounded to the engine block.



OPERATION:—Pump is connected to the battery when the ignition switch is turned on. Current flows from terminal on side of case through primary winding to contacts which are normally closed on suction stroke and grounds through case. The coil draws the armature downward expanding the bellows chamber and draws gasoline from tank through inlet to filter chamber then through filter screen and suction valve to bellows chamber. During suction stroke contacts are kept closed by action of steel sleeve in the coil which stresses the spring under the lower contacts. When the armature hits the spring the contacts open and primary circut is broken. A special design short circuited secondary coil prevents arcing at the contacts. The driving spring in the coil core then forces the armature upward collapsing the bellows and forcing the gasoline through the check valve and outlet passage to the carburetor bowl. When the delivery stroke is completed, contacts close and Autopulse repeats suction stroke.

REGULATION:—The operation of the pump is controlled entirely by the hydraulic pressure of the gasoline in the float chamber of the carburetor. When the float valve closes with the float chamber filled with gasoline the hydraulic pressure in the line prevents the pump completing its delivery stroke and the contacts remain open. The pump thus remains inoperative until gasoline is drawn from the carburetor float chamber and does not draw any current even though the ignition switch is on. The pump can only operate while the engine is running unless there is a leak in the line.

CAPACITY:—The Autopulse draws .25-.5 amperes at 6 volts when operating at full capacity. It is normally rated at 5 gallons per hour but will pump 7-8 gallons at full load. On larger engines or where a very even flow of gasoline is desired two, three, four, five or six units may be operated in parallel on the same feed and delivery lines. In this case each unit operates independently. A five unit or Quintette installation will pump 35-40 gallons per hour drawing approximately 2 amperes at 6 volts. Other units are designed for 12 and 32 volt installation.

TROUBLE SHOOTING:—Installation Test. When installing pump, partially drain carburetor bowl. Then close ignition switch but do not crank engine. The pump will operate at high speed for several seconds and should then stop. If pump continues to operate at slow speed this is an indication of leakage in the suction or delivery lines.

Test for Gasoline Leakage. This is indicated by continued action of pump with engine stopped and with ignition switch on. Check carburetor for leaking float valve and check delivery line for poor connections. Then check pump for leaking suction valve.

Test for Air Leakage. This is indicated by noisy or uneven operation of the pump. Crank engine and allow it to idle. The pump should operate uniformly. If it speeds up or is noisy, turn ignition switch on after engine has been standing for several seconds but do not crank engine. If there is air in the suction line the pump will vibrate without pumping even after the carburetor chamber is full. The gasoline tank must be full in making this test.

Test for Clogged Line. With pump operating and engine idling watch the dash ammeter. The pump normally draws 1/2 ampere which may not be noticeable on dash ammeter. If needle vibrates noticeably with each stroke check the gasoline line for clogged openings and clean all screens. **Multiple units** should be tested individually by disconnecting lead wires and connecting one unit in the circuit at a time. Actual capacity of unit can be tested by placing container under delivery port and turning on ignition switch. The unit will pump at full capacity until the switch is turned off.

SERVICING:—If Autopulse fails to pump with carburetor bowl empty, and pump properly connected and grounded, check outlet valve by raising valve off seat and rotating with a pen knife inserted through outlet passage. Then blow through pump from inlet side. If obstructed take off filter base and press gently on suction valve to test for gummed seat. To assemble suction valve after removal, place spring in retainer with small hole up. Place valve over spring, polished side up, with boss on lower side of valve in hole on spring. Then snap retainer over valve cage and replace in chamber with cork gasket under cage flange. The delivery valve screw should not be removed as valve can be checked through outlet passage.

FILTER:—A fine mesh screen filter is enclosed in the glass chamber on top of the unit. To remove filter, take out cap screw and lift off glass cover. The filter screen can then be cleaned.

STEWART WARNER FUEL PUMP

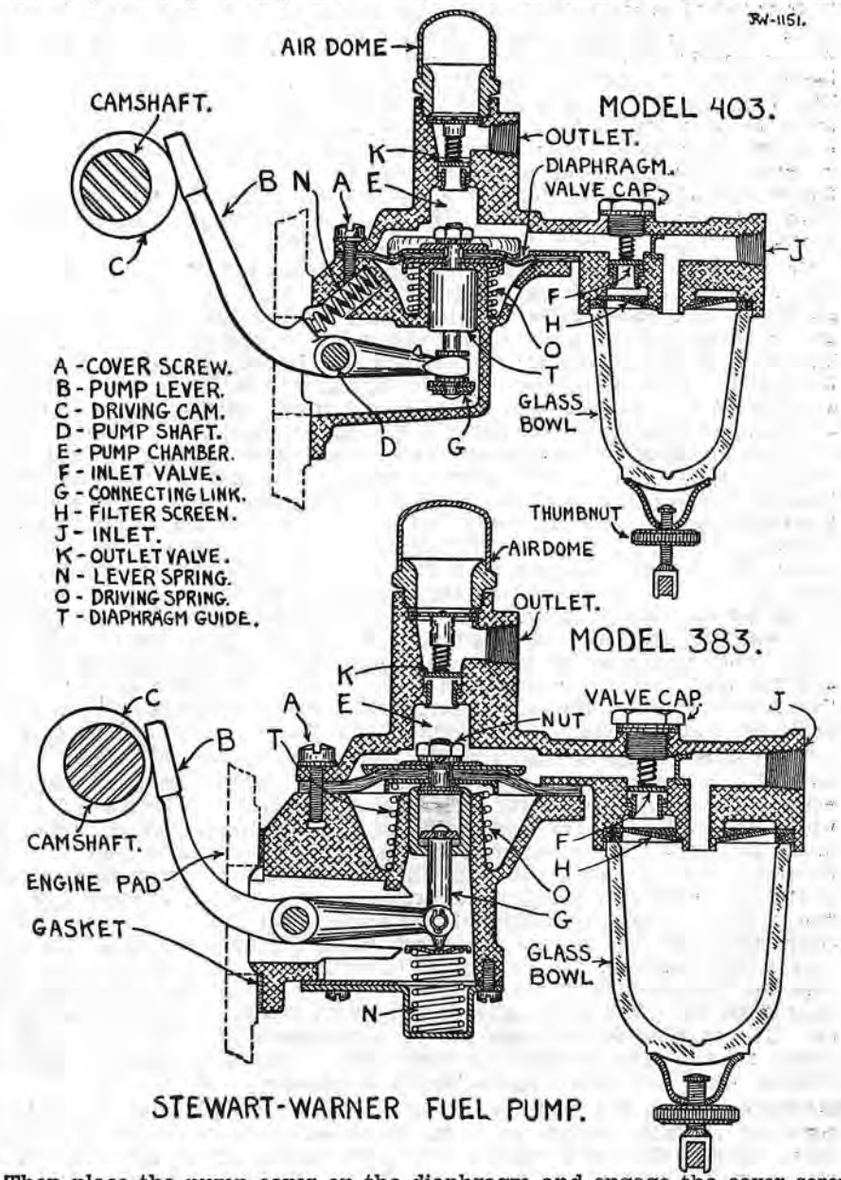
MODELS 383 AND 403

DESCRIPTION:—The Stewart Warner Fuel Pump is a mechanical diaphragm pump driven from the cam shaft of the engine and designed to deliver gasoline from the fuel tank at he rear of the car to the float chamber of the carburetor. A filter and glass sediment bowl are incorporated in the supply line of the pump so that all fuel passes through the glass bowl and then through a fine mesh strainer before it enters the pump chamber. From the pump chamber it is forced to the carburetor bowl, maintaining a constant supply which is designed to be in excess of the actual requirements of the engine. There is an air dome on the pump directly over the outlet valve which relieves the carburetor float valve of excessive pressure on the delivery stroke of the pump by allowing the air in the dome to be compressed.

OPERATION:—On the suction stroke of the pump the special cam on the camshaft forces the lever 'B' down, drawing the pump shaft and diaphragm downward. This creates a vacuum in the pump chamber 'E' which opens the inlet valve 'F' and causes gasoline from the fuel tank at the rear of the car to flow through the inlet 'J' into the glass reserve bowl or sediment chamber and then through the filter screen 'H' and the inlet valve to the pump chamber. As the camshaft rotates the pump lever moves upward through the action of the spring 'N'. This allows the driving spring 'O' to force the diaphragm upward closing the inlet valve, opening the outlet valve 'K' and forcing the gasoline out through the outlet to the carburetor. Air and gasoline vapor are compressed in the air dome during this delivery stroke and expand during the subsequent suction stroke so that the flow of gasoline in the line is kept more uniform and the rate is increased about twenty five per cent. When the diaphragm reaches the top of the stroke the outlet valve closes and the inlet opens and the cycle of operations is repeated. The pump is designed to operate at a maximum pressure of 2.5 pounds per square inch. The actual flow of gasoline to the carburetor is controlled by the carburetor float valve. When the float chamber of the carburetor is filled the float closes this valve. The back pressure of gasoline in the line (when it has built up to 2.5 pounds) is then sufficient to hold the diaphragm at the bottom of the stroke against the pressure of the driving spring. The pump lever continues to move with the action of the cam as long as the engine is running but the pump shaft moves freely in the diaphragm guide 'T' until sufficient gasoline in the carburetor bowl is used so that the driving spring can force the diaphragm up on the delivery stroke when the pumping action begins. The spring 'N' is used only to keep the pump lever in contact with the cam on the camshaft.

TROUBLE SHOOTING:—If the pump fails to deliver gasoline to the carburetor, disconnect delivery line and watch pump action while turning the engine over with the starter. If gasoline spurts from the delivery tube, the line to the carburetor is clogged or the carburetor needle valve is clogged. Observe breather hole in pump housing. If gasoline flows from this hole, the pump diaphragm is cracked and must be replaced. Disconnect supply line to gasoline tank and check for stoppage by blowing through the line. Then examine inlet and outlet valves, clean valves and valve seats and check valve springs. If the valves are warped or gummed, replace valves using new gaskets under the valve retaining nuts. Draw nuts down tight and tighten diaphragm screws. Clean out vent hole in pump housing to prevent back pressure in pump. If this does not correct trouble, remove pump from engine and test by connecting short pieces of rubber tubing to the inlet and outlet. Immerse the inlet tube in a glass of gasoline and operate pump by hand. Gasoline should spurt out of the outlet tube. If the pump does not operate it will be necessary to disassemble and examine the diaphragm and diaphragm driving spring. A weak spring or cracked or leaky diaphragm must be replaced.

To Replace Diaphragm:—Remove the pump cover by taking out cap screws. Unscrew the nut holding diaphragm on pump plunger using a second wrench to hold the large hexagonal nut from turning (this is very important to prevent tearing diaphragm and injuring pump). Remove old diaphragm and lay four pieces of diaphragm material in position on the spring retainer. Insert two cover screws to line up holes. Then place the two washers on the diaphragm, lining up the keyways in the washers and diaphragm with the key on the pump plunger stud. Compress driving spring by forcing these parts down on the stud until they seat properly with the key engaged in the keyway and screw the retaining nut down (holding the large hexagonal nut with a second wrench to prevent turning).



STEWART-WARNER FUEL PUMP.

Then place the pump cover on the diaphragm and engage the cover screws. Turn these screws down about three threads and then flex diaphragm by pushing the pump lever toward the pump as far as possible. Hold it in this position while the cover screws are tightened. This is very important to allow the proper pump action. In replacing the pump on the engine make certain that he gasket is in place between the pump and the engine pad. The pump will prime itself in approximately 20 strokes or 40 R.P.M. of the engine.

AC ELECTRIC GASOLINE GAUGE

DESCRIPTION:—The AC Gasoline Gauge is of the electric type and consists of two units, a dash unit or recording gauge and a tank unit or measuring device mounted on the gasoline tank. The dash unit is mounted on the instrument panel. It consists of two coils in which an armature is free to move. The pointer of the gauge is fixed to this movable armature. The dash gauge is connected to the ignition circuit and to the tank unit through insulated wires. The tank unit consists of a fixed resistance and a movable contact arm which is connected to a double float which floats on top of the gasoline in the tank.

OPERATION:—Terminal (1) of the Dash Unit is connected to coil side of the ignition switch so that current is supplied to the gauge whenever the ignition is turned on. The current flows through coil 'A' of the gauge to terminal (2). The second coil is connected to this terminal and the other end of the coil is grounded. The tank unit is likewise connected to terminal (2). The tank unit consists of a resistance coil 'C' of Chromel wire. A movable arm 'D' which is grounded moves across the resistance coil. This arm is connected to the float which rises and falls with the gasoline in the tank so that the resistance is cut in or out of the gauge circuit as the gasoline level in the tank changes. When the gasoline tank is empty the float will be at its lowest position and the contact arm will be in position 'E'. This means that the resistance is entirely out of the circuit and that coil 'B' of the dash unit is shorted. Current will flow through coil 'A' to ground attracting the armature and swinging the pointer to the 'Empty' position. As the level of gasoline in the tank rises the contact arm will swing to the right, cutting more of the resistance in series with coil 'A' and causing more of the current to flow through coil 'B' until when the float reaches the highest position with the gasoline tank full the resistance will be entirely in series with coil 'A' and entirely out of the circuit of coil 'B'. Coil 'B' will thus attract the armature and cause the pointer to swing to the 'Full' position of the dial.

The gauge is of the 'Balanced Coil' type and variations in battery voltage will have no effect on the accuracy of the gauge readings. The current consumption is 1/6-1/16 ampere while the gauge is operating and need not be considered.

MOUNTING:—Both the dash unit and tank unit are grounded. If they are taken off the car care must be used in mounting to see that a good ground is provided. It is not practical to attempt repairs to either the dash unit or tank unit and if units are defective they should be replaced. If the gauge does not register correctly, check trouble from following table:

Pointer does not move when ignition switch is turned on.

The line from the ignition switch to the dash unit is open. Check connections and supply a new lead from the coil side of the ignition switch to the 'IGN' terminal of the gauge.

Gauge indicates 'Full' at all times.

The line from the dash unit to the tank unit is open. Test connections and if necessary replace line with insulated wire.

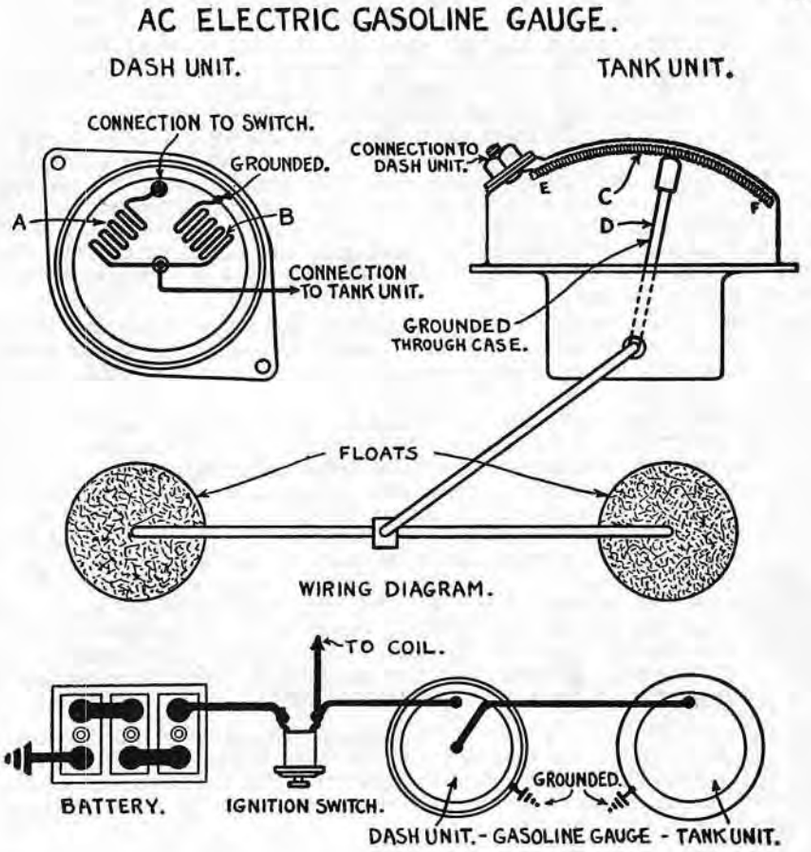
Wires reversed on dash unit. Reverse connections and see if gauge registers correctly.

Gauge indicates 'Empty at all times.

Dash unit not grounded. See that unit is properly grounded to car frame. If gauge still does not register correctly, the dash unit must be replaced.

Tank unit not grounded. See that tank unit is grounded to gasoline tank or car frame. If gauge does not register the tank unit must be replaced.

Rd-1152.



MOTOMETER TEMPERATURE GAUGES

TYPES US, UL, NS, N, L, AND FS (FORD SPECIAL)

DESCRIPTION:—These Motometer Temperature Gauges are of the Vapor Tension type. They consist of a dash unit calibrated to read in degrees of engine temperature, an operating bulb or engine unit, and a capillary tube connecting the dash unit with the engine unit. The Types US, UL, and NS are designed for steering column or dash mounting with the engine unit mounted in a special cylinder head nut or screwed into the engine block in place of the special half inch plug which is provided for this purpose on some engines. The bulb of the engine unit is filled with a liquid and the remainder of the system (capillary tubing and dash instrument) is evacuated. For this reason the capillary tubing must never be disconnected from the bulb or the dash unit and must not be cut or kinked.

OPERATION:—The bulb is exposed to the heat of the engine block (or the water in the cooling system in the Type N and L gauge) and the liquid in the system is raised to the same temperature. The pressure which results from this increase in temperature causes the dash unit to indicate a reading which is calibrated in degrees. All these models are of the illuminated 'Red Ball' type and must be connected to the lighting system of the car. See Mounting.

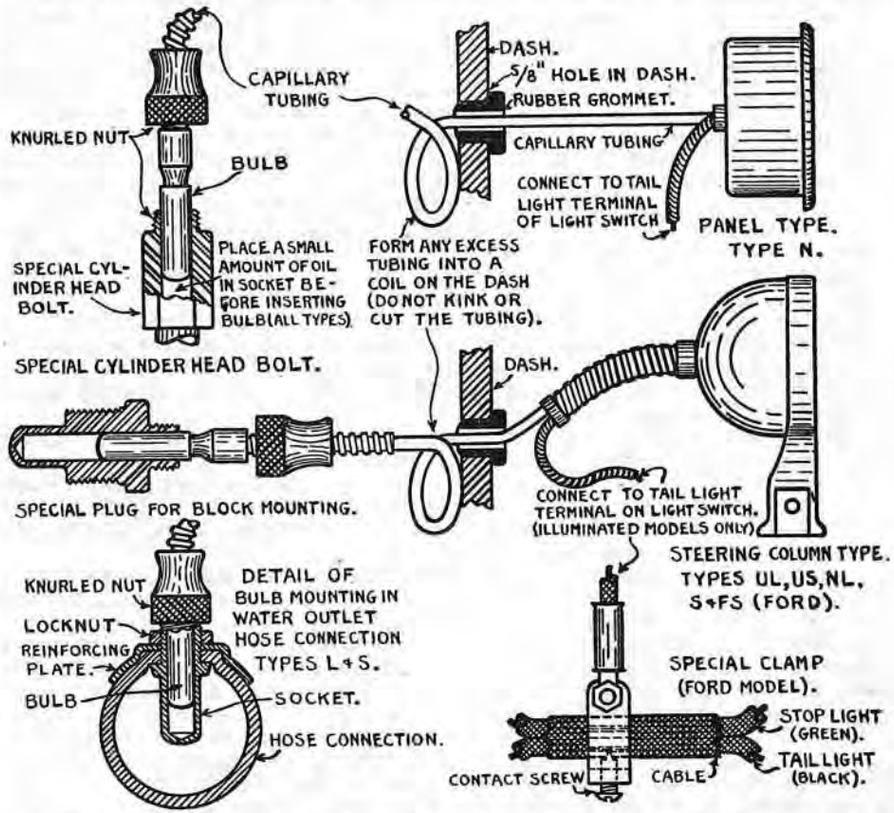
MOUNTING:—Types US, UL NS. These gauges are of the 'Distance Type' and are designed to be mounted on the steering column or on the dash with the engine unit or operating bulb mounted on the engine block. They are furnished with a special cylinder head bolt and with a special plug which is screwed in the engine block on engines where provision is made for this mounting (these engines are equipped with a half inch plug which should de taken out and the special mounting plug screwed in the opening). To mount the gauge, first mount the dash unit on the steering column or drill a 2 1/16 inch hole in the dash for dash mounting. The securing clamp on the dash mounting type is adjustable for mounting on dash boards of various thicknesses. Then drill ⅝ inch hole in the partition at the left of the engine and pass the engine bulb, capillary tubing and knurled nut through this hole. A special rubber plug or grommet is supplied for this opening to prevent the capillary tubing chafing on the edge of the hole. Then remove the nut from the second cylinder head stud at the left of the engine and take out the stud with a Stillson wrench. Screw the special cylinder head bolt in place. Put a small quantity of oil in the bulb socket, insert the bulb and tighten the knurled nut.

If the engine is equipped with the half inch plug for gauge mounting, take out the plug, and screw the special half inch motor block connection in this hole. Put a small quantity of oil in the bulb socket, insert the bulb and tighten the knurled nut. The bulb lead on the dash instrument should be connected to the tail light terminal of the lighting switch. The capillary tubing should not be allowed to chafe against the engine and must not be under tension.

Types L and S. The engine unit or bulb on these types is designed to be inserted in the water outlet hose connection at the front of the engine. Mount the dash instrument as directed above, connect the lead to the tail light terminal of the switch and pass the capillary tubing and bulb through to the engine compartment. Drain the water from the engine, and with the special cutter cut a half inch hole in the hose midway between the ends. Force the bulb socket through this opening, place the reinforcement plate on the outside of the hose and tighten the lock nut. This will make a water tight connection. Form a one inch coil in the tubing and insert the bulb in the socket and tighten the knurled nut. This coil will take up any strain and allow for vibration. Form the surplus tubing into a coil and fasten to the dash. Support the tubing on the radiator tie rod so there is no strain on the tubing at any point. Under no circumstances should any attempt be made to remove surplus tubing by cutting the tube or disconnecting it from the dash gauge or operating bulb as this will destroy the instrument.

If it is necessary to replace the lamp in these instruments, remove the two screws holding the bottom case at the rear of the gauge and insert a 6-8 volt, 2 cp. single contact bulb. If this provides too much light, a 12 volt bulb can be used.

Type FS (Ford). This type gauge is designed to be mounted on the steering column. The second cylinder head stud on the left of the engine should be removed and the special cylinder head bolt screwed in place. The bulb should then be inserted in the socket in the bolt and the knurled nut tightened. A special clamp is provided to tap the tail light lead at a point near the lighting switch (on the lower end of the steering column). This clamp is provided with a pointed set screw which pierces the insulation on the lead and makes contact with the conductor. The tail light lead and stop light lead are both contained in a braided cable and care must be used to connect the gauge lead to the tail light wire. The lamp in the gauge is replaced as directed above.



SERVICING:—It is not possible to repair these instruments and they must be replaced whenever they are found to be defective.

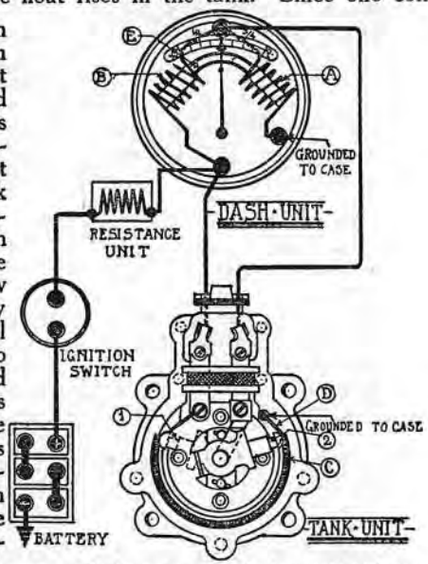
NAGEL GASOLINE GAUGE

Model R.K.D.

Electric Gasoline Gauges will be found as standard equipment on a large number of passenger car models. These units do not require attention in service other than tests to locate trouble when the gauge does not register correctly. As long as the gauge works properly no attention is necessary.

DESCRIPTION:—The Model R.K.D. gauge consists of two parts, the recording gauge mounted on the dash and the tank unit mounted on the gasoline tank at the rear of the car. They are connected by two wires running along the car frame from the dash to the tank. A lead from the No. 1 terminal of the dash unit is connected to the ignition terminal of the switch or directly to the ammeter through a special resistance unit. It is important that this resistance be wired in the circuit.

OPERATION:—The gauge is an accurate current balancing device with two coils 'A' and 'B'. A variable resistance 'C' in the tank unit is cut in or out of each coil circuit by the action of the float in the gasoline tank rising or falling with the gasoline level. The magnetic action of the coils causes the pointer of the gauge to move from the 'Empty' to 'Full' as the float rises in the tank. Since one coil is balanced against the other a variation of the battery voltage has no effect on the reading of the gauge and a correct reading will be obtained with a discharged battery as well as when the battery is fully charged. When the gas tank is entirely empty and the float is at its lowest position the contact arm 'D' of the tank unit will be in position 1 and the resistance 'E' will be entirely in series with coil 'A' and will be entirely out of the circuit of coil 'B'. Coil 'B' will thus draw a slightly greater current from the battery and the greater magnetic attraction will draw the circular solenoid 'E' around so that the pointer attached to the solenoid will register 'Empty' on the gauge. As the gasoline level and the float rise in the gasoline tank the contact arm 'D' moves along the resistance unit cutting the resistance out of the coil 'A' circuit and in the circuit of coil 'B'. At the top of the stroke with the gasoline tank full the contact arm reaches position 2 with the resistance entirely cut out of the coil 'A' circuit and entirely in series with coil 'B'. At this point the solenoid has reached a position in coil 'A' and the pointer indicates 'Full'. When the ignition switch is turned off the gauge becomes inoperative and the pointer may rest in any position. It will be necessary to switch the ignition on momentarily to secure a gauge reading.



MOUNTING:—It is very important that the wiring of the instrument is exactly as shown. The gauge will not operate correctly with reversed connections. Both the dash unit and the tank unit must be grounded. If the gauge is mounted on a wooden dash it will be necessary to run a wire from one of the mounting screws on the case to the engine block or to the car frame. The tank unit must be well grounded to the gasoline tank.

TROUBLE SHOOTING:—Minor adjustments can be made on the tank unit. No attempt should be made to repair the dash unit and it should be returned to the manufacturer for repairs if tests indicate that it is defective. Neither dash unit or tank unit require lubrication in service. In making tank unit repairs use alcohol to clean parts. Do not use gasoline or oil.

Check gauge trouble from the following table:

Gauge does not give any definite reading.	1. Ground in Number 1 line or ground in line at dash terminal or tank terminal. 2. Open battery circuit caused by open resistance unit, loose terminal at gauge or switch, or broken switch wire.
Gauge registers empty until tank is nearly full; then no definite reading.	1. Ground in Number 2 line or ground in line at dash terminal or tank terminal. 2. Dash unit is not properly grounded. 3. Dash unit is defective.
Gauge registers 'Empty' with tank empty and '¼' with tank full.	1. Open circuit in Number 1 line or open circuit at dash terminal or tank terminal. 2. Open circuit in tank unit resistance.
Gauge registers 'Full' until tank is nearly empty. Then no definite reading.	1. Reversed connections with battery connected to terminal Number 2 on dash unit. Examine tank unit resistance for fused grounded end. 2. Open circuit at Number 1 terminal on dash unit. 3. Dash unit is defective.
Gauge does not give definite reading with tank empty. Registers '¾' with tank ¼ full. Registers 'Full' with tank filled.	1. Reversed connections on dash unit with battery connected to terminal Number 1. 2. Reversed connections on tank unit. Check tank unit resistance for fused grounded end.
Gauge registers '½' with tank empty. Registers 'Full' with tank ¼ to completely filled.	1. Reversed connections on dash unit with battery improperly connected to No. 2 terminal.
Gauge registers '½' at all times.	1. Open circuit in Number 2 line or loose connection at dash terminal or tank terminal. 2. Tank unit is defective. Check for sticking plunger, weak plunger spring or poor contact of center brush caused by dirt.
Gauge registers '¾' with tank empty. Registers 'Full' with tank full.	1. Tank unit is not grounded. 2. Tank unit resistance is open at grounded end.
Gauge inaccurate or erratic.	1. Loose terminals. 2. Number 2 line broken. 3. Tank unit defective. Check for irregular resistance winding, poor contact of brush or sticking plunger. 4. Damp car terminal block. 5. Defective dash unit.
Gauge registers high. Does not reach 'Empty' with tank empty or gauge registers low and does not reach 'Full' with tank completely filled.	1. Bent float rod. Float rod should be straight. 2. Loose screws holding tank unit contactor in place. Check to see that contactor is at extreme end of resistance unit when tank is empty.

NATIONAL GASOLINE GAUGE

ELECTRIC AND HYDROSTATIC TYPES

ELECTRIC TYPE

DESCRIPTION:—The National Gasoline Gauge is of the balanced coil type and consists of a dash recording unit and a tank resistance or variable resistance connected to a float in the gasoline tank. The gauge operates only when the ignition switch is on and indicates 'Empty' with the switch off. With engine stopped it will be necessary to turn the switch on to secure a correct reading. The gauge is not affected by changes in battery voltage and will give a correct reading with a discharged battery.

MOUNTING:—Both the dash unit and the tank unit should be grounded. If the gauge is mounted on a wooden dash it will be necessary to run a wire from the gauge case to the engine block or car frame. The tank unit is grounded through the mounting screws. One wire from the 'Ga' terminal on the dash unit runs to the terminal on the tank unit. A second wire from the dash unit terminal 'IGN SW' should be connected to the coil terminal of the ignition switch. Make certain that all connections are tight.

TROUBLE SHOOTING:—If gauge does not register correctly in service, first check for loose connections at switch, dash unit, or tank unit and check lines for broken wires. Make certain that both dash unit and tank unit are properly grounded. Then make the following tests:

Defective Dash Unit. Turn on ignition switch. Remove wire at tank unit. Gauge should register 'Empty'. Ground wire to car frame. Gauge should register 'Full'. If it does not, the dash unit is defective.

Defective Tank Unit. If the above tests indicate that the dash unit is operating correctly and the gauge will not operate in service, the tank unit is probably defective.

Do not attempt to make repairs to either the dash unit or tank unit. The manufacturer will replace all defective instruments.

HYDROSTATIC TYPE

DESCRIPTION:—The National Hydrostatic Gasoline Gauge consists of a pressure gauge on the dash calibrated to read in gallons of gasoline, an operating cup or air chamber in the gasoline tank, and a tube connecting the two units. This tube has a coupling at the dash unit and at the top of the gasoline tank and these couplings must be tight to prevent any leakage of air pressure from the system. The gauge line is also connected to the vacuum tank so that the air is removed whenever the tank operates. This has the effect of removing any gasoline vapor from the air line, which would interfere with the correct reading of the gauge. For this reason the gauge reading will drop back to zero or 'Empty' whenever the vacuum tank operates but the gauge will shortly afterward indicate a correct reading.

OPERATION:—The gauge, air line and operating cup are normally filled with air. The operating cup is open only at the bottom and the air will be trapped in the cup by the gasoline in the tank. The weight of the gasoline will exert a pressure on the air, compressing it slightly. This pressure is transmitted to the dash unit, which is a pressure gauge, and will be indicated on the scale in terms of gallons of gasoline. The pressure depends entirely on the height of the gasoline in the tank, increasing from no pressure when the gasoline level is below the bottom of the operating cup to a greater pressure when the tank is full. Naturally any leak in the air line will permit the escape of air and the pressure will be lost, causing the dash unit to register a lower reading than it should.

TROUBLE SHOOTING:—If the gauge fails to register, the trouble may be in the gauge or dash unit, the air line may be clogged, or the coupling may be loose. Check as follows:

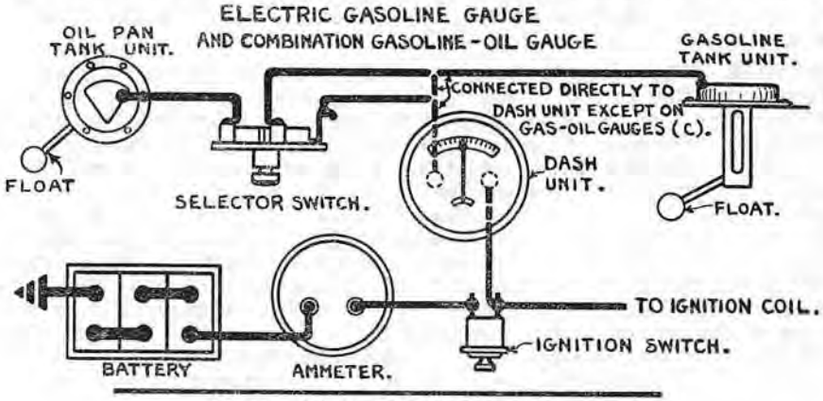
Testing Dash Unit. Disconnect the air line at the back of the dash unit and slip a short piece of rubber tubing over the gauge socket and then blow through the tubing until the gauge reading is approximately ¾ 'Full'. Any excessive pressure will destroy the gauge. Seal the rubber tube and watch to see if the gauge holds the reading. Tap the gauge glass slightly. If the pointer remains at the ¾ mark, the dash unit is operating satisfactorily. If the pointer drops back to '0', indicating that the pressure is being lost, the dash unit is defective and must be replaced. No repairs are possible.

To Free Air Line. Disconnect the air line at the dash unit. Remove the gasoline tank filler cap. Then blow out the lines with a hand tire pump or tire air line. Any pressure may be used but the hand air pump is preferable. When the air bubbles through the gasoline in the tank, showing the air line is open, connect the air line to the dash unit. Use two wrenches to prevent damage to the dash unit. It will be necessary to run the engine to free the operating cup from gasoline which fills it whenever the air line is disconnected.

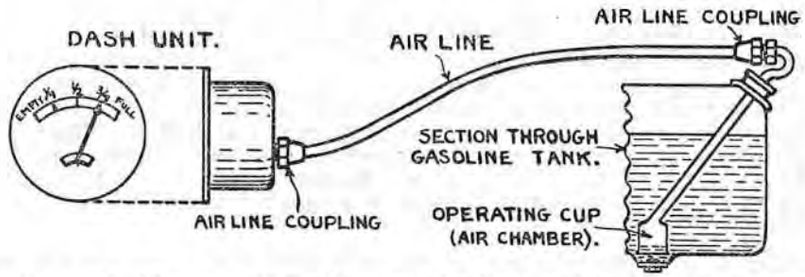
If the gauge registers less than the actual contents of the tank, it is an indication that the air line is not tight. Blow out the line and tighten the couplings, using two wrenches to avoid twisting the dash unit and tank unit.

If the gauge registers more than the actual contents of the gasoline tank, it is an indication that the dash unit has been subjected to excessive pressure. The dash unit must be replaced.

ELECTRIC GASOLINE GAUGE



HYDROSTATIC GASOLINE GAUGE.



ROBERT BOSCH GENERATOR

BATTERY TYPE

DESCRIPTION:—This type Bosch Generator has been developed for use with a battery. It is of the voltage regulation type which charges the battery at a constant voltage so that the current delivered to the battery depends directly on the battery itself. The charging current will be relatively high with a discharged battery and tapers off as the battery becomes charged. This keeps the battery in a fully charged condition and at the same time eliminates all danger of overcharging.

The generator is of the four pole shunt wound type with a field coil wound on each pole. There are two main brushes mounted at an angle of 90 degrees on the lower side of the commutator. The regulator and cutout are mounted directly above the commutator under the pressed steel end cover. In addition there is a fixed resistance which is cut in the shunt field circuit by the regulator.

OPERATION:—When the generator is operating at low speeds, Contact 'A' of the regulator is closed, short circuiting the resistance so that the generator operates as a straight shunt machine. Contact 'C' of the relay cutout is likewise open and the lamp load is carried by the battery. As the generator speed increases Contact 'A' opens inserting the resistance in the field circuit. As the generator voltage reaches the figure for which the relay is set to operate Contact 'C' closes, connecting the generator to the battery and lamp circuits. At higher speeds Contact 'B' alternately opens and closes which momentarily short circuits the shunt field and helps the voltage constant. The series coil, which is a feature of the 'No-Battery' Generator, is not used on this type.

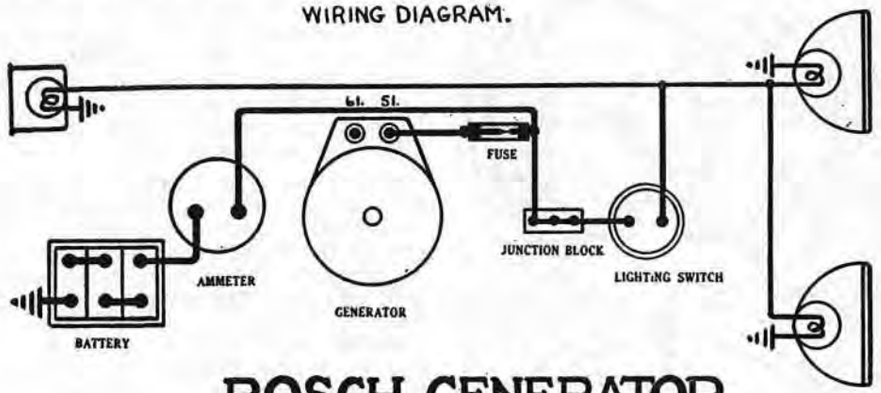
INSTALLATION:—The generator as ordinarily supplied is designed for cradle mounting. It should be driven at approximately 1½ engine speed. There are two main terminals (51) which is the main lead and should be connected to the light switch and battery, and (61) which is ordinarily not used.

ROTATION:—The direction of rotation is stamped on the commutator end of the generator. However, the rotation can be changed by reversing the shunt field leads. These are brought out to the terminal block directly under the regulator and cutout and are marked by red and green insulation.

ADJUSTMENT:—The regulator is contained in the turned steel case. There is a floating armature in the center of the coil with a contact on each end. The second contact of each set is mounted on a threaded plug in the end cap of the regulator case. One contact plug is fitted with a very fine thread for fine adjustments. The regulator is adjusted by varying the contact gap. The Robert Bosch Company have developed special tools for use in setting the regulator and it will not be possible to secure as satisfactory an adjustment without their use.

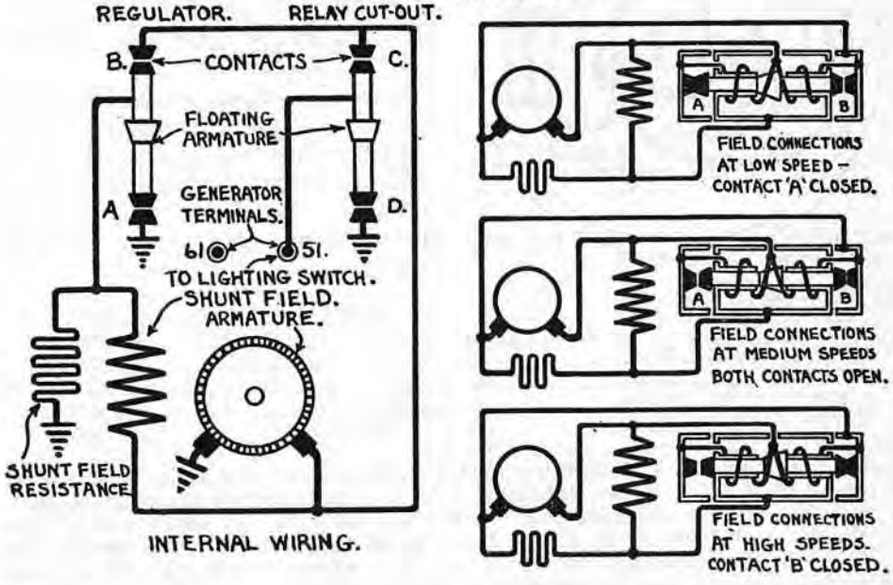
OILING:—The armature shaft is carried on ball bearings which are packed with a special heat resisting grease. These bearings will not require any attention in service but whenever the generator is disassembled for inspection or servicing, the bearings should be repacked with the special grease secured from the Robert Bosch Company.

WIRING DIAGRAM.



BOSCH GENERATOR

BATTERY TYPE.



NORTH EAST LAMP CONTROL GENERATOR

MODEL LAB, TYPE 6620 AND 6564-A, CHECKER CAB AND MACK EQUIPMENT

DESCRIPTION:—This type generator, although it resembles the ordinary generator in construction (except that there are two terminals 'L' and 'B' on the field frame), operates differently than the regular third brush shunt field control types. The regular shunt field connected between the third brush and the grounded main brush through a field fuse mounted on the end plate is wound on one field pole. The other pole carries a divided series field ('A' and 'B' on the diagram). Both sections of this field are inoperative at speeds below the relay cut-in point when the lamps are turned off. When the lamps are turned on, the lighting current from the battery goes through both sections of the series field, which strengthens the magnetic field and causes the generator to cut in at a lower speed. The 'A' section of the series field continues to strengthen the magnetic field as long as the lights are turned on and is inoperative at all speeds when the lights are turned off. The 'B' section of the series field acts to strengthen the magnetic field when the lights are turned on until the relay cut-out contacts close and the generator takes care of the lamp load when it opposes or bucks the shunt field. This 'B' section also bucks the shunt field at all speeds above the cut-in point with the lights turned off. This tends to hold the charging rate down with the lights turned off and automatically increases the generator output when the lights are being used.

ADJUSTMENT:—Generator output can be adjusted in the usual manner by shifting the third brush. The third brush adjusting screw is located on the commutator end plate. Turn the adjustment screw to the right or in a clockwise direction to increase the charging rate and in the opposite direction to decrease the charging rate.

PERFORMANCE:—With standard car setting, the generator performance is as follows:

Generator Data—Type 6620

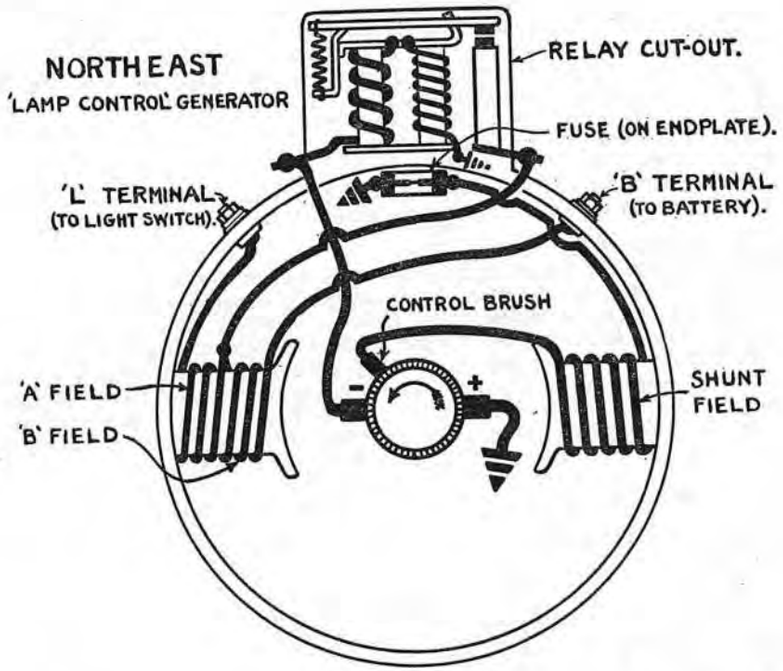
Load	Amperes	Volts	R.P.M.
Lamps off	9	8.0	1620
Lamps on	13.5	8.0	1600

Type 6564-A

Lamps off	7.7	8.0	1930
Lamps on	13.0	8.0	1900

RELAY CUTOUT:—Type 20220. Relay is mounted on the generator field frame. One terminal is connected to the negative main brush and the other relay terminal is connected to the series field lead. Note that the relay is not connected to the battery as is the usual practice. The battery is connected to the 'B' terminal on the field frame. Relay contacts close when the generator voltage reaches 6.75 volts and open with a discharge current of 1-2 amperes when the generator voltage drops to 5.75-6.0 volts. Relay contact gap is .020-.025 inch. Air gap is .015 inch with contacts closed.

FUSES:—The shunt field is grounded through a 10 ampere fuse mounted in a plug on the commutator end plate. No other size fuse should be used for replacement.



OWEN-DYNETO BATTERY CHARGE REGULATOR

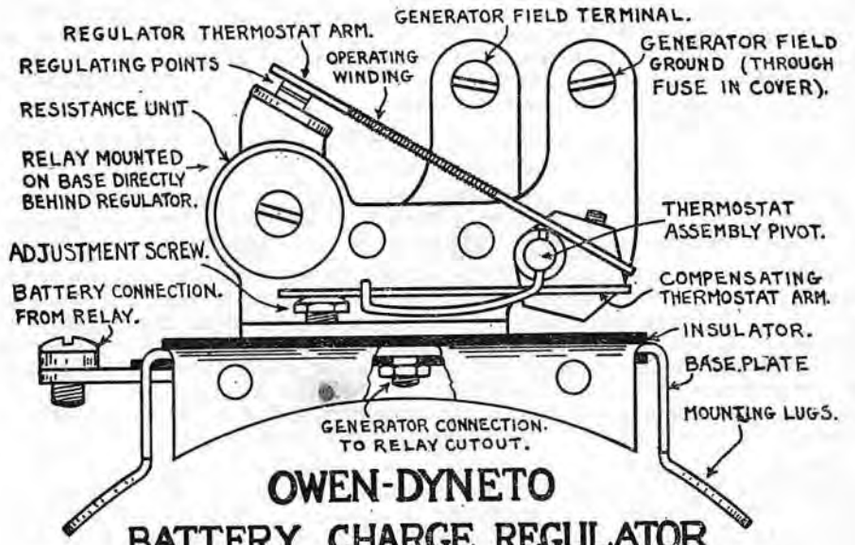
DESCRIPTION:—The Owen-Dyneto Battery Charge Regulator consists of an electrically operated thermostatic regulator and a relay cut-out mounted in a single case which is designed to be mounted on top of the generator. It is standard equipment on certain models of Owen-Dyneto generators and can be installed on generators of other manufacture by making minor alterations in the relay mounting and wiring hookup. The regulator permits a relatively high charging rate without danger of damaging the battery and automatically varies the charging rate to cover different driving conditions by permitting the high charging rate over short periods of time or for short trips and automatically cutting down the rate after the regulator thermostat heats up which will occur on long trips or after the generator has nearly completed the battery charge.

OPERATION:—The regulator consists of two thermostat arms mounted on a pivot. The upper arm carries the regulator contacts and has a fine resistance unit wound on it. This resistance is connected directly between the generator relay terminal in the base of the unit and ground and is thus connected directly across the main brushes of the generator. The lower thermostat arm is a compensating unit and carries no winding. It is designed to compensate the regulator for temperature changes. The spring which normally keeps the regulator contacts closed engages the lower thermostat arm. The two upper terminals of the regulator should be connected to the field as marked in the illustration. The field resistance is wound on a spool on the regulator frame and is connected between the two regulator terminals and across the contacts. It is thus connected in series with the generator field winding but is short circuited by the regular contacts when the contacts are closed.

In operation with the regulator contacts closed the generator operates as a straight third brush shunt machine charging the battery at the rate determined by the third brush setting. Current likewise flows through the winding on the upper thermostat arm. When the generator voltage reaches 8 volts (cold) or 7.5 volts (hot) this winding heats up causing the arm to flex and open the contacts which inserts the resistance in the field circuit. This reduces the charging rate to the finish rate of the battery.

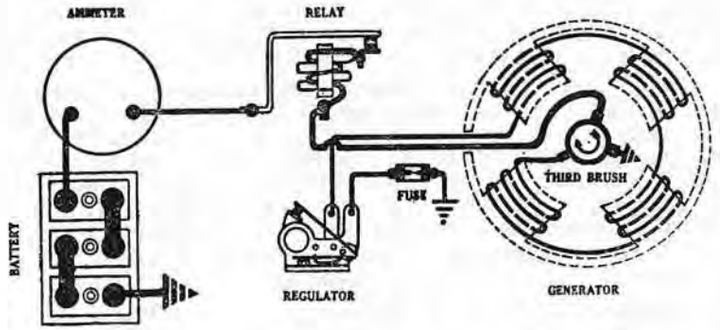
ADJUSTMENT:—The regulator is set at the factory and should not require adjustment. However, if adjustment is necessary, connect a voltmeter between the battery terminal of the generator and ground and operate the generator for several minutes to allow the thermostat winding to heat. The regulator cover must be in place or the air blast of the fan will prevent the proper functioning of the thermostat. Then turn the adjusting screw under the lower thermostat arm clockwise to increase the operating voltage and counter-clockwise to decrease the voltage. The regulator should operate at 8.0 volts cold or 7.5 volts hot.

INSTALLATION:—The regulator can be installed on practically any generator after removing the old relay cutout and modifying the old relay mounting to take the regulator mounting screws. Then connect the old relay lead from the generator main brush to the terminal in the base of the regulator unit. Disconnect the generator shunt field ground and bring this lead out of the generator, drilling a hole through the commutator cover band to take the wire. Connect this lead to the regulator field terminal. The other regulator terminal should be grounded through the fuse mounted in the regulator cover. On Owen-Dyneto generators or generators with the field grounded through a fuse mounted on the generator frame, the field should be disconnected from the fuse terminal and brought out to the regulator and a second lead should be brought out from the fuse terminal to the regulator ground terminal. On generators with the field grounded through a thermostat, it will be necessary to take off the resistance connected across the thermostat contacts and then render the thermostat inoperative by bending one arm back so that the contacts are permanently open.



OWEN-DYNETO BATTERY CHARGE REGULATOR

WIRING DIAGRAM.



OWEN-DYNETO STARTER-GENERATOR

TYPES KB-873, KB-897, KB-878 AND KB-890

OUTBOARD EQUIPMENT ON JOHNSON, CAILLE AND OUTBOARD CORP. ENGINES

MOUNTING:—The starter-generator must be disassembled before it can be removed from the engine. To remove starter-generator, perform the following operations in order:

1. Remove the cover. Take out the six screws that hold the cover in place on the field frame (Types KB-878, 890) or loosen the clamping screw (Types KB-873, 897). Raise the cover slightly and disconnect the spark advance control wire from the ignition mounting plate and the ignition coil lead from the breaker assembly. Then lift the cover from place.

2. Remove the ignition unit. Mark the position of the breaker plate on the armature (so that it may be reassembled in the same position without disturbing timing). Insert a screwdriver through the opening of the breaker plate and take out the six screws mounting the ignition unit on the end of the armature shaft. The ignition unit may then be lifted off.

3. Remove the hand cranking pulley (Types KB-873, 897, used on Johnson engines only). On the Type KB-873 the pulley is mounted on a split sleeve which screws into the armature hub and is held in place by a taper plug in the armature hub. The taper plug is locked in place by a nut on the stud which projects up through the pulley from the plug. To remove this type pulley, loosen the nut on the stud in the center of the pulley and tap stud down to loosen the taper plug. The pulley can then be unscrewed. The split sleeve has a right hand thread. On the Type KB-897 the pulley is mounted on a stud which is mounted on the end of the armature shaft by six screws. To remove pulley, take off the nut and cam on the stud bolt and lift pulley from place.

4. Remove the Brush Ring assembly. Take out the three screws which mount the brush ring on the field frame. Remove the two terminal stud nuts on the main brush leads and disconnect the shunt field coil lead at the regulator. The brush ring can then be lifted off.

5. Remove the Armature. The armature can be withdrawn after the nut which holds it in place on the crankshaft has been taken off. Several special armature pullers have been developed by the Owen-Dyneto Corporation for this purpose.

6. Remove the Field Frame Assembly. The field frame is mounted on the crankcase by four machine screws. These screws are accessible after the machine has been disassembled as directed above.

NOTE:—Since the armature is designed to be mounted on the crankshaft there is no armature shaft. If the armature is to be mounted in a lathe to turn down the commutator a special arbor must be used. This can be secured from the Owen-Dyneto Corporation.

IGNITION

OPERATION:—The ignition unit is of standard automotive design with a single lobe cam mounted on the crankshaft revolving at engine speed. The coil for two cylinder ignition is of the two spark type with both ends of the secondary brought out to high tension terminals which are connected to the spark plugs. Both cylinders fire simultaneously once in each revolution of the crankshaft. On four sylinder engines a double coil is used with two primaries and two secondaries which terminate in four high tension terminals. One coil fires the two upper cylinders and the other coil fires the two lower cylinders. Two breakers are used, each breaker controlling one coil. Both breakers are mounted on the breaker plate and operate on the same cam. The condensers for the breakers are mounted under the breaker plate.

TIMING THE ENGINE:—To set the ignition timing, turn the engine over until the pistons reach top dead center (the extreme outer end of the stroke). Fully retard the spark advance. Loosen the locking nut on the upper end of the breaker shaft and carefully locate the cam so that contacts are beginning to open. Tighten the locking nut and connect the coil secondary leads to the spark plugs. With the spark advanced the contacts will be wide open at top dead center. Breaker contact gap should be .022-.025 inch. Set contact gap by loosening lock nut on stationary contact mounting stud and turning up stud. Resurface contacts when necessary with a fine flat contact file or on a medium hard oilstone.

BOSCH FLYWHEEL MAGNETO

TYPE FY-2, ED. 1

EQUIPMENT ON CAILLE MASTER TWIN OUTBOARD

DESSCRIPTION:—The Bosch FY-2, Ed. 1 magneto is of the high tension flywheel type. The windings are stationary and are mounted on a mounting plate which is clamped on the crankcase under the flywheel. A permanent magnet is mounted on the flywheel and revolves at crankshaft speed. The coil core is laminated and dovetails with two laminated pole pieces mounted on the mounting plate. The two screws (A and B) serve to hold the coil in position. The magnet completes the magnetic field through the coil core once in each revolution as it passes the pole pieces. The breaker is mounted on the flywheel. The coil has two secondary windings and fires the plugs in both cylinders simultaneously. The spark is advanced and retarded by rotating the mounting plate around the crankshaft.

BREAKER:—Breaker contacts can be adjusted through an inspection hole in the flywheel after the starting pulley has been removed. Breaker gap should be 1/64-1/32 inch. Contact gap is adjusted by loosening the lock nut on the stationary contact mounting stud and turning up the stud. Contact can be resurfaced when necessary with a fine flat contact file or fine sandpaper. The breaker assembly is held in place on the mounting plate by two mounting screws. The condenser is also mounted on the plate.

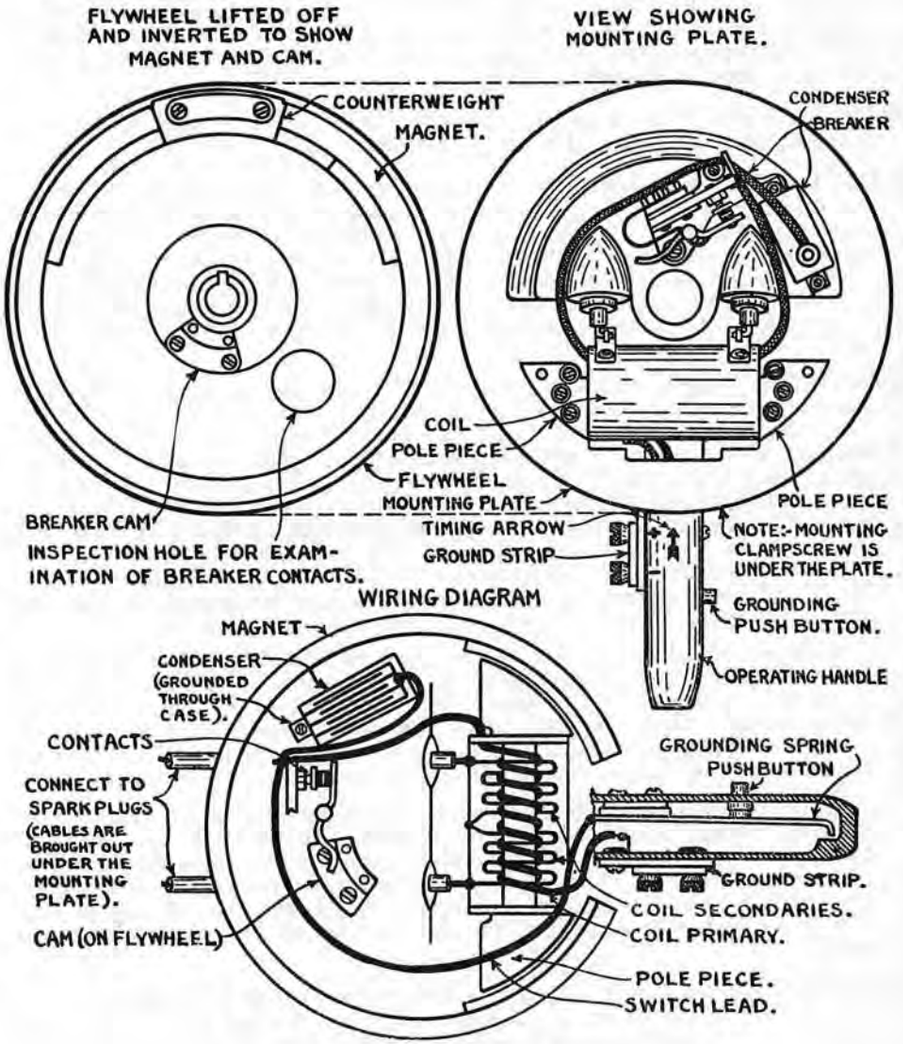
TIMING:—The mounting plate is swung around the crankshaft by means of a handle on the plate (which also serves as the control switch) to advance and retard the spark. The handle should be swung to the left (in the direction of crankshaft rotation) to retard the spark and to the right (or against the direction of rotation) to advance the spark. The extreme left position or full retard is the starting position. The engine should be run with spark fully advanced at normal speeds. Breaker contacts should open when the mark on the flywheel (a straight line on the periphery of the flywheel) is directly opposite the arrow on the spark control lever. This is set in the assembly of the engine.

SPARK PLUGS:—Spark plug gaps should be 1/32 inch.

OILING:—Put one drop of oil on the wick which oils the breaker lever bearing once each month. This is the only moving part which requires attention.

REMOVAL OF MAGNETO:—To remove the magneto from the engine, disconnect the spark plug cables. Remove the three screws on the top of the starting pulley and take off the hexagonal nut. Lift off the pulley or starting plate and the flywheel. The flywheel is mounted on a tapered shaft and it may be necessary to use a puller. The magnet and breaker cam will be found on the under surface of the flywheel. Then loosen the clamp screw on the mounting plate and lift the entire magneto assembly from place.

CONTROL SWITCH:—The control switch is built in the spark control lever and consists of a push button which grounds the magneto primary whenever the button is pressed. This ground is broken when the button is released and it will not be necessary to open the switch when the engine is started. The other end of the primary is brought out to the terminal marked (+) and is grounded to the (—) terminal through a strap connector. If it is desired to use a battery to facilitate starting, this strap connector should be disconnected and the positive terminal of a dry cell should be connected to the (+) terminal. The negative terminal of the battery should be connected to the (—) terminal. This practice is not recommended except in emergencies.



AMERICAN BOSCH MAGNETO

TYPE ZR-4 AND ZR-6 FOUR AND SIX CYLINDER MODELS

DESCRIPTION:—The Bosch Magneto Type ZR is of the high tension armature type. Two magnets are mounted above the armature and the end plates completely enclose all working parts. A safety spark gap is located above the armature under the magnets. The Type ZR magneto can be used with a Bosch Duplex Vibrating ignition coil to provide dual battery and magneto ignition. The Type ZR-4 magneto should be driven at crankshaft speed on four cylinder four cycle engines. The Type ZR-6 magneto must be driven at one and one half crankshaft speed on six cylinder four cycle engines. The direction in which magneto should be driven is stamped on the frame.

OILING:—Put 2 or 3 drops of light machine oil in the oiler at each end of the magneto every 500 miles of operation. Do not oil the interrupter. Examine interrupter occasionally and wipe off all oil and dirt.

BREAKER:—Breaker or interrupter contacts separate .4 millimeter or 1/64 inch with interrupter arm on highest point of cam. At this point the fiber bumper of the interrupter arm will be in the center of the steel segment of the cam ring. Set contact gap by turning armature shaft until fiber bumper is on highest point of cam. Then loosen lock nut on stationary contact stud and turn contact until proper gap is secured. Tighten the lock nut. Contacts are made of platinum. Resurface contacts with worn No. 00 sandpaper or with a fine flat jeweler's file. Do not use emery cloth.

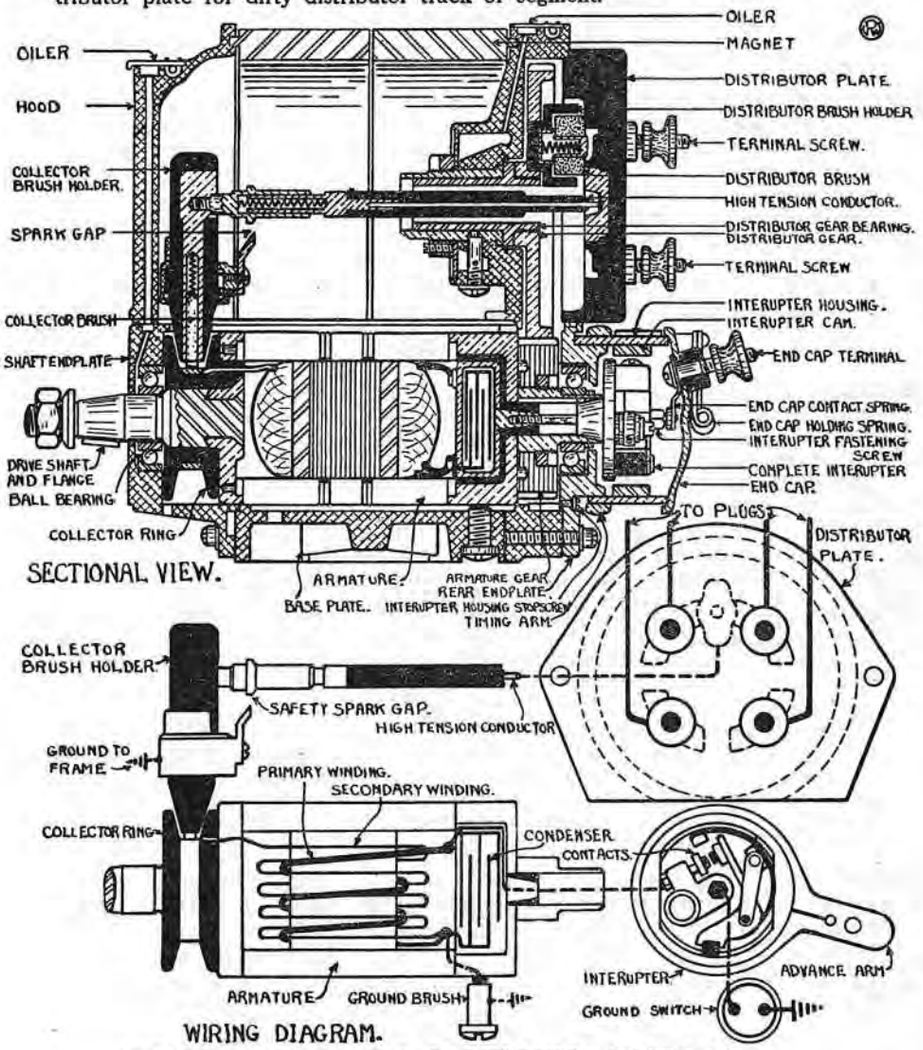
TIMING:—Crank engine until crankshaft reaches proper position for piston in No. 1 cylinder with manual advance lever fully retarded. See manufacturers' specifications as given on specific car data sheets in the National Manual. Fully retard magneto advance arm and turn magneto in direction of rotation until contacts begin to separate when the fiber bumper of the interrupter arm reaches the steel segment in the cam ring. Make certain that magneto is firmly bolted to base mounting and couple drive shaft to engine without disturbing either crankshaft or magneto armature shaft. Remove distributor cover and note position of distributor brush. Connect the segment directly over the brush to the spark plug in cylinder No. 1 and connect remaining plugs in proper firing order around the distributor plate in a direction opposite to rotation of the interrupter.

When manufacturers' specifications are not available, the engine may be timed to fire with piston on top dead center entering power stroke with full retard. Crank engine over until piston No. 1 enters compression stroke (the upstroke with both valves closed). Then continue to crank engine slowly noting dead center on flywheel or checking piston travel with a wire inserted in spark plug port until the piston reaches top dead center. Then connect magneto as directed above.

Timing Magneto with Impulse Coupling:—Turn magneto in direction of rotation until coupling is released from arrester plate. This point will be after proper firing position since impulse coupling will spin magneto over firing position. Then turn magneto backward in direction opposite to rotation until the breaker contacts open and begin to close as fiber bumper passes off steel segment in cam ring. This is the correct firing position and the magneto can then be coupled to the engine.

SPARK PLUG GAPS:—Spark plug gaps must be set at .020 or 1/50 inch. It is important that the gap be set at this figure. If spark plug gap is too wide engine will miss at low speeds and will be difficult to start. A safety spark gap is located above the armature. If spark jumps safety gap frequently check magneto and spark plugs to locate trouble.

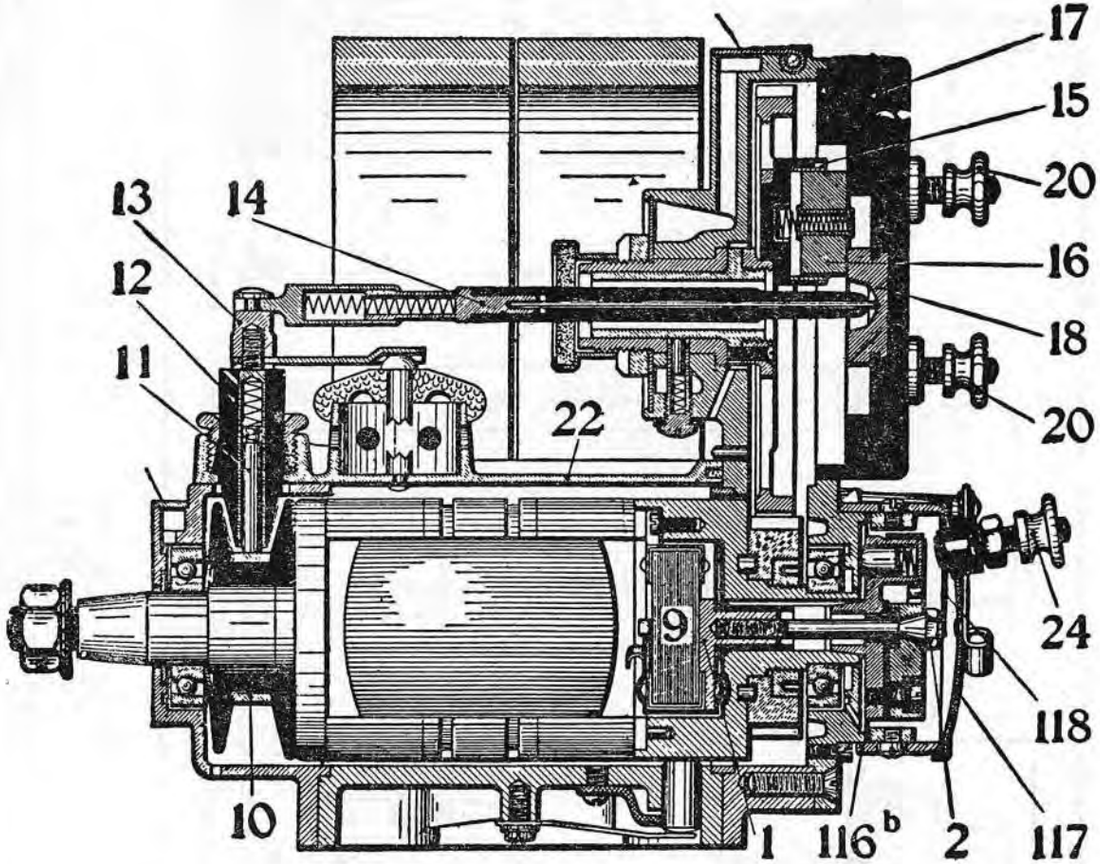
TROUBLE SHOOTING:—Engine Misses on One Cylinder:—Check spark plugs for correct gap. Check spark plug in missing cylinder for short circuit due to fouling or cracked insulator. Check for chafed or burnt insulation on cable. Check distributor plate for dirty distributor track or segment.



AMERICAN BOSCH MAGNETO - TYPE ZR.

Irregular Firing on All Cylinders:—Check interrupter contacts and set gap. Resurface contacts if necessary. Tighten fastening screw in center of interrupter plate. Check ground brush under armature in base plate. Check collector brush and collector ring. Check distributor plate and wipe out with a clean rag moistened with gasoline if dirty or gummed with oil.

Longitudinal Section of DU4 Magneto



1. Brass plate for connecting the end of armature primary circuit.
2. Fastening screw for magneto interrupter.
9. Condenser.
10. Slipring.
11. Slipring brush.
12. Slipring brush holder.
13. Cap nut for slipring brush holder.
14. Connecting bar.
15. Distributor brush holder.
16. Distributor brush.
17. Distributor plate.
18. Central distributor contact.
20. Terminal nut for distributor plate.
22. Dust cover over armature.
24. Terminal nut for grounding terminal.
116. Interrupter housing and timing arm.
117. Cover for interrupter housing.
118. Contact spring for grounding terminal.

BOSCH MAGNETO

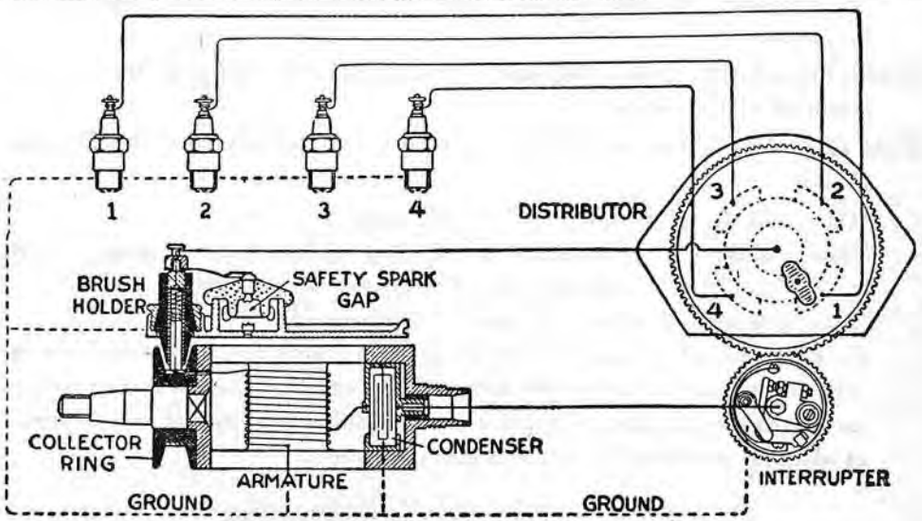
TYPES DU4 AND DU6, SINGLE SPARK, INDEPENDENT

BREAKER CONTACTS.—Breaker contacts separate .014 to .016 inch. They are made of platinum. When the condition of the contacts affects the ignition, resurface with a fine, flat jeweler's file or worn No. 00 sandpaper.

OILING.—Put 2 or 3 drops of light engine oil in each of the magneto oilers every two weeks. Apply a small amount of vaseline to the fiber bumper of the contact arm with a toothpick. If the car is driven more than 500 miles in two weeks, these attentions must be given every 500 miles.

TIMING.—Turn the engine crankshaft until the piston in No. 1 cylinder is in the position where the spark is desired to occur. Place the breaker housing in the fully retarded position by turning it as far as it will go in the direction of the armature rotation. Remove the breaker cap and turn the armature shaft until the breaker contacts are just beginning to separate. Then couple the magneto to the engine, being careful not to change the relative position between the armature shaft and driving member. Remove the distributor block and note which segment is in contact with the distributor brush. Replace block and connect the terminal of this segment with the plug in No. 1 cylinder. Connect the other cables in accordance with the firing order of the engine.

SPARK PLUG GAPS.—Spark plug gaps are .020 to .025 inch.



Bosch Magneto, Circuit Diagram, Type DU4

BOSCH MAGNETO

TYPES D, DR AND ZR, TWO-SPARK, INDEPENDENT AND DUAL

OPERATION.—The purpose of a two-spark ignition system is to produce ignition at two points in the combustion chamber, thus cutting down the time interval between ignition and complete combustion, which in turn adds power and efficiency to the engine. Bosch two-spark magnetos are produced in either independent or dual types. In external appearance the two-spark magneto is very similar to the single-spark type, the chief difference being the distributor and the fact that there is an extra safety gap. On the single-spark type of magneto one end of the secondary is grounded, while on the two-spark type both ends are brought out to two segments diametrically opposite on a single slip-ring. Two slip ring brushes are provided, which are horizontally located on opposite sides of the magneto end plate. During the portions of the armature rotation when the secondary is delivering current, each of the brushes will be in contact with a slip ring segment. One brush is connected to the inner distributor as in a single-spark magneto, while the other brush is connected to the outer distributor by means of a short cable passing around the magnets. The distributor rotor is of double length and carries two brushes, insulated from each other.

BREAKER.—Breaker contacts separate .015 inch. When the condition of the contacts affects the ignition, resurface with a fine, flat jeweler's file or worn No. 00 sandpaper

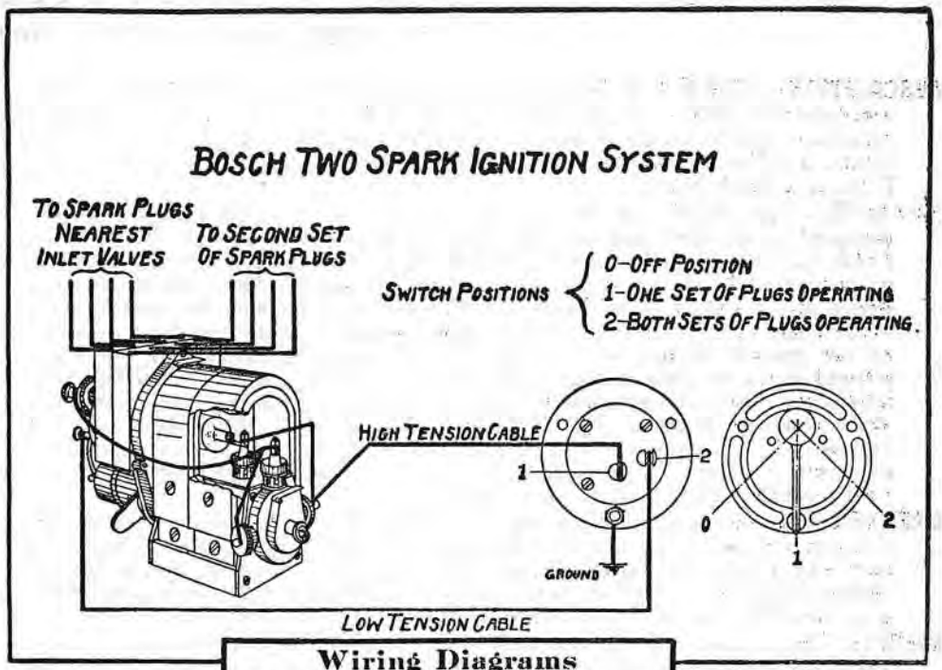
OILING.—Put 2 or 3 drops of light engine oil in each of the oil cups every two weeks. Put a small amount of vaseline on the cam, applying with a toothpick. If the car is driven more than 500 miles in two weeks, these attentions must be given every 500 miles.

TIMING.—Turn the engine crankshaft until the piston in No. 1 cylinder is in the position where the fully retarded spark is desired to occur. Turn the magneto shaft until the breaker contacts are just beginning to separate, with the breaker housing in the fully retarded position. Couple the magneto to the engine. The use of two-spark ignition does not require the same amount of advance as the single-spark type, due to the much shorter time which elapses between ignition and complete combustion. The effect of retarding the spark results if one set of plugs is cut out of operation.

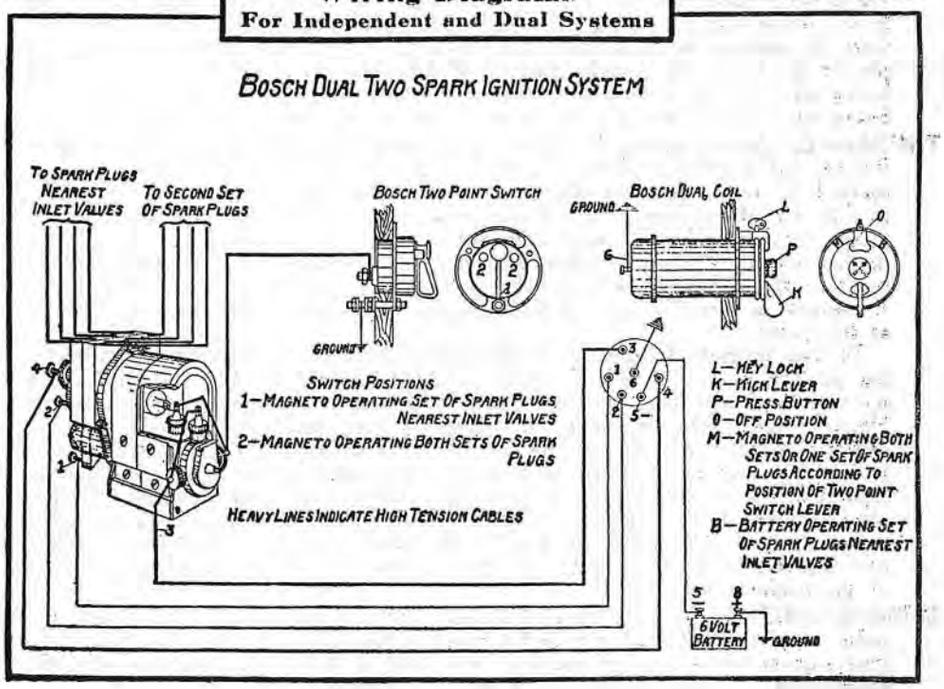
SPARK PLUG GAPS.—Spark plug gaps are .016 to .030 inch, depending upon the characteristics of the engine.

SPARK PLUG LOCATION.—No advantage is secured from the use of two-spark magnetos if the spark plugs are located close together. They must be separated by at least one-half of the width of the combustion chamber, inclusive of valve-pockets. In "T" head engines it is customary to place the plugs in the inlet and exhaust valve caps.

DUAL COIL.—The coil is the same as is used with the single-spark dual system. In both the independent and dual systems a switch is arranged to cut one set of plugs out of operation by grounding one end of the secondary winding of the magneto.



Wiring Diagrams
For Independent and Dual Systems



ROBERT BOSCH MAGNETO

TYPES FR4B AND FR6C. FOUR AND SIX CYLINDER MODELS

DESCRIPTION:—The Robert Bosch Magneto Types FR4B and FR62 are powerful magnetos of the armature type with all moving parts entirely enclosed. They are furnished with flat base and tapped holes for bracket mounting. Magneto should be driven only in direction shown by arrow on top of magneto frame.

ADVANCE:—Type FR4B has 30° manual advance range. This is equal to 30° measured on the flywheel since magneto must be driven at crankshaft speed. Type FR6C has 45° manual advance range equal to 30° on the flywheel since the magneto must be driven at 1½ times crankshaft speed. The manual advance mechanism may be locked by inserting a set screw screwed in the breaker housing so that the latter is held in advance position. The manual advance arm may be set in any desired position to facilitate connecting of advance control rod. The advance arm ring is held in position by friction against the interrupter housing. To set arm, loosen set screw in side of arm and turn to desired position. Then tighten the set screw.

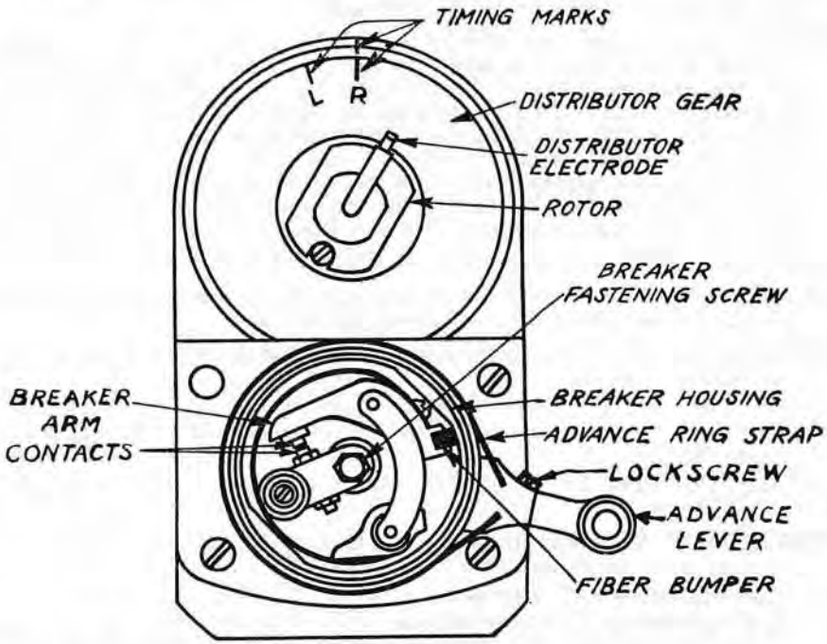
BREAKER:—Breaker is mounted on end of armature shaft and rotates with armature. Contacts separate 1/64 inch with bumper of contact arm on cam. Clean contacts with a soft brush and gasoline. Contacts may be trued up with a fine flat contact file or on a medium hard oilstone. To replace contacts, take out breaker fastening screw and remove breaker. Replace in correct position, with key properly engaging the corresponding keyway.

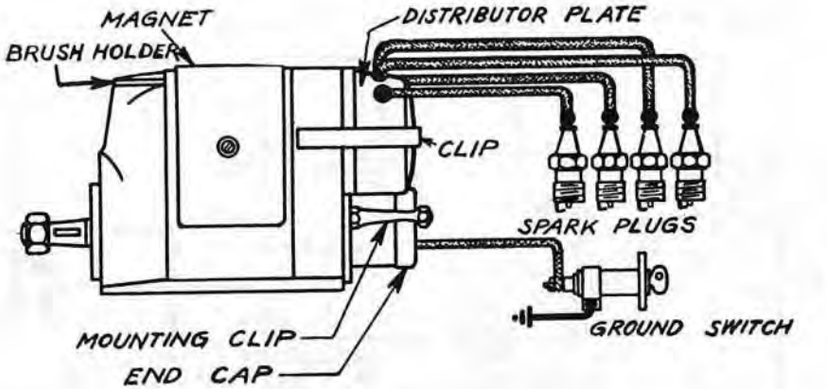
OILING:—The armature shaft is mounted on ball bearings packed with heavy grease. The breaker arm pivot pin is oiled by wick oiler saturated with oil. This is sufficient for a running period of 35,000-50,000 miles and need be renewed only when the magneto is disassembled for servicing. Every 4500 miles fill oil cup in the top of the magneto with light machine oil, preferably Robert Bosch non-freezing oil US-506.

TIMING:—To Check Magneto for Correct Position of Armature When Contacts open. Remove the distributor plate. There are two lines in the large gear marked 'R' and 'L'. Fully advance manual control arm and turn magneto shaft in direction of rotation until proper line on gear is opposite timing mark on magneto frame. Use 'R' mark in timing clockwise magnetos and 'L' mark in timing counter-clockwise drive magnetos. If magneto is correctly assembled the breaker contacts will just begin to separate at this point.

To Time Magneto to Engine. Crank engine until crankshaft reaches proper firing position of No. 1 cylinder with manual advance lever fully retarded. See manufacturer's specifications as given on specific car data sheets in the National Manual. Then fully retard manual advance arm and turn magneto shaft in direction of rotation until proper mark ('R' for clockwise, 'L' for anti-clockwise rotation) is opposite timing mark on magneto frame. Continue to turn the shaft until breaker contacts begin to separate. Couple the magneto to the engine being careful not to disturb the relative position of the magneto and crankshaft. Connect the distributor head segment opposite the distributor electrode to the spark plug in cylinder No. 1. Connect the remaining terminals to the spark plugs following the proper firing order of the engine.

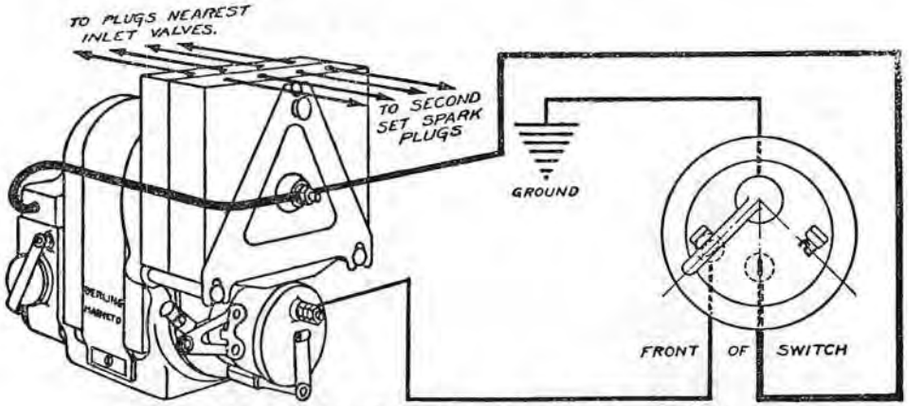
IMPULSE COUPLING:—Both the FR4B and FR6C magnetos can be fitted with impulse couplings to furnish a very hot spark at low speeds to start the engine. To time engines where impulse couplings are used, it will be necessary to turn the magneto in the opposite direction from that in which the magneto is driven (as given by arrow on top of magneto frame). If this is not done the impulse coupling will prevent the proper setting of the magneto.



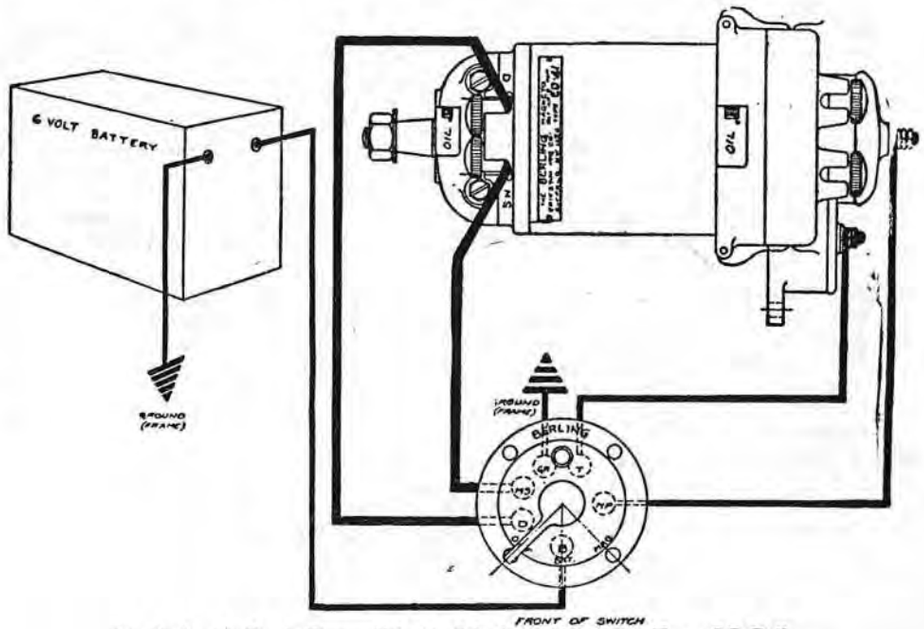


BERLING MAGNETO

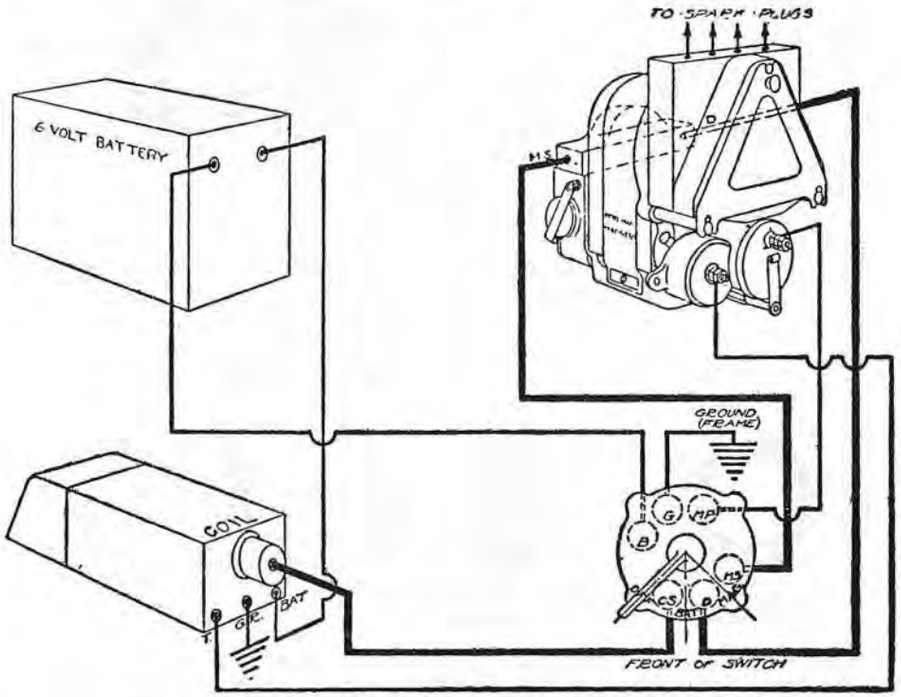
SINGLE SPARK DUAL, TYPES ED-41, DD-41, DD-61 AND DD-81
TWO SPARK INDEPENDENT, TYPES D-44, D-66 AND D-88



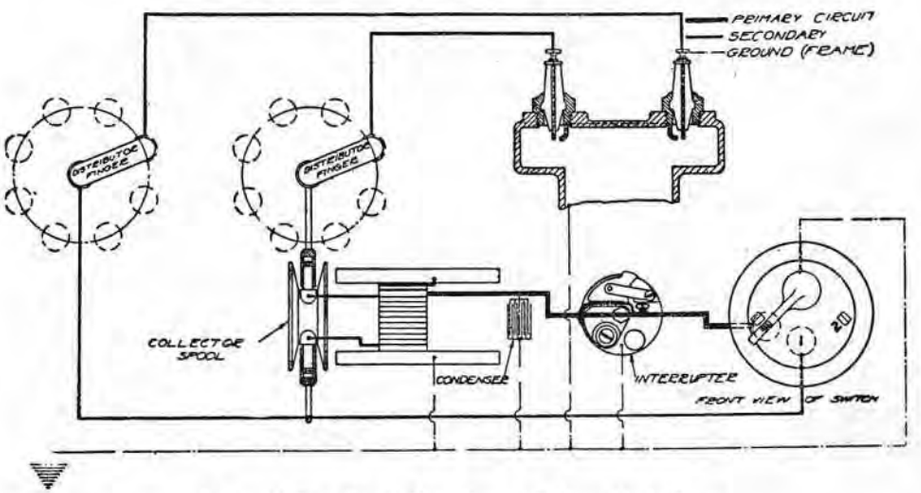
Two-Spark Independent. Types D-44, D-66 and D-88.



Single-Spark Dual, Types DD-41, DD-61 and DD-81, Type SC Coil



Single-Spark Dual, Type ED-41, Type SC Coil



Internal Circuits of Two-Spark Independent Type

EISEMANN MAGNETO

TYPE GN-6

DESCRIPTION:—The Type GN-6 Magneto is of the high tension shuttle wound armature type. The rotating armature is carried on ball bearings which are insulated from the frame. The armature is grounded through a special ground brush mounted in the base plate at the drive end of the magneto. This prevents any current flow through the armature bearings. A single 'U' shaped magnet is mounted directly above the armature. Magneto should be driven at 1½ times crankshaft speed. It is furnished with a 30 degree timing range for variable ignition although special timing ranges are furnished and magneto can be equipped for fixed ignition. The base plate is drilled and tapped for base mounting bolts. It may likewise be strap mounted with a brass or other non-magnetic mounting strap if dowel pins are used in the base to provide alignment.

ROTATION:—The magneto is designed to be driven only in the direction of rotation stamped on the oil well cap on the drive end of the magneto. In order to change the direction of rotation, it is necessary to disassemble the magneto and replace the breaker plate and breaker lever with units designed for opposite rotation.

BREAKER:—Breaker contacts separate .012 inch. Set contact gap by loosening the lock nut on the stationary contact mounting stud and turning up the stud until the correct gap is secured with the fiber bumper of the breaker arm on the high point of the cam. Resurface contacts when necessary with a fine flat contact file. Platinum contacts are furnished as standard equipment.

TIMING:—Crank engine over until correct firing position for piston No. 1 is reached. See car data sheets for this information. If specifications are not available, crank engine until piston No. 1 reaches top dead center entering power stroke. Fully retard magneto timing lever. Remove distributor plate and turn magneto shaft until the indicator mark on the distributor disc is directly under the set screw in the housing above the disc. Breaker contacts should begin to open at this point. Carefully connect the magneto to the engine without disturbing the relative positions of the armature shaft and crankshaft. Connect the extreme left hand terminal of the distributor plate to the spark plug in cylinder No. 1. Connect the remaining spark plugs in accordance with the firing order of the engine. Distributor cables are held in place by set screws in the carbon brush holders under the brushes. To fasten cables, remove distributor plate, remove carbon brush and spring and back out set screw. Then strip insulation from end of cable, twist the stranded wire tightly together and insert in the proper terminal and tighten the set screw.

OILING:—Oil wells are provided at each side of the distributor plate directly behind the timing lever. These oilers both oil the same bearing and only the most accessible one need be used. Put one drop of light machine oil in the oiler every 1000 miles. Put 15 drops of oil in the oil well at the top of the housing on the drive end of the magneto every 1000 miles or 100 hours of operation. This oils the distributor shaft. Put 2 drops of oil in the oiler directly above the bearing retainer on the drive end every 1000 miles. Carefully clean the entire breaker mechanism and wipe out the distributor plate with gasoline whenever necessary. Carefully dry all parts before the magneto is again operated.

SPARK PLUGS:—Spark plugs should be set at 1/64-1/32 inch. This will depend largely on the compression ratio of the engine. A safety spark gap of 8 MM. is provided by the set screw in the base plate directly under the collector ring.