SECTION 7

ELECTRICAL SYSTEM

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

ELECTRICAL SYSTEM

SERVICE STANDARDS

MODEL DESIGNATION →	1-08AD 1-08AF 1-08AS	2-26AD 2-26AF 2-26AS	2-33AD 2-33AF 2-33AS	3-59AD 3-59AF 3-59AS	6-71AD 6-71AF 6-71AS	8-65AD 8-65AF 8-65AS	8-71AD 8-71AF 8-71AS	8-71AD-D 8-71AF-D 8-71AS-D
Electrical System:								
Battery—	One	One	One	One	One	One	One	Two
Fully charged Hydrometer reading	1.275 to 1.285	1.275 to 1.285	1.275 to 1.285	1.275 to 1.285	1.275 to 1.285	1.275 to 1.285	1.275 to 1.285	1.275 to 1.285
Terminal grounded	Positive	Positive	Positive	Positive	Positive	Positive	Positive	Positive
Capacity Ampere Hours	70 at 20 minute rate	70 at 20 minute rate	70 at 20 minute rate	70 at 20 minute rate	70 at 20 minute rate	70 at 20 minute rate	70 at 20 minute rate	136 @ 20 min. rate
Voltage	12	12	12	12	12	12	12	6
Number of Plates	9	9	9	9	9	9	9	17
Generator—								
Model	C45-PV-5	C45-PV-5	C45-PV-5	C45-PV-5	C45-PV-5	C45-PV-5	C45-PV-5	C45-PV-5
Voltage	12	12	12	12	12	12	12	12
Maximum Charging Rate —Amps	22 @ 1700 r.p.m.	22 @ 1700 r.p.m.	22 @ 1700 r.p.m.	22 @ 1700 r.p.m.	22 @ 1700 r.p.m.	22 @ 1700 r.p.m.	22 @ 1700 r.p.m.	22 @ 1700 r.p.m.
Brush Spring Tension	36-44 oz.	36-44 oz.	36-44 oz.	36-44 oz.	36-44 oz.	36-44 oz.	36-44 oz.	36-44 oz.
Minimum Cut Out Point Gap	.002 to .006	.002 to .006	.002 to .006	.002 to .006	.002 to .006	.002 to .006	.002 to .006	.002 to .006
Starter—Model	M45G	M45G	M45G	M45G	M45G	M45G	M45G	
Brush Spring Tension	30-40 oz.	30-40 oz.	30-40 oz.	30-40 oz.	30-40 oz.	30-40 oz.	30-40 oz.	
Distributor—Model	DXH6A	DXH6A	DXH6A	DXH6A	DXH6A	DXH6A	DXH6A	
Breaker Point Gap	.014 to .016	.014 to .016	.014 to .016	.014 to .016	.014 to .016	.014 to .016	.014 to .016	

SERVICE STANDARDS (Continued)

MODEL DESIGNATION →	1-08AD 1-08AF 1-08AS	2-26AD 2-26AF 2-26AS	2-33AD 2-33AF 2-33AS	3-59AD 3-59AF 3-59AS	6-71AD 6-71AF 6-71AS	8-65AD 8-65AF 8-65AS	8-71AD 8-71AF 8-71AS	8-71AD-D 8-71AF-D 8-71AS-D
Breaker Arm Spring Tension (ounces)	20 to 24	20 to 24	20 to 24	20 to 24	20 to 24	20 to 24	20 to 24	
Cam or Dwell Angle (Minimum)	32°	32°	32°	32°	32°	32°	32°	
Condenser Capacity	.2	.2	.2	.2	.2	.2	.2	
Maximum Spark Advance— Mechanical (degree and maximum r.p.m.)	13° @ 2000 r.p.m.	13° @ 2000 r.p.m.	13° @ 2000 r.p.m.	13° @ 2000 r.p.m.	13° @ 2000 r.p.m.	13° @ 2000 r.p.m.	13° @ 2000 r.p.m.	
Ignition Timing— Piston position when points commence to open	* T.D.C.	* T.D.C.	* T.D.C.	* T.D.C.	* T.D.C.	* T.D.C.	* T.D.C.	
Spark Plugs— Size	14 m.m.	14 m.m.	14 m.m.	14 m.m.	14 m.m.	14 m.m.	14 m.m.	
Gap	.030	.030	.030	.030	.030	.030	.030	
Firing Order—All Models	1, 5, 3, 6, 2, 4	1, 5, 3, 6, 2, 4	1, 5, 3, 6, 2, 4	1, 5, 3, 6, 2, 4	1, 5, 3, 6, 2, 4	1, 5, 3, 6, 2, 4	1, 5, 3, 6, 2, 4	1, 5, 3, 6, 2, 4
Lights— Headlights (watts) Upper Beam	42	42	42	42	42	42	42	42
Lower Beam	36	36	36	36	36	36	36	36
Parking (watts)	6	6	6	6	6	6	6	6
Tail and Stop (candlepower)	21-6	21-6	21-6	21-6	21-6	21-6	21-6	21-6

* Applicable for Premium Grade Fuels. When using lower grade fuels, or after carbon has accumulated, spark ping may be excessive with the specified timing. In such cases the ignition should be retarded not to exceed 4 degrees later than specified timing.

CABLES AND LOOMS

To simplify identification and handling, basic standard cable assembly has been adopted. This is supplemented as required by small ancillary cable assemblies.

These minor assemblies are the only cables that vary to meet the need of a particular model.

A standard colour code has been adopted as explained in the following chart which enables ready identification at any point.

COLOUR	BLACK	BROWN	RED	ORANGE	YELLOW	GREEN	BLUE	MAUVE	GREY	WHITE
NUMERICAL EQUIVALENT	0	1	2	3	4	5	6	7	8	9
General Circuit Classification .	Starting Earths	Lighting	Feeders	Signals	Charging	Horn Gen. Field	Fuel Choke (60)	Body	Accessories	Ignition
Chassis Lighting Classification	Earths	Lighting Panel Warning	Feeders	Stop and Trafficators	High Beam Warning	Low Beam	Tail Licence (Double Trace)	Body	Inspection	Parkers
Body Lighting Classification .	Earths	Lighting	Feeders	Boot	Courtesy	Dome	Quarters	Body	Map	Glove
Accessories Classification .	Earths	Fan	Feeders	Radio	Clock	Cigar Lighter	Heater	Body	Accessories	Windscreen Wiper

The method of building up the code symbols shown on detail drawings is as follows. As will be seen from the chart, the ten colours are allocated numbers. A typical example is the tail lamp to lamp switch, 16-16.

16 - 16 Tail Lamp	——	16 - 16 Tail Lamp Switch

The number preceding the hyphen is the gauge of the wire, i.e., 16 gauge, and each succeeding digit after the hyphen designates the colour, i.e., one is for a brown wire and six for the blue tracer.

The first line of the chart shows general application.

The second line of the chart shows general chassis.

The third line of the chart shows general body.

The fourth line of the chart shows general accessories.

E.g., Headlamp low beam wire would be 15 (Lighting—low beam). Earth wire from dome lamp switch would be 0175 (earth-lighting body dome).

Wire from fuses to windshield wiper switch would be 829 (accessories—feeder—wiper).

OUTER LOOM CLASSIFICATION

The outer loom covering will be black in all cases. The year is indicated by tracers, e.g., No. 5—green and No. 3—Orange 1953. Single Cross trace is used on all looms for model identifications:

No. 9 White to indicate passenger cars.

No. 2 Red to indicate trucks.

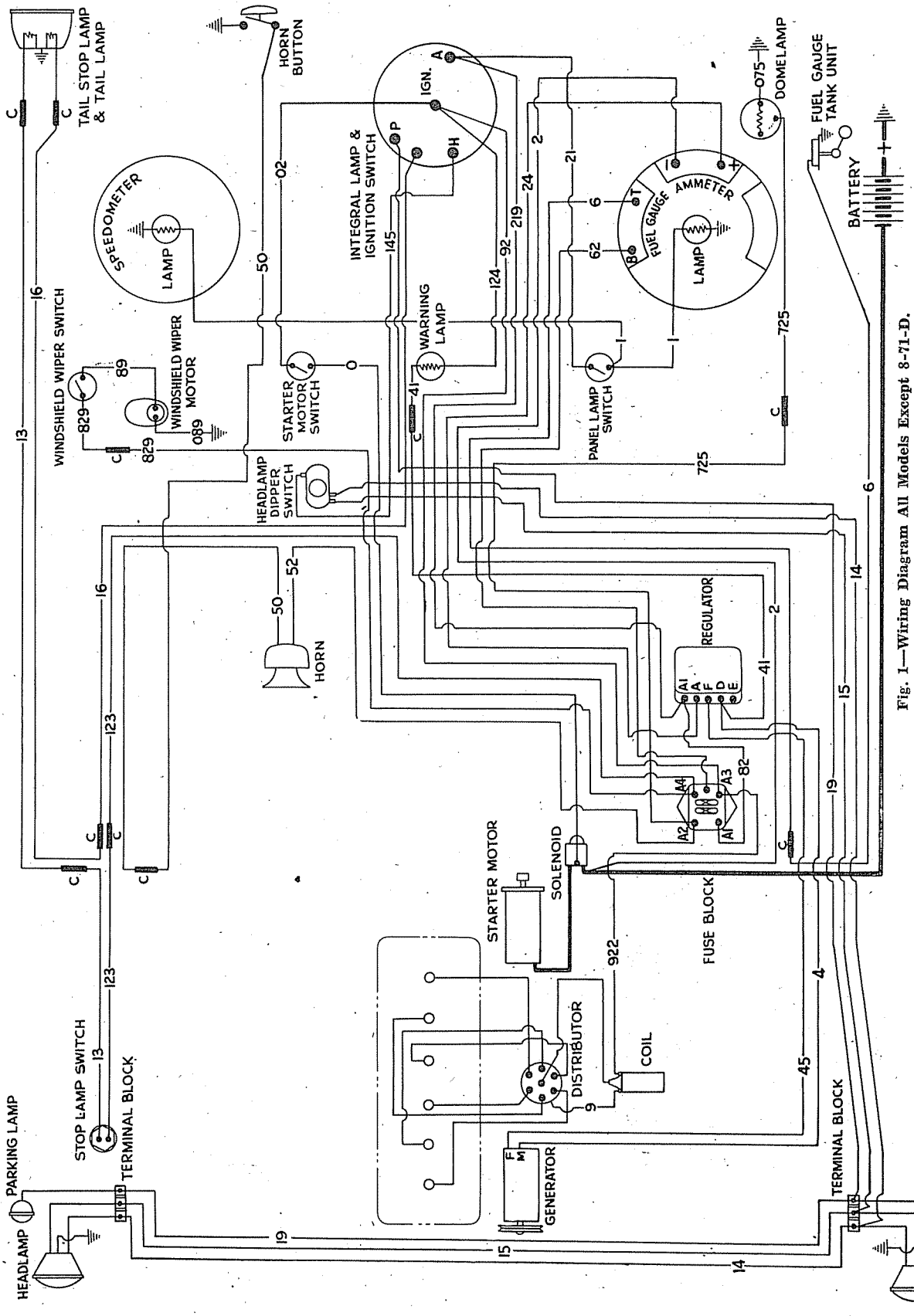

Fig. 1—Wiring Diagram All Models Except 8-71-D.

COLOUR CODE

02	Black-Red	1	Brown	13	Brown-Orange	21	Red-Brown
04	Black-Yellow	2	Red	14	Brown-Yellow	24	Red-Yellow
075	Black-Mauve-Green	4	Yellow	15	Brown-Green	41	Yellow-Brown
089	Black-Grey-White.	6	Blue	16	Brown-Blue	45	Yellow-Green
0	Black	9	White	19	Brown-White	50	Green-Black

52	Green-Red	123	Brown-Red-Orange	829	Grey-Red-White
62	Blue-Red	124	Brown-Red-Yellow	922	White-Red-Red
82	Grey-Red	145	Brown-Yellow-Green		
89	Grey-White	219	Red-Brown-White		"C" Denotes Connector
92	White-Red	725	Mauve-Red-Green		

ELECTRICAL SYSTEM

CONTROL BOX MODEL RB106-1

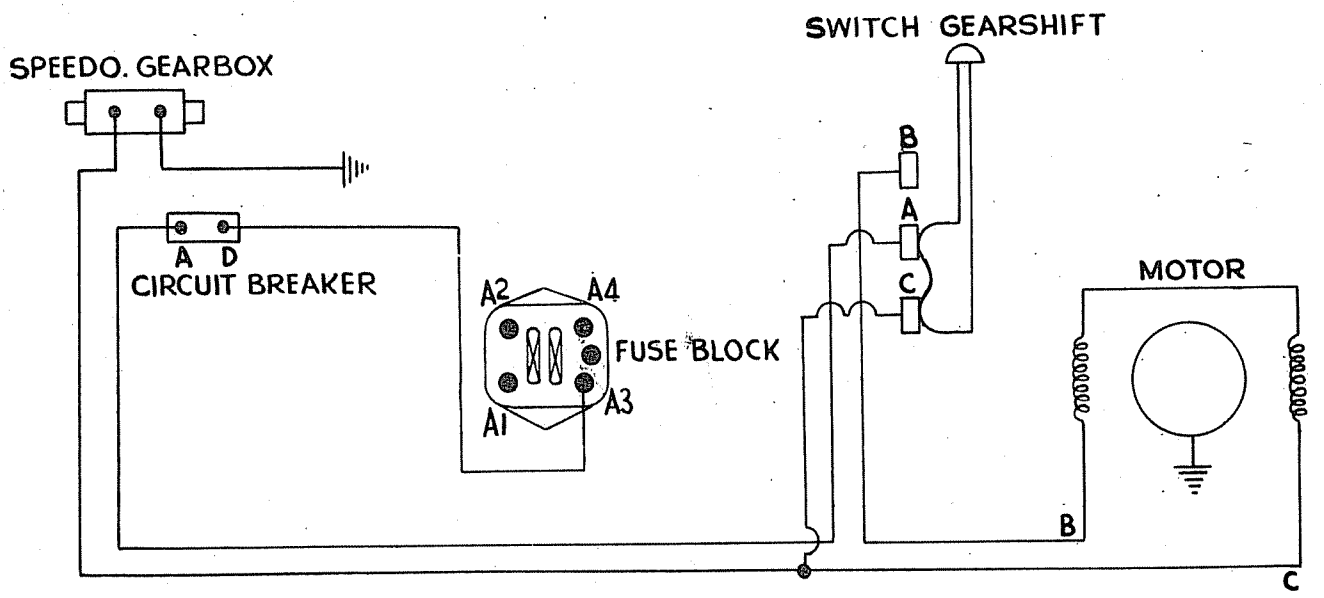

Fig. 2—Wiring Diagram, Two Speed Axle.

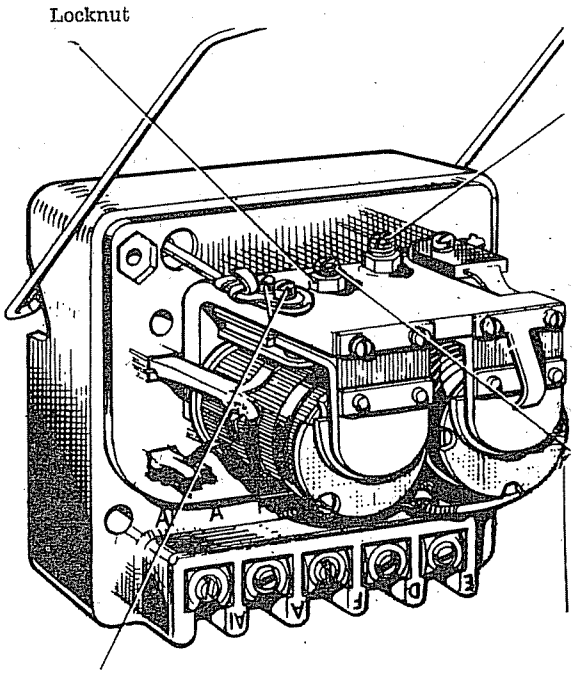

Fig. 3—Control Box with cover removed

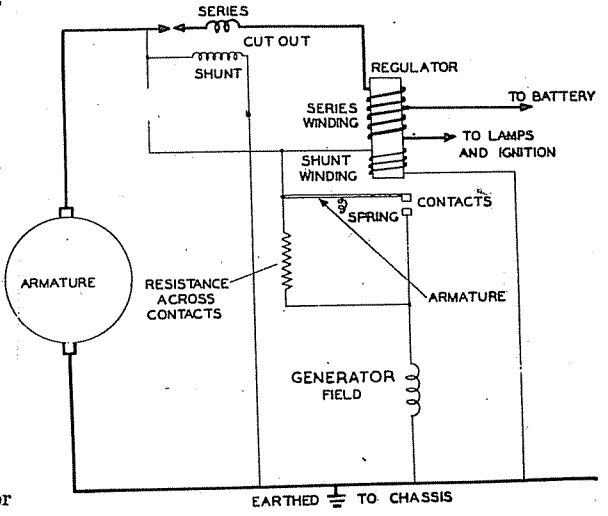

Fig. 4—Diagram of compensated voltage control charging circuit.

1. GENERAL DESCRIPTION.

The control box houses the generator voltage regulator unit and the cut-out. Although combined structurally, the regulator and cut-out are electrically separate. Both are accurately adjusted during manufacture, and the cover protecting them should not be removed unnecessarily. Connections are by means of the normal grub screw terminal.

a. The Regulator.

The regulator is set to maintain a pre-determined generator voltage at all speeds above the regulating point, the field strength being controlled by the automatic insertion of a resistance in the generator field circuit. When the generator voltage reaches a pre-determined value, the magnetic field due to the shunt or voltage winding becomes sufficiently strong to attract the armature. This causes the contacts to open, thereby inserting the resistance in the field circuit.

The consequent reduction in field current lowers the generator voltage and this, in turn, weakens the magnetic field due to the voltage coil. The armature is allowed to return to its original position, thus closing the contacts, so that the voltage returns to the pre-determined maximum. The cycle is then repeated, and the armature is set into vibration.

As the speed of the generator rises above that at which the regulator comes into operation, the amplitude of vibration increases and the periods of interruption increase in length, with the result that the mean value of the generator voltage undergoes practically no increase once the operating speed has been attained.

The series or current winding provides a compensation on this system of control, for if the control were arranged entirely on the basis of voltage, there would be a risk of very seriously overloading the generator when the battery was in a low state of charge, particularly if the lamps were simultaneously in use.

Under these conditions, with a battery of low internal resistance, the generator would be forced to give an output to bring the voltage of the system up to the same value as if the battery were fully charged. This would necessitate an extremely heavy current, far beyond the normal capacity of the machine. The series winding assists the voltage coil, so that when the generator is delivering a heavy current into a discharged battery the regulator comes into operation, at a somewhat reduced voltage, thus limiting the output accordingly. A split series winding is used, the centre tapping carrying the battery charging current while the complete winding carries lighting and ignition loads.

By means of a temperature compensation device the voltage characteristic of the generator is caused to conform more closely to that of the battery under all climatic conditions. In cold weather the voltage required to charge the battery increases, whilst in warm weather it is lower. The method of compensation takes the form of a bimetallic spring located behind the tensioning spring of the regulator armature. The bimetallic spring causes the operating voltage of the regulator to be increased in cold weather and reduced in hot weather, and thereby to compensate for the variations in charging current which would otherwise occur due to the charging characteristics of the battery.

b. The Cut-out.

The cut-out is an automatic switch connected between generator and battery. It consists of a pair of contacts held open by a spring and closed magnetically when the engine is running fast enough to cause the generator voltage to exceed that of the battery. The battery will then be charged by the generator. On the other hand, when the speed is low or the engine is stationary the contacts open, thus dis-connecting the generator from the battery and preventing current flowing from the battery through the windings.

2. SETTING DATA.

(a) Cut-out.

Cut-in voltage	12.7-13.3 volts
Drop-off voltage	9 -10 volts
Reverse current	3.0- 5.0 amps

(b) Regulator-setting on open circuit.

10°C. (50°F.) Cold Climate	16.1-16.7 volts
20°C. (68°F.) Normal Temperature	15.8-16.4 volts
30°C. (86°F.) Hot Climate	15.6-16.2 volts
40°C. (104°F.) Very Hot	15.3-15.9 volts

3. SERVICING.

(a) Testing in Position to Locate Fault in Charging Circuit.

If the generator is in order, proceed to check further as follows:

(1) First ensure that the wiring between battery and regulator is in order. To do this, disconnect the wire from the A terminal of the control box and connect the end of the wire removed to the negative terminal of a voltmeter.

Connect the positive voltmeter terminal to an earthing point on the chassis. If a voltmeter reading is given, the wiring is in order and the regulator must be examined.

(2) If there is no reading, examine the wiring between battery and control box for broken wires or loose connections.

(3) Reconnect the wire to terminal A.

(b) Regulator Adjustment.

The regulator is carefully set during manufacture to suit the normal requirements of the standard equipment and in general it should not be necessary to make further adjustments.

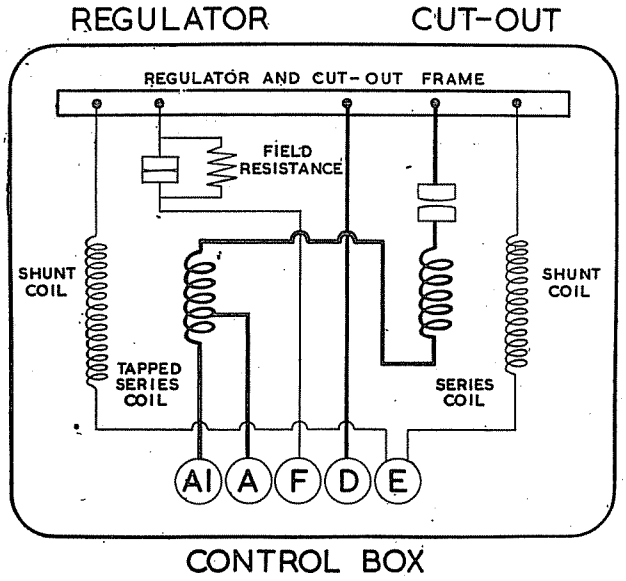

Fig. 5—Control Box Internal Connections

However, if the battery does not keep in a charged condition, or if the generator output does not fall when the battery is fully charged, it may be advisable to check the setting and readjust if necessary.

It is important before altering the regulator setting when the battery is in a low state of charge, to check that its condition is not due to a battery defect or to the generator belt slipping.

(1) Electrical Setting.

It is important that a good quality MOVING COIL VOLTMETER (0-20 volts) be available before attempting to adjust the regulator. The electrical setting can be checked without removing the cover from the control box.

Withdraw the cables from the terminals marked A and A1 at the control box (Figure 3) and join the wires together.

Connect the negative lead of the moving coil voltmeter to the D terminal on the generator and connect the other lead from the meter to a convenient chassis earth.

Slowly increase the speed of the engine until the voltmeter needle "flicks" and then steadies, this should occur at a voltmeter reading between the limits given in Paragraph 2-b for the appropriate temperature of the regulator.

If the voltage at which the reading becomes steady occurs outside these limits the regulator must be adjusted.

Shut off the engine and remove the control box cover.

Release the locknut (A) holding the adjusting screw (B) and turn the screw in a clockwise direction to raise the setting or in an anti-clockwise direction to lower the setting. Turn the screw a fraction of a turn only at a time and then tighten the locknut. Repeat as above until the correct setting is obtained. (Refer to Figure 6).

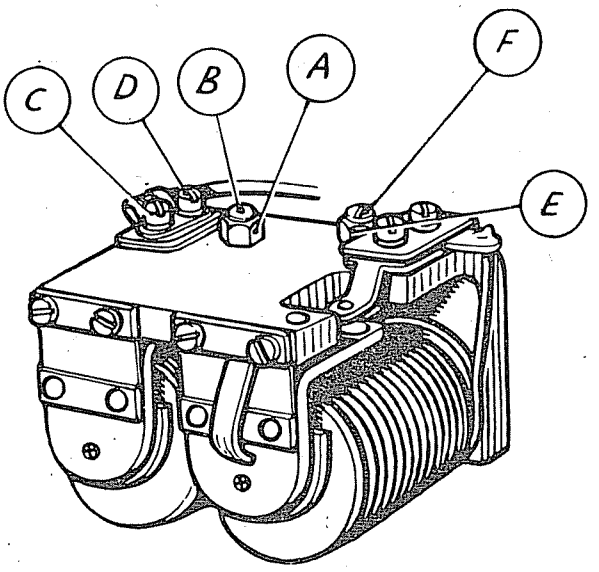

Fig. 6—Cut-out and Regulator Assembly.

Remake the original connections.

When the generator is run at a high speed on open circuit, it builds up a high voltage. Therefore when adjusting the regulator do not run the engine up to more than half throttle or a false voltmeter reading will be obtained.

(2) Mechanical Setting.

The mechanical setting of the regulator is accurately adjusted before leaving the works and provided that the armature carrying the moving contact is not removed, the regulator will not require mechanical adjustment. If, however, the armature has been removed from the regulator for

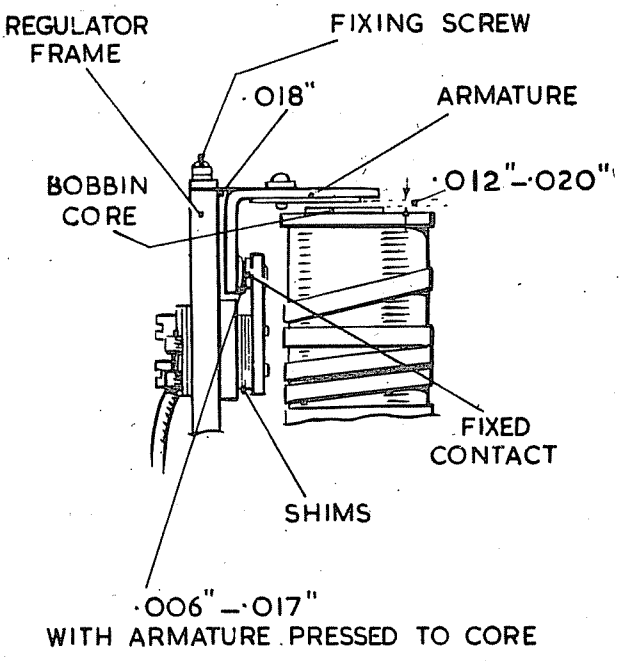

Fig. 7—Mechanical Setting of Regulator.

any reason, the contacts will have to be reset. To do this, proceed as follows:

Slacken the two armature fixing screws.

Insert a .018 inch feeler gauge between the back of the armature and the regulator frame.

Press back the armature against the regulator frame and down on to the top of the bobbin core with gauge in position, and lock the armature by tightening the two fixing screws. Remove the .018 inch gauge and check the gap between the underside of the arm and the top of the bobbin core. A shim is fitted to the underside of the arm, and the gap should be .012 inch-.020 inch. If the gap is outside these limits correct by adding or removing shims at the back of the fixed contact.

Remove the gauge and press the armature down, when the gap between the contacts should be .016 inch-.017 inch.

(3) Cleaning Contacts.

After long periods of service it may be found necessary to clean the vibrating contacts of the regulator. These are made accessible by slackening the screws securing the plate carrying the fixed contact. It will be necessary to slacken the upper screw (C)-Figure 6, a little more than the lower (D) so that the contact plate can be swung outwards. Clean the contacts by means of a fine carborundum stone or fine emery cloth.

Carefully wipe away all traces of dirt or other foreign matter.

Finally tighten the securing screws.

(c) Cut-out Adjustment.

(1) Electrical Setting.

If the regulator setting is within the correct limits, but the battery is still not receiving current from the generator the cut-out may be out of adjustment. To check the voltage at which the cut-out operates, remove the control box cover, and connect the voltmeter between the D terminal (Figure 5) and earth. Start the engine and slowly increase its speed until the cut-out contacts are seen to close, noting the voltage at which this occurs. This should be 12.7-13.3 volts.

If operation of the cut-out takes place outside these limits, it will be necessary to adjust. To do this, slacken the locknut on the cut-out adjustment screw (F, Figure 6) and turn the screw in a clockwise direction to raise the voltage setting or in an anti-clockwise direction to reduce the setting, testing after each adjustment by increasing the engine speed until the cut-out is seen to operate, and noting the corresponding voltmeter reading.

Tighten the locknut after making the adjustment. If the cut-out does not operate, there may be an open circuit in the wiring of the cut-out and regulator unit, in which case the unit should be removed for examination or replacement.

(2) Mechanical Setting.

If for any reason the cut-out armature has to be removed from the frame, care must be taken to obtain the correct gap settings on re-assembly. The correct settings can be obtained as follows:

Slacken the two armature fixing screws and also the two screws securing the fixed contact. Insert a .008 inch gauge between the back of the armature and the cut-out frame, and a .011 inch-.015 inch gauge between the core face and the armature. (A .005 inch brass shim is fitted to the underside of the armature, and the gap must be measured between the core face and the underside of this shim.)

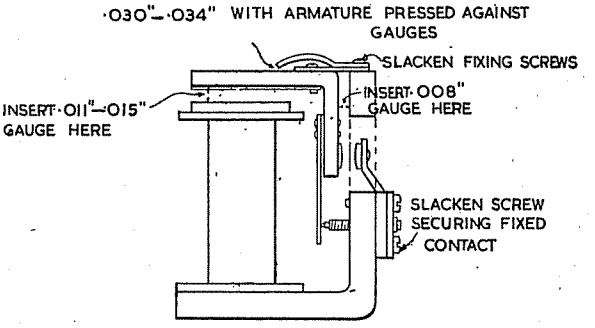

Fig. 8—Mechanical Settings of Cut-out.

Press the armature down and back against the two gauges and tighten the armature fixing screws. With the gauges still in position, set the gap between the armature and the stop plate arm to .030 inch-.034 inch by carefully bending the stop plate arm.

Remove the gauges and tighten the screws securing the fixed contact. Insert a .025 inch gauge between the core face and the armature. Press the armature down on the gauge. The gap between the contacts should now measure .002 inch to .006 inch. Adjust the gap, if necessary, by adding or removing shims beneath the fixed contact plate.

(3) Cleaning Contacts.

If the cut-out contacts appear burnt or dirty, place a strip of fine glass paper between the contacts — then, with the contacts closed by hand, draw the paper through. This should be done two or three times with the rough side towards each contact.

Do not use emery cloth or a carborundum stone for cleaning cut-out contacts.

GENERATOR MODEL C45-PV/5

4. GENERAL DESCRIPTION.

The generator is a shunt-wound, two-pole, two brush machine, arranged to work in conjunction with a compensated voltage control regulator unit.

A fan integral with the driving pulley, draws cooling air through the generator, inlet and outlet holes being provided in the end brackets of the unit.

The output of the generator is controlled by the regulator and is dependent on the state of charge of the battery and the loading of the electrical equipment in use. When the battery is in a low state of charge, the generator gives a high output, whereas if the battery is fully charged, the generator gives only sufficient output to keep the battery in good condition without any possibility of overcharging. In addition, an increase in output is given to balance the current taken by lamps and other accessories when in use. Further, a high boosting charge is given for a few minutes immediately after starting up, thus quickly restoring to the battery the energy taken from it by the electric starting motor.

5. ROUTINE MAINTENANCE.

(a) Lubrication.

Every 12,000 miles, unscrew the cap of the lubricator, lift out the felt pad and spring and about half fill the lubricator cap with high melting point grease (H.M.P. Grease).

Replace the spring and felt pad and screw the lubricator cap back into position.

Generators not fitted with a screw type lubricator have an oiling hole at the end of the shaft allowing access to a felt ring. Every 12,000 miles inject a medium-heavy oil through this hole in order to replenish the felt pad.

(b) Inspection of Brushgear and Commutator.

At the same time, remove the metal band cover to inspect the brushgear and commutator.

Check that the brushes move freely in their holders by holding back the brush springs and

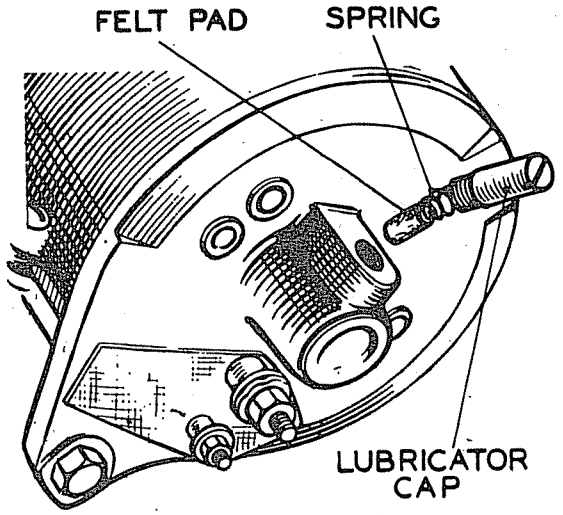

Fig. 9—Lubricator (Generator).

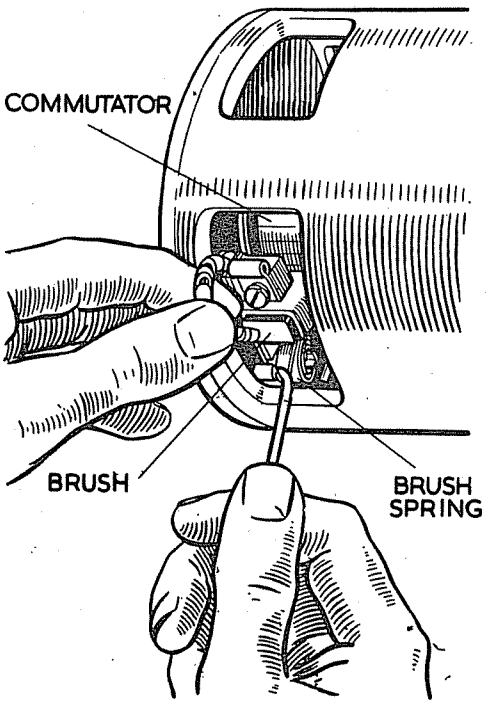

Fig. 10—Checking Brush Gear.

pulling gently on the flexible connectors. If a brush is inclined to stick, remove it from its holder and clean its sides with a petrol-moistened cloth. Be careful to replace brushes in their original positions in order to retain the "bedding". Brushes which have worn so that they will not "bed" properly on the commutator must be renewed.

The commutator should be clean, free from oil and dirt and should have a polished appearance. If it is dirty, clean it by pressing a fine dry cloth against it while the engine is slowly turned over by hand. If the commutator is very dirty, moisten the cloth with petrol.

(c) Belt Adjustment.

Occasionally inspect the generator driving belt and adjust, if necessary, to take up any undue slackness by turning the generator on its mounting. Care should be taken to avoid overtightening the belt, which should have sufficient tension only to drive without slipping.

See that the machine is properly aligned, otherwise undue strain will be thrown on the generator bearings.

6. PERFORMANCE DATA.

Cutting in speed 900-1050 r.p.m. at 13 generator volts.

Maximum output:— 22 amps. at 1600-1800 r.p.m. at 13.5 generator volts.

Field resistance 6 ohms.

7. SERVICING.

(a) Testing in position to locate fault in charging circuit.

In the event of a fault in the charging circuit, adopt the following procedure to locate the cause of trouble.

(1) Inspect the driving belt and adjust if necessary (See Paragraph 5-c).

(2) Check that the generator and control box are connected correctly. The generator terminal "D" must be connected to control box terminal "D", Figure 3, and generator terminal "F", Figure 11, to control box terminal "F", Figure 3. Check the earth connection to terminal "E", Figure 3, of the control box.

(3) Switch off all lights and accessories, disconnect the cables from terminals of generator marked "D" and "F" (Figure 11) and connect the two terminals with a short length of wire.

(4) Start the engine and set to run at normal idling speed.

(5) Clip the negative lead of a moving coil type voltmeter, calibrate 0-20 volts, to one generator terminal and the other lead to a good earthing point on the yoke.

(6) Gradually increase the engine speed, when the voltmeter reading should rise rapidly and without fluctuation. Do not allow the voltmeter reading to reach 20 volts and do not race the engine in an attempt to increase the voltage. It is sufficient to run the generator up to a speed of 1000 r.p.m.

If there is no reading, check the brush gear as described in (7) below. If there is a low reading of approximately ½-1 volt, the field winding may be at fault (See Paragraph 7-e). If there is a reading of 4-5 volts the armature winding may be at fault (See Paragraph 7-d).

(7) Remove the cover band and examine the brushes and commutator. Hold back each of the brush springs and move the brush by pulling gently on its flexible connector, See Figure 10. If the movement is sluggish, remove the brush from its holder and ease the sides by lightly polishing on a smooth file. Always replace brushes in their original positions. If the brushes are worn so that they do not bear on the commutator, or if the brush flexible is exposed on the running face, new brushes must be fitted and bedded to the commutator.

Test the brush spring tension with a spring scale. The tension of the springs when new is 36-44 ozs. In service it is permissible for this value to fall to 30 ozs. before performance may be affected.

Fit new springs if the tension is low.

If the commutator is blackened or dirty, clean it by holding a petrol-moistened cloth against it while the engine is turned slowly by hand cranking. Re-test the generator as in (6), if there is still no reading on the voltmeter, there is an internal fault and the complete unit, if a spare is available, should be replaced. Otherwise the unit must be dismantled (See Paragraph 7-b) for internal examination.

(8) If the generator is in good order, remove the link from between the terminals and restore the original connections, taking care to connect generator terminal "D" to control box terminal "D" and generator terminal "F" to control box terminal "F".

(b) To dismantle (Refer Figure 11).

(1) Take off the driving pulley.

(2) Remove the cover band, hold back the brush springs and remove the brushes from their holders.

(3) Remove the nut, spring washer and flat washer from the smaller terminal (i.e. the FIELD terminal) on the commutator end bracket.

(4) Unscrew and withdraw the two through bolts. In some cases locking nuts are fitted.

(5) The commutator end bracket can now be withdrawn from the generator yoke.

(6) The driving end bracket together with the armature can now be lifted out of the yoke.

(7) The driving end bracket, which on removal from the yoke has withdrawn with it the armature and armature shaft ball-bearing,

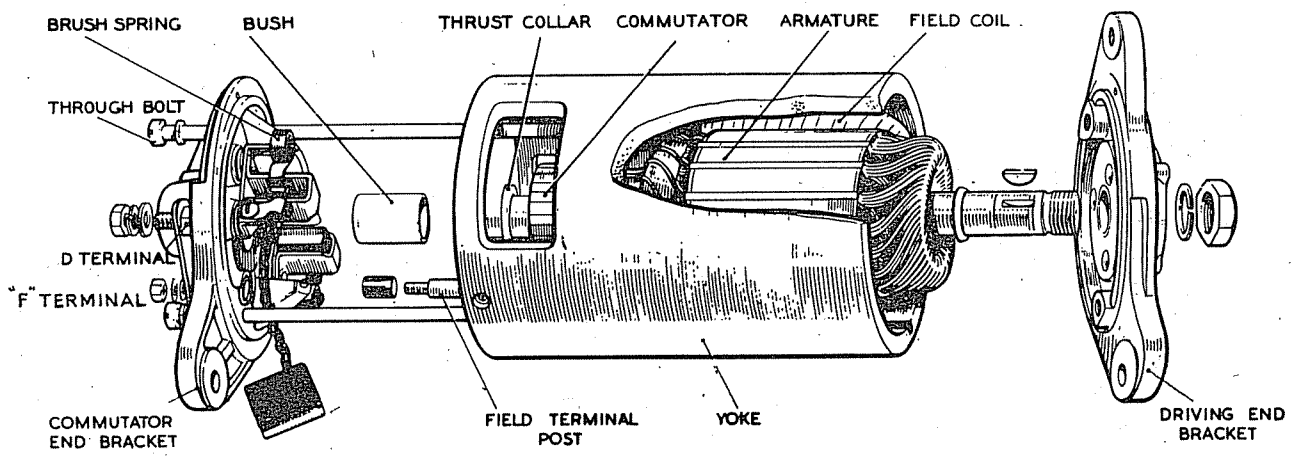

Fig. 11—Generator Dismantled View (Yoke cut away to show interior).

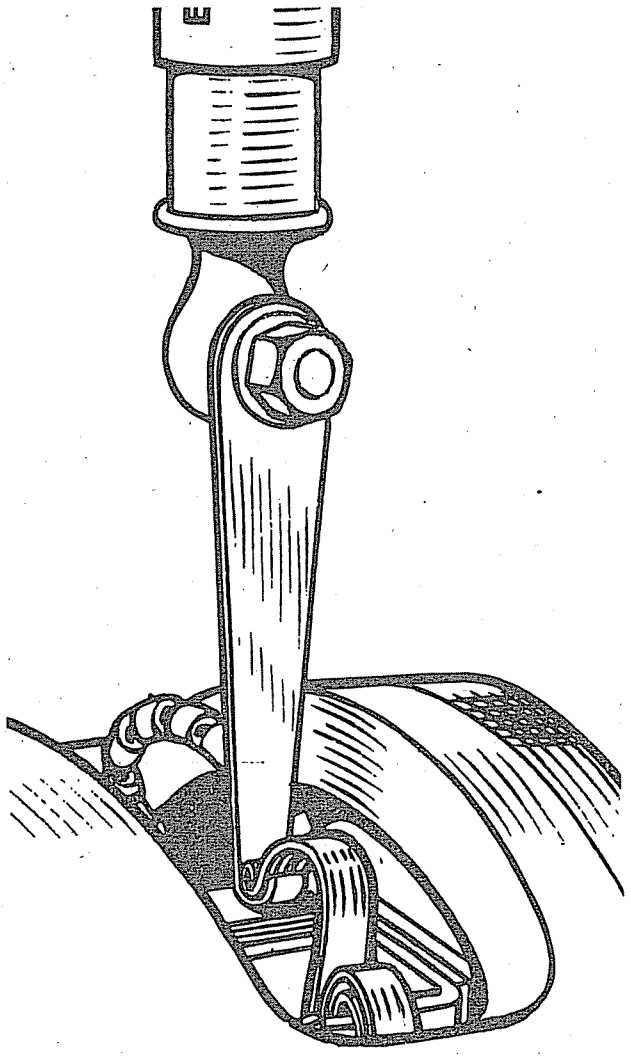

Fig. 12—Testing Brush Spring Tension.

need not be separated from the shaft unless the bearing is suspected and requires examination, or the armature is to be replaced; in this event the armature should be removed from the end bracket by means of a hand press.

(c) Commutator.

A commutator in good condition will be smooth and free from pits or burned spots.

Clean the commutator with a petrol-moistened cloth. If this is ineffective carefully polish with a strip of fine glass paper while rotating the armature. To remedy a badly worn commutator, mount the armature, with or without the drive end bracket, in a lathe, rotate at high speed and take a light cut with a very sharp tool. Do not remove more metal than is necessary. Polish the commutator with very fine glass paper. Undercut the insulators between the segments to a depth of $\frac{1}{32}$ inch with a hacksaw blade ground down to the thickness of the insulator.

(d) Armature.

The testing of the armature winding requires the use of a volt drop test and growler. If these are not available the armature should be checked by substitution. No attempt should be made to machine the armature core or to true a distorted armature shaft.

(e) Field Coils.

Measure the resistance of the field coils without removing them from the generator yoke, by means of an ohmmeter.

The ohmmeter should read 6 ohms approximately.

If an ohmmeter is not available, connect a 12 volt D.C. supply with an ammeter in series between the field terminal and generator yoke. The ammeter reading should be approximately 2 amperes. No reading on the ammeter indicates an open circuit in the field winding.

To test for earthed field coils, unsolder and isolate the end of the field winding from the earth terminal on the generator yoke and, with a mains test lamp, check between the field terminal and yoke. If the lamp lights, the field coils are earthed.

In either case, unless a substitute generator is available, the field coils must be replaced. To do this, carry out the procedure outlined below, using a pole shoe expander and a wheel-operated screwdriver (See Figure 15 and 16).

(1) Remove the insulation piece which is provided to prevent the junction of the field coils from contacting with the yoke.

(2) Mark the yoke and pole shoes in order that they can be fitted in their original positions.

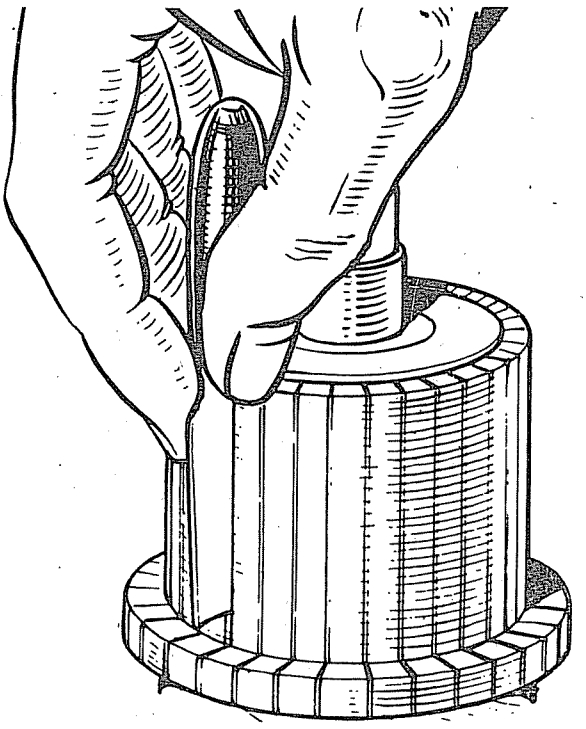

Fig. 13—Method of Undercutting Commutator Insulation

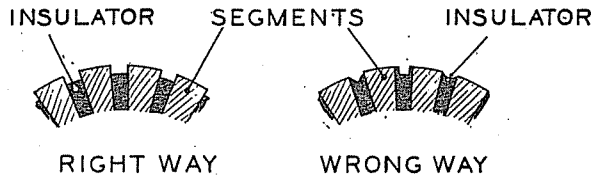

Fig. 14—Method of Undercutting Commutator Insulation.

(3) Unscrew the two pole shoe retaining screws by means of the wheel-operated screwdriver (Figure 16).
(4) Draw the pole shoes and coils out of the yoke and lift off the coils.
(5) Fit the new field coils over the pole shoes and place them in position inside the yoke. Take care to ensure that the tapping of the field coils is not trapped between the pole shoes and the yoke.

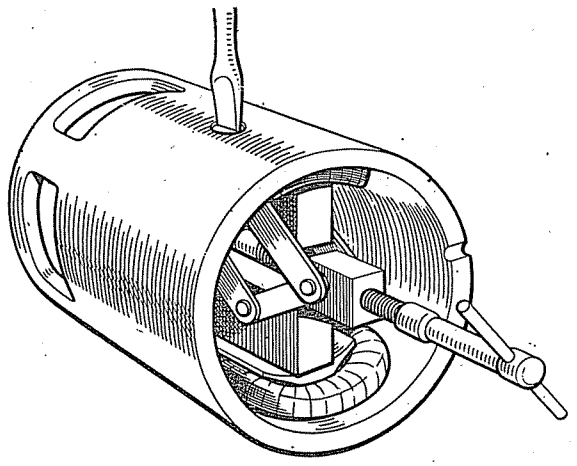

Fig. 15—Pole Shoe and Field Coil Assembly.

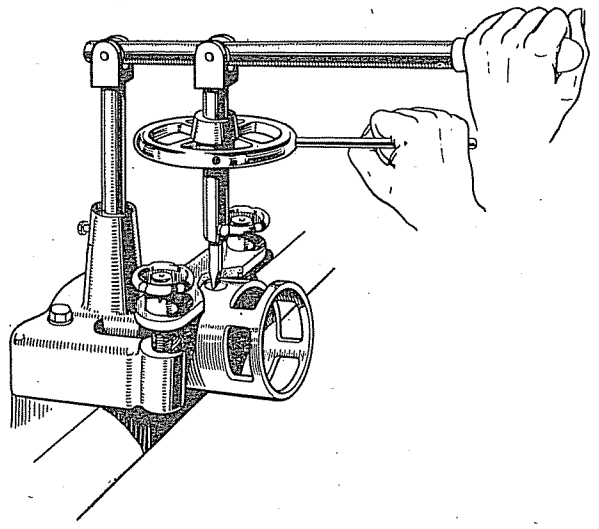

Fig. 16—Tightening Pole Shoe Retaining Shoes

(6) Locate the pole shoes and field coils by lightly tightening the fixing screw.
(7) Insert the pole shoe expander (Figure 15) open it to the fullest extent and tighten the screws.
(8) Finally tighten the screws by means of the wheel-operated screwdriver (Figure 16) and lock them by staking.
(9) Replace the insulation piece between the field coil connections and the yoke.

(f) Bearings.

Bearings which have worn to such an extent that they will allow side movement of the armature shaft must be replaced.

To replace the bearing bush in a commutator end bracket, proceed as follows:

(1) Remove the old bearing bush from the end bracket. The bearing should be removed by means of a lipped expanding type extractor, or in an emergency by screwing an $\frac{11}{16}$ inch tap into the bush for a few turns and pulling out the bush with the tap. Screw the tap SQUARELY into the bush to avoid damage to the bracket.
(2) Press the new bearing bush into the end bracket using a shouldered, highly polished mandrel of the same diameter as the shaft which is to fit in the bearing. POROUS BRONZE BUSHES MUST NOT BE OPENED OUT AFTER FITTING, OR THE POROSITY OF THE BUSH MAY BE IMPAIRED.

Note: Before fitting the new bearing bush it should be allowed to stand for 24 hours completely immersed in thin engine oil; this will allow the pores of the bush to be filled with lubricant. In cases of extreme urgency, this period may be shortened by heating the oil to 100°C when the time of immersion may be reduced to two hours.

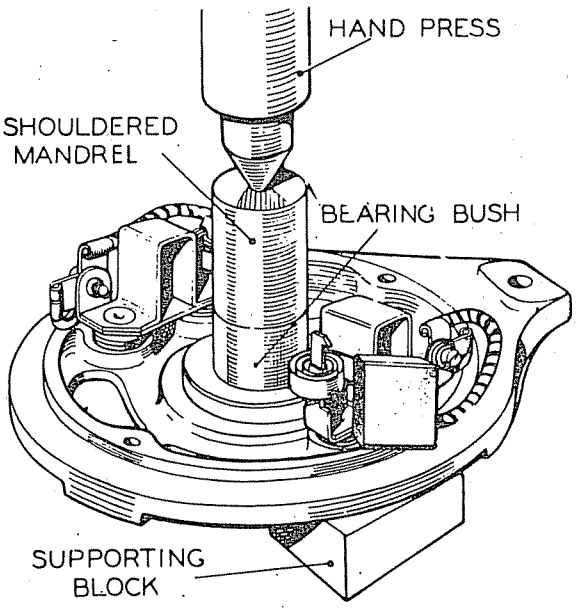

Fig. 17—Method of Fitting Porous Bronze Bearing Bush.

The ball bearing at the driving end is replaced as follows:

(1) Knock out the rivets which secure the bearing retaining plate to the end bracket and remove the plate.

(2) Press the bearing out of the end bracket and remove the corrugated washer, felt washer and oil retaining washer.

Note: The drive end ball bearing on some machines will not need much pressure to remove it from the end bracket as the method of fitting has been modified from an interference fit to a light push fit.

(3) Before fitting the replacement bearing see that it is clean and pack it with high melting point grease.

(4) Place the oil retaining washer, felt washer and corrugated washer in the bearing housing in the end bracket.

(5) Locate the bearing in the housing and press it home by means of a hand press if necessary.

(6) Fit the bearing retaining plate. Insert the new rivets from the inside of the end bracket and open the rivets by means of a punch to secure the plate rigidly in position.

(g) Re-assembly.

In the main the re-assembly of the generator is a reversal of the operation described in Paragraph 7-b. Unscrew the lubricator (Figure 9), lift out the felt wick and spring and refill the cap with H.M.P. grease. Replace spring and wick and screw the lubricator in position in the end bracket.

Special Precautions When Fitting Replacement Armatures.

The inner journal of the drive end ball race **must** always be supported by a tube when a drive end bracket is assembled to an armature shaft.

ON NO ACCOUNT SHOULD THE DRIVE END BRACKET BE USED TO SUPPORT THE BEARING WHILST THE SHAFT IS BEING PRESSED HOME. This would cause the bearing to move and collapse the corrugated spring washer locating the bearing felt. As a result the armature will not be in the correct position when the machine is assembled, and the brushes would tend to over-hang the end of the commutator.

A mild steel tube approx. 4 inches long and $\frac{1}{8}$ inch thick with an inside diameter of $\frac{11}{16}$ inch (17 m.m. approx,) should be used to support the inner journal of the drive end ball race.

(h) Replacement Commutator End Brackets.

Replacement C.E. brackets may be found to have tapped holes for the through bolts and it will be necessary to remove the thread by means of a $\frac{1}{4}$ inch clearance drill.

DISTRIBUTOR MODEL DXH6A

8. GENERAL DESCRIPTION.

The coil ignition equipment comprises a high tension induction coil and a combined distributor, contact breaker and automatic timing control assembly driven at half engine speed via the camshaft. Current flowing through the primary or low tension winding of the coil sets up a strong magnetic field about it. This current is periodically interrupted by a cam-operated contact breaker driven from the engine, and the subsequent collapse of the magnetic field across the secondary winding of the coil induces a high voltage in it. At the same time, a rotor arm in the distributor connects the secondary winding of the coil with one of a number of metal electrodes, from which cables lead to the sparking plugs in the engine cylinders. Thus, a spark is arranged to occur in the cylinder under compression at the exact moment required to produce combustion of the mixture.

Mounted on the distributor driving shaft, immediately beneath the contact breaker, is an automatic timing control mechanism. It consists of a pair of spring-loaded governor weights, linked by lever action to the contact breaker cam. At slow engine speeds, the spring force maintains the cam in a position in which the spark is slightly retarded. Under the centrifugal force imparted by high engine speeds, the governor weights swing out,

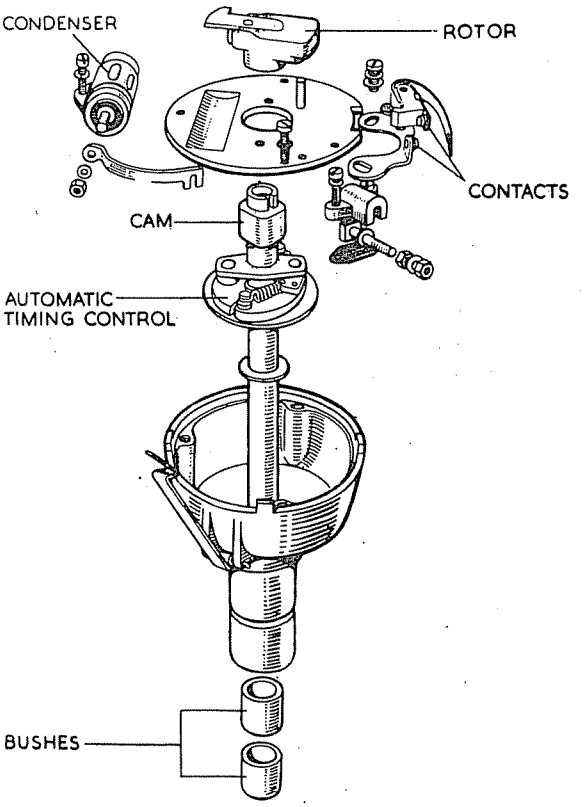

Fig. 18—Distributor Dismantled.

against the spring pressure, to advance the contact breaker cam and thereby the spark, to suit engine conditions at the greater speed.

9. ROUTINE MAINTENANCE.

In general, lubrication and cleaning constitute normal maintenance procedure.

(a) LUBRICATION—EVERY 3,000 MILES.

Take great care to prevent oil or grease from getting on or near the contacts.

Smear the cam and the pivot on which the contact breaker works with general purpose grease.

Lift off the rotor arm by pulling vertically and apply to the spindle a few drops of thin machine oil to lubricate the cam bearing. It is not necessary to remove the exposed screw, since it is either drilled or affords a clearance to permit passage of oil.

Replace the rotor arm, carefully locating its moulded projection in the keyway in the spindle and pushing it on as far as it will go in order to avoid the risk of the moulded cap being burned or tracked. A few drops of thin machine oil should be applied, through the hole in the contact breaker base through which the cam passes, to lubricate the automatic timing control.

(b) CLEANING—EVERY 6,000 MILES.

Thoroughly clean the moulded distributor cap, inside and out, with a soft dry cloth, paying particular attention to the spaces between the metal electrodes. Ensure that the small carbon brush moves freely in its holder.

Examine the contact breaker.

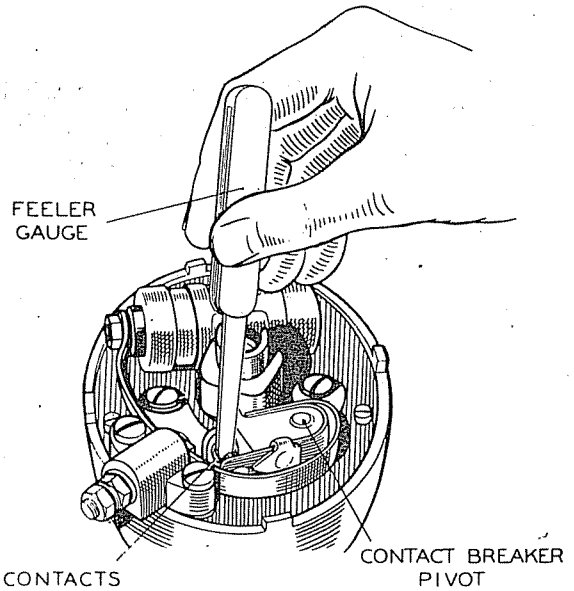

Fig. 19—Checking Distributor Contact Breaker

The contacts must be quite free from grease or oil. If they are burned or blackened, clean them with very fine carborundum stone or emery cloth, then wipe with a petrol-moistened cloth. Cleaning is facilitated by removing the contact breaker lever. To do this, slacken the nut on the moulded terminal block and lift out the end of the contact breaker spring. The contact breaker lever may now be removed from its pivot. After cleaning, check the contact breaker setting. Turn the engine by hand until the contacts show the maximum opening. This should measure .014 to .016 in.

If the measurement is incorrect, keep the engine in the position giving maximum opening, slacken the two screws securing the fixed contact plate and adjust its position to give the required gap. Tighten the screws. Recheck the setting for other positions of the engine giving maximum opening.

10. DESIGN DATA.

(a)

Open Period	Closed Period	Firing Angles
28°	32° minimum	0°, 60°, 120°, etc. ±1°

(b) Contact breaker gap, .014 in. to .016 in.

(c) Contact breaker spring tension, measured at contacts, 20-24 oz.

(d) Condenser capacity: 0.2 microfarad.

(e) Automatic Timing Control: The performance of the control may be checked against the figures given below if the requisite equipment is available.

Rotation: Clockwise.

To check advance:

(1) Set to zero.

(2) Run up to 2000 r.p.m. Range must not exceed 13°.

(3) Decelerate to 1500 r.p.m. Advance must be between 11½° - 13°.

(4) Test at following decelerating speeds.

1300 r.p.m. — 10° — 12°
700 r.p.m. — 6° — 8°
550 r.p.m. — 5° — 7°
400 r.p.m. — 1° — 6°

11. SERVICING.

Before starting to test, make sure that the battery is not fully discharged, as this will often produce the same symptoms as a fault in the ignition circuit.

(a) Testing in Position to Locate Cause of Uneven Firing.

Run the engine at a fairly fast idling speed.

Short circuit each plug in turn with, say, the blade of an insulated screwdriver or a hammer head

placed across the terminal to contact the cylinder head. Short circuiting the defective plug will cause no noticeable change in the running note. On the others, however, there will be a pronounced increase in roughness.

Having thus located the defective cylinder, stop the engine and remove the cable from the sparking plug terminal.

Restart the engine and hold the cable end about $\frac{3}{16}$ in. from the cylinder head. If sparking is strong and regular, the fault lies with the sparking plug, and it should be removed, cleaned and adjusted, or a replacement fitted.

If, however, there is no spark, or only weak irregular sparking, examine the cable from the plug to the distributor for deterioration of the insulation, renewing the cable if the rubber is cracked or perished.

Clean and examine the distributor moulded cap for free movement of the carbon brush. If tracking has occurred, indicated by a thin black line, usually between two or more electrodes, a replacement distributor must be fitted.

(b) TESTING IN POSITION TO LOCATE CAUSE OF IGNITION FAILURE.

Spring back the clips on the distributor head and remove the moulded cap. Lift off the rotor, carefully levering with a screwdriver if necessary.

Check the contacts for cleanliness and correct gap setting as described in Paragraph 9-b.

Switch on the ignition and turn the engine. Observe the ammeter (if one is fitted) reading, which should rise and fall with the closing and opening of the contacts if the low tension wiring is in order. When the reading does not fluctuate, either a short circuit, or contacts remaining closed is indicated.

No reading indicates a broken or loose connection in the low tension wiring or badly adjusted or dirty contacts.

(c) LOW TENSION CIRCUIT—FAULT LOCATION.

If it is determined that the fault lies in the low tension circuit, by the eliminating check (b) above, switch on the ignition and turn the engine until the contact breaker points are fully opened. Refer to the wiring diagram and check the circuit with a voltmeter (0-20 volts) between the following points and a good earth. If the circuit is in order, the voltage reading should be approximately 12 volts. No reading indicates a damaged cable or loose connections, or a breakdown in the section under test.

(1) Battery to Ammeter.

Connect the voltmeter between the ammeter (battery side) and a good earth on the chassis.

(2) Ammeter.

Check the voltage to earth at the other ammeter terminal and earth. No reading indicates a faulty ammeter.

(3) Ammeter to Control Box.

Connect the voltmeter between the control box terminal "A" (Figure 3) and earth. No reading indicates a faulty lead or loose connection.

(4) Control Box.

Check the voltage to earth at the control box terminal "A1" (Figure 3). No reading indicates a broken connection in the series winding.

(5) Control Box to Ignition Switch.

Connect the voltmeter between the ignition switch terminal to which the lead from the control box is connected and a good earth. No reading indicates a faulty lead or loose connection.

(6) Ignition Switch.

Check the voltage between the other terminal of the ignition switch and earth. No reading indicates a fault in the switch.

(7) Ignition Switch to Ignition Coil.

Remove the lead from the ignition coil feed wire terminal, and connect the voltmeter between the free end of the cable and earth. This portion of the circuit is made by way of the fuse box "A3" terminal and a voltage check should be made at this point also.

Remake the connection to the coil.

(8) Ignition Coil.

Disconnect the lead from the contact breaker terminal of the coil and connect the voltmeter between this coil terminal and a good earth. No reading indicates a fault in the primary winding of the coil, necessitating coil replacement. If, however, the correct reading is obtained, remake the cable connections to the coil terminal.

(9) Ignition Coil to Distributor

Disconnect the low tension cable to the distributor and connect the voltmeter between the end of the cable removed and earth. No reading indicates a faulty lead or loose connection. Reconnect the cable to the distributor.

(10) Contact Breaker and Condenser.

Connect the voltmeter across the contact points with the points separated. If no reading is obtained, recheck with the condenser removed. If a reading is now given, the condenser is faulty and must be replaced.

(11) Measure the contact breaker spring tension. This should be 20-24 oz., measured at the contacts.

(d) HIGH TENSION CIRCUIT.

If, after carrying out these tests, the fault has not been located, remove the high tension lead from the centre terminal of the distributor.

Switch on the ignition and turn the engine until the contacts close. Flick open the contact breaker lever while the high tension lead from the coil is held about $\frac{3}{16}$ in. from the cylinder block. If the ignition equipment is in good order, a strong spark will be obtained. If no spark occurs, a fault in the circuit of the secondary winding of the coil is indicated and the coil must be replaced.

The high tension cables must be carefully examined, and replaced if the rubber insulation is cracked or perished, using 7 m.m. rubber covered ignition cable. To fit a new high tension cable to the ignition coil, pass the cable through the knurled, moulded nut, bare about $\frac{1}{4}$ in. of the end of the cable, thread the wire through the brass washer (removed from the original cable) and bend back the strands. Finally screw the nut into its terminal.

To make connections to the terminals in distributor cap, remove the cap and slacken the screws on the inside of the moulding. Cut the cables to the length required and push firmly home in the holes in the moulding.

Tighten the screws which will pierce the rubber insulation to make good contact with the cable core. The connection to the centre terminal is made accessible by removing the small carbon brush.

The cables from the distributor to the sparking plugs must, of course, be connected in the correct firing order.

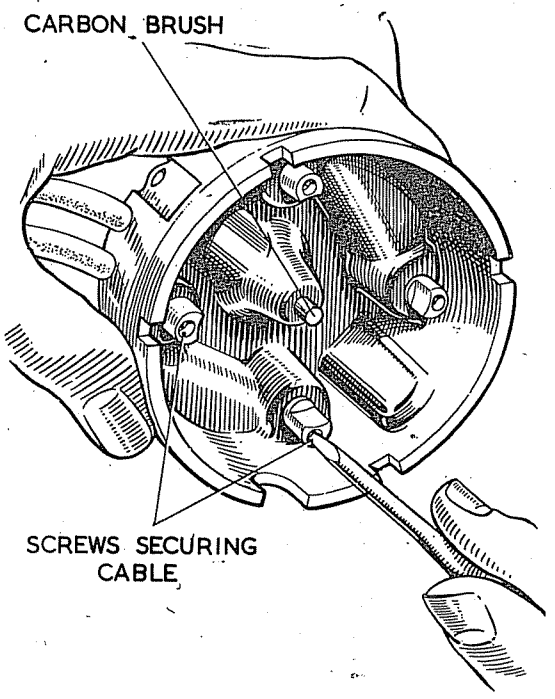

Fig. 20—Making Connections to High Tension Cable Contacts.

(e) CONTACT BREAKER MECHANISM.

Check and adjust as described in Paragraph 9B.

Ensure that the moving arm moves freely on its pivot. If sluggish, remove the arm and polish the pivot pin with a strip of fine emery cloth. Replace the arm and lubricate with a spot of clean engine oil.

(f) DISMANTLING.

Before dismantling, carefully note the positions in which various components are fitted, in order to ensure their correct replacement on subsequent re-assembly. If the driving member is offset, or marked in some way for convenience in timing, note the relation between it and the rotor electrode, and maintain this relation when re-assembling the distributor.

(1) Spring back the securing clips and remove the moulded cap.

(2) Lift the rotor off the top of the spindle. If tight, carefully lever off with a screwdriver.

(3) Slacken the nut on the terminal screw of the moulded terminal block. Lift out the end of the contact breaker spring, which is slotted for this purpose. The contact breaker lever may now be lifted off its pivot pin. Lift the insulating washer from the pivot. Remove the two screws, together with their spring and plain washers, securing the fixed contact plate, and lift off the plate.

(4) Undo the screws with the spring washers at the edge of the contact breaker base. One of these screws secures the condenser clip, and when it has been withdrawn, the condenser and connecting strip may be lifted off.
Remove the contact breaker base from the distributor body.

(5) Remove the dog or driving gear from the shaft.

(6) Remove the cam, automatic timing control and shaft assembly from the distributor. Take out the screw from inside the top of the cam spindle. Lift off the cam, affording access to the automatic timing control.

(g) BEARING BUSHES—REPLACEMENT.

(1) Bushes are removed and fitted using a vertical drilling machine or hand press in which is fitted a highly polished mandrel of the same size as the distributor shaft.

(2) To remove the bushes, locate the distributor body (inverted) beneath the press, a sleeve must be fitted over the mandrel, to enlarge it to the size of the bushes. Apply a steady pressure to force the bushes from their seats. Remove the sleeve.

(3) New bushes must be completely immersed in thin engine oil for 24 hours before fitting. In cases of emergency, this process may be shortened by heating the oil to 100°C., when

the period of immersion may be reduced to 2 hours.

(4) Place a long bush on the mandrel, then the distributor body (inverted) and finally one of the smaller bushes. Locate the lower end of the mandrel in a suitable packing block and apply a steady downward pressure. Ensure that both bushes enter the distributor squarely, and when they have been fully inserted, carefully withdraw the mandrel.

On no account should the bushes be overbored by reaming or any other means, since this will impair the porosity and thereby the effective lubricating quality of the bushes.

12. RE-ASSEMBLY.

(1) Before assembly, the automatic advance mechanism, distributor shaft and the portion of the shaft on which the cam fits, must be lubricated with thin engine oil.

(2) Assemble the automatic timing control, taking care that the parts are fitted in their original positions and the control springs not stretched. Two holes are provided in each toggle: the springs must be fitted to the inner hole in each case. Place the cam on the spindle and secure by tightening the locking screw.

(3) Fit the shaft in its bearings and replace the driving member.

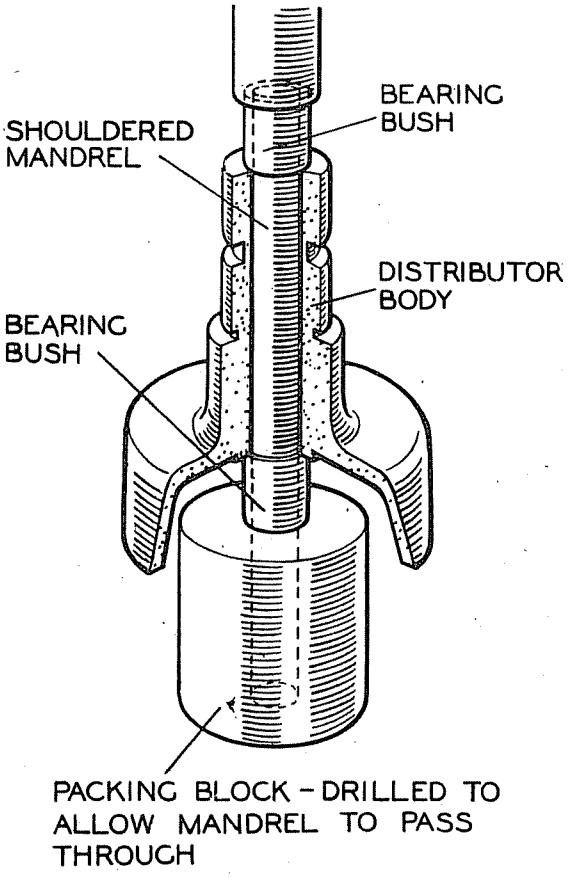

Fig. 21—Replacing Bearing Bush of Distributor.

(4) Place the contact-breaker base in position on the distributor body, securing by replacing the two side screws. Spring washers must be fitted under each screw head and the screws firmly tightened. Replace the condenser and fit the remaining securing screw.

(5) Place the end of the connector strip over the condenser terminal post, refit the spring washer and secure by tightening the terminal nut.

(6) Replace the fixed contact plate on the contact-breaker base, fit the two screws, together with their plain and spring washers, and lightly tighten.

Place the insulating washer over the contact-breaker pivot pin and fit the contact-breaker lever on the pin. Locate the slotted end of the contact-breaker spring under the head of the terminal screw and tighten the nut to lock the spring in position. Adjust the contact-breaker setting to give a gap of .014 in. to .016 in. when the contacts are fully opened.

NOTE: If it is necessary to renew the contacts, a replacement set comprising fixed and moving contacts must be fitted.

(7) Place the rotor on the spindle, locating the register correctly and pushing the rotor fully home.

(8) Fit the distributor cover moulding and secure by means of the spring clips.

STARTING MOTOR MODEL M45G

13. GENERAL DESCRIPTION.

The electric starting motor is a four-pole machine having an extended shaft which carries the engine engagement gear, or starter drive as it is more usually named. The diameter of the yoke is $4\frac{1}{2}$ in.

The starting motor is of similar construction to the generator except that heavier copper wire is used in the construction of armature and field windings, as it must be remembered that the current consumption of the motor is very high.

The starting motor is a four brush machine and has a series—parallel field connection.

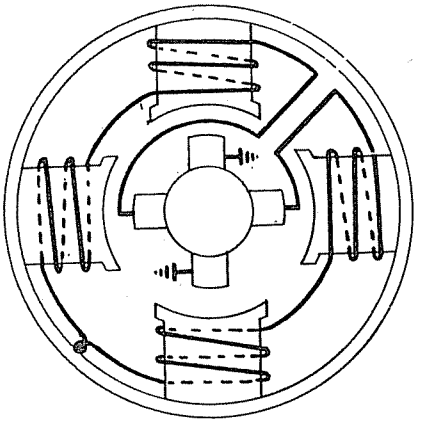

Fig. 22—Internal Connections of the Starting Motor.

14. ROUTINE MAINTENANCE.

The only maintenance normally required by the starting motor is the occasional checking of brush-gear and commutator. About every 12,000 miles, remove the metal band cover. Check that the brushes move freely in their holders by holding back the brush springs and pulling gently on the flexible connectors.

If a brush is inclined to stick, remove it from its holder and clean its sides with a petrol-moistened cloth. Be careful to replace brushes in their original positions in order to retain the "bedding". Brushes which have worn so that they will not "bed" properly on the commutator must be renewed.

The commutator should be clean, free from oil or dirt and should have a polished appearance. If it is dirty, clean it by pressing a fine dry cloth against it while the starter is turned by hand by means of a spanner applied to the squared extension of the shaft. Access to the squared shaft is gained by removing the thimble-shaped metal cover. If the commutator is very dirty, moisten the cloth with petrol.

15. PERFORMANCE DATA.

Lock torque, 22 lbs. ft. with 430-450 amps. at 7.8-7.4 volts.

Torque at 1000 r.p.m., 8.3 lbs. ft. with 200-220 amps. at 10.2-9.8 volts.

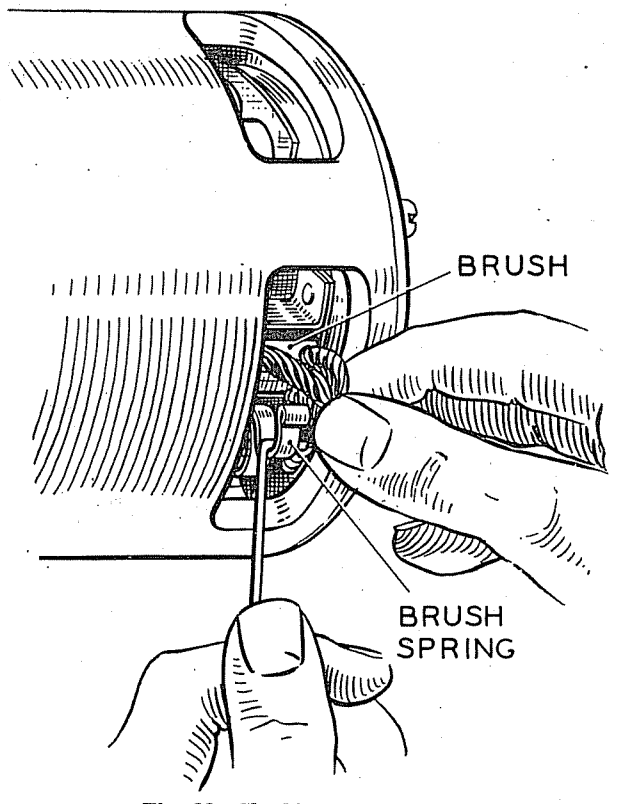

Fig. 23—Checking Brush Gear.

16. SERVICING.

(a) Testing in Position.

(1) Switch on the lamps and operate the starter control.

If the lamps go dim, but the starting motor is not heard to operate, an indication is given that current is flowing through the starting motor windings, but that the armature is not rotating for some reason; possibly the pinion is meshed permanently with the geared ring on the flywheel. In this case, the starting motor must be removed from the engine for examination.

(2) Should the lamps retain their full brilliance when the starter switch is operated, check the circuit for continuity from the battery to starting motor via the starter switch, and examine the connections at these units. If the supply voltage is found to be applied to the starting motor when the switch is operated, an internal fault in the motor is indicated and the unit must be removed from the engine for examination.

(3) Sluggish or slow action of the starting motor is usually caused by a poor connection in the wiring, giving rise to a high resistance in the motor circuit. Check as described above.

(4) If the motor is heard to operate, but does not crank the engine, indication is given of damage to the drive.

(b) Bench Testing and Examination of Brush-gear and Commutator.

(1) If it is necessary to remove the starting motor from the engine, first proceed as follows:

Disconnect the cable from the positive battery terminal to avoid any danger of causing short circuits.

Disconnect the heavy cable from the starting motor.

(2) After removing the starting motor from the engine, secure the body in a vice and test by connecting it with heavy gauge cables to a battery of the appropriate voltage. One cable must be connected to the starter terminal and the other held against the body or end bracket. Under those light load conditions, the starter should run at a very high speed.

(3) If the operation of the starting motor is unsatisfactory, remove the cover band and examine the brushes and commutator. Hold back each of the brush springs and move the brush by pulling gently on its flexible connector (See Figure 23). If the movement is sluggish, remove the brush from its holder and ease the sides by lightly polishing on a smooth file. Always replace brushes in their original positions. If the brushes are worn so that they will not bear on the commutator, or if the brush flexible is exposed on the running face, they must be replaced (See Para. 16d).

Check the tension of the brush springs with a spring scale. The correct tension is 30-40 ozs. New springs should be fitted if the tension is low.

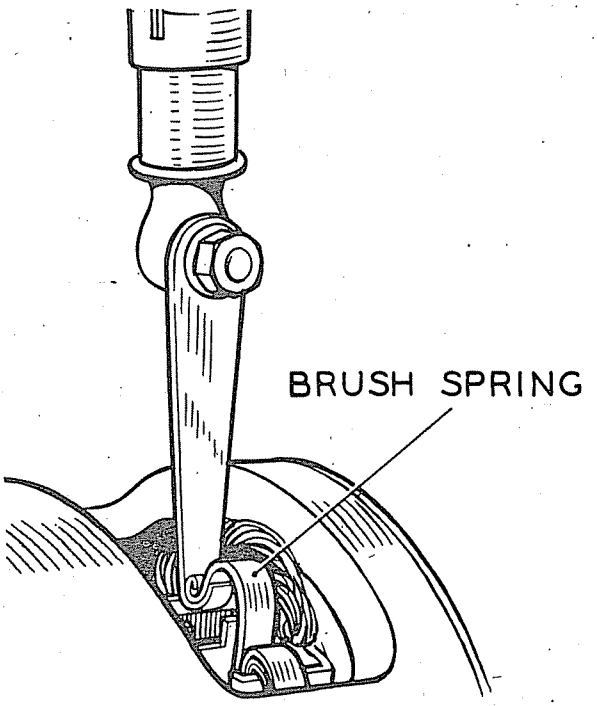

Fig. 24—Testing Brush Spring Tension

If the commutator is blackened or dirty, clean it by holding a petrol-moistened cloth against it while the armature is rotated.

(4) Re-test the starter as described under (2). If the operation is still unsatisfactory, the unit must be dismantled for detailed inspection and testing.

(c) To Dismantle.

(1) Remove the cover band, hold back the brush springs and lift the brushes from their holders.

(2) Remove the nuts from the terminal post which protrudes from the commutator end bracket.

(3) Unscrew the two through bolts from the commutator end bracket. Remove the commutator end bracket from the yoke.

(4) Remove the driving end bracket complete with armature and drive from the starting motor yoke.

If it is necessary to remove the armature from the driving end bracket, it can be done by means of a hand press after the drive has been dismantled.

(d) Replacement of Brushes.

If the brushes are worn so that they do not bear on the commutator, or if the flexible connectors are exposed on the running face, they must be replaced.

Two of the brushes are connected to terminal eyelets attached to the brush boxes on the commutator end bracket (Figure 26) and two are connected to tappings on the field coils (Figure 27).

The flexible connectors must be removed by unsoldering and the connectors of the new brushes secured in their place by soldering. The brushes are pre-formed so that bedding to the commutator is unnecessary.

(e) Commutator.

A commutator in good condition will be smooth and free from pits and burned spots. Clean the commutator with a petrol-moistened cloth.

If this is ineffective, carefully polish with a strip of fine glass paper, while rotating the armature. To remedy a badly worn commutator, dismantle the starter drive and remove the armature from the end bracket. Now mount the armature in a lathe, rotate at a high speed and take a light cut with a very sharp tool. Do not remove any more metal than is necessary. Finally polish with a very fine glass paper. The insulators between the commutator segments MUST NOT BE UNDERCUT.

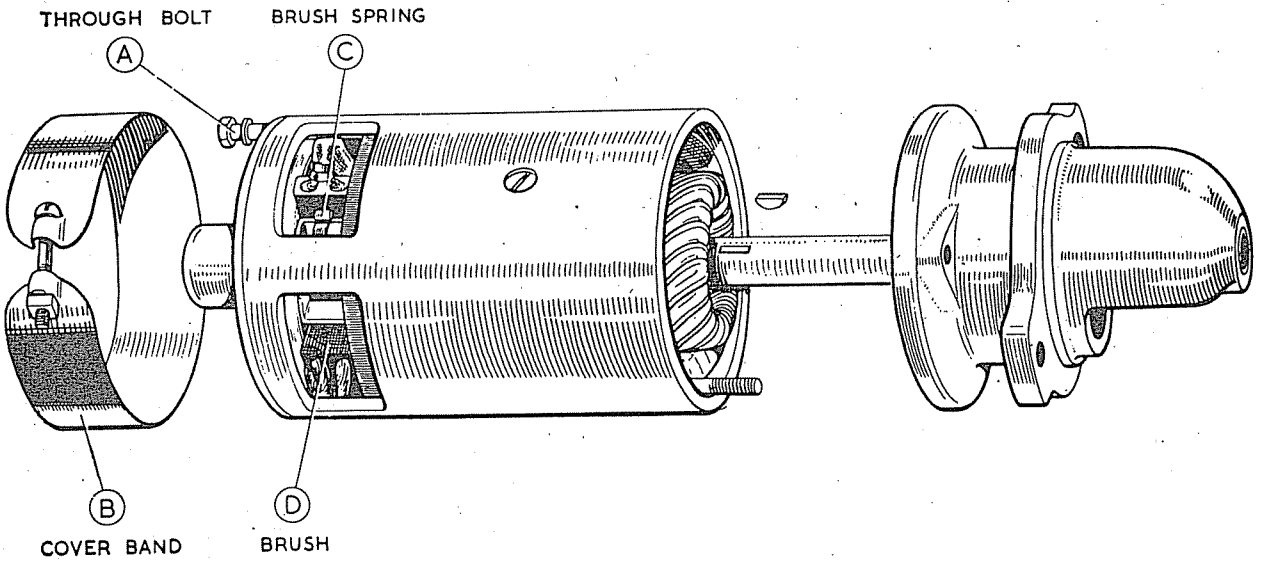

Fig. 25—Starter Motor Dismantled.

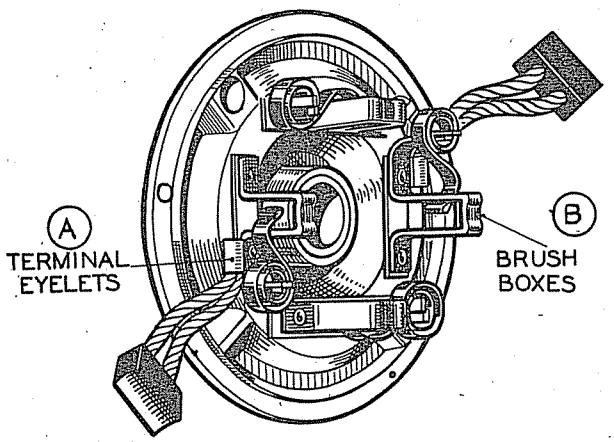

Fig. 26—Commutator End Bracket Brush Connections.

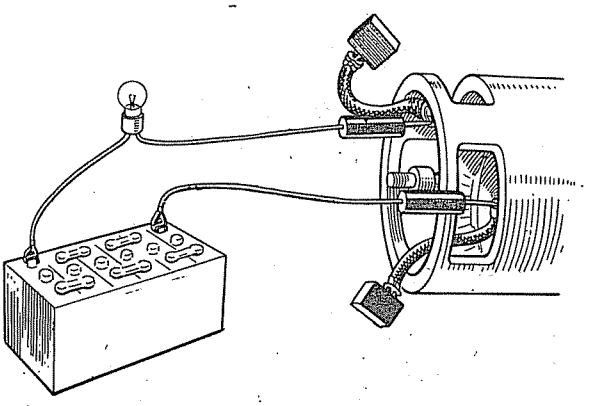

Fig. 28—Checking Field Coils for Open Circuit.

(f) Armature.

Examination of the armature may reveal the cause of the failure, e.g., conductors lifted from the commutator due to the starting motor being engaged while the engine is running and causing the armature to be rotated at an excessive speed. A damaged armature must in all cases be replaced—no attempt should be made to machine the armature core or to true a distorted armature shaft.

(g) Field Coils.

(1) Test the field coils for continuity by connecting a 12 volt battery with a 12 volt bulb in series between the tapping points of the field coils and the tapping point at which the brushes are connected.

(2) Lighting of the lamp does not necessarily mean that the field coils are in order, as it is possible that one of them may be earthed to a pole shoe or to the yoke. This may be checked with a test lamp connected from the supply mains, the test leads being connected to one of the field coil tapping points, and to a clean part of the yoke. Should the lamp light, it indicates the field coils are earthed to the yoke.

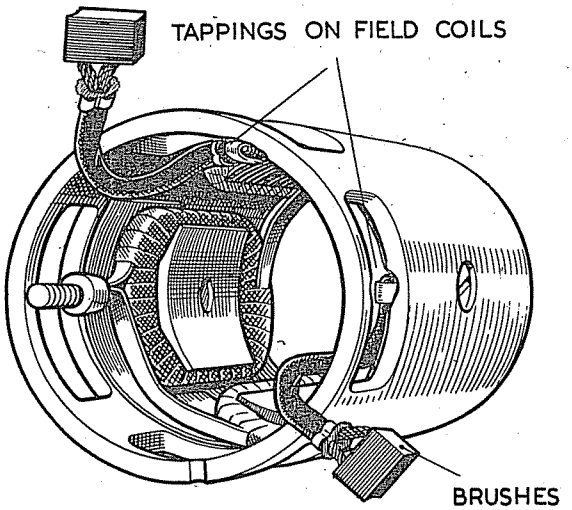

Fig. 27—Brush Connections to Field Coil Tappings.

In either case, unless a replacement starting motor is available, the field coils must be replaced. To do this, carry out the procedure outlined below, using a pole shoe expander and a wheel-operated screwdriver, as shown in Figures 15 and 16.

Remove the insulation piece which is provided to prevent the intercoil connectors from contacting with the yoke.

Mark the yoke and pole shoes in order that they can be fitted in their original positions.

Unscrew the four pole shoe retaining screws by means of the wheel-operated screwdriver.

Draw the pole shoes and coils out of the yoke and lift off the coils.

Fit the new field coils over the pole shoes and place them in position inside the yoke. Take care to ensure that the tapping of the field is not trapped between the pole shoes and the yoke.

Locate the pole shoes and field coils by lightly tightening the fixing screws.

Insert the pole shoe expander, open it to the fullest extent and tighten the screws.

Finally tighten the screws by means of the wheel-operated screwdriver.

Replace the insulation piece between the field coil connections and the yoke.

(h) Bearings.

Bearings which are worn to such an extent that they will allow excessive side play of the armature shaft must be replaced. To replace the bearing bushes, proceed as follows:

(1) Press the bearing bush out of the end bracket.

(2) Press the new bearing bush into the end bracket, using a shouldered highly polished mandrel of the same diameter as the shaft, which is to fit in the bearing. Porous bronze bushes must not be opened out after fitting, or the porosity of the bush may be impaired.

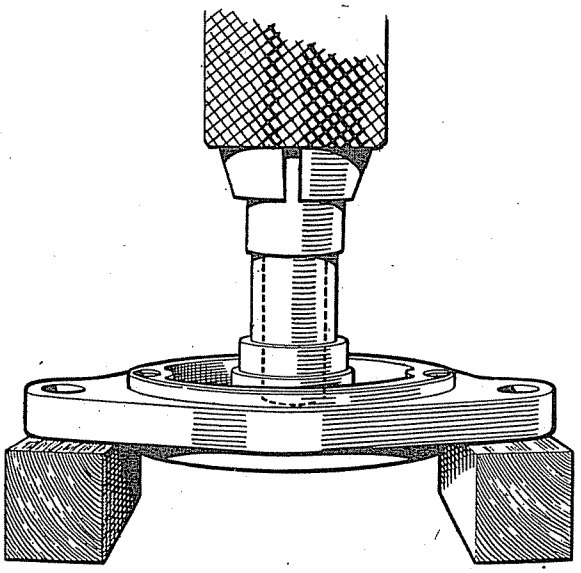

Fig. 29.—Method of Fitting Bearing Bushes.

Note: Before fitting a new porous bronze bearing bush, it should be completely immersed for 24 hours in clean, thin engine oil. In cases of extreme urgency this period may be shortened by heating the oil to 100°C. when the time of immersion may be reduced to two hours.

(j) Re-assembly.

The re-assembly of the starting motor is a reversal of the dismantling procedure.

STARTER DRIVE "ECLIPSE" DRIVE

17. GENERAL DESCRIPTION.

The pinion is carried on a barrel type assembly which is mounted on a screwed sleeve. This sleeve is carried on a centre sleeve which is secured to the armature shaft by means of a retaining pin and key. The barrel assembly is arranged so that it can move along the screwed sleeve until its travel is limited by the control nut meeting the location nut on the centre sleeve.

When the starter switch is operated, the armature shaft and screwed sleeve rotate. The inertia of the barrel assembly allows it to move along the screw thread into engagement. When the pinion has entered the flywheel and meets torsional resistance, the main spring is first compressed and then rotated in torsion. At the same time the screwed sleeve contacts a fibre washer which forms a friction clutch. Thus, the load path to the pinion is split, one part going through the main torsional spring and the other part going via the friction clutch.

If the pinion meets the flywheel teeth on the initial engagement, the main spring compresses and absorbs the shock loading, thus preventing pinion and flywheel damage.

As soon as the engine fires and commences to run under its own power, the flywheel will be driven faster by the engine than the starter. This will cause the barrel assembly to be screwed back along the sleeve, so drawing the pinion out of mesh with the flywheel teeth. In this manner, the drive safeguards the starter against damage due to being driven at high speeds.

To prevent the barrel assembly from being screwed violently back along the sleeve and

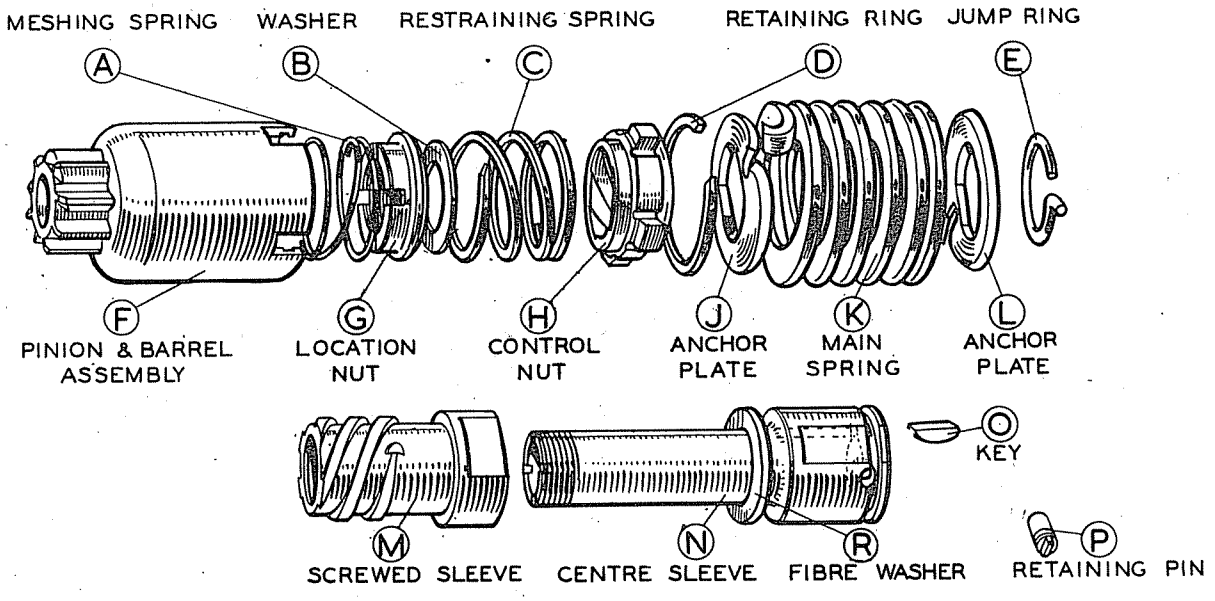

Fig. 30—Starter Drive — Dismantled View.

rebounding from the flange, back into mesh with the flywheel again, a ratchet arrangement is provided in the barrel assembly. Thus, if the pinion is flung out of engagement it will spin freely on the screwed sleeve.

A pinion restraining spring is incorporated in the drive, preventing the pinion vibrating into mesh when the engine is running.

18. ROUTINE MAINTENANCE.

If any difficulty is experienced with the starting motor not meshing correctly with the flywheel, it may be that the drive requires cleaning. The barrel assembly should move freely on the screwed sleeve; if there is any dirt or other foreign matter on the sleeve, it must be washed off with kerosene. In the event of the pinion becoming jammed in mesh with the flywheel, it can usually be freed by turning the starter motor armature by means of a spanner applied to the shaft extension at the commutator end. This is accessible by removing the cap which is either a push fit or is secured by two screws.

19. DISMANTLING AND RE-ASSEMBLY (Refer to Figure 30).

Having removed the armature as described in the section dealing with starter motors, the drive can be removed from the armature shaft as follows:

(a) Dismantling.

Note: To withdraw the drive it is only necessary to take out the retaining pins.

The drive can be dismantled as follows:

Remove the retaining ring (D) from inside the end of the pinion and barrel assembly (F) and slide off the pinion and barrel assembly (F) and meshing spring (A). Unscrew the location nut (G). This nut is held in position on the centre sleeve (N) by staking. When re-assembling therefore, it will be necessary to fit a new sleeve.

Remove the washer (B), restraining spring (C), control nut (H) and withdraw the screwed sleeve (M).

Remove the anchor plate (J), main spring (K) and fibre washer (R). The other anchor plate (L) can be removed from the centre sleeve assembly (N) by withdrawing the jump ring (E).

(b) Re-assembly.

The drive must be re-assembled and fitted to the starter shaft by reversing the above procedure. Take care to stake the centre sleeve to the location nut.

LIGHT UNIT AND ADAPTOR ASSEMBLY

20. GENERAL DESCRIPTION.

The construction of the light unit ensures that the reflector is permanently protected with obvious advantage to its efficiency. The outer surface of the front lens is smooth, to facilitate cleaning, but the inner surface has formed in it a series of small lenses which determine the spread and pattern of the light.

The "prefocus" bulb eliminates the need for any focusing device in the lamp, The bulb is cylindrical in shape so as to reduce the overall diameter to a minimum, an important feature where, as in this type of lamp, the bulb is fitted through an aperture in the rear of the reflector. The bulb has a large cap, of the same size as those on domestic bulbs, but instead of being located by the usual bayonet fixing, the cap is carried on a flange accurately positioned in relation to the filament during manufacture. A slot in the flange engages with a projection on the inside of the bulb holder at the back of the reflector, thus ensuring the correct positioning of the filament. An adaptor assembly with spring-loaded contacts secures the bulb firmly in position, and also carries the supply to the bulb contacts.

21. SERVICING.

Bulb Removal.

The bulb is made accessible by removal of the adaptor. To do this, twist in an anti-clockwise direction and pull it off. The bulb can now be removed from the rear of the reflector and the new bulb fitted.

Engage the projections on the inside of the adaptor with the slots in the bulb holder, press on and secure by twisting to the right.

STARTER SWITCH MODEL ST950

22. GENERAL DESCRIPTION.

This switch is designed to be mounted remote from the starter and is usually fitted on the engine bulkhead. The switch mechanism is solenoid operated and works in conjunction with a separate push-operated control.

23. SERVICING.

If it appears that faulty operation of the starting motor is due to some cause outside the motor itself, carry out a point to point check of the circuit as follows:

(1) Connect the voltmeter to the supply side of the push and earth. No reading indicates a completely discharged battery, faulty cable or loose connection.

(2) Operate the push and connect a voltmeter to the second terminal on the push and earth. No reading indicates a faulty push which must be replaced as a complete unit.

(3) Connect a voltmeter to the small terminal on the starter switch and earth. Operate the push and observe reading on voltmeter. No reading indicates faulty cable or loose connection.

(4) Connect a voltmeter to the supply side of the starter switch terminal and earth. No reading indicates a faulty cable or loose connection.

(5) Having ascertained that the supply to the starter switch is in order, connect a voltmeter to the second (large) terminal and earth, and operate the switch manually. No reading

indicates a faulty switch which must be replaced.

(6) If, however, the switch is in order, connect a voltmeter to the terminal on the starter and earth. No reading indicates a faulty cable or loose connection.

DIPPER SWITCH MODEL FS32

24. GENERAL DESCRIPTION.

This switch is designed to control the dipping of the headlamp beams and is robustly constructed for foot operation. The internal contact movement of the switch has a quick and positive make-and-break action. The normal mounting position for the switch is low down in the engine bulkhead adjacent to the foot operated controls.

25. SERVICING.

If it is suspected that the dip switch is faulty, turn the lighting switch to the HEAD position, and connect a voltmeter between the terminal marked BATT on the dip switch and earth, to ensure that the battery supply is reaching the switch.

Next connect the voltmeter to each of the other two terminals on the dip switch in turn, operating the switch and so testing for continuity in each position. No reading in one or both positions, or a reading at both terminals simultaneously indicates a faulty switch which must be replaced complete.

26. BATTERY.

In order to obtain long life and efficient service from a battery, two important service operations must be done periodically.

(1) The electrolyte must be kept approximately $\frac{3}{8}$ in. above the plates and separators. Add only pure distilled water. UNDER NO CIRCUMSTANCES SHOULD ELECTROLYTE BE ADDED TO MAINTAIN THE LEVEL, except when the electrolyte has been spilled out of the case.

(2) Be sure the battery is maintained in a charged condition. Test the specific gravity at frequent intervals in order to determine the state of charge. Should the specific gravity fall below a dangerously low limit, remove the battery and charge it.

CAUTION.

Avoid overcharging the battery. This is important. If the battery is overcharged the following damage may result:

(1) High internal heat may be produced which speeds corrosion of the positive plate grids, damages separators, and negative plates may soften and distort the case and displace sealing compound.

(2) The water and electrolyte may separate so that the acid is present in concentrated form. With the existence of high temperature, this can harm the separators and negative plate material (if condition persists over a period of time). The result could be charring of the separators and rapid corrosion of the positive grids.

(3) Overcharging may force liquid from the cells and result in corrosion of the cables, battery supports and other vital electrical or engine parts.

(4) The water in the electrolyte may vaporize and form bubbles of hydrogen and oxygen gases. These gas bubbles have a tendency to wash active material from the plates, liberating moisture and acid from the cells in a fine mist.

(5) If overcharging alone (or after an undercharged condition) occurs, the result may be a severe warping or buckling of the positive plates and perforation of the separators. This may allow an internal "short".

BATTERY HOLD DOWN BOLTS, if not properly tightened, may allow the battery to "bounce" or "jiggle" in the support causing case and plate failure. If hold down bolts are drawn too tight, a cracked or distorted case may result. Either of these conditions will result in premature failure of the battery and should be avoided. Tighten battery hold down bolts with a torque wrench to the recommended maximum torque of three foot pounds.

27. STORAGE CARE.

The battery will deteriorate at a faster rate if it is not maintained in a constant state of charge. Therefore if a vehicle is to be placed in storage for an extended period (over 30 days) provision should be made to ensure the battery is maintained.

The battery should be removed and placed in a battery service where it will receive a charge frequently enough to keep it in good condition.

28. COLD WEATHER CARE.

A battery that is operated in an undercharged condition may freeze during severe winter weather. The freezing point of electrolyte varies with specific gravity variations. A fully charged battery will not freeze in temperatures ordinarily encountered. However, if the state of charge approaches the dangerously low point, the battery will freeze at increasingly higher temperatures. The battery should therefore be maintained at a high state of charge at all times to prevent freezing during usage in cold weather.

The following hydrometer readings will illustrate the state of charge of the electrolyte solution with the normal solution used for temperate or tropical climates:

	Temperate	Tropical
Fully charged	1.275 - 1.295	1.225 -
One half charged ..	1.210	1.190
Dangerously low ..	1.175	1.150
Freezing point of discharged battery	—5°F.	+5°F.

KEEP BATTERY CHARGED IN COLD WEATHER

A temperate climate is one in which freezing of water may occur.

A tropical climate is one in which water never freezes.

CAUTION

Never allow a flame or spark to be brought near the battery vent openings. Hydrogen gas, which forms in normal battery operation, may be present and explode. If it is ever necessary to use a flame near a battery, just remove the filler caps and blow out cells gently enough to avoid splashing the acid.

29. TESTING BATTERY.

The battery should be checked periodically with a hydrometer. The readings illustrated under Cold Weather Care show charge conditions. When reading a hydrometer, hold the barrel in a vertical position with sufficient amount of acid in it to lift the float freely. Take the reading at eye level disregarding the curvature of the liquid at the edges. The reading of a hydrometer will vary with temperature variations.

A hydrometer reading of a cell with the electrolyte temperature of above 80°F. will indicate less than the reading with the electrolyte at 80°F. The opposite holds true where the temperature of the electrolyte is below 80°F.

Hydrometer floats are calibrated to indicate a correct reading at one temperature, 80°F. In addition to the periodical hydrometer check, a high rate discharge test should be made to ensure that the battery is in operating condition and able to supply the necessary current.

30. CORRODED BATTERY TERMINALS.

All battery terminals should be periodically removed, thoroughly cleaned, refitted and coated with vaseline to retard corrosion, this applies especially to the positive earth return connections. It is important that all battery connecting terminals remain tight, otherwise trouble will be experienced with light bulb filaments burning out and possible damage to the electrical system.

31. ELECTRIC WINDSHIELD WIPER.

The wiper motor is fitted on the inside of the right hand cowl panel, and in front of the instrument panel. The wiper motor is operated by a switch situated at the right hand underside of the instrument panel. Dual arms are fitted as special equipment.

SERVICE DIAGNOSIS

Motor will not operate.

Possible Causes.

(a) Brush holders shorting to cover.
(b) Broken field wire open circuit.
(c) Armature spindle seized.
(d) Armature fouling field coil or cover.
(e) Armature or commutator burned out or shorting.
(f) Brush spring weak or burnt.
(g) Gears seized or broken.
(h) Broken or jammed crank link.

Remedies.

(a) Align brush holders clear of cover.
(b) Check field current. Test series windings, trace and repair.
(c) Refit armature spindle in bearing.
(d) Align field and cover to armature.
(e) Replace armature or commutator.
(f) Replace with new springs.
(g) Fit new gears.
(h) Replace crank wheel or refit crank.

Motor Noisy.

Possible Causes.

(a) Armature spindle loose in bearing.
(b) Brushes not seating properly.
(c) Dry armature bearing.
(d) No thrust washer on armature spindle.

Remedies.

(a) Replace and fit complete body.
(b) Reseat brushes and clean commutator.
(c) Lubricate bearing with grease.
(d) Fit new thrust washer.

Wiper Arm Spindle does not operate while motor is running.

Possible Causes.

(a) Broken rack or crank link.
(b) Broken or stripped gears.
(c) Stripped front plate spindle.
(d) Link pin disengaged from crank.
(e) Distorted front plate.

Remedies.

(a) Replace with new parts.
(b) Replace faulty parts.
(c) Replace front plate assembly.
(d) Refit wiper arm crank.
(e) Replace with new front plate.

Wiper Motor runs intermittently (dead spots).

Possible Causes.

(a) Series field wire shorting to cover.
(b) Field out of alignment with armature.
(c) Armature spindle fitted too tight in bearing.
(d) Brushes not seating properly or out of alignment.
(e) Shunt wire of field broken.
(f) Commutator segments shorting across slots.
(g) Broken armature wire.
(h) Tight or eccentric gears.
(i) Pin in crank wheel fouling front plate.

Remedies.

(a) Check wire insulation.
(b) Align field or cover with armature.
(c) Free armature spindle in bearing.
(d) Reseat brushes and align.
(e) Repair field wire.
(f) Clean out commutator slots.
(g) Repair or replace armature.
(h) Replace faulty gears.
(i) Replace crank wheel.

33. RADIO.

General instructions for the installation of MOPAR radio equipment are furnished with each set.

By carefully following them in every detail, the best radio performance will be assured with a minimum amount of installation labour.

34. HORN.

Description.

The horn is of a diaphragm type based on the electrical vibrator mechanism. The note or tone of the horn is developed by the diaphragm which causes the centre disc to resonate, thus producing a high pitch note.

35. HORN ADJUSTMENT.

(Refer Figures 31 and 32).

(1) Remove the centre disc "A", centre adjusting screw "B" and lock nut "C". See Figure 31.
(2) Adjust the humming or starting current by means of screw "D" and lock nut "E" located on back of body (Figure 32). The note should be smooth and clear when correctly set and the current and voltage should correspond with the following table:
(3) Re-assemble the centre disc, screw and lock nut and adjust the horn until a clear note is produced. Lock adjusting nut tightly and recheck current consumption with the following table:

36. OPERATION.

	Volts.	Amps.
(1) Humming or starting test without centre disc, screw and nut	12	5
(2) Tone setting and final test centre disc, screw and nut fitted	12	3

37. TESTING EQUIPMENT.

Comprises a voltmeter 0-20 volts and an ammeter 0-20 amps. connected to flexible leads. Suitable clips should be soldered to one end of each lead.

38. SERVICE DIAGNOSIS.

If the horn does not function properly after carrying out instructions in Horn Aljustments, Para. 35, the following points should be checked to locate the cause of the failure:
(1) Incorrect voltage and current. Both ratings should correspond to the test setting data in the foregoing paragraph when measured at the horn terminals.
(2) Loose electrical connectors.
(3) Loose adjusting screw "D" (Figure 32).
(4) Loose flange screws and nuts.
(5) Loose resonator disc "A" (Figure 31).
(6) Leaking or broken gasket.

39. SPARK PLUGS.

To obtain the maximum efficiency from the engine it is important that the sparking plugs are kept clean and the correct gap maintained. Too wide a gap reduces engine power and too narrow a gap causes uneven running at idling speeds.

Spark plugs should be cleaned frequently by sand blasting and regapped as necessary. In addition, the electrodes and the porcelains should be cleaned every 2,500 to 3,000 miles. Even though a protective hood is used, a coating may accumulate on the porcelains which will affect engine performance.

After cleaning the spark plugs, adjust the gap to .030 inches, using a round feeler gauge. Make all adjustments on the side wire of the plug. If the centre electrode is bent the porcelain may crack, resulting in plug failure.

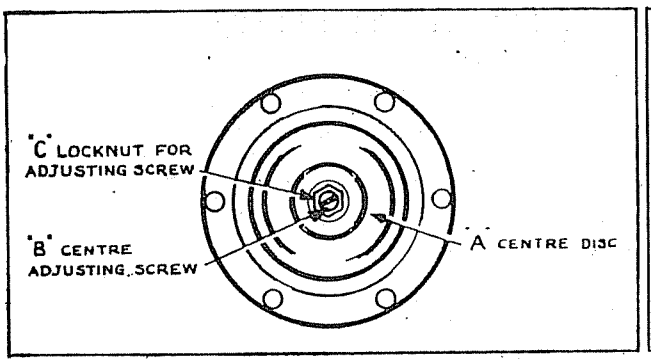

Fig. 31.

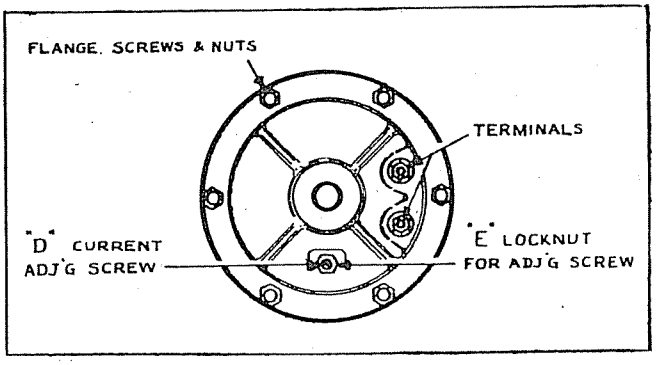

Fig. 32.

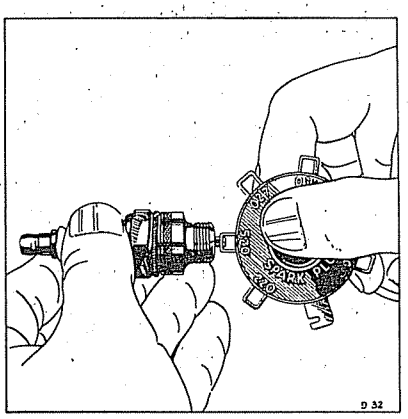

Fig. 33—Measuring Spark Plug Adjustment with Gauge.

The spark plug should be tested occasionally with a reliable tester and replaced if faulty. To ensure maximum efficiency, replace the plugs at reasonable intervals, using the same type, and make as originally installed at the factory.

When installing spark plugs, tighten them with a torque wrench from 30 to 32 foot pounds.

40. AIMING HEADLIGHT BEAM.

The vehicle should be placed without load on a level surface, with the headlights located 25 feet from a light coloured wall.

A horizontal line "A" (Figure 34), should be drawn on the surface at a height 3 inches below the headlight centres. The centre point "B" should be located on this line by sighting through the centre of the rear window of the vehicle and in line with the ornament on the engine hood and the windshield centre strip. Using this as a centre point, two vertical lines, C and D, should be drawn at equal distance from the centre point. The distance between these lines should equal the distance between the centres of the headlights. These two lines will be immediately ahead of and in line with the headlights.

Sometimes it is difficult to place the truck on a level floor for locating the horizontal line and aiming the lights.

If such a condition exists, locate the line in this manner.

Mark two sticks or rods. Each mark should be exactly the same distance from one end of each stick as from the floor up to the centre of the headlight. Then, stand both sticks against the fenders (one front and one rear) or in the case of the larger truck, where no rear fender is fitted, stand the stick perpendicular at approximately the rear axle centre line. Stand back from the rear stick and sight forward at the mark on each stick (in a manner similar to sighting a gun). Have a helper mark the point where your sight strikes the wall. Then, move the sticks to the other side of the truck, repeat the sighting and mark another spot on the wall at the end of the line of vision. Measure 3 inches downwards from these marks and connect the two low marks with a straight line. This lower horizontal line will be exactly the right height. It will also be parallel to the plane of the headlight

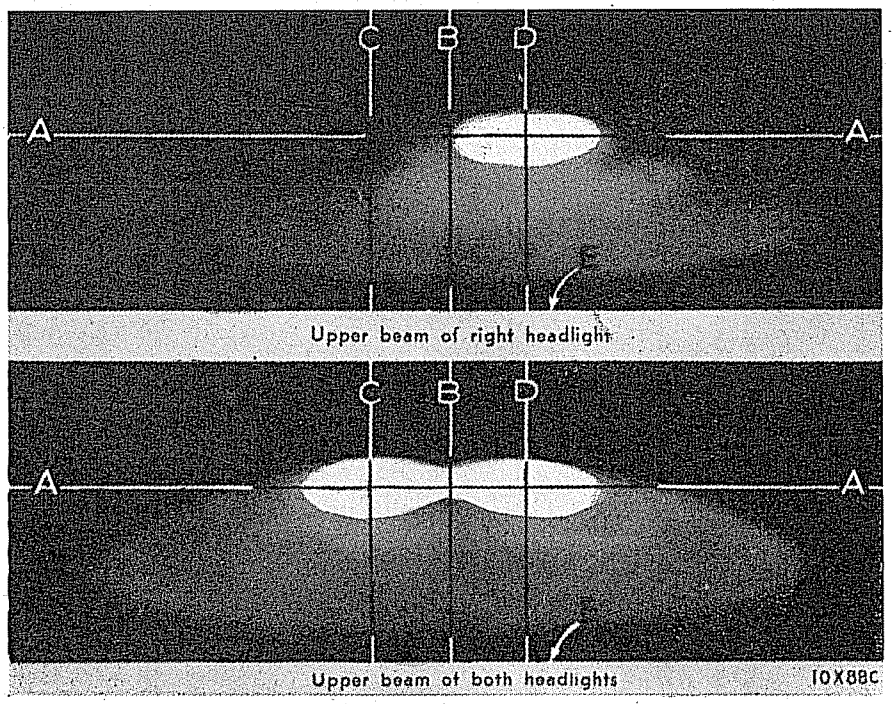

Fig. 34—Light Reflections from Properly Aimed Headlights.

filaments, regardless of whether the truck is standing up grade or down grade, or whether the wheels on one side are higher than the wheels on the other side.

The intersections of the horizontal line and the two vertical lines (Figure 34) are directly ahead of the light filaments and should mark the centre of the bright spot of each light. Cover one headlight and adjust the other headlight, then cover the properly adjusted light and adjust the one which was covered.

Adjustment should be made with the high beam turned on. The lower or "dipped" beam will be in the proper position. The lower beam must not be used when aiming headlight beams.

To adjust headlight beams, proceed as follows:

(1) To raise or lower the beam, turn the adjusting screw in the centre at the top of the headlight frame.

(2) To move the beam to the left or right, turn the adjusting screw at the side of the headlight frame.

NOTE—In most cases, headlights should be aimed as shown in Figure 34. When State laws differ from these specifications, however, lights should be aimed to conform with such laws.

SECTION 8

COOLING SYSTEM

SERVICE BULLETIN REFERENCE

NUMBER	DATE	SUBJECT	CHANGES

NOTES

COOLING SYSTEM

SERVICE STANDARDS

Model Designation. →	1-08AD 1-08AF 1-08AS	2-26AD 2-26AF 2-26AS	2-33AD 2-33AF 2-33AS	3-59AD 3-59AF 3-59AS	6-71AD 6-71AF 6-71AS	8-65AD 8-65AF 8-65AS	8-71AD 8-71AF 8-71AS	8-71AD-D 8-71AF-D 8-71AS-D
Capacity (Imp. Gallons)	4	4	4	4	4	4	4	3½
Radiator outlet, Upper-inside dia.	1½″	1½″	1½″	1½″	1½″	1½″	1½″	1½″
Length	3¾″	3¾″	3¾″	3¾″	3¾″	3¾″	3¾″	3¾″
Radiator outlet, Lower-inside dia.	1½″	1½″	1½″	1½″	1½″	1½″	1½″	1½″
Length	6¾″	6¾″	6¾″	6¾″	6¾″	6¾″	6¾″	6¾″
Radiator inlet, Inside dia. ..	1¾″	1¾″	1¾″	1¾″	1¾″	1¾″	1¾″	1¾″
Length	Moulded	Moulded	Moulded	Moulded	Moulded	Moulded	Moulded	Moulded
Temperature when thermostat starts to open	157° to 162° F.	157° to 162° F.	157° to 162° F.	157° to 162° F.	157° to 162° F.	157° to 162° F.	157° to 162° F.	—
Temperature when thermostat is fully open	183° to 187° F.	183° to 187° F.	183° to 187° F.	183° to 187° F.	183° to 187° F.	183° to 187° F.	183° to 187° F.	—
Water Pump—Shaft end play	.002″ to .004″	.002″ to .004″	.002″ to .004″	.002″ to .004″	.002″ to .004″	.002″ to .004″	.002″ to .004″	.030″ max.
Location of drain cock and plugs—all models	Lower right of radiator and lower left hand side of water jacket, left hand side of engine.*							

*Drain cocks are situated on either side of the diesel engine.

TIGHTENING REFERENCE

Part Name	Torque (foot pounds)
Fan attaching screw	10 to 15
Water outlet elbow stud	25 to 30
Water outlet elbow cap screw	25 to 30
Water pump assembly to cylinder block studs.....	25 to 30

COOLING SYSTEM

REMOVAL, INSTALLATION AND MAINTENANCE

Except Model 8-71A-D

1. REMOVAL AND INSTALLATION OF RADIATOR ASSEMBLY.

(1) Remove hood and drain cooling system.

(2) Disconnect the inlet and outlet hoses.

(3) Remove the six support studs.

(4) Lift the radiator assembly up and out.

When the radiator is assembled, connect the hoses, close the drain valves and refill the system with the proper amount of coolant.

2. REMOVAL OF WATER PUMP.

(1) Drain the cooling system.

(2) Loosen the generator pivot bolt and remove fan belt.

(3) Disconnect water pump by-pass hose if so equipped and engine inlet hose.

(4) Remove cap screws which hold pump body to cylinder block and lift out water pump assembly.

(5) Remove fan blades, pulley (and by-pass elbow is so equipped).

When assembling, remove all traces of old gasket and carefully clean the faces of the pump and cylinder block. After assembly, adjust the fan belt, lubricate the water pump (refer Lubrication Section) and fill the cooling system.

3. DISASSEMBLY AND ASSEMBLY OF WATER PUMP.

(1) Remove fan pulley hub pin and hub.

(2) Remove bearing lock ring.

(3) Remove water pump body back plate.

(4) Remove impeller. Drive impeller shaft out through the front of pump housing.

When assembling the pump, use a new hub and impeller because the bore of the old hub and impeller may be distorted. Intal the hub so that it is flush with the shaft.

After new parts have been installed in a new impeller, face the pump body (Figure 2).

The tool has cutters on both ends (one for roughing and the other for finishing). The shaft of the pump should be used as a pilot for the tool. After facing the pump body, press the new impeller with new seal parts on to the water pump shaft. Then, by looking in the water inlet, check the clearance between the seal washer and washer lock ring. This clearance should be $\frac{3}{32}$ inch. It is controlled by pushing the impeller on the shaft until the correct clearance is obtained.

When lubricating the pump, rotate the shaft to ensure complete lubrication. Make sure the grease vent holes are open.

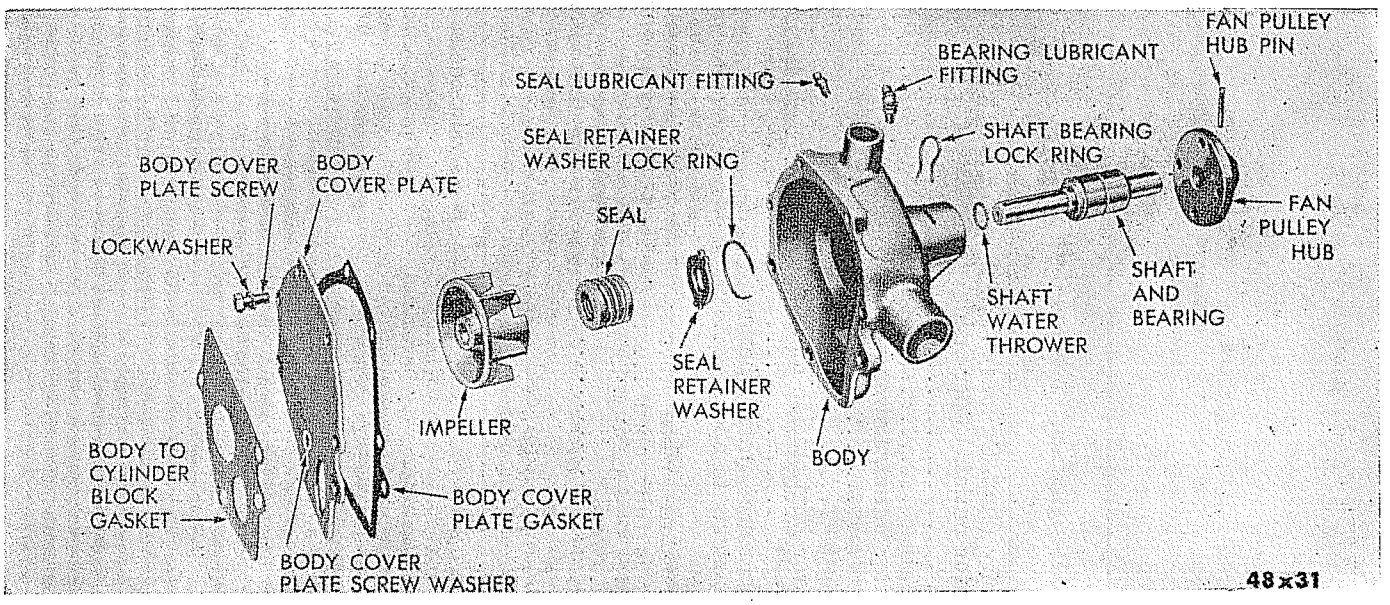

Fig. 1—Water Pump Except 8-71A-D

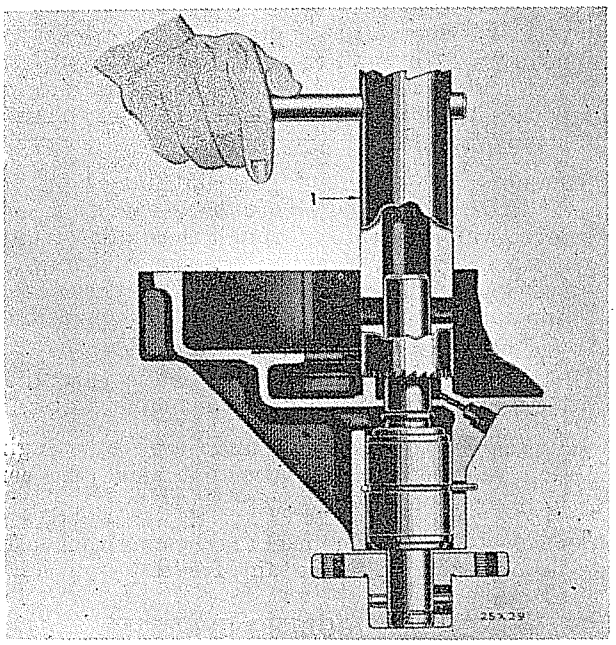

Fig. 2—Refacing Water Pump Housing.

1 — Tool C551.

4. REMOVAL AND INSTALLATION OF THERMOSTAT.

The thermostat, in the cylinder water outlet elbow prevents water circulation through the radiator until the engine reaches its normal operating temperature.

The thermostat has four by-pass ports (3), Figure 3. It is important that these ports be in the proper position. The thin bridges that divide the ports should be in line with the front and rear of the truck. This will face the two wide faces to the left and right.

During the warming up period, water circulates through the cylinder block. The thermostat is designed to start opening from 157° to 162° F. The thermostat will be fully opened at 183° F.

To test the thermostat for correct opening, place the thermostat in a pail of water. Use an accurate thermometer for this test. Heat the water until the thermostat stars to open. The thermometer reading should be from 157° to 162° F. At 183° F. (thermometer reading) the thermostat should be wide open. The temperature at which the thermostat opens is very important, the thermostat should be tested whenever the cooling system is checked.

NOTE.—When the engine has been exposed to extreme freezing temperature, or has been overheated, be sure to test the thermostat. Excessive temperatures may cause the bellows of the thermostat to stay in the expanded position or wide open. If such is the case, replace the thermostat.

The thermostat cannot be adjusted or repaired. If the unit has failed, instal a new thermostat.

ADJUSTMENTS.

5. FAN BELT.

(1) Loosen generator pivot bracket bolt.
(2) Loosen adjustment locking nuts.
(3) Pull outward on generator with hand until fan belt is snug. While holding in this position, tighten the adjustment locking bolts and pivot bolts.

Under no circumstances should the fan belt be adjusted by moving the generator with a pry bar.

MAINTENANCE.

6. DRAINING THE COOLING SYSTEM.

To drain the radiator and cylinder block open the radiator drain cock situated at the bottom of the radiator outlet connection pipe on the right hand side of the radiator, and the cylinder water jacket drain tap at the lower edge of the water jacket on the left hand side of the engine. When draining water, both drain taps should be tested with a piece of wire to make sure the flow of water is not restricted by sediment which may have collected at the rear of the openings.

7. FLUSHING THE COOLING SYSTEM.

(1) Open radiator drain cock.
(2) Remove water hose from radiator inlet (top).

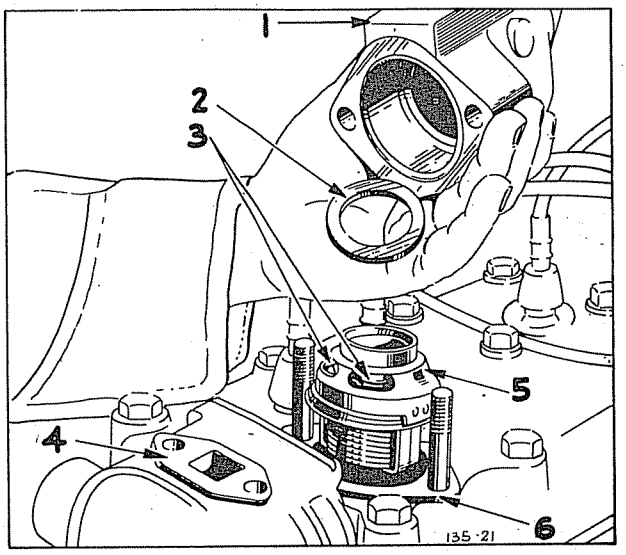

Fig. 3—Typical View of Thermostat.

1—Cylinder water outlet elbow, water pump by-pass elbow and hose
2—Thermostat gasket
3—Thermostat openings
4—Water pump by-pass elbow gasket
5—Thermostat
6—Cylinder water outlet elbow gasket

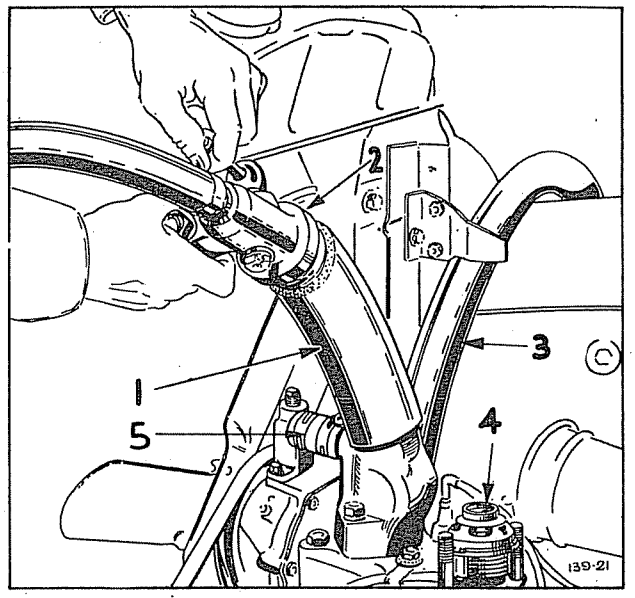

Fig. 4—Flushing Cylinder Block with Flushing Gun (Typical View)

1—Radiator inlet hose
2—Flushing gun
3—Water outlet hose
4—Thermostat removed
5—By-pass

(3) Remove cylinder head water outlet elbow from the cylinder head and take out the thermostat. Plug the by-pass elbow with a cork and instal elbow.

(4) Remove water hose from the radiator outlet bottom.

(5) Attach flushing gun to the hose on the engine water outlet elbow at the top of the cylinder head. (Figure 4).

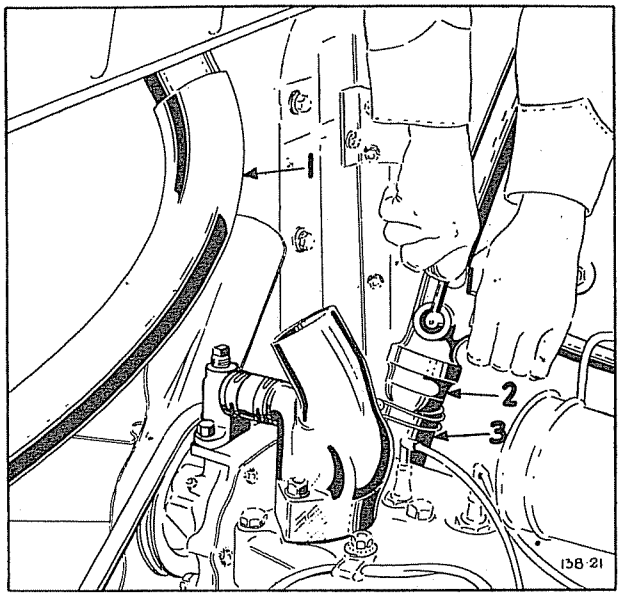

Fig. 5—Flushing Radiator with Flushing Gun

1—Water outlet hose
2—Flushing gun
3—Radiator outlet hose—lower

(6) Turn on the water supply and force the water downward through the cylinder block until the water jacket is cleaned. A pulsating flow of water will loosen sediment quicker than a steady flow.

(7) Remove the flushing gun and instal on the radiator outlet elbow (bottom of radiator) and force water upwards through the radiator until clean (Figure 5). When pressure flushing the cooling system, care should be taken not to apply excessive pressure to the system because of damaging the radiator.

Before applying any pressure, make sure there is a clear open outlet for the incoming water.

(8) Assemble the thermostat and hose to the engine and radiator, taking care to remove the cork or plug from the by-pass elbow.

(9) Inspect for water leaks at connection after filling with water or anti-freezing solution.

8. FILLING THE COOLING SYSTEM.

Use clean water and MOPAR Rust Resistor, or in winter MOPAR Anti-freeze, which has a freeze point below prevailing or anticipated minimum temperature. Bring the level of the liquid to approximately one inch below the bottom of the filler neck. Thus sufficient space is left so that subsequent expansion under heat will not raise the coolant level to the over-flow pipe. This is important in winter to prevent the loss of anti-freeze through the overflow pipe.

9. RUST RESISTOR.

MOPAR rust resistor is a fluid which should be added to the water in the cooling system to prevent the accumulation of rust and scale in the radiator and cylinder block. This rust inhibitor is not a rust remover, it is a rust preventative and should be added to the cooling system of new trucks and every time the cooling system is drained or flushed.

10. CYLINDER BLOCK DISTRIBUTOR TUBE.

The distributor tube directs the flow of coolant from the pump to the rear of the engine. Outlets in the tube are provided at each exhaust port so that the coolant will be directed against the valve seats which are the hottest parts of the engine. The tube is located between the cylinder and valve ports near the top of the cylinder block.

If the tube becomes corroded, rust will result, and overheating of the engine will occur, because the water will not be circulated properly through the cylinder block.

The tube should be pulled out and examined in conjunction with a water pump replacement or repair after the engine has had considerable service. It is good practice to always make replacement of the tube whenever an engine is completely overhauled in order to make sure the engine will be properly cooled.

Replacement of the tube requires the removal of the radiator except in conjunction with an engine repair out of chassis. The tube is readily accessible when the water pump is removed from the cylinder block and it is necessary to use a heavy hooked rod to withdraw the tube from the block. (Figure 6).

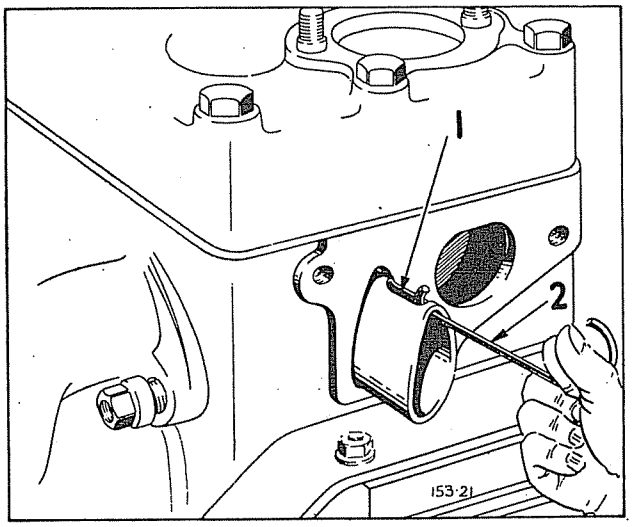

Fig. 6—Removing Cyclinder Block Water Distributor Tube.

1—Tube 2—Hook

When installing a new distribution tube the outside end should be flared and driven into the cylinder block until it is flush with the outer face of the block, but not beyond this point, because in such cases some amount of the coolant will by-pass between the tube and the pump opening.

11. WATER TEMPERATURE INDICATOR.

The temperature of the water in the cylinder block is indicated by a temperature gauge situated on the instrument panel.

The dial assembly of this unit is operated by a fluid that expands or contracts when heated. This fluid is enclosed in a bulb that is connected to the dial assembly by a thin (capillary) tube. The bulb is screwed into the water jacket of the cylinder block. If the unit fails to operate properly, or operate correctly, instal a new complete unit (tube, dial and bulb).

When working on the engine, or when removing the cylinder head, be careful not to damage the tube or bulb. Also avoid making sharp kinks in the tube.

SERVICE DIAGNOSIS

Conditions — Possible Causes — Remedies

12. EXTERNAL LEAKAGE.

Possible Causes.

a. Loose hose clamps.
b. Defective rubber hose.
c. Broken radiator seams.
d. Worn water pump.
e. Loose core hole plugs.
f. Damaged gaskets, or dry gaskets if engine has been stored.
g. Warped cylinder head.
h. Cracked cylinder head.
i. Cracked cylinder block.
j. Cracked thermostat housing (water outlet elbow).
k. Leak at water temperature indicator bulb (in head).
l. Leak at exhaust manifold centre studs (long).
m. Water pump attaching bolt leak—through hole into cylinder block water passage.

Remedies.

a. Inspect and tighten clamps. Replace if necessary.
b. Replace defective hoses.
c. Remove radiator and solder seams. Test radiator for possible leaks before installation.
d. Remove and recondition water pump.
e. Remove loose core hole plug, clean out hole and instal new plug.
f. Inspect for leaks at water pump, cylinder head, thermostat housing (water outlet elbow) and by-pass tube flange. Replace gaskets as required.
g. Replace cylinder head and gasket. Tighten bolts to specified torque and in sequence.
h. Replace cylinder head and tighten as outlined above.
i. Replace cylinder block.
j. Replace thermostat and housing.
k. Tighten nut or replace adaptor.
l. Remove long studs and coat with suitable sealing compound. Reinstal and inspect for leaks.
m. Remove bolts and coat with sealing compound, re-install and inspect for leakage.

13. INTERNAL LEAKS.

Possible Causes.

a. Warped cylinder head.
b. Blown cylinder head gasket.
c. Cracked cylinder wall.
d. Loose cylinder head bolts.
e. Cracked valve port.
f. Crack in cylinder block at valve chamber.

Remedies.

a. Replace cylinder head and gasket. Tighten bolts in sequence to required torque.
b. Replace gasket and tighten bolts as described above.
c. Replace cylinder block.
d. Tighten cylinder head bolts in sequence to specified torque.
e. Weld the crack in the valve port or replace the cylinder block.
f. Replace cylinder block.

14. OVERFLOW LOSS.

Possible Causes.

a. Refer to causes listed in paragraph 15.
b. Boiling (overheating).
c. Leak in cylinder head gasket.
d. Restricted radiator.
e. Overfilling.

Remedies.

a. Refer to remedies listed in paragraph 15 when Coolant level is low. Other causes are:
b. Common causes of overheating directly traceable to the cooling system are: clogging, improper circulation of coolant, or running engine when coolant level is low. Other causes are: incorrect ignition or valve timing, dragging brakes, overloading of truck, operating in heavy sand or mud, excessive engine idling, or operating under extreme conditions of heat and altitude.

Make sure fan belt is tight (properly adjusted), in good condition and not slipping. Be sure water pump impeller is operating. Impeller

pin may be sheared off. Inspect hose connections for tightness, hoses for plugging, collapsed condition, or damage. Test for plugged radiator and make certain outside of radiator is free from bugs, leaves, etc., that would restrict airflow. Check cylinder block for restricted distributor tube or passages.

c. Replace cylinder head gasket. If leak is internal, check oil for contamination. Drain, flush and refill to correct level.

d. Reverse flush radiator.

e. Fill radiator to approximately 1 inch below filler neck. Due to expansion within system, excess water is forced out of the overflow tube. This may give impression that a leak has developed in cooling system.

15. POOR CIRCULATION.

Possible Causes.

a. Restricted radiator core.

b. Restricted water jacket.

c. Restricted distributor tube.

d. Low coolant level.

e. Collapsed radiator hose.

f. Water pump impeller loose on shaft.

g. Fan belt loose.

h. Scale in cylinder block.

Remedies.

a. Drain and reverse flush radiator.

b. Drain system, disconnect radiator hoses and reverse flush cylinder block.

c. Remove distribution tube and inspect for rust, corrosion or restrictions in water outlet holes. Replace if necessary.

d. Refill radiator to approximately 1 inch below filler neck.

e. Replace radiator hose. Check clamps for fatigue. Replace as necessary.

f. Remove and recondition water pump.

g. Check driving surfaces of fan belt and tighten. If belt is frayed or checked, or greasy on the sides or bottom, replace and adjust.

h. Reverse flush cylinder block to correct this condition. After correction, use MOPAR Rust Resistor in system to prevent recurrence.

16. CORROSION.

Possible Causes.

a. Impurities in water.

b. Failure to use rust resistor in system.

c. Improper draining and service.

d. Air leaks in system.

Remedies.

a. Drain and flush radiator and cylinder block until clean. Refill system with clean water and add MOPAR Rust Resistor.

b. Drain and flush radiator and cylinder block until clean. Refill system with clean water and add MOPAR Rust Resistor.

c. When draining system, be sure that the drain cock in cylinder block is open. In severe cases of restriction, remove the drain cock to allow large particles of sediment to be washed out.

d. Tighten all hose connections. Check for possible leaks in cylinder head gasket. Inspect water level in system. If necessary, fill system to required level.

17. OVERHEATING.

Possible Causes.

a. Refer to causes listed in paragraph 15.

b. Excessive sludge in crankcase of engine.

c. Radiator core air passages plugged.

d. Obstruction in front of radiator.

Remedies.

a. Refer to remedies listed in paragraph 15.

b. Drain lubricating oil from crankcase. Refill to required level with light flushing oil. Then, operate engine at a low speed for about 15 or 20 minutes. Drain and refill crankcase with proper grade of oil. Refer to Lubrication Section in this manual. In severe cases of sludging, remove oil pan and clean inside of block by hand.

c. Thoroughly clean out the passages from the back of radiator core with air pressure.

d. Remove any obstruction that may block entry of air to radiator.

18. OPERATING FACTORS THAT MAY CAUSE HIGHER THAN NORMAL WATER TEMPERATURE.

a. Incorrect ignition timing.

b. Incorrect valve timing.

c. Low oil level.

d. Tight engine.

e. Defective heat control valve.

f. Clogged, defective muffler or exhaust pipes.

g. Dragging brakes.

h. Overloading truck.

i. Driving in heavy sand or mud.

j. Engine labouring on grades.

k. Excessive engine idling.

l. "Stop" and "go" operation.

Remedies.

a. Check ignition timing and adjust as needed.

b. Check valve timing and adjust as required.

c. Inspect condition of oil. Drain and refill to proper level, if necessary.

d. Use extreme care during engine "break-in." Drive as recommended in Driver's Manual—at moderate speed not too slow. Check oil and water levels often and add water or oil as needed.

e. Replace heat control valve spring and inspect valve stop for wear or damage. Replace stop if necessary.

f. Check exhaust system for restriction or rust. Replace parts as needed.

g. Correct "dragging brakes" as outlined in Brakes Section in this manual.

h. Avoid overloading truck.

i. When operating in sand or mud, watch temperature indicator and drive with care to avoid overheating engine.

j. To avoid engine lugging or labouring on grades, shift as recommended in Driver's Manual.

k. Avoid excessive engine idling.

l. Watch water temperature indicator during excessive "stop" and "go" driving to avoid engine overheating.

19. OVERCOOLING.

Possible Causes.

a. Defective thermostat.

b. Inaccurate temperature gauge.

Remedies.

a. Check thermostat for operation, and replace as necessary.

b. Check water temperature gauge and replace as needed.

NOTES

NOTES