ALTERNATOR MODEL 11AC

1. DESCRIPTION

The alternator is shown dismantled in Fig. 1 (note that some machines are mounted by the drive end bracket only).

The stator comprises a 24-slot, 3-phase star-connected output winding on a ring-shaped lamination pack, housed between the slip-ring end and drive end brackets. The rotor is of 8-pole construction and carries a slip-ring fed rotor (field) winding. It is supported by a ball-bearing in the drive end bracket and a needle roller bearing in the slip-ring end bracket.

The brushgear for the field system is mounted on the slip-ring end bracket. Two carbon brushes bear against a pair of concentric brass slip-rings carried on a moulded disc attached to the end of the rotor.

The slip-ring end bracket also carries six silicon diodes connected in a 3-phase bridge circuit to give rectification of the generated a.c. output (see Fig. 2).

The diodes and stator windings are cooled by airflow through the alternator induced by a ventilating fan at the drive end.

A plastic strip — coloured either yellow, red or black — is attached to the output terminal of earth return machines and to each of the output terminals on insulated-return units. Each strip carries the polarity symbol or colour coding of its associated terminal. The strip was coloured yellow on all early production machines but units now being produced have a black-coloured strip to denote that the machine is to be employed on the positive-earth system only and a red strip for the negative earth system. There are one of each of these strips on insulated-return machines.

Output Control

The alternator output is controlled by an electronic voltage regulator unit (see Part B).

Field Isolating Device

The voltage regulator and the alternator rotor winding are isolated from the battery when the engine is stationary. With petrol-engined vehicles this is achieved either by a special double-pole ignition switch or by the normally-open contacts of a model 6RA relay whose operating coil is fed from a standard ignition switch. Low voltage relays, designed to operate at about 3 volts, are sometimes used with diesel-engined vehicles. In this application, the operating coil is energised from the mid-point of one pair of alternator diodes. With any arrangement the contacts are connected directly to the battery (or to the ammeter, when this is fitted) since the alternator output must respond to changes in battery voltage and not to conditions occurring elsewhere in the system.

Warning Light Control

A further terminal, marked 'AL', is provided for use with a warning light control (see Part K).

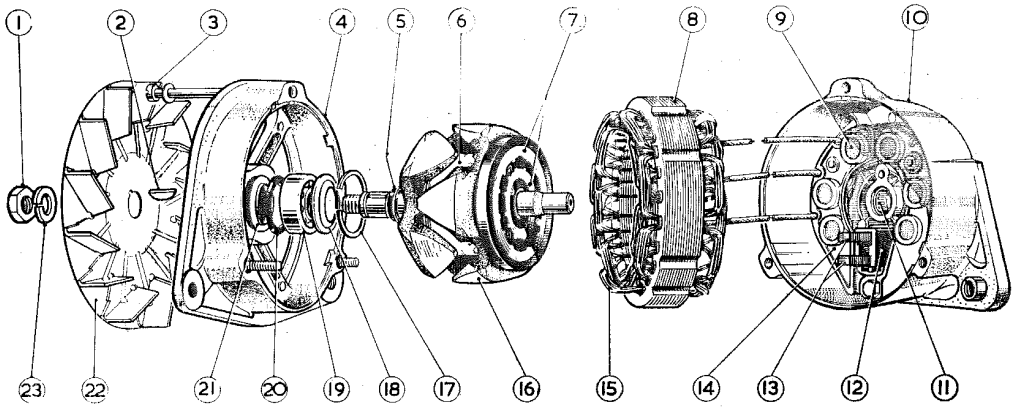

Fig. 1 Alternator model 11AC, dismantled

1 Shaft nut
2 Key
3 Through fixing bolts (3)
4 Drive end bracket
★ 5 Jump ring shroud (earlier models only)
6 Rotor (field) winding
7 Slip rings
8 Stator laminations
9 Silicon diodes (6)
10 Slip-ring end bracket
11 Needle roller bearing
12 Brush box moulding
13 Brushes
14 Diode heat sink
15 Stator winding
16 Rotor
17 Circlip
18 Bearing retaining plate
19 Ball bearing
20 'O' ring oil seal
21 'O' ring retaining washer
22 Fan
23 Shaft washer

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Alternator Model 11AC

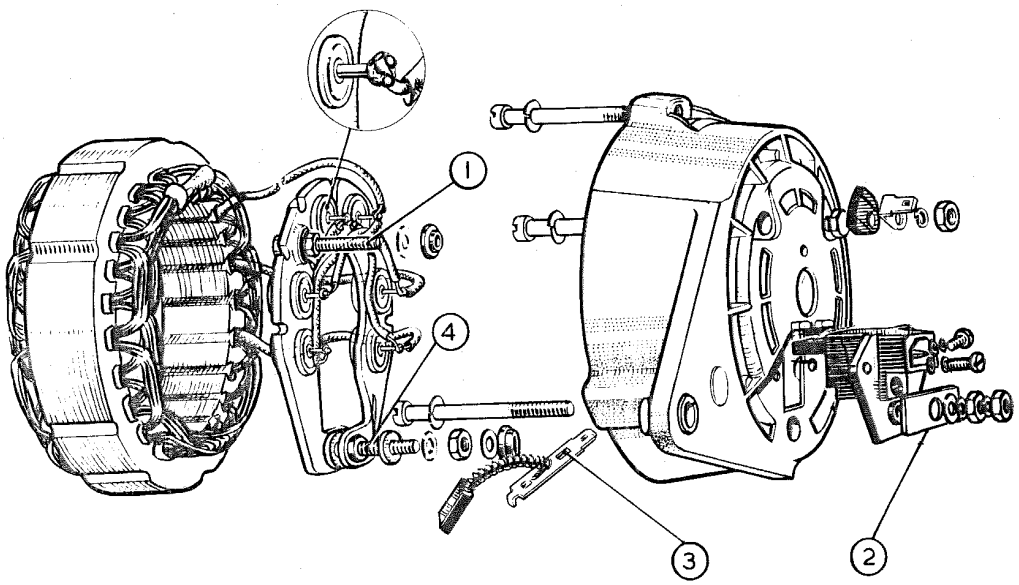

Fig. 2 Slip-ring end, showing heat sinks withdrawn

1 Warning light terminal 'AL'
2 Output terminal plastic strip
3 Terminal blade retaining tongue
4 Output terminal

2. ROUTINE MAINTENANCE

(a) Cleaning

Wipe away any dirt or oil which may collect around the slip-ring end cover ventilating apertures.

(b) Belt Adjustment

Occasionally inspect the driving belt, for wear and tension. Refer to the vehicle manufacturer's handbook for the correct method of adjusting belt tension.

Important. To avoid bearing damage when adjusting belt tension, apply leverage **only** on the alternator drive end bracket, **not** on any other part of the alternator. The lever should be a soft material preferably wood.

(c) Lubrication

The bearings are packed with grease during assembly and do not require periodic attention.

(d) Terminal Connexions

Make sure that all terminal connexions are tight.

3. TECHNICAL DATA

(i)	Nominal voltage	12	24
(ii)	Nominal d.c. output (hot) in amperes	43	23
(iii)	Resistance of rotor winding in ohms at 68°F (20°C)	3.8 ±5%	10.3 ±5%

Data Common to 12 and 24-volt alternators

(iv)	Maximum permissible rotor speed in rev/min	12,500
(v)	Rotation	Either, with suitable fan
(vi)	Stator phases	3
(vii)	Stator connexion	Star
(viii)	Number of rotor poles	8
(ix)	Number of rotor windings	1
(x)	Brush spring tension with brush face flush with brushbox housing	8–16 oz (227–454 g)

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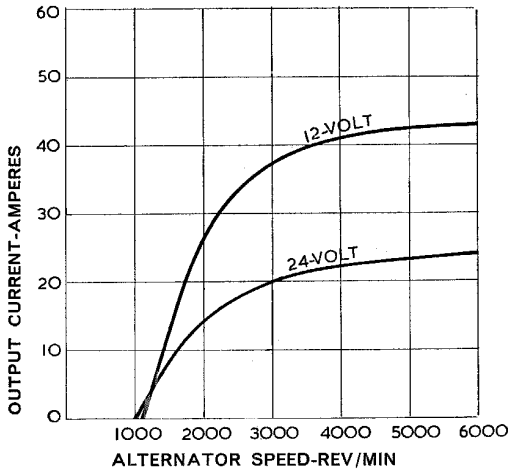

Fig. 3 Typical performance curve (alternator hot)

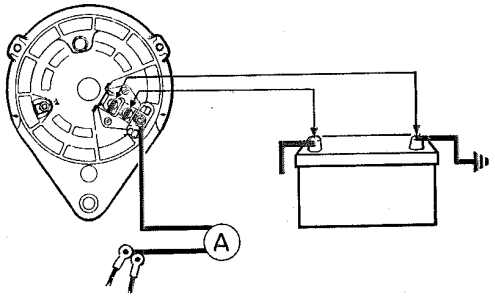

Fig. 4 Alternator output test-wiring connexions

4. SERVICING

WARNING: **The alternator must never be run on open circuit with the field winding energised, otherwise the rectifier diodes may be damaged.**

(a) Testing the Alternator in Position

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

Inspect the driving belt for wear and tension.

Start the engine and check that battery voltage is being applied to the rotor winding by connecting a voltmeter between the cable ends normally attached to the field terminals. Stop the engine.

Disconnect the battery earth cable.

★ If an ammeter is not fitted to the vehicle, disconnect the cable(s) from the alternator output terminal including (when fitted) the suppression capacitor connexion. Connect a good-quality moving-coil ammeter of appropriate range between the output terminal and the disconnected cable(s) excluding the capacitor connexion.

Withdraw the cables from the alternator field terminals and, using a suitable pair of auxiliary cables, connect these terminals directly to the battery. For this test polarity matching is unimportant. Fig. 4 shows the alternator output test circuit.

Re-connect the battery earth lead. Start the engine and slowly open the throttle until the alternator speed is approximately 4,000 rev/min. At this speed the reading on the ammeter should be approximately 40 amperes (12-volt) or 22 amperes (24-volt).

If a zero reading results, stop the engine and disconnect the cables from the field terminals. Withdraw the two brushbox moulding retaining screws and remove the brushgear for examination as described in 4c. Fit new brush and spring assemblies if necessary and retest the alternator output. If the zero reading persists, the alternator must be removed from the engine and dismantled for detailed inspection (see 4b).

A low output current reading will indicate either a faulty alternator or poor circuit wiring connexions. Check the latter while keeping the

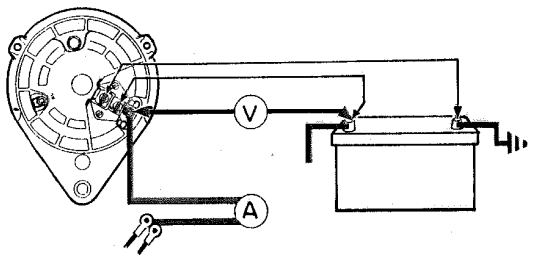

Fig. 5 Charging circuit voltage drop testing (insulated side)

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alternator connected and running as described above; connect a good-quality voltmeter — of low range if available — between the alternator output terminal and the battery insulated terminal (see Fig. 5) and note the voltmeter reading.

Now transfer the meter connexions to the alternator frame and battery earth terminal, Fig. 6, and again note the reading.

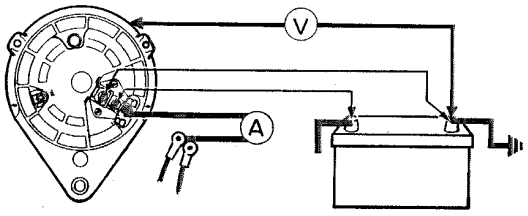

Fig. 6 Charging circuit voltage drop testing (earth side)

If either of these readings exceed 0.5 volt there is high resistance in the charging circuit which must be traced and remedied.

If, however, these tests show that there is no undue resistance in the charging circuit (although output is low) proceed to dismantle the alternator as described below.

(b) Dismantling the Alternator

Disconnect the battery and alternator cables and remove the alternator from the vehicle.

From the drive end remove the shaft nut, spring washer, pulley and fan.

Unscrew and withdraw the three 'through' bolts.

Mark the drive end bracket, lamination pack and slip-ring end bracket to facilitate reassembly in correct angular relation to each other.

Withdraw the drive end bracket and rotor from the stator. The drive end bracket and rotor need not be separated unless the drive end bearing requires examination or the rotor is to be replaced. In this event the rotor should be removed from the drive end bracket by means of a hand press, having first removed the shaft key.

From the slip-ring end bracket remove the terminal nuts, washers, insulating pieces, brushbox screws and the 2BA hexagon-headed bolt. With earlier units take care not to misplace the two washers fitted between the brushbox moulding and the end bracket.

Withdraw the stator and heat sink assemblies from the slip-ring end bracket.

Close up the retaining tongue at the root of each field terminal blade and withdraw the brush-spring-and-terminal assemblies from the moulded brushbox.

(c) Inspection of Brushgear

The brush length when new is $\frac{5}{8}$″ (15.9 mm). ★ The serviceability of the brushes may be gauged by measuring the amount by which they protrude beyond the brushbox moulding when in the free position. For a brush to remain serviceable the amount protruding should exceed 0.2″ (5 mm). Renew brush assemblies if the brushes are worn to or below this length. The new brush is supplied complete with brush spring and "Lucar" terminal blade and has merely to be pushed in until the tongue registers. To ensure that the terminal is properly retained, carefully lever up the retaining tongue with a fine screwdriver, so that the tongue makes an angle of about 30° with the terminal blade.

Check the brush spring pressures using a push-type spring gauge. ★ Push each brush in turn back against its spring until the brush face is flush with the housing. The gauge should then indicate 8–16 oz. (227–454 g). Replace a brush assembly which gives a reading appreciably outside these limits where this is not due to the brush movement being impeded for any reason.

Check that the brushes move freely in their holders. If at all sluggish, clean the brush sides with a petrol-moistened cloth or, if this fails to effect a cure, lightly polish the brush sides on a smooth file. Remove all traces of brush dust before re-housing the brushes in their holders.

Note: The brush which bears on the inner slip-ring is always associated with the positive pole of the electrical system, since the lower linear speed of the inner ring results in reduced mechanical wear and helps to offset the higher rate of electrical wear peculiar to the positive-connected brush.

(d) Inspection of Slip-rings

The surfaces of the slip-rings should be smooth and uncontaminated by oil or other foreign matter. Clean the surfaces using a petrol-moistened cloth, or if there is any evidence of burning, very fine glass-paper. On no account must emery cloth or similar abrasives be used. No attempt should be made to machine the slip-rings, as any eccentricity in the machining may adversely affect the high speed

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performance of the alternator. The small current carried by the rotor winding, and the unbroken surface of the slip-rings mean that the likelihood of scored or pitted slip-rings is almost negligible.

(e) Rotor

Test the rotor winding by connecting either an ohmmeter (Fig. 7) or the appropriate battery supply (Fig. 8) between the slip-rings.

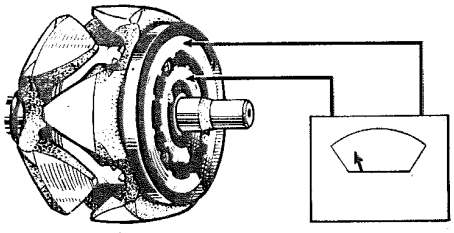

Fig. 7 Measuring rotor winding resistance with ohmmeter

The reading of resistance should be as given in 3(iii). If the alternative test has been made, the value of the current should be approximately 3.2 amperes (12-volt) or 2.3 amperes (24-volt).

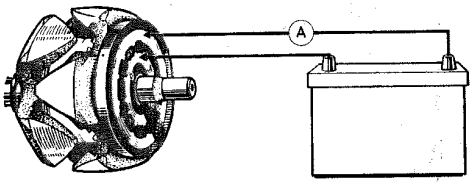

Fig. 8 Measuring rotor winding resistance with battery and ammeter

Test for defective insulation between one of the slip-rings and one of the rotor poles using a 110-volt a.c. mains supply and a 15-watt test lamp (Fig. 9). If the lamp lights, the coil is earthing and a replacement rotor/slip-ring assembly must be fitted.

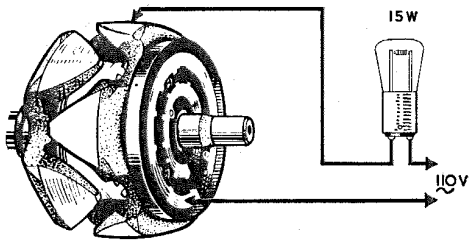

Fig. 9 Insulation test of rotor winding

No attempt should be made to machine the rotor poles or to straighten a distorted shaft.

(f) Stator

Unsolder the three stator cables from the heat sink assembly, taking care not to overheat the diodes — (see 4h page 6). Check the continuity of the stator windings by first connecting any two of the three stator cables in series with a test lamp of not less than 36 watts and a 12-volt battery as shown in Fig. 10. Repeat the test, replacing one of the two cables by the third cable. Failure of the test lamp to light on either occasion means that part of the stator winding is open-circuit and a replacement stator must be fitted. ★

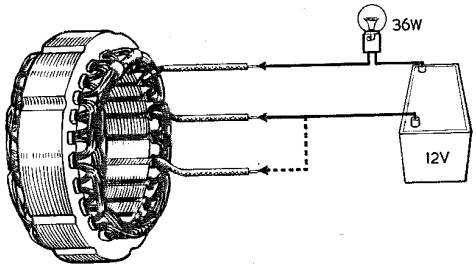

Fig. 10 Stator winding continuity test

Test for defective insulation between stator coils and lamination pack with the mains test lamp (see

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Fig. 11). Connect the test probes between any one of the three cable ends and the lamination pack. If the lamp lights, the stator coils are earthing and a replacement stator must be fitted.

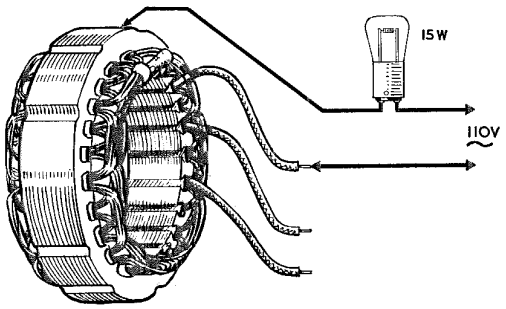

Fig. 11 Insulation test of stator windings

Before re-soldering the stator cable ends to the diode pins carry out the following test.

(g) Diodes

Each diode (whether on a 12-volt or 24-volt system) can be checked by connecting it in series with the 1.5-watt test bulb across a 12-volt d.c. supply and then reversing the connections (Fig. 12).

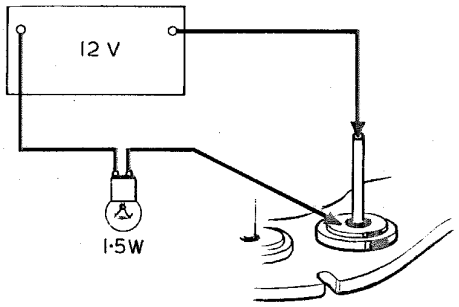

Fig. 12 Simple test for diodes

Current should flow, and the bulb light, in one direction only. Should the bulb light up in both tests or not light up in either, the diode is defective and the appropriate heat sink assembly must be replaced.

The above procedure is adequate for service purposes. Any accurate measurement of diode resistance requires factory equipment. Since the forward resistance of a diode varies with the voltage applied, no realistic readings can be obtained with battery-powered ohmmeters. However, should a battery-ohmmeter be used, a good diode will yield 'Infinity' in one direction, and some indefinite but much lower reading in the other.

WARNING: Ohmmeters of the type incorporating a hand-driven generator must never be used for checking diodes.

(h) Alternator Diode Heat Sink Replacement

The alternator heat sink assembly consists of two parts, one of positive polarity and the other negative (see Fig. 2). The positive portion carries three cathode base diodes marked red, and the negative portion three anode base diodes marked black. The diodes are not individually replaceable, but, for service purposes, are supplied already pressed into the appropriate heat sink portion.

When soldering the interconnexions, 'M' grade 45–55 tin-lead solder should be used.

Great care must be taken to avoid overheating the diodes or bending the diode pins. The diode pins should be lightly gripped with a pair of suitable long-nosed pliers (which act as a thermal shunt) and soldering must be carried out as quickly as possible. The operation is shown in Fig. 13. To facilitate cable positioning and the soldering operation the diode pins are bifurcated in later units. ★

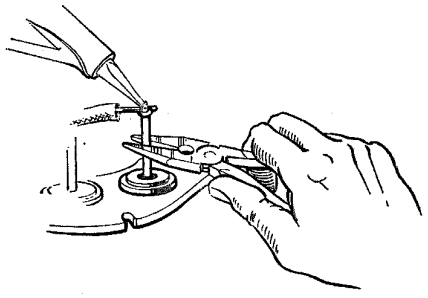

Fig. 13 Use of thermal shunt when soldering diode connexions

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After soldering, the connexions must be neatly arranged around the heat sinks, to ensure adequate clearance for the rotor, and be tacked down with 'MMM' EC1099 adhesive where indicated in Fig. 14. The stator connexions must pass through the appropriate notches at the edge of the heat sink.

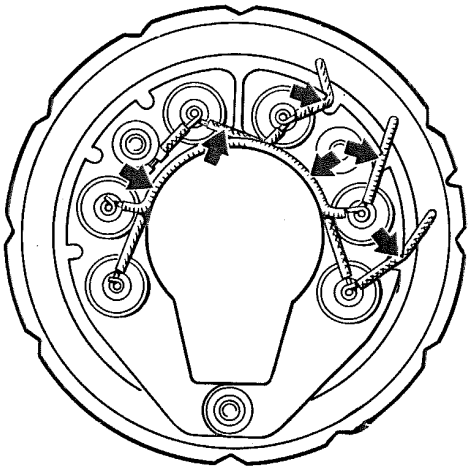

Fig. 14 Heat sink cable securing points

★ (j) Bearings

Bearings which are worn to the extent of allowing excessive side-movement of the rotor shaft must be renewed (Service replacement bearings are pre-packed with grease ready for use).

During reconditioning of the alternator, check the bearing lubricant and if necessary re-pack the original bearings with Shell Alvania 'RA' grease, or an equivalent lubricant.

Renewing the Bearings

The drive end ball-bearing is a press fit in the bracket and can be renewed by means of a wheel-operated, or power-assisted press. To renew the bearing, it will first be necessary to dismantle the bearing retaining plate which will be secured by screws, a circlip, or rivets. According to the method of fixing, remove the screws, file away the rivet heads, or insert the tip of a small screwdriver in the extractor notch and prise free the circlip from its groove. Assembling a new bearing into the bracket is simply a reversal of the dismantling procedure involved in removing the original bearing.

If the needle roller bearing in the slip ring end bracket needs to be renewed, first inspect the inside of the bracket and determine whether the bearing-housing incorporates a felt seal. If not, it is advisable to renew the bracket complete with bearing so that a bracket of improved design incorporating a felt seal is fitted. If the original bracket incorporates a felt seal, either the bracket complete with bearing can be renewed, or the bearing can be serviced separately. The bearing can be serviced by using a needle roller bearing kit (Lucas Pt. No. 54219553), comprising bearing, felt seal and associated assembly washers, as illustrated in Fig. 16.

In the case of brackets incorporating a felt seal, renewing the needle roller bearing is facilitated by using a specially designed and recommended jig and tool (Hartridge Cat. No. 99–70), manufactured and supplied by Leslie Hartridge Ltd., Buckingham, Bucks., England. The jig and tool (see Fig. 15 and 16) is used in conjunction with a wheel-operated, or power-assisted, press.

With the stator and heat sinks removed from the bracket, and using the recommended jig and tool, procedure for renewing the bearing is as follows:—

(i) Place the new felt seal in light oil and leave to soak.

(ii) Press out the old bearing assembly, using the smaller diameter of the punch supplied with the jig.

(iii) Locate the bracket on the jig and fit the new bearing on the spring loaded insert, as shown in Fig. 15.

(iv) Using the larger diameter of the punch, press the bearing into the housing. Ensure that the bearing is inserted to the full depth allowed by the jig, but avoid excessive pressure.

(v) Invert the bracket and place on the the jig, using the two small lugs for locating, as shown in Fig. 16.

(vi) Remove the felt seal from the oil.

(vii) Place felt seal and washers on bracket, as shown in Fig. 16.

(viii) Press the retaining washer into the housing, using the smaller diameter of the punch.

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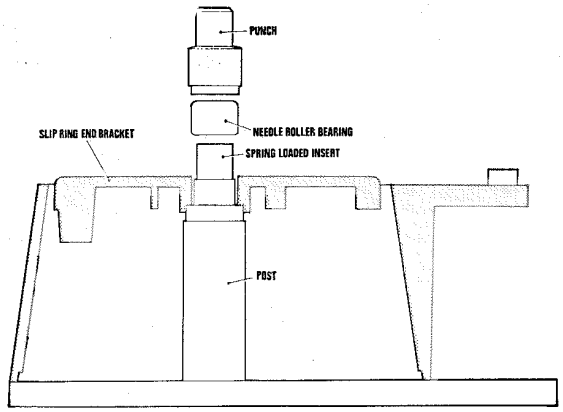

Fig. 15 Fitting the needle roller bearing in the slip ring end bracket

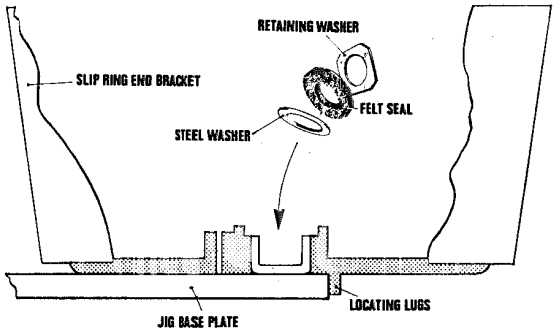

Fig. 16 Method of assembling the felt seal in the slip ring end bracket

(k) Reassembly

Reassembly of the alternator is the reversal of the dismantling procedure given in 4(b). Take care to align the drive-end bracket, lamination pack and slip-ring end bracket properly. Tighten the three 'through' bolts evenly. If the rotor and drive-end bracket have been separated, the inner journal of the drive-end bearing must be supported by a suitably-dimensioned tube for the re-assembling operation. Do not use the drive-end bracket as a support for the bearing while fitting the rotor.