

SECTION A-2

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LUCAS

Quality

EQUIPMENT

VOLUME 2

WORKSHOP INSTRUCTIONS

GENERATORS

MODELS

C39P, C39PV, C45P, C45PV, etc.



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LUCAS WORKSHOP INSTRUCTIONS

GENERATORS

MODELS C39P, C39PV, C45P, C45PV, ETC.

1. GENERAL

The generator is a shunt-wound two-pole two brush machine, arranged to work in conjunction with a compensated voltage control regulator unit (see SECTION F). On generators having the letter V in their model number, a fan, usually 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 other models are non-ventilated and will be found fitted to vehicles such as tractors which operate under severe service conditions.

The chief points of difference between the various models are tabulated below for reference.

- C39P: 3.9 inch diameter, non-ventilated machine. Standard finish. Ball bearing at driving end of armature and porous bronze bush at commutator end.
- C39P-2: Similar to and supersedes model C39P.
- C39PV: Ventilated machine. Otherwise similar to model C39P.
- C39PV-2: Supersedes model C39PV and has slightly higher maximum output.
- C45P: 4.5 inch diameter, non-ventilated machine. Standard finish. Ball bearing at driving end of armature and porous bronze bush at commutator end.
- C45P-5: Similar to and supersedes model C45P.
- C45PV-4: Ventilated machine. Otherwise similar to model C45P.
- C45PV-5: Supersedes model C45PV-4 and has slightly higher maximum output.
- C45PVB: Ventilated machine, standard finish, with ball bearing at both ends of armature shaft.
- C45PVB-5: Supersedes model C45PVB and has slightly higher maximum output.
- C45PVS: Special finish, but otherwise similar to model C45PVB.
- C45PVS-5: Special finish, but otherwise similar to model C45PVB-5.

CONTROL BOXES

The control boxes, models RF95, RF96 and RF97 (see SECTION F), may be used in conjunction with any of these generators. On the other hand control boxes, models RB106-1 and RB106-2, may be used only in conjunction with the latest ventilated generators, models C39PV-2, C45PV-5, C45PVB-5 and C45PVS-5; if these control boxes are used with any other generators there will be a risk of burning out the armature windings.

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.

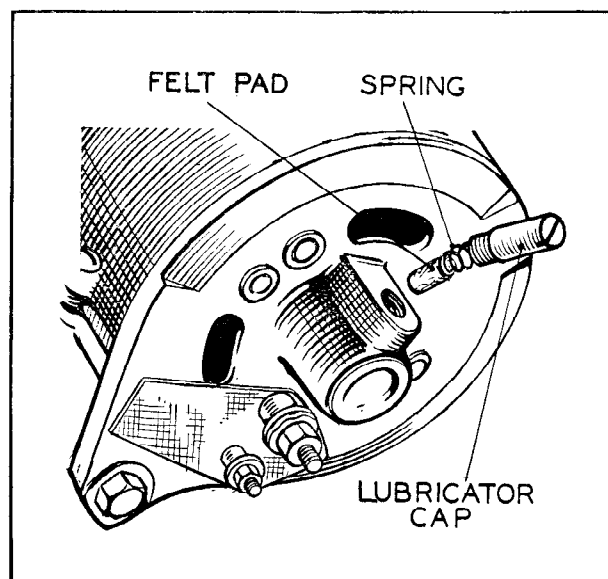


Fig. 1.

Generator with lubricator on commutator end bracket



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2. ROUTINE MAINTENANCE

(a) LUBRICATION

Generators with lubricator on commutator end bracket:

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.

No lubrication is necessary on generators having two ball bearings, as the bearings are packed with grease before assembly.

(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 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 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.

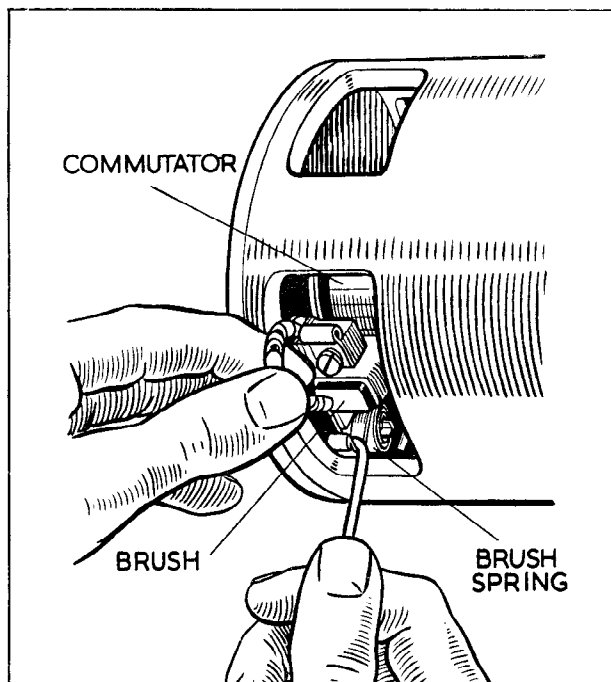


Fig. 2.
Checking brushgear

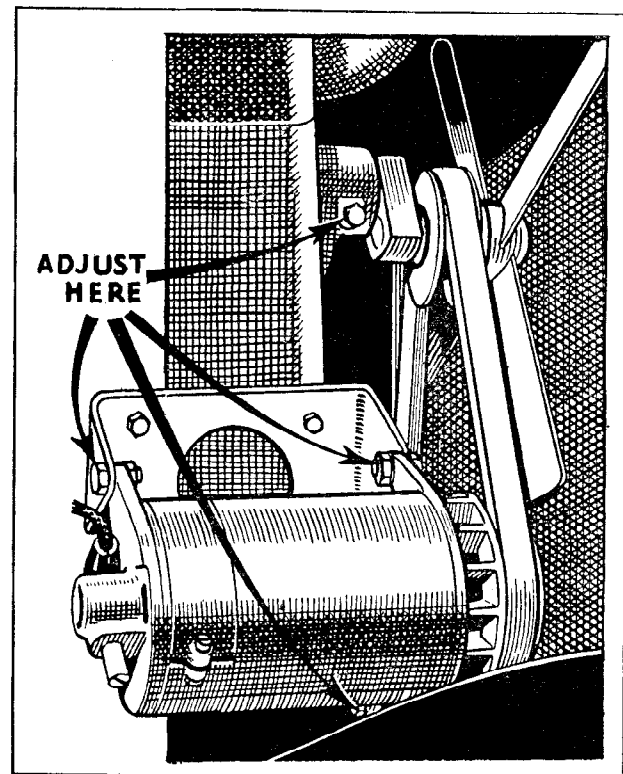


Fig. 3.
Belt adjustment



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3.

PERFORMANCE DATA

Model	Nominal Voltage	Cutting-in Speed (r.p.m.)	At Generator Volts	Max. Output (Amps.)	At r.p.m.	At Generator Volts	On Resistance Load (ohms.) *	Field Resistance (ohms)
C39P	6	950—1050	6.5	14	1500—1700	7.0	0.5	2.7
C39P	12	1050—1200	13.0	11	1600—1800	13.5	1.23	6.2
C39P-2							0.33	2.7
C39PV	6	950—1050	6.5	21	1850—2100	7.0		
C39PV	12	1050—1200	13.0	17	1850—2100	13.5	0.8	6.2
C39PV-2	12	1050—1200	13.0	19	2000—2150	13.5	0.7	6.2
C45P	12	900—1050	13.0	13	1200—1350	13.5	1.04	6.0
C45P-2								
C45PV-4	12	900—1050	13.0	20	1500—1700	13.5	0.67	6.0
C45PVB								
C45PVS	12	900—1050	13.0	22	1600—1800	13.5	0.61	6.0
C45PV-5								
C45PVS-5								

* Resistance load in each case must be capable of carrying the current stated without overheating.

4.

SERVICING

Reference to model C39 in the following instructions must be taken to cover all 3.9 inch diameter generators, both 6 and 12 volt, unless otherwise stated. Similarly model C45 refers to all 4.5 diameter machines.

(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.

(i) Inspect the driving belt and adjust if necessary (see Para 2c).

(ii) Check that the generator and control box are connected correctly. The generator terminal "D" must be connected to control box terminal "D" and generator terminal "F" to control box terminal "F".

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

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

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

(vi) Gradually increase the engine speed, when the voltmeter reading should rise rapidly and without fluctuation. Do not allow the voltmeter reading to

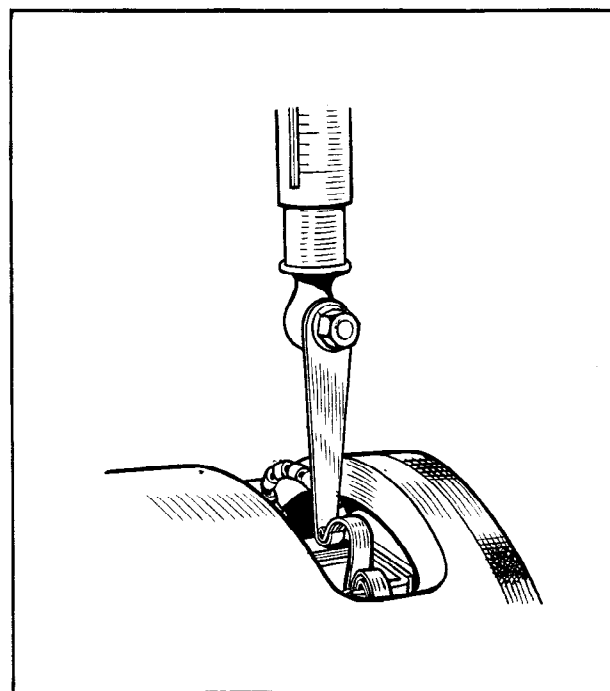


Fig. 4.
Testing brush spring tension



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reach 20 volts (or 10 volts for 6 volt generators), 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 brushgear as described in (vii) below. If there is a low reading of approximately $\frac{1}{2}$ —1 volt, the field winding may be at fault (see Para. 4e). If there is a reading of 4—5 volts ($1\frac{1}{2}$ — $2\frac{1}{2}$ volts for 6 volt machines) the armature winding may be at fault (see Para. 4d.).

(vii) 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. 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 oz. for C45 models and 22—25 oz. for C39 models. In service, it is permissible for these values to fall to 30 and 15 oz. respectively 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 (vi) on p.3 ; 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 Para. 4b) for internal examination.

(viii) 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". Proceed to test the regulator unit as described in SECTION F.

(b) TO DISMANTLE

(i) Take off the driving pulley.

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

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

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

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

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

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

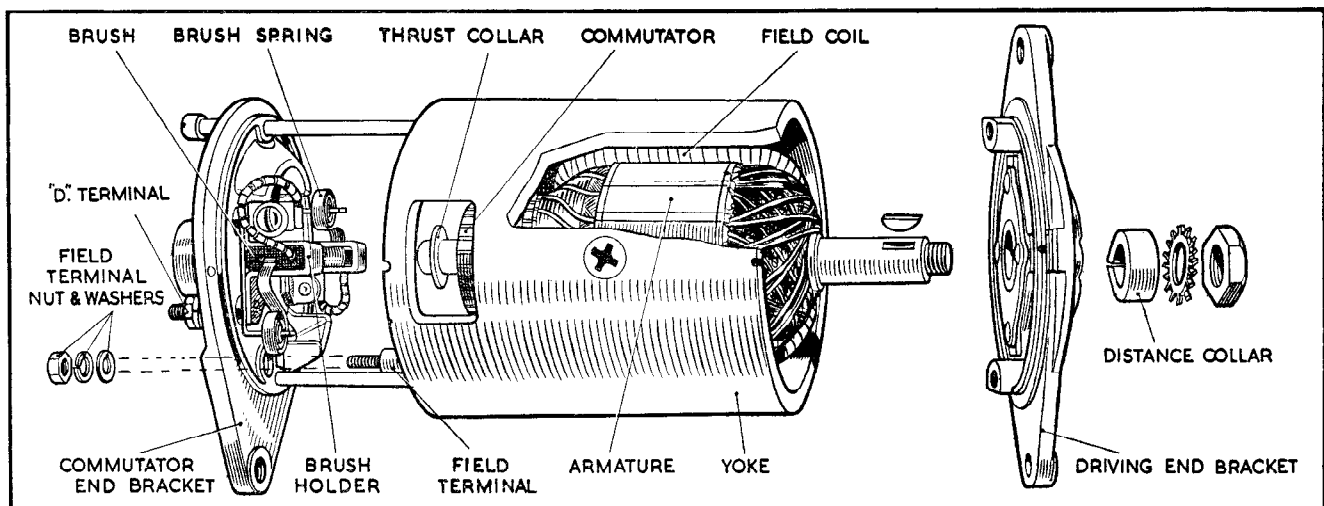


Fig. 5.
Typical generator, dismantled view
(yoke cut away to show interior)



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(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 $1/32$ " with a hack saw 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 ohm meter. These values are as follows :—

Model C39 (6 volt) : 2.7 ohms approx.

Model C39 (12 volt) : 6.2 ohms approx.

Model C45 : 6.0 ohms approx.

If an ohm meter is not available, connect a 12 volt D.C. supply (or 6 volt in case of model C39, 6 volt) with an ammeter in series between the field terminal and generator yoke. The ammeter reading in each case 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.

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

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

(iii) Unscrew the two pole shoe retaining screws by means of the wheel operated screwdriver.

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

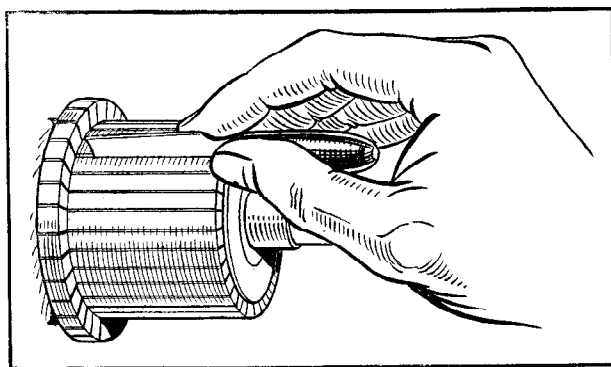
(v) Fit the new field coils over the pole shoes and place them in position inside the yoke. Take care to ensure that the taping of the field coils is not trapped between the pole shoes and the yoke.

(vi) Locate the pole shoes and field coils by lightly tightening the fixing screw.

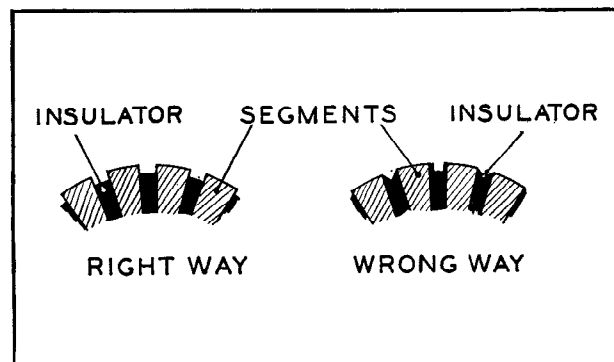
(vii) Insert the pole shoe expander, open it to the fullest extent and tighten the screws.

(viii) Finally tighten the screws by means of the wheel operated screwdriver and lock them by caulking.

(ix) Replace the insulation piece between the field coil connections and the yoke.



(a)



(b)

Fig. 6.
Method of undercutting commutator insulation



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(f) BEARINGS

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

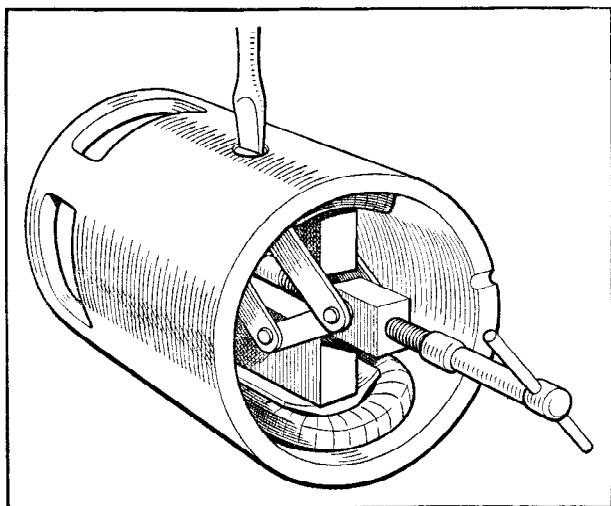


Fig. 7.
Pole shoe and field coil assembly

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

(i) Remove the old bearing bush from the end bracket. On some generators the bush can be pressed out of the bracket, using a suitable mandrel, but on the latest machines this is impossible as the bearing housing is closed at its outer end. The bearing should be removed by means of a lipped expanding type extractor, or in an emergency by screwing a tap into the bush for a few turns and pulling out the bush with the tap. Use a 5/8 inch tap for model C39 generators and an 11/16 inch tap for C45 machines. Screw the tap squarely into the bush to avoid damage to the bracket.

(ii) 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 2 hours.

The ball bearing at the driving end on all models is replaced as follows:—

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

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

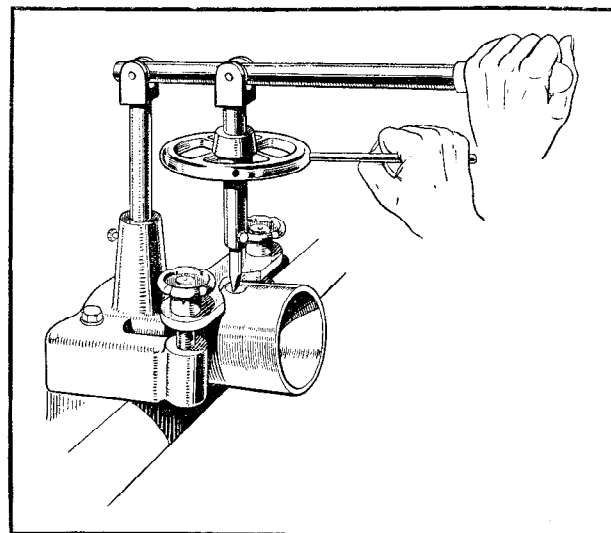


Fig. 8.
Tightening pole shoe retaining screws

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

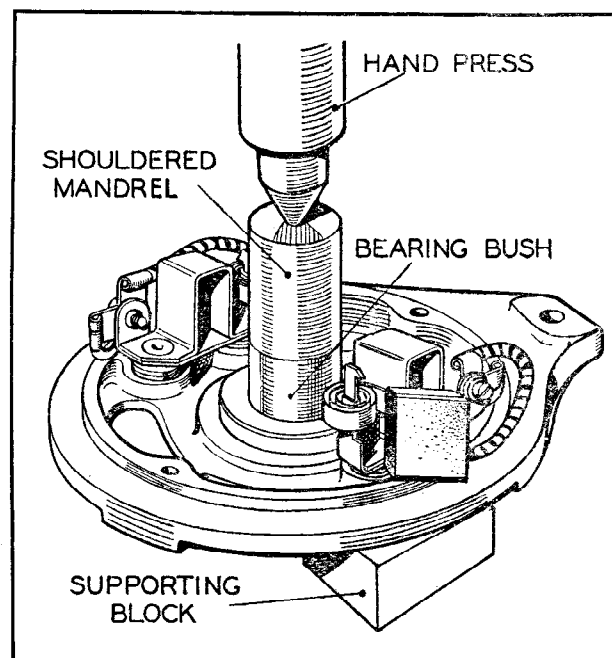


Fig. 9.
Method of fitting porous bronze bearing bush



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

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

(vi) 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.

The ball bearing at the commutator end of generators model C45PVB, C45PVS, etc., is replaced as follows:—

(i) On generators of the earlier design shown in Fig. 10 remove the square bearing cover plate and press the bearing out of the end bracket. See that the new bearing is clean and packed with high melting point grease, and press it into the housing in the end bracket.

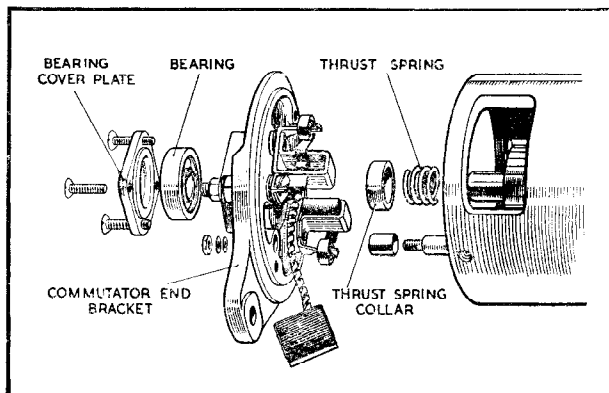


Fig. 10

Commutator end bearing details (generators model C45PVB, C45PVS, etc., earlier models)

(ii) On later machines the bearing assembly has been modified (see Fig. 11) to give the bearing a longer service life. The bearing is secured to the armature shaft by a thrust-screw, and can be withdrawn with

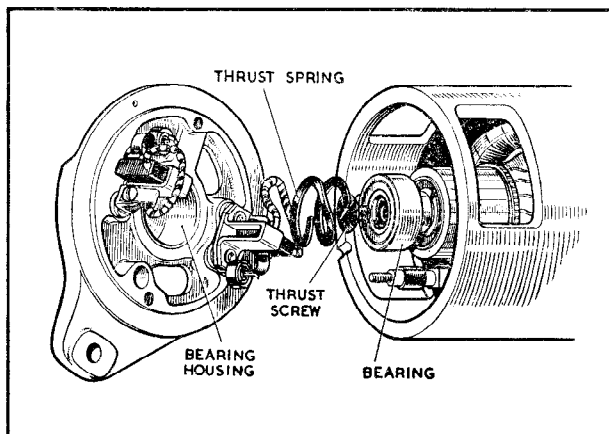


Fig. 11

Commutator end bearing details (generators model C45PVB, C45PVS, etc., later models)

an extractor after the screw has been removed. See that the new bearing is clean and packed with high melting point grease; force it home against the shoulder on the armature shaft and insert and tighten the thrust screw.

When fitting a replacement armature or commutator end bracket to a generator model C45PVB or C45PVS of the earlier design, it may be necessary slightly to modify the existing end bracket or armature of the generator in order to incorporate the improved bearing arrangement shown in Fig. 11. Damaged or worn components should not be modified in this way; if a new armature and a new end bracket are to be fitted, no modification is necessary.

The operations required are as follows:—

Commutator end bracket. The existing housing for the bearing must be bored completely through the bracket to remove the shoulder at the inner end. The existing diameter of the bearing housing must not be increased. The locating spigot must be machined off the inner face of the square bearing cover plate.

Armature. To use an existing armature with a new commutator end bracket, modify the commutator end of the armature shaft as shown in Fig. 12.

After modification the armature should be used in conjunction with a new bearing (Part No. 189237), thrust spring and thrust screw. Alternatively if the original bearing is in perfect condition it may be used, but in this case a felt washer and an oil thrower washer must be fitted behind the bearing.

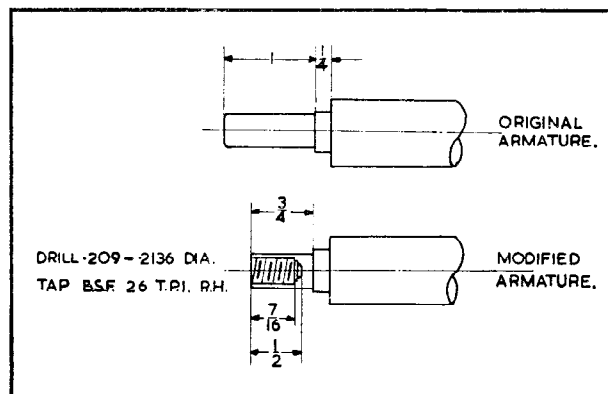


Fig. 12

Modified armature shaft, models C45PVB, C45PVS, etc.

(g) REASSEMBLY

In the main the reassembly of the generator is a reversal of the operations described in Para. 4(b). When reassembling models C45PVB, C45PVS, etc., take care that the thrust spring and collar (if fitted) of the commutator end bracket are correctly positioned. If the generator is of the type with the lubricator on the commutator end bracket, unscrew the lubricator, 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.

