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EQUIPMENT

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WORKSHOP INSTRUCTIONS

GENERATORS

MODELS
C39P, C39PV, C45P, C45PV, C47PV, etc.

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GENERATORS

MODELS C39P, C39PV, C45P, C45PV, C47PV, ETC.

1. GENERAL

The generator is a shunt-wound two-pole two-brush machine, arranged to work in conjunction with a regulator and cut-out unit (see SECTION F). The output of the generator is controlled by the regulator(s) and is dependent on the state of charge of the battery and the loading of the electrical equipment in use.

When fitting a new control box, it is important to use only an authorised replacement. An incorrect replacement can result in damage to the generator.

With 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 exposed 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: 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-4.

C45PV-4: Ventilated machine. Otherwise similar to model C45P-4.

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.

C47PV-O: 4.7-inch diameter, ventilated, high-output machine used in conjunction with a current-voltage regulator unit. Provision for built-in radio suppression capacitor(s). Otherwise similar to C45PV-5.

2. ROUTINE MAINTENANCE

(a) LUBRICATION

Every 12,000 miles, inject a few drops of Oiline BBB, or any high quality medium viscosity (S.A.E. 30) engine oil into the hole marked "OIL" at the end of the bearing housing.

On earlier models, unscrew the cap of the lubricator on the side of the bearing housing, lift out the felt pad and spring and about half fill the lubricator cap with high melting point grease (H.M.P. Grease). Refit the spring, felt pad and lubricator cap.

No lubrication is necessary on generators having two ball bearings, as the bearings in these generators 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 refit brushes in their original positions in order to retain the bedding. Brushes which are badly worn must be replaced. (See also para. 4 (a) (vii).

The commutator should be clean, free from oil or dirt and should have a polished appearance. If it is dirty,

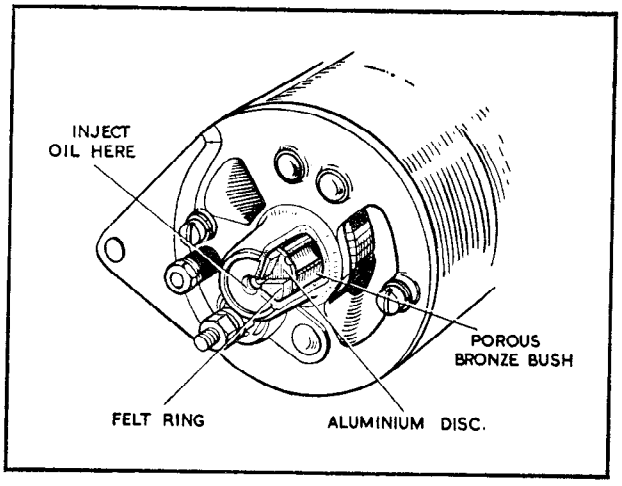


Fig. 1 Details of lubricator in commutator end bracket

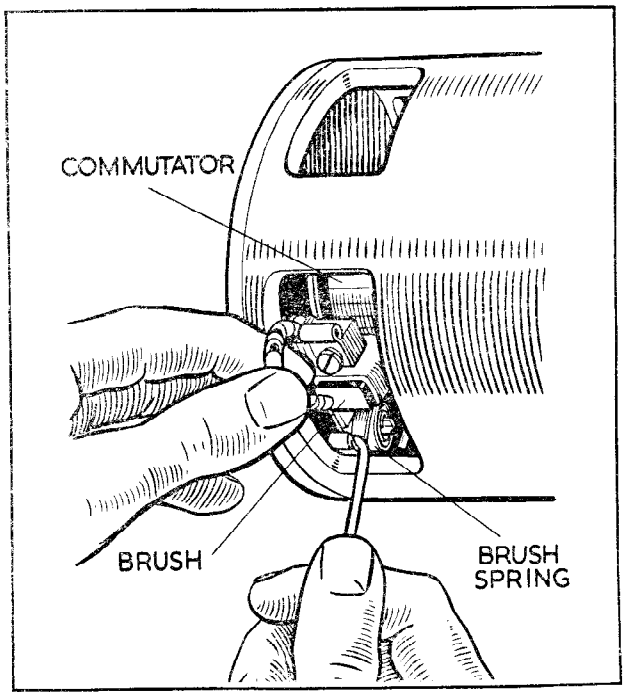


Fig. 2 Checking brushgear

clean it by pressing a clean dry fluffless 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, the tension needed being just enough to drive without slipping. See that the machine is properly aligned, otherwise undue strain will be thrown on the generator bearings.

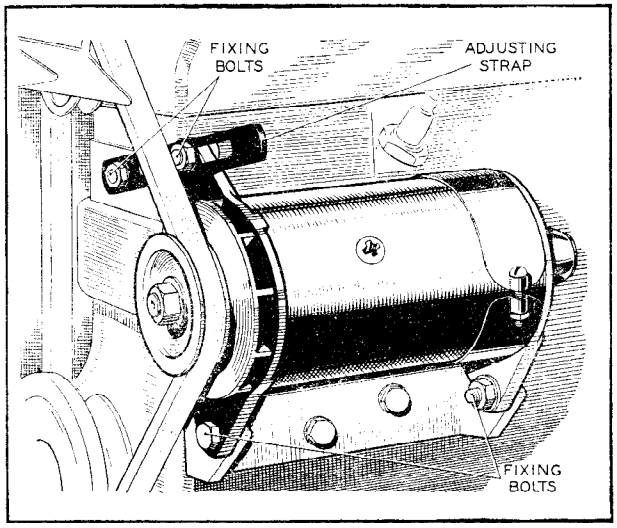


Fig. 3 Tension adjustment of driving belt

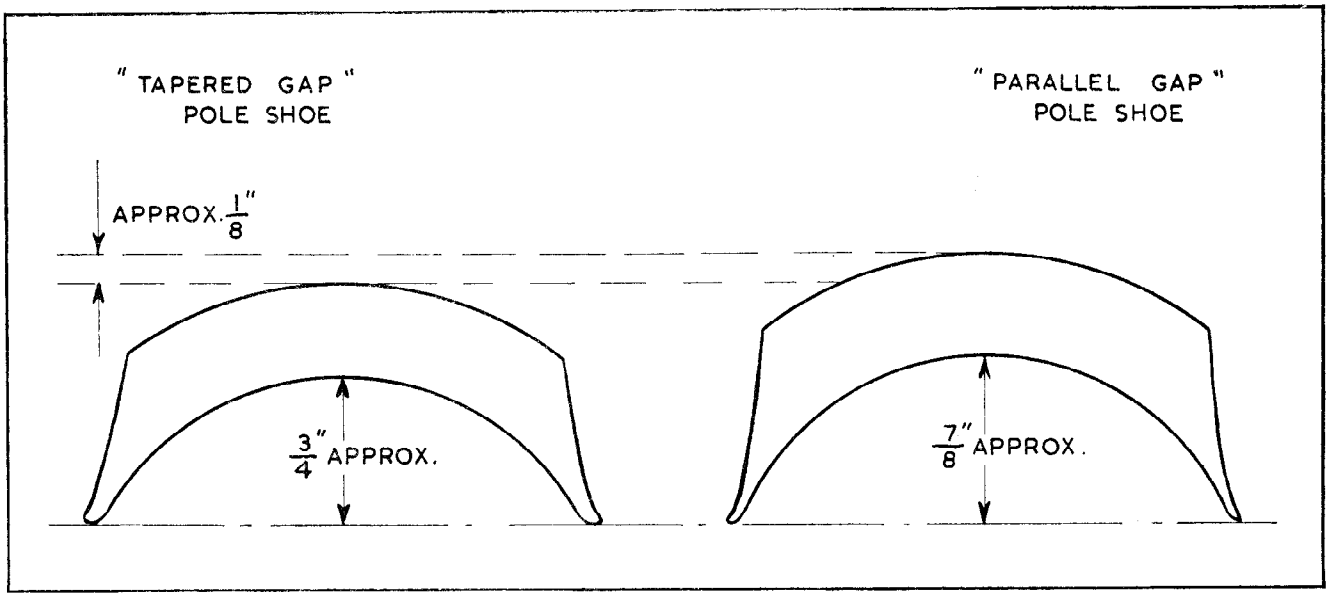


Fig. 4 Comparison of pole shoe designs

3. PERFORMANCE DATA

Model	Nominal Voltage	Cutting-in Speed (r.p.m.)	At Generator Volts	Max. Output (Amp.)	At r.p.m.	At Generator Volts	On Resistance Load (ohms) *	Field Resistance (ohms)
C39P C39P-2	6	950—1050	6.5	13	1400—1600	7.0	0.54	2.7
C39PV	6	950—1050	6.5	21	1850—2100	7.0	0.33	2.7
C39PV-2	6	950—1050	6.5	23	1850—2100	7.0	0.3	2.7
C39P C39P-2	12	1050—1200	13.0	11	1450—1700	13.5	1.23	6.1
C39PV	12	1050—1200	13.0	17	1850—2100	13.5	0.8	6.1
C39PV-2	12	1050—1200	13.0	19	1900—2150	13.5	0.71	6.1
C45PV-4	6	700—800	6.5	20	1400—1500	7.0	0.35	3.0
C45P-4	12	900—1050	13.0	13	1200—1350	13.5	1.04	6.0
C45PV-4 C45PVB C45PVS	12	900—1050	13.0	20	1500—1700	13.5	0.67	6.0
†C45P-5	6	1100—1150	6.5	16	1325—1525	7.0	0.44	2.8
†C45PV-5	6	1000—1150	6.5	35	1950—2150	7.0	0.2	2.8
†C45P-5	12	1100—1250	13.0	13	1450—1650	13.5	1.04	6.0
†C45PV-5 †C45PVB-5 †C45PVS-5	12	1100—1250	13.0	22	1700—1900	13.5	0.61	6.0
C47PV-0	12	900—1050	13.0	30±1½	1550—1750	13.5	0.45	5.9

* The load resistors must be capable of carrying the maximum output current without overheating.

† The cutting-in and maximum output speeds given for C45P-5, C45PV-5, C45PVB-5 and C45PVS-5 generators relate to six-volt machines manufactured during and since November 1953 and to twelve-volt machines manufactured during and since October 1953. These generators, which can be identified by reference to the date-stamp on the yoke, are fitted with pole shoes shaped to produce tapering air gaps between pole shoe and armature.

Test data for generators of earlier manufacture having "parallel" or concentric air gaps are given below. For comparison, the two types of pole shoe are shown in Fig. 4.

Model	Nominal Voltage	Cutting-in Speed (r.p.m.)	At Generator Volts	Max. Output (Amp.)	At r.p.m.	At Generator Volts	On Resistance Load (ohms) *	Field Resistance (ohms)
C45P-5	6	700—800	6.5	16	1225—1425	7.0	0.44	3.0
C45PV-5	6	700—800	6.5	35	2500—2700	7.0	0.2	3.0
C45P-5	12	900—1050	13.0	13	1200—1350	13.5	1.04	6.0
C45PV-5 C45PVB-5 C45PVS-5	12	900—1050	13.0	22	1600—1800	13.5	0.61	6.0

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, references to models C45 and C47 refer to all 4.5 and 4.7-inch diameter machines, respectively.

(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 larger generator terminal must be connected to control box terminal "D" and the smaller generator terminal to control box terminal "F". With compensated voltage control units, check the earth connection to control box terminal "E".

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

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

(*v*) With 'positive-earth' machines, 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. (With 'negative-earth' machines, the positive voltmeter lead should be clipped to the linked generator terminals in this test.)

(*vi*) 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 (or 10 volts with 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 approximately half the nominal voltage, the armature winding may be at fault (see para. 4d).

Note: Excessive sparking at the commutator in the above test indicates a defective armature which should be replaced.

(*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 refit brushes in their original positions. If the brushes are badly worn, new brushes must be fitted and bedded to the commutator. The minimum permissible length of brush is $\frac{11}{32}$" for C39 generators, $\frac{7}{16}$" for C45 generators, and $\frac{5}{16}$" for C47 generators. Test the brush spring tension with a spring scale. The tension of the springs when new is 22—25 oz. for C39 models, 36—44 oz. for C45 models and 20—25 oz. for C47 models. In service, it is permissible for these values to fall to 15, 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. Refit the cover band and re-test the generator as in para. 4 (*a*) (vi).

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.

NOTE: If a capacitor is fitted between the output terminal (or insulated brushbox) and earth, disconnect this capacitor and re-test the machine before dismantling. If a reading is now given on the voltmeter, the capacitor is defective and must be replaced.

(*viii*) Slacken the driving belt and check the generator bearings for free-running by spinning the pulley by hand. If the armature fails to spin freely, with the brushes raised from the commutator, the generator should be dismantled and the bearings examined.

(*ix*) If the generator is in good order, remove the link from between the terminals and restore the original

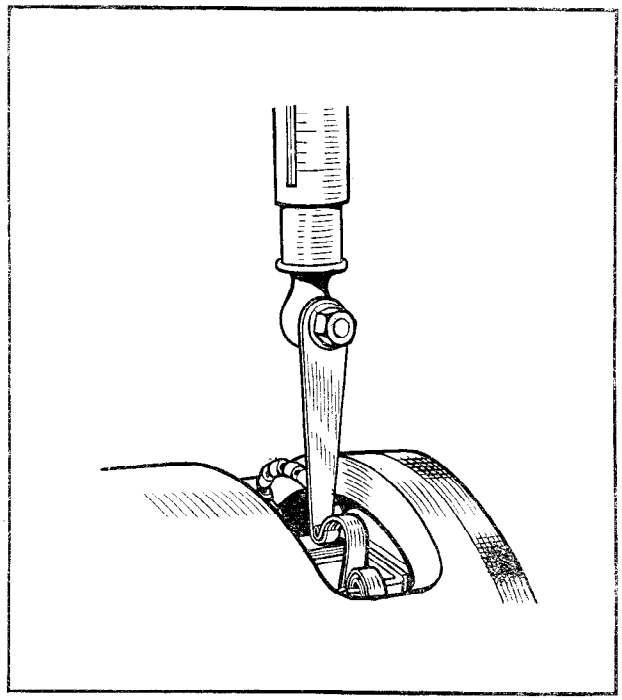


Fig. 5 Checking brush spring tension

connections, taking care to connect the larger generator terminal to control box terminal "D" and the smaller generator terminal 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*) Unscrew and withdraw the two through bolts. With earlier types it will be necessary first to remove the nut, spring washer and flat washer from the smaller terminal (i.e. the Field terminal) on the commutator end bracket.

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

(*v*) The driving end bracket together with the armature can now be lifted out of the yoke. Take care not to lose the fibre thrust washer or collar.

(*vi*) 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.

(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. Emery cloth must not be used on the commutator. Undercut the insulators between the segments to a depth of 1/32" with a hack saw blade ground to the thickness of the insulator.

(d) ARMATURE

Indication of an open-circuited armature winding will be given by burnt commutator segments. If armature testing facilities are not available, an armature can be checked by substitution.

To remove the armature shaft from the drive end bracket and bearing, support the bearing retaining plate firmly and press the shaft out of the drive end bracket. When fitting the new armature, support the inner journal of the ball bearing, using a mild steel tube of suitable diameter, whilst pressing the armature shaft firmly home (see also Para. 4g).

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 connected between the field terminal and the yoke.

Field resistance values are tabulated in Para. 3.

If an ohm meter is not available, connect a 12-volt d.c. supply (or 6-volt in case of 6-volt generators) between the field terminal and generator yoke with an am-

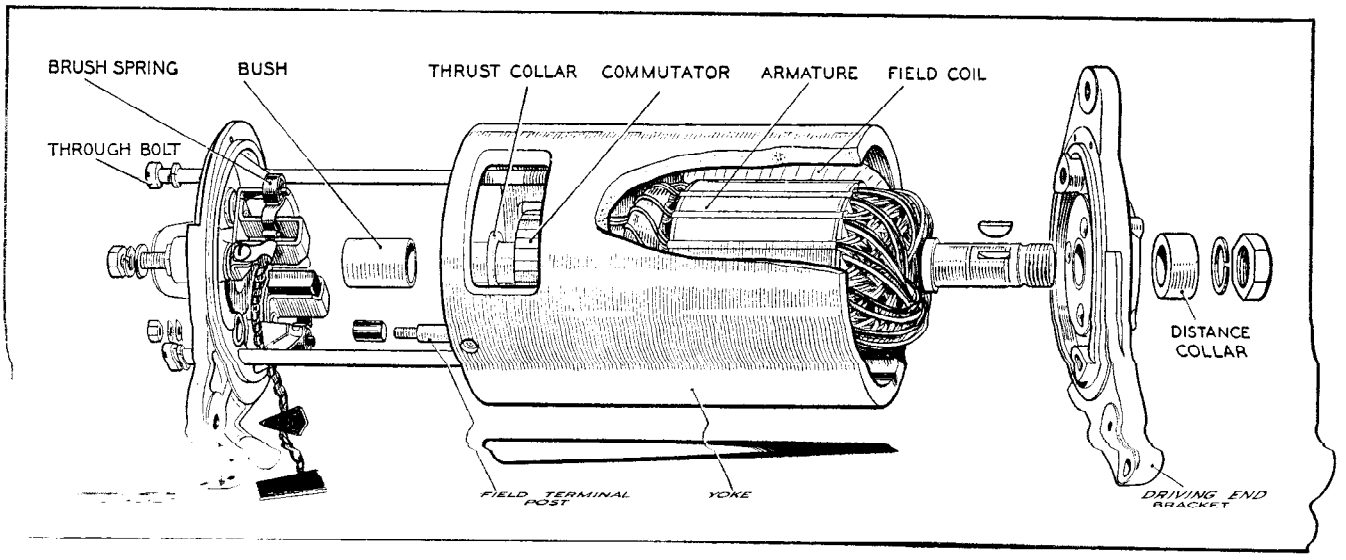


Fig. 6 Dismantled view of typical generator with yoke cut away to show interior

meter in series. The ammeter reading in each case should be approximately 2 amperes. Zero reading on the ammeter or an "Infinity" ohm meter reading indicates an open circuit in the field winding.

If the current reading is much more than 2 amperes, or the ohm meter reading much below 6 ohms, it is an indication that the insulation of one of the field coils has broken down.

In either event, unless a substitute generator is available, the field coils must be replaced. To do this, carry out the procedure outlined below:—

(*i*) Drill out the rivet securing the field coil terminal assembly to the yoke, and unsolder the field coil connections.

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

(*iii*) Mark the yoke and pole shoes so that the latter can be refitted in their original positions.

(*iv*) Unscrew the two pole shoe retaining screws by means of a wheel-operated screwdriver.

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

(*vi*) 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.

(*vii*) Locate the pole shoes and field coils by lightly tightening the fixing screws.

(*viii*) Fully 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.

(*x*) Re-solder the field coil connections to the field coil terminal tags and re-rivet the terminal assembly to the yoke.

(*f*) BEARINGS

Bearings which are 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:—

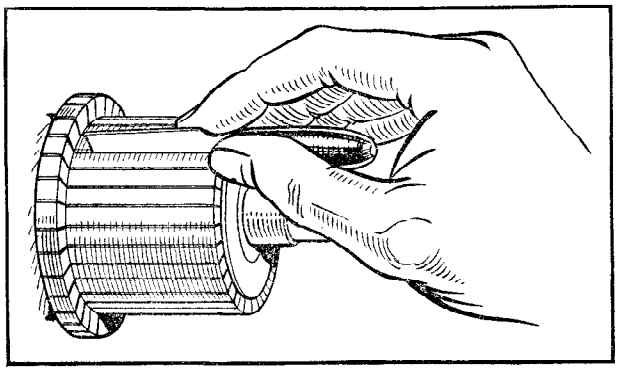
(*i*) Remove the old bearing bush from the end bracket. The bearing can be withdrawn with a suitable extractor or by screwing a tap into the bush for a few turns and pulling out the bush with the tap. Use a 5/8 inch tap for model C39 generators, or an 11/16 inch tap for C45 and C47 machines. Screw the tap squarely into the bush to avoid damage to the bracket.

With earlier generators, the bush can be pressed out of the bracket using a suitable mandrel.

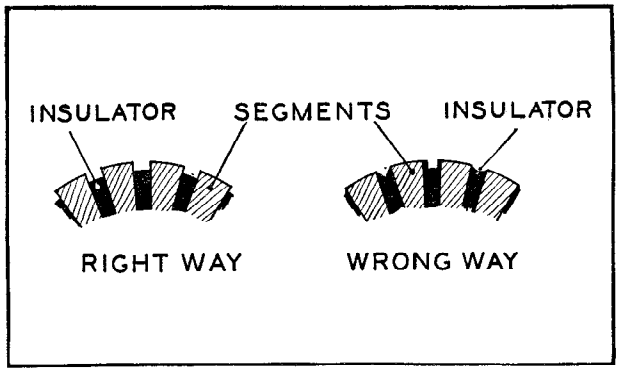
(*ii*) Insert the felt ring and aluminium disc in the bearing housing, then press the new bearing bush into the end bracket, using a shouldered, highly polished mandrel of the same diameter as the shaft which is to fit in the bearing, until the visible end of the bearing is flush with the inner face of the bracket. (A few generators were made in which the lubricator incorporated a single porous bronze disc. When replacing a commutator end bearing lubricated by this system, it is important to press the new bush fully home against the porous bronze disc.) Earlier models, fitted with screw-cap type lubricators, do not have a felt ring or aluminium disc in the bearing housing.

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 a good grade thin engine oil; this will allow the pores of the bush to be filled with lubricant.



(*a*)



(*b*)

Fig. 7
Method of undercutting commutator insulation

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

(*i*) Drill out the rivets or withdraw the screws (C47 models) which secure the bearing retaining plate to the end bracket and remove the plate.

(*ii*) Press the bearing out of the end bracket and, with C39 and C45 models, remove the corrugated washer, felt washer and oil retaining washer.

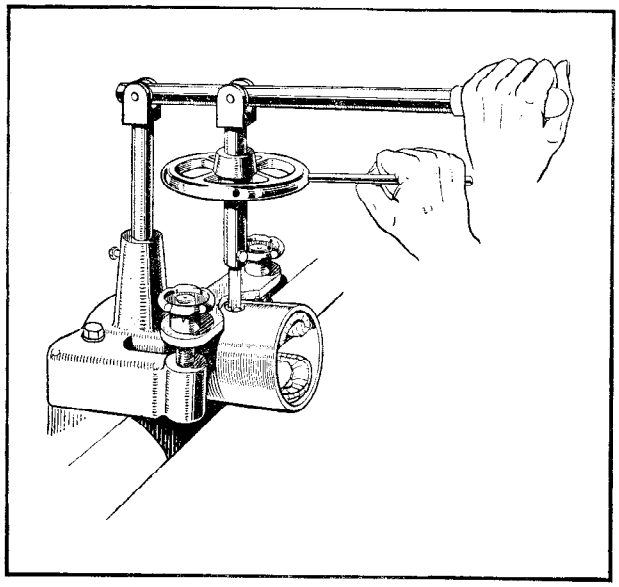


Fig. 8 Tightening pole shoe retaining screws

(*iii*) Before fitting the replacement bearing see that it is clean and pack it with high melting point grease, such as Energrease R.B.B.3.

(*iv*) With C39 and C45 models, 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. On earlier models the outer journal should be pressed home by means of a hand press.

(*vi*) Fit the bearing retaining plate. Insert the new rivets, or original screws, 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 generator models C45PVB, C45PVS, etc., is replaced as follows:—

(*i*) With generators of the earlier design shown in Fig. 11, 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.

(*ii*) With later machines the bearing assembly has been modified (see Fig. 12) 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 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.

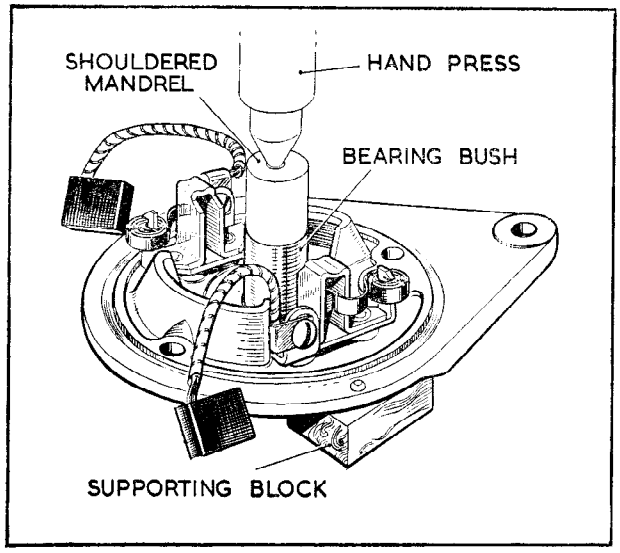


Fig. 9 Method of fitting porous bronze bearing bush

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. 12. Damaged or worn components should not be modified in this way; if a new

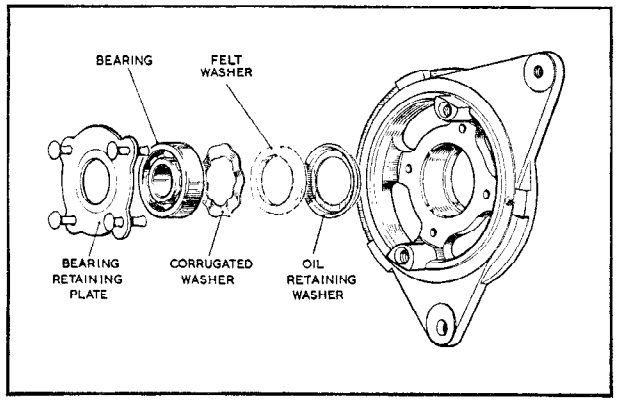


Fig. 10 Exploded view of typical drive end bearing

armature *and* a new end bracket are to be fitted, no modification is necessary.

The operations required for modification 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.

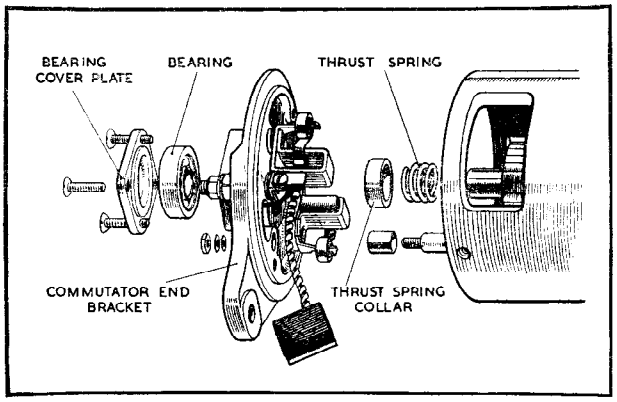


Fig. 11 Commutator end bearing details (generators C45PVB, C45PVS, etc., earlier models)

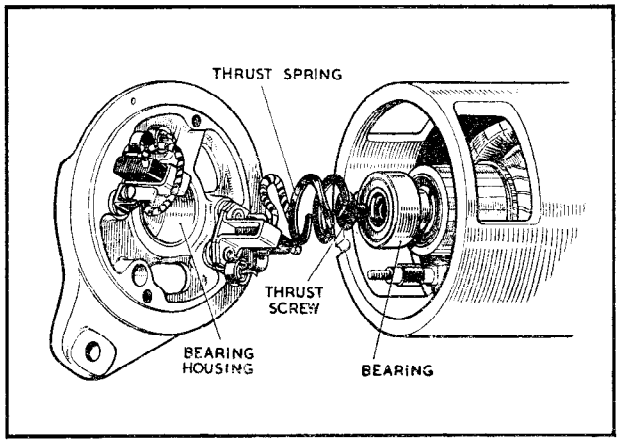


Fig. 12 Commutator end bearing details (generators C45PVB, C45PVS, etc., later models)

Armature. To use an existing armature with a new commutator end bracket, modify the commutator end of the armature shaft as shown in Fig. 13.
After modification the armature should be used in conjunction with a new bearing (Part No. 189237), thrust spring, collar and thrust screw. 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 between the bearing and the commutator

(g) REASSEMBLY

In the main the reassembly of the generator is a reversal of the operations described in Para. 4(b).

The dimensions of the drive end bearing housing on Models C39 and C45 generators have been modified to give a light push fit for the bearing outer journal instead of a tight press fit.

When fitting any drive end bracket to an armature shaft, the inner journal of the bearing **must** be supported by a suitable tube. Mild steel tubes approximately 4 in. long and 1/8 inch thick can be used, the internal diameters being 5/8 inch for model C39 generators and 11/16 inch for models C45 and C47 generators.

Do not use the drive end bracket as a support for the bearing whilst fitting an armature.

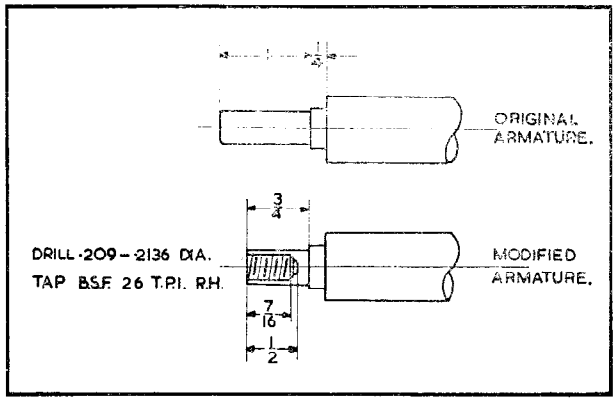


Fig. 13 Modified armature shaft, models C45PVB, C45PVS, etc.

When reassembling models C45PVB, C45PVS, etc., take care that the thrust spring and collar (if fitted) of the commutator end bracket are correctly positioned.

After reassembly lubricate the commutator end bearing, referring to Para. 2(a) for the correct procedure.