Practical Dynamo Maintenance by W.Topping

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DESPITE the increasing use of crankcase mounted A.C. equipment with a rectifier for D.C. conversion, it will, in my opinion, be a very long while before the conventional magneto and/or dynamo are superseded. For a considerable time to come, therefore, the need to overhaul these parts will continue seasonally to produce a headache for the uninitiated or, on the other hand, a. degree of pleasure and sense of achievement in those who know how to set about the task.

" Know-how," actually, is what the customer pays for if he farms out the work. Dynamo spare parts are not necessarily expensive, but the time involved, even when an expert mechanic is doing the work, can make the bill formidable. To be one's own mechanic, however, calls for a little knowledge of how to diagnose trouble without needlessly dismantling the complete equipment.

To test a dynamo, one needs an ordinary inspection lamp, fitted with a 12-v. bulb. You may ask why 12-v? Well, a dynamo has to be tested as a separate component, and as such must be disconnected from the remainder of the charging circuit. That entails the removal—on two-brush dynamos —of the two wires marked " D " and " F." Older three-brush charging systems have dynamo terminals marked " POS " and " F."' With the circuit thus disconnected and the engine running, a rise in voltage occurs through a building up of current due to the absence of any stabilizing factor, i.e., the battery or regulator. At fairly high speeds 25 v. on open circuit (wires disconnected) may be forthcoming, so that it will be seen that a 12-v. bulb is needed to absorb this high voltage; even then the engine should be accelerated up very gently, otherwise the bulb may blow.

An initial test of a two-brush dynamo is to bridge the " D and F " terminals with a short length of wire. Now connect the test-lamp from the bridge-wire. as shown in Fig 1, to the frame, or earth, of the machine. Start the engine and run up slowly. An increasing glow should he apparent in the bulb as engine speeds are increased. If there is no light at all from the bulb, then the dynamo is not functioning. A weak glow indicates either a slipping drive to the dynamo—an occasional fault in Magdynos fluted with a clutch drive—or a partial breaking down of the armature windings. But before condemning the dynamo absolutely in these circumstances, try polarising the field by connecting a lead direct from the live side (positive terminal) of the battery to the “F” terminal of the dynamo for a second or two. This expedient often works in cases where the machine has been standing for some time without being used.

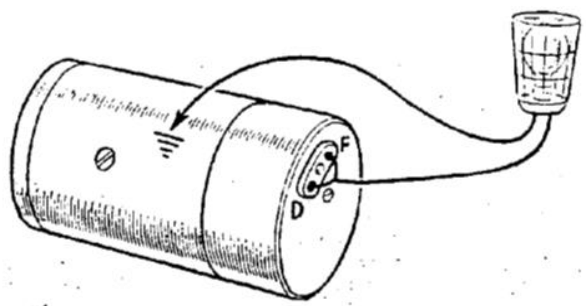
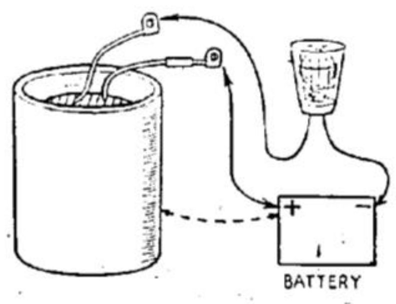


Fig. 1 (Left) Test rig for a modern two-brush Lucas dynamo. Fig. 2 (Right) Checking the field coil for continuity and (dotted) for short circuit to earth.



Most three-brush dynamos arc fitted with a cut-out unit integral with the instrument. Thus the " D " terminal becomes " POS," or " As" (ammeter), because this lead must be connected to the live side of the battery via the ammeter. No external regulation of charge is usual with a three brush dynamo, except for a simple change-over switch which inserts a resistance between the field windings and earth. This resistance is usually situated just behind the lighting/charging control switch.

It follows, then, that to obtain a test reading from a three-brush dynamo the " F." or field terminal must he connected to earth. The " POS." or " A." is connected to one side of the lamp and the engine speed increased gradually.

Polarizing can in this case be affected, if necessary, by touching a " POS " line from the battery straight on to the field brush. This sends a current through the dynamo armature coils to earth and induces charge—unless there is something radically wrong. Do not forget that a faulty cut-out will not pass any dynamo current through your test-lamp, so close the points by hand while testing, to establish this possibility. Of course, if a charge, or light, shows only when the cut-out is manually closed, then the chances are that the cut-out itself is at fault. One other possibility when this symptom occurs is that the armature windings are partially broken down resulting in a proportionate decrease in voltage, but not necessarily amperage. The cut-out relics on voltage (7.2v.) to overcome the tension spring which holds the points apart. If there is insufficient voltage then the points will not close.

Similar tests, then, apply with both two-and three-brush dynamos. Remember, first test with a lamp. then try polarizing. Fingering the brushes, checking visible connections, also cleaning the commutator bars may also bring success.

These methods failing, the dynamo must be removed for a thorough examination. Some machines have the dynamo fitted very inaccessibly; despite this snag it usually pays to spend time taking the instrument off the model and working on the bench.

Inspect everything, for one fault may cause another. A typical example is that of the dynamo which is forever burning out armatures. After the second or third armature, looking like a burnt offering, has been removed from the dynamo, the owner, per-chance by accident, checks the bearings. He finds, say, a commutator end-bush is worn and he replaces it. Behold, no more armatures burn out; the problem is solved because the bush is no longer allowing the armature to rub the field pole at high speed.

With this point clear in mind. you can start the really interesting part of the work. Lift up the brush springs and slide the brushes partly out of the holders. Allow the springs to rest against the sides of the brushes. This achieves the effect of "cocking " the brushes so that they remain in the holders yet are free of the commutator. It is important not to get the brushes in the wrong holders when reassembling. and "cocking" them ensures that confusion does not arise on this point.

The through bolts are now he removed and the armature withdrawn. Before cleaning the component parts of the dynamo make a careful examination. Initial observation can reveal a lot. Note if burning has occurred around the brush gear due to the carbon dust shorting. Another thing which is sometimes overlooked is a ring of solder finely sprayed around the inside of the dynamo carcase. or yoke at the commutator end. This is a sign of severe overheating, which melts solder at the commutator bars and invariably causes an open-circuit, or ' break,' in the armature-windings. In fact, it may be said that three out of four armature failures are caused by open circuiting of the windings, for it is comparatively rare to find a short-circuited motorcycle dynamo armature. But the field coil should he examined for signs of shorting on the through bolts and pole-piece.

After this preliminary inspection the main task comes. Clean all the components, except the commutator, in petrol: check the bearings and renew if there is any doubt about them, especially the previously mentioned porous bronze bush at the commutator end of some W.D. and post-war pattern Lucas dynamos. Make sure the main drive-end bearing is clean and packed with a high melting point grease and that the armature windings are wiped clean and dry.

Test the field coil by connecting the test-lamp through the coil to a battery as shown in Fig. 2. Check the coils for an earthed, or short circuit, and also for continuity. When used for the continuity test. the lamp should glow less brightly, due to the resistance of the field-coil winding which is then in circuit. If the glow is of normal brightness, then the field coil may be shorting internally.

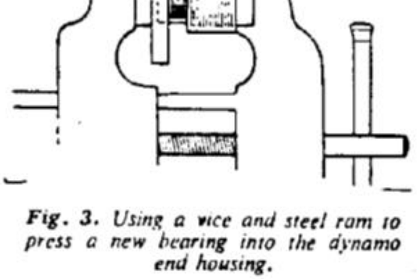


Fig. 3. Using a vice and steel ram to press a new bearing into the dynamo end housing.

Renew the brushes if they are worn and check the field coil leads where they pass through the insulated brush-holder plate. The armature may look sound, but if you want to be quite sure. have it tested at a garage or auto electrician. They will be only too pleased to test it on what is known as a "growler." Or you can make a rough check yourself by connecting battery positive and negative leads and test bulb to adjacent commutator bars; in this position the bulb should light up. Connected from any one bar to " earth" i.e.. the armature spindle, the test-lamp should reveal no electrical flow at all.

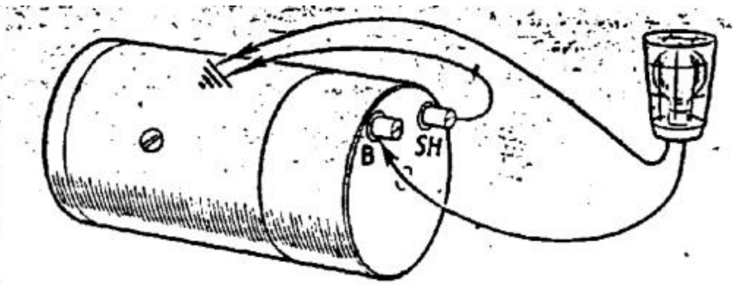
If the field and armature are sound then the dynamo can be assembled. Take care that no rubbing of the- field poles is apparent when the through-bolts are tightened. To ensure this, keep the brushes cocked and rotate the armature slowly by hand. Any resistance to motion should be investigated. Perhaps the pole shoe is loose—it must be very tightly fitted in the yoke and the fixing screw caulked—or is the armature slightly out of alignment. The end-brackets of the dynamo should be tapped gently with a wooden mallet until satisfactory armature rotation is obtained. Serious rubbing is caused by a bent armature spindle and will entail replacement of the faulty part.

When fitting bearings or bushes it is imperative that they are pressed in evenly; this can be effectively done by using a vice and a small block of metal, as shown in Fig. 3.

The correct connecting-up of the field leads is important. The sleeved lead goes to earth. If these leads are reassembled in the reverse manner the dynamo will charge only when rotated in the opposite direction to that indicated by the arrow on the yoke.

The field connections being tightened, and terminals checked, all that remains is to slip the brushes back on to the commutator and to replace the dynamo on the machine.

Fig. 4. Test equipment and connections suggested for the older type of Lucas three-brush dynamo. "B" is alternatively "POS" or "A": "SH" is "FIELD."



In general, repairs to any three-brush dynamo are more difficult. For one thing a three-brush instrument is very compact. Also the integral cut-out unit is an additional complication which increases the number of internal leads and connections to be handled. Despite this, difficulty will not arise if dismantling is done with care. Note that some of the small tag terminals are prone to break off if handled roughly. It is also advisable to mark any connections which are removed, to ensure correct replacement when re-assembling.

An example of a widely-used type of three-brush machine is the Miller DM3G or DYR dynamo, which incorporates its own cut-out, this being situated on the insulated portion of the commutator end-bracket. The cut-out is protected by a metal cap through which project two terminal, marked " B " and " SH". "B" means battery or ammeter; " SH" shunt, "F" field.

The third-brush adjustment is achieved by slackening a small screw which locates the brush-box on the insulated plate, and moving the box in the direction required, afterwards tightening the screw.

When looking for a fault, make sure first that the field coil is sound; test it by disconnecting the field leads from the terminal ends and checking through, as previously described. One field lead should go to the field brush, the other to the "SH" terminal. The field-coil resistance on a three-brush machine is usually higher than that of the two-brush type. On Miller dynamos the resistance of the field coil is just over 5 ohms which will reduce the glow of the test-lamp appreciably. The lead going to the field brush is usually sleeved: the field-terminal ("SH") lead is not sleeved.

Cut-out trouble may be evident, and it is useful to know how to fit a replacement part. After dismantling the dynamo which is easily done by removing the through bolts and tapping out the armature from the com-mutator end the cut-out becomes accessible. Bend back the tabs holding the main cut-out post nut—this is connected to the main brush and becomes virtually the equivalent of "D" in the later-type dynamos. The nut is situated under the cut-out on the underside of the insulated plate. Remove the nut and the "D" strap connection, then disconnect the main lead from the " B" terminal. One other lead is still *in situ* it is the end of the cut-out shunt winding and is connected to earth --the carcase of the dynamo. The cut-out may now be removed and a new unit fitted, reconnecting as before.

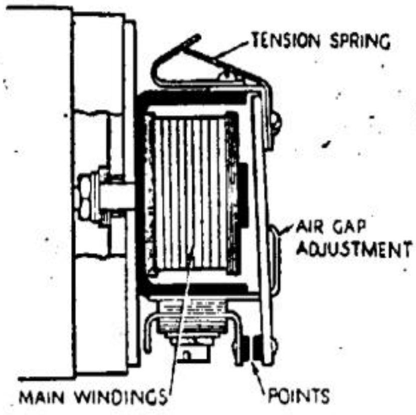


Fig. 5. The Miller-type cut-out showing main components.

One thing common to all motorcycle dynamos is the importance of having a clean commutator. and also clear segments. To undercut the segments, grind off a piece of hacksaw blade to make it thin enough to fit into the mica slots, and cut them down to leave the copper segments standing slightly proud. A few strokes of the blade in each slot should be sufficient. to clear it of foreign matter which may short out the segment bars.

Miller dynamos usually have two ball bearings instead of the one ball and one phosphor-bronze bush of the early Lucas type. Both bearings should be removed and packed with high melting point grease. The drive-end bearing is exposed when the protective plate is removed by releasing the retaining screws. Packing the commutator end-bearing is easier, for this is situated on the armature and comes away with it.

General tests of insulation should be carried out whenever work is done on a three-brush dynamo. The positive brush-box and any parallel connections from that brush must, of course, be insulated from the carcase of the unit. And that applies also to the field brush connections. Conversely, the earth brush must be in contact with the carcase. It is surprising, how many people forget this obvious fact.

Another, and perhaps less obvious, fault is a bad earth connection in the fine shunt winding of the cut-out. To test the shunt, connect 8 volts across the main cut-out post and the end of the shunt winding. If the points do not then close smartly, adjust the return spring.

One other thing which will prevent the points operating under 8 volts pressure is too wide an air gap between the cut-out armature and the face of the shunt core. The farther away the cut-out armature is from the actual attraction centre, the weaker the pull. Thus, if the armature is pressed nearer to the shunt core then it will be in a stronger magnetic flux and will, therefore, be more strongly attracted.

It is often these glaring defects that are overlooked. Their rectification is simple and inexpensive provided one has a modicum of elementary knowledge.