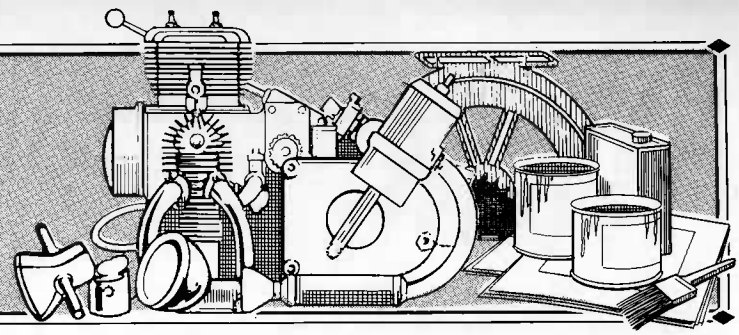
The PRINCIPLES of RESTORATION



John Salis

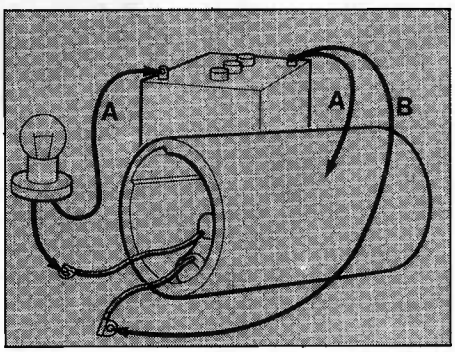
ANOTHER high distress factor in the amateur's rebuild is to be found in the electrics of the machine, at the heart of which are the dynamo and voltage control units. They are the subject of much abuse and neglect, but with the aid of my two favourite spanners – patience and common sense – can be made to work quite reliably enough. I won't say that they will be up to modern day standards, but they will glow in the dark. All the following remarks and illustrations are for Lucas units, though in general they will work for Miller equipment. Much unfair badinage has been prompted by the Lucas name, but all my Lucas stuff works well enough, which is more than can be said for Miller bits.

Whether as a separate unit or as part of a Magdyno unit, the dynamo will remove from the machine easily and obviously enough. There are several types of dynamo made since the late thirties but I am going to ignore 3-brush units for reasons of clarity, although some of the comments apply to them. Of these several types, the differences consist mostly in small internal details such as bearings, but generally they all come to bits in the same way. All the amateur can do by way of repair is carry out a series of checks and routine servicing. Any major fault will mean consigning the unit to a specialist.

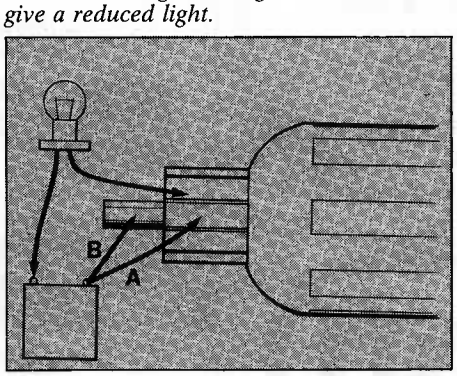
The bits which break, like the end covers or the aluminium end brackets, are getting harder and harder to find and consequently more expensive. You will have to resort to the usual places to find them. I have found Russell Motors at Falcon Road, Battersea useful in the past for many bits, they having vast stocks of WD surplus bits for the blessed M20 BSA, which used a Magdyno that has parts in common with many others. Try them for brushes, armature bearings, Magdyno fibre gears, the little rubber sleeves, and also a small ex-army repair kit of nuts, bolts and screws for use on dynamos. Ask for LV6/MT8 LU/200806 kit sundry parts Qty 1. Don't you just love those WD spare parts labels . . .

Hold the dynamo gently in a vice. At this stage a rough and ready check can be made with the aid of a fully charged 6 volt battery – bridge the D and F terminals and connect them as in the diagram, keeping the connections as appropriate to the earth terminal of the machine to which the unit is to be fitted, and the dynamo should perform as an electric motor. If it does, you can be 90 percent sure the dynamo is okay. This is a useful and easy test to check out a second-hand unit before purchase.

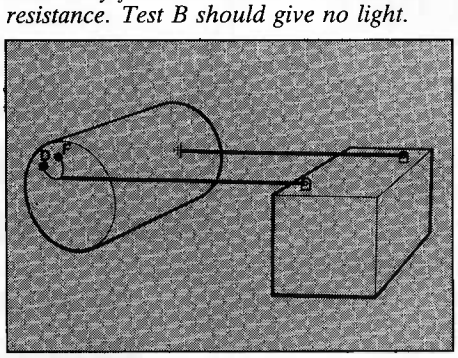
Remove the driving gear or sprocket from the shaft. Some sprocket nuts have a split pin hidden under grease which is hard to spot. You'll need a puller to get it off. Gear driven units should have a small lock washer under the retaining screw. These gears are



Field coil test, using a 6 volt headlamp bulb. Test A should give no light. Test B should give a reduced light.



Armature test, using 3 or 6 watt 6 volt bulb. Test A, between each adjoining commutator strip, should give a normal light from the bulb. Any fluctuation indicates excessive resistance. Test B should give no light.



In this test D and F terminals on the dynamo are bridged and connected as shown. The dynamo will then act as an electric motor.

located by a Woodruff key but shouldn't need any more than slight pressure to shift it. Prise out the Woodruff key(s) and keep it or them somewhere safe. You'll get lots of small screws and fixtures from these units which will lose themselves if at all possible. I stick mine onto an old alternator rotor, and the non-magnetic bits go into a small round tobacco tin stuck on top of it.

Now remove the cover band (or the one piece cover on later E3L types). The cover band should have a cork gasket secured by bifurcated rivets. Hold up the brush springs and lift out the carbon brushes. Remove the 2BA screw from the centre of the Bakelite cap. As this cap comes off you'll see that it is attached to two leads. The two terminals are, or should be, marked D and F. The D terminal is attached directly to the positive brush and the F terminal to one of the two leads emerging from the body of the unit. The other lead of this pair runs to the other (negative) brush lead on the commutator end bracket. As you look at this end bracket you should see a felt washer surrounding a bronze brush. This is meant to have a drop of oil from time to time, but seldom does. If there is any side-play in this brush, it must be replaced. It is a tight press fit, but preferably replaced with a shaped mandrel, not an old socket. These brushes are supposed to be soaked in light oil for 24 hours before fitting.

Inset in this bracket there are two 2BA nuts on long through bolts – undo these, they are not tight, but will require a screwdriver to hold the opposite end. Note that they should have a shaped shake-proof washer under the *head* of the bolts as well as under the nut. These can be found in those useful little kits I mentioned earlier. Do not overtighten these nuts on re-assembly, as they will distort the soft metal of the bracket. Withdraw the bracket – it will need a little wriggling or prising – it locates on two pegs in the body and will only refit in one position. The armature can now be removed from the opposite end, complete with the driving end bracket. On this end bracket there is either a round plate retained (under the grease and muck) by three small screws or, on Magdyno units, a triangular plate, and two screws and a screwed collar on a usually bent screw. Remove these and you'll see another collar which retains the driving end bearing. This is not usually tight and can be undone by holding the armature *very lightly* in a vice, or by use of a strap wrench (the sort of item found in car accessory shops for removing canister oil filters is ideal). Tap the armature out with a soft hammer, from the driven end.

This is about as far as one needs to dismantle. The field coil and pole shoe can be removed by using an impact driver on the securing screw(s), but this serves no useful purpose unless the body is to be cadmium plated. Should it be removed, it is supposed to be refitted with a device like a small scissor jack which ensures that the pole shoe is a tight fit against the body, but if one is reusing the old field coil it should not be necessary. Just ensure that the screws are good and tight, and lock them into position with a centre punch dot into the screwdriver slot.

There are a number of useful tests that can now be performed for the curious. For

those who possess the necessary resistance meters the average resistance is 2.8 to 3.0 ohms. Mere mortals can utilise a couple of 6v bulbs either in a suitable holder or merely with leads soldered to them. These tests are best explained in the accompanying diagrams. Any of these faults can only be remedied by specialist repairers or replacement of the defect part.

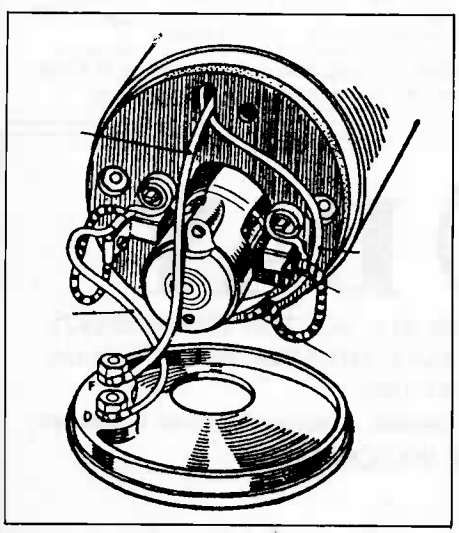
If you have the means, check the shaft for true running. It has been (rarely) known for them to be bent.

Should the armature pass these tests, then inspect the commutator strips, which can be lightly polished with 400 grade wet and dry paper. There should be no "ridging" in the area where the brushes bear. Any that there is can be remedied by those who have access to a lathe by taking extremely light cuts with a very sharp tool. In this case the mica strips separating the dynamo should be recut. They can be checked anyway, and they should be 1/32in deep – lay a 1/32in drill in the slot to check. A hacksaw blade ground down on the sides makes an excellent tool for the purpose. Cut them square, though, as in the illustration.

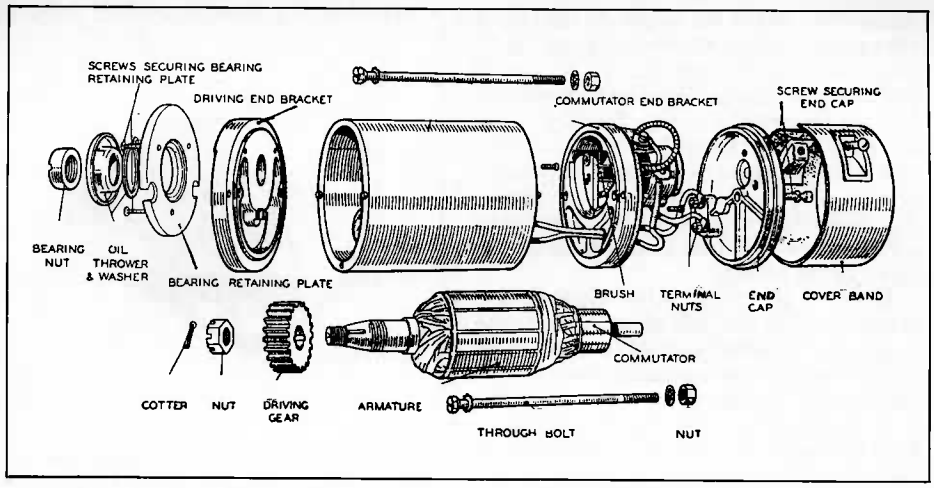
Now all should be ready for re-assembly which is a straightforward reversal of the process. The bearings are cheap enough to replace as a matter of course, and should be packed with a high melting point grease. Brushes should be replaced when less than 5/16in long. They must be a nice sliding fit. Don't be afraid to use a fine file on them.

Other points to watch are the threads in the driving end bracket which often suffer; usually these have been loose and allowed the bearing retaining plate to fluctuate. Loctite will prevent this. There is no repair save replacement. The bearings are often loose – Loctite again may save the day. Sprocket driven types suffer from hammered threads so check this 3/8in BSF thread and clear the remains of any mangled split pins from the hole. The commutator end bracket will distort and is best checked for truth on the empty body before assembly. The negative brush fixing point is often stripped; a very small self-tapping screw will do at a pinch, though I prefer to tap oversize.

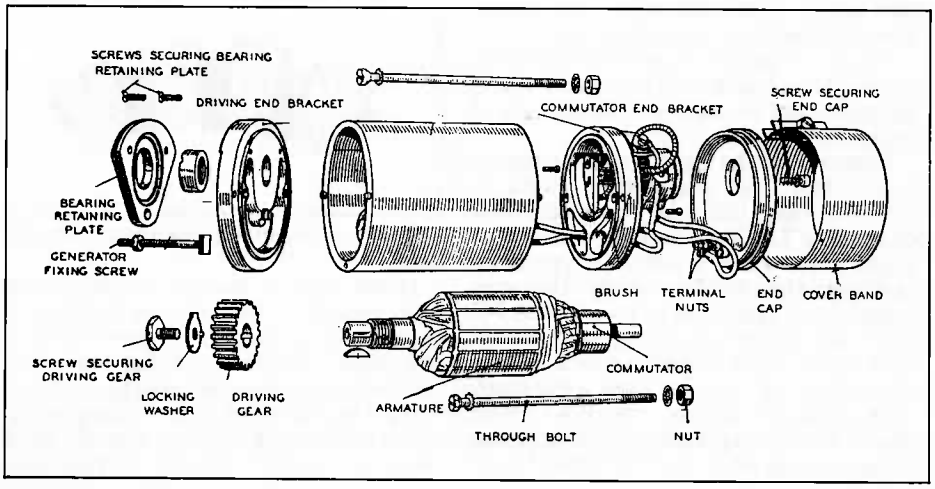
Before the brushes are refitted make sure that the armature spins easily especially if



General connections – on later machines the white lead is omitted, the brush flexible lead being connected direct to terminal D.



Lucas model E3H, with oil seal.



Lucas model E3HM.

the pole shoe has been out. A slackening of the through bolts and a twist of the end brackets may be all that is required otherwise. Sometimes the holes in the end brackets for the locating pegs wear oval.

When fully re-assembled, check that the dynamo "motors" as in the test described at the beginning. It should motor in the direction of the arrow stamped on the body. If it motors in the opposite direction then the brush connections must be reversed.

After the dynamo has been fitted to the machine it must be polarised. This is done by touching a lead from the battery live terminal to the F (field) terminal for about three seconds. Care must be taken to use the correct terminal of the battery – negative if positive earth, or vice versa. Before 1951 a negative earth was often used. The dynamo must be properly fitted and clamped to ensure an earth and the voltage control box disconnected. Use the proper little bullet connectors with the wire strands spread evenly back over it, and secured by the little kidney shaped fibre device. The little rubber covers are readily available at autojumbles, either as original or repro items. A spot of Vaseline on these terminals helps to keep things working.

All the Lucas series of dynamos come to bits in much the same way except the early E3AR types found on AMC machines, which carry the magneto type bearings in the end covers. This can be a pain if the bearings are worn out, as they cannot be removed from the covers.

Magdyno units have a small clutch drive assembly which is easily dismantled. There is a lock tab under the nut hidden in old grease, and the whole assembly is *not* locked by a screwdriver jammed into the gear but by a piece of 1/4in rod bent to a flat "U" at 3 3/16in centres, one tail of the "U" being longer to go through the topmost hole of the Magdyno body and the other to a hole in the backplate on the magneto shaft. The fibre gear often wears badly. Where you find them is your problem, though I have often been lucky at autojumbles. Pack with HMP Grease, and use a very thin gasket, which you will have to make, on the cover.

The nut of this clutch should be set up with the gear locked as described, so that it begins to slip when a torque of 5-10 ft.lbs is applied. Less than that and the spring is too weak, more and it is too tight.

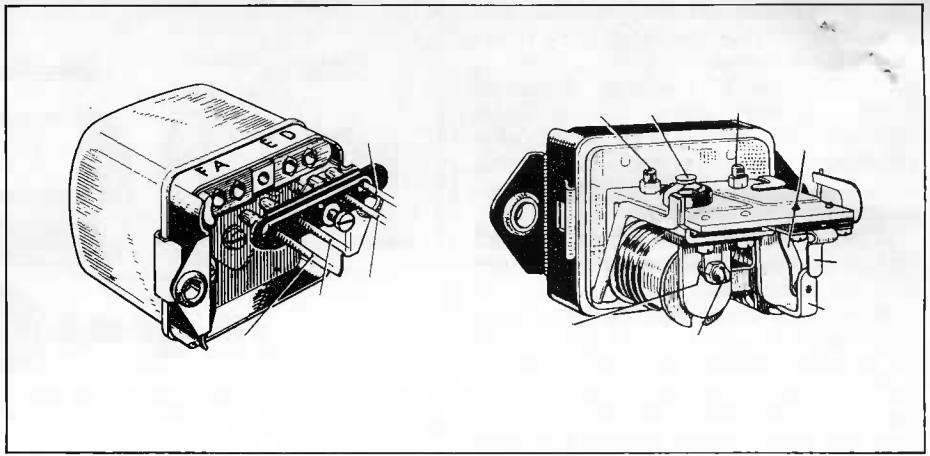
All the electricity now generated by your overhauled dynamo is pumped into the battery by a device known as a Voltage Control Unit (or CVC). It is a device which monitors the state of charge of the battery, and controls the flow of currrent into it accordingly. It also contains a cut-out which stops the battery discharging itself via the dynamo windings when the engine is not running. Thus, if the battery is fully charged, and the engine is running, *no charge* will be indicated on the ampmeter. Turn on all the lights and rev the engine, and the needle should then swing from a discharge indication to slightly above the zero position. Thus all is well. Similarly if the battery is absolutely dead flat, no charge will be indicated, as the instrument needs to sense some current to switch itself in. A high state of revs, however, should move the ampmeter needle over to positive quite

noticeably. When the engine is running at revs equal to about 30mph in top gear, then, with the lamps full on, the needle should show balance charge. Too much charge may boil the battery and buckle the plates – and at around £20 for those little black batteries that is a situation to avoid. Too little charge and on long runs in the dark the battery will slowly discharge itself as the lamps draw off the extra power they need from the reserve in the battery.

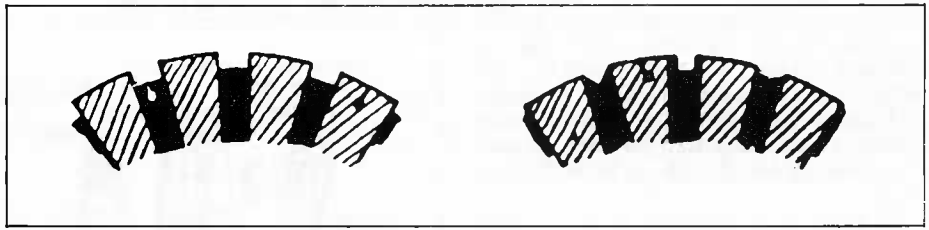
Before I go much further I'll state that these units are best left alone – more than a soupçon of ability is needed and no spares are available to my knowledge, save by cannibalisation. In case of trouble, where one is in doubt as to where the trouble lies – start the engine and with the engine running quite fast, short together the D and F terminals at the control box, and if a charge is then shown on the ampmeter, the fault is almost certainly in the control box.

There are three or four basic models of Lucas CVCs, but they all look more or less the same, and all share a common logic of operation.

Prior to 1953 the legend on the terminals read FADE. An unfortunate choice of letters. Perhaps that is why they were later changed to FAED? There are two sets of points inside which, if left out of operation in a damp atmosphere, corrode. They may respond to a light wipe with a piece of 400 grade wet and dry paper, likewise the top of the coils. I just fill mine up with WD40. Incidentally all electrical units suffer badly from any degree of damp, even if A1. Good spares should be kept warm and dry. Airing cupboards are ideal, and it's where I keep



Control box layout and internal connections.



The way to undercut commutator insulation.

mine.

In the back of the unit are two screws with locknuts. One controls the rate of change. *Do not tamper with these lightly.* If you must, however, turning this screw clockwise increases the charge, and vice versa. On your head be it. Lucas give precise data for setting these screws, which takes into account ambient temperatures, and needs a 0-20v voltmeter for setting. Far better you should send it to a specialist.

Finally in an emergency or for super-lightweight specials, providing that the battery leads are taped up out of harm's way, the machine can be used at night without the battery, though the lights resulting are, I feel, always a little below par, and will vary in brightness with the engine speed.