

SECTION D-6

ISSUE 2, APRIL 1953

Supersedes Issue 1, February 1952

# LUCAS

*Quality*

## EQUIPMENT

VOLUME 2

### WORKSHOP INSTRUCTIONS

#### REMAGNETISATION OF MAGNETOS



JOSEPH LUCAS LTD • BIRMINGHAM 19 • ENGLAND

Printed in England

# LUCAS WORKSHOP INSTRUCTIONS

## REMAGNETISATION OF LUCAS MAGNETOS

### INTRODUCTION

Recent development in the manufacture of alloy steels for permanent magnets has been most marked. Magnetos now have about 26 times the energy possessed by an obsolete tungsten steel horseshoe magnet of the same size. Tungsten steel was the chief magnetic alloy used until about 1920. Since then other strongly magnetic steels have been made containing Chromium, Cobalt and Nickel and, more recently, magneto magnets have been made from compressed metal powders such as Alnico, Alcomax, Ticonal E, Ticonal G and Alcomax 2. These special high energy magnetic materials are more expensive than tungsten steel but their development has made possible the compact high efficiency magneto in use today.

Under normal conditions these small magnets will retain their power for very long periods but some-

times it is necessary to remagnetise them, particularly after an armature or rotor has been removed from a magneto for repair or examination.

Powerful electro-magnetic magnetising machines are used, classified as either vertical or pot type. The vertical type is the more common machine and is the type referred to in these notes, but the principle and method of use is similar in both cases. The magnet to be re-magnetised is placed on or in the magnetiser so that by bridging two pole faces or adjustable jaws it completes an iron circuit round which the magnetising flux can pass. The principle of all electro-magnetic magnetisers is shown symbolically in Fig. 1.

As the current is switched on, the coils on each limb produce a magnetic field. This field is concentrated within the limbs, since these form a common iron core. The intensity of such a field is a product of the current flowing (in amperes) and the number of turns of wire on the core. The recommended number of ampere-turns for a machine to remagnetise Lucas magnetos is stated on Page 2. The magnetising effect of one ampere flowing through one thousand turns of wire, is the same as one thousand amperes flowing round one turn, and either method may be used, whichever is the more convenient. In practice, since smaller currents are more easily switched, it is usual to employ many turns of fairly light-gauge wire and a small magnetising current.

Due to requirements of machine mounting and to the irregular shapes of some magnets, or of complete magnetos, the horse-shoe form of magnetiser shown in Fig. 1 is seldom used. A typical inverted horse-shoe or vertical magnetiser is shown in Fig. 2.

Should the magnet to be re-magnetised be of the horse-shoe form, as illustrated in Fig. 2, it will be a simple matter to obtain good magnetic contact with the ends of the magnet, and the flux path will then be through a closed iron circuit. However, with present day magnetos the magnet system is often cast integral with an aluminium or other non-magnetic alloy body. In such cases some sections of the flux path or circuit may, of necessity, be through air and aluminium; but by supplementing the iron circuit between the pole faces with adaptor pieces, and by building up with specially shaped soft iron blocks, these non-magnetic sections of the flux circuit can be kept to a minimum and the flux concentration within such a circuit can be greatly increased.

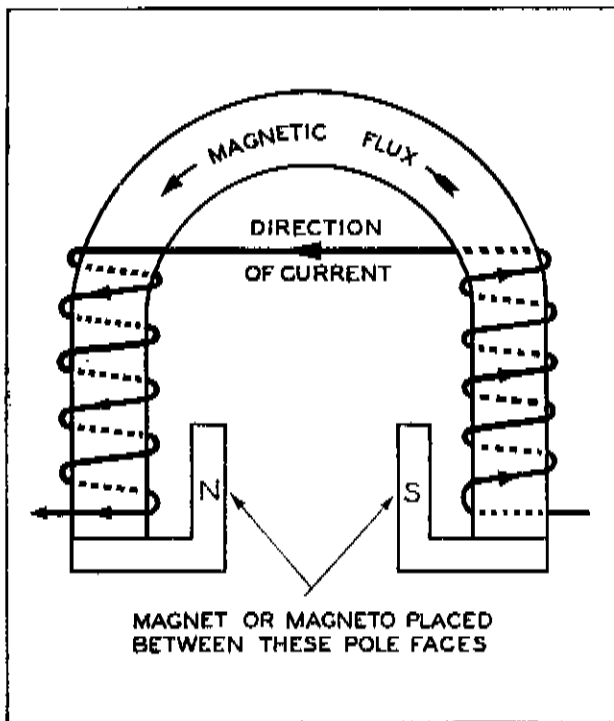


Fig. 1

Principle of an electro-magnetic magnetiser



# LUCAS WORKSHOP INSTRUCTIONS

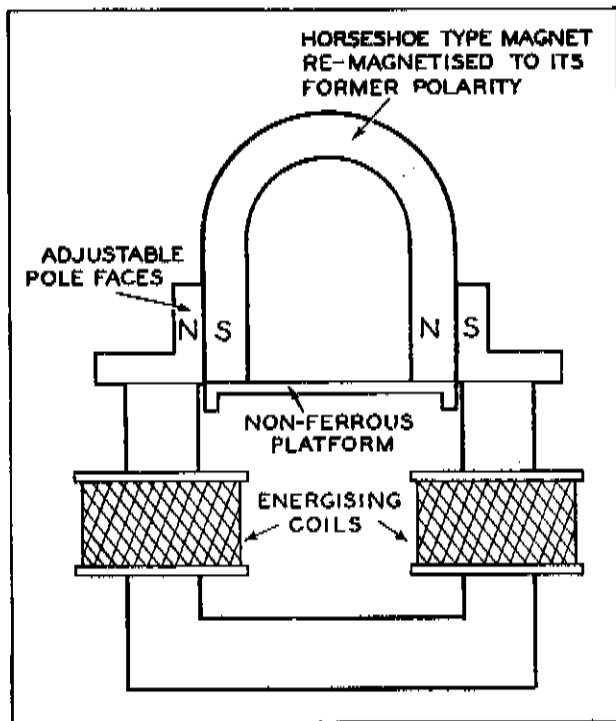


Fig. 2  
Vertical type magnetiser

## SPECIFICATION OF A TWO-POLE MAGNETISER

A two-pole magnetiser complying with the minimum specification detailed below would be capable of magnetising to saturation all commonly met with magnetos, including all Lucas models referred to in the following notes.

Core Material	Soft (preferably Swedish) Iron
Core Area	9 square inches
Recommended Core Winding	65,000-70,000 ampere-turns
Magneto Platform	Brass or other non-magnetic material
Minimum Distance Between Poles	Width of magneto body

## NOTES ON THE REMAGNETISING OF VARIOUS LUCAS MAGNETOS AND INDUCTOR GENERATORS

### MAGNETIC CIRCUIT

The recommended ampere-turns value given in the foregoing specification is intended only as a guide to cover the most difficult cases of re-magnetisation.

In practice it may be found that saturation is possible at much lower values but this will depend on the efficiency of the external magnetic circuit. It is, therefore, most important when setting up magneto and blocks to keep all air gaps to a minimum, and to butt the various components so as to give maximum metal surface contact between them. The contacting faces of the blocks should be ground in order to increase this metal-to-metal contact. If these precautions are not observed the magnetiser may fail to saturate the magneto magnet.

### VOLTAGE DROP

Cables connecting the magnetiser to the supply must be of sufficient section to carry the magnetising current without causing an excessive drop in volts. Likewise, any cable joints must be capable of passing the required current. To test for voltage-drop, a voltmeter reading must be obtained at the magnetiser terminals **with the magnetiser switched on**. The reading so obtained must not be less than the rated voltage of the magnetiser. If this is not the case, raise the supply voltage to compensate for line volt drop and for other losses which may occur.

### IMPULSE STARTERS

Some magnetos are fitted with Impulse starters. These must always be removed before such magnetos are remagnetised, otherwise the starter pawls will become polarised and may cease to function.

### SPARK POLARITY

The voltage at which a spark will jump the plug gap is influenced by the temperature of the negative electrode — the hotter this electrode the lower will be the voltage required to cause a spark, and since it is desirable to keep the plug voltage as low as possible, in order to prevent undue electrical stressing of the windings, the central electrode, being hotter than the outer earthed electrodes, is normally made negative. The sparks produced by a magneto designed for multi-cylinder engines are alternately positive and negative in polarity; that is to say, they jump alternately from the central electrode of the sparking plug to earth ('positive spark'), and from earth to the central electrode ('negative spark'). When remagnetising it is normally not necessary, therefore, to observe the original polarity of the magnet in a magneto for multi-cylinder engines. (An exception to this will be found in Model KVF. This magneto, designed for use with V-twin engines, produces two sparks, one of which is much retarded, and in order to obtain the most favourable slow speed performance, it is desirable to make the retarded spark of predetermined polarity.) On the other hand, the sparks produced by single-cylinder magnetos (and all ignition coils) are always of the same polarity — every spark can be a positive spark or a negative spark according to design — and the question arises regarding the most suitable polarity to adopt.



# LUCAS WORKSHOP INSTRUCTIONS

For the reason given a spark of negative polarity is chosen.

The production of a negative spark by a single-cylinder magneto is determined by the polarity of its magnet and rotation, together with the fitting of a contact breaker cam designed to interrupt a primary current of predetermined polarity.

## CHECKING SPARK POLARITY BY INSPECTION

After a little practice, it is possible to check the spark polarity of a single-cylinder magneto by inspection. To make this check, connect the magneto high tension cable to a 3-point spark gap and run the machine at a fairly high speed. A glow will appear round the negative electrode. This glow, sometimes referred to as the 'feather' or 'ball' of the spark, should appear on the centre electrode of a sparking plug for correct polarity sparking.

## REMAGNETISING

The influence of cam fitments on spark polarity with single-cylinder magnetos precludes remagnetising according to a rule-of-thumb based on polarity and rotation alone.

It is necessary therefore, before remagnetising, to

check with a pocket compass the polarities of both magneto and magnetiser.

**Note:** When a compass needle is brought near to a magnet, that end of the needle which normally indicates North will be attracted to the South pole of the magnet.

When the polarities of magneto and magnetiser have been ascertained, place the magneto on the magnetiser so that unlike poles are adjacent, as shown in the accompanying sketches.

In the sketches, it will be noted that some models are shown with the driving end facing the viewer, whilst in others the contact breaker is shown. These are only sample illustrations and are not intended to show the only method of mounting any particular magneto model. A magneto must be mounted on the magnetiser so that unlike poles come together, according to the findings of the preceding compass check.

## DISTRIBUTOR AND CONTACT BREAKER COVERS

It is important that distributor and contact breaker covers are in position during remagnetisation to prevent the possible entry of foreign particles.

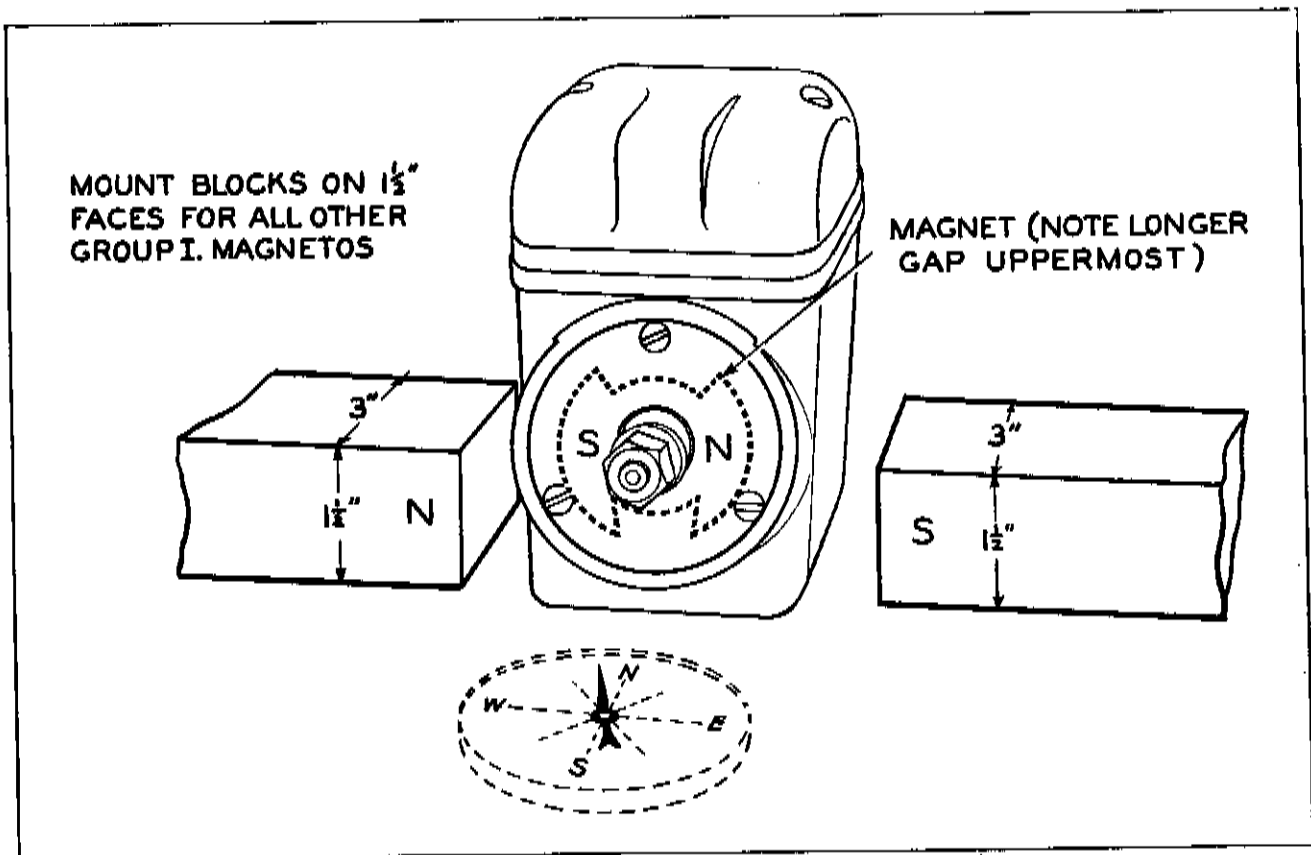


Fig. 3

Typical arrangement for remagnetising magnetos of Group 1 showing magneto model RS1 and blocks



# LUCAS WORKSHOP INSTRUCTIONS

## APPLYING THE MAGNETISING CURRENT

After placing the magneto between the pole faces of the magnetiser and arranging blocks or jigs so that air gaps are kept to a minimum, the current should be intermittently applied. Five or six applications are recommended, each of one second's duration with two-second intervals. Further or longer applications will not increase magnetisation.

## PROCEDURE FOR MAGNETISING

The following sections show which magneto models may be remagnetised using the same pair of blocks. The block dimensions are given, together with points to be watched with individual magneto models. The accompanying illustrations show one magneto from each group in position for remagnetising. They also show in broken line the approximate location, shape, and size of the magnet(s) within the magneto.

### 1. GROUP I

#### (a) Comprises:

(i) Rotating Armature Magnetos:—  
Model GJ4 and others having horseshoe magnets;  
Models N1, KN1, N2, KN2 etc.

(ii) Rotating Magnet Magnetos:—  
Models RF2, RF2F, RF4, RF4F; Model RS1.

#### (b) Blocks:

The above ranges of magnetos require butting with two plain-ended, annealed mild steel blocks of  $1\frac{1}{4}$ " x 3" section—their length will depend on the distance between the magnetiser poles. Note that, except for model RS1 magnetos, the blocks are mounted on the  $1\frac{1}{2}$ " face.

#### (c) Procedure:

Remove the impulse starter, if fitted.

#### (i) Rotating Armature Magnetos:

Check polarity of the magneto and magnetiser, and place unlike poles adjacently.

Arrange blocks to give a good magnetic circuit. Operate the magnetiser.

(ii) Rotating Magnet Magneto: Single-Cylinder  
Model RS1.

Remove the moulded cover and turn the rotor shaft until the longer of the two gaps between the rotor poles is seen to be at the top.

**DO NOT FORGET TO REMOVE IMPULSE STARTER (when fitted)**

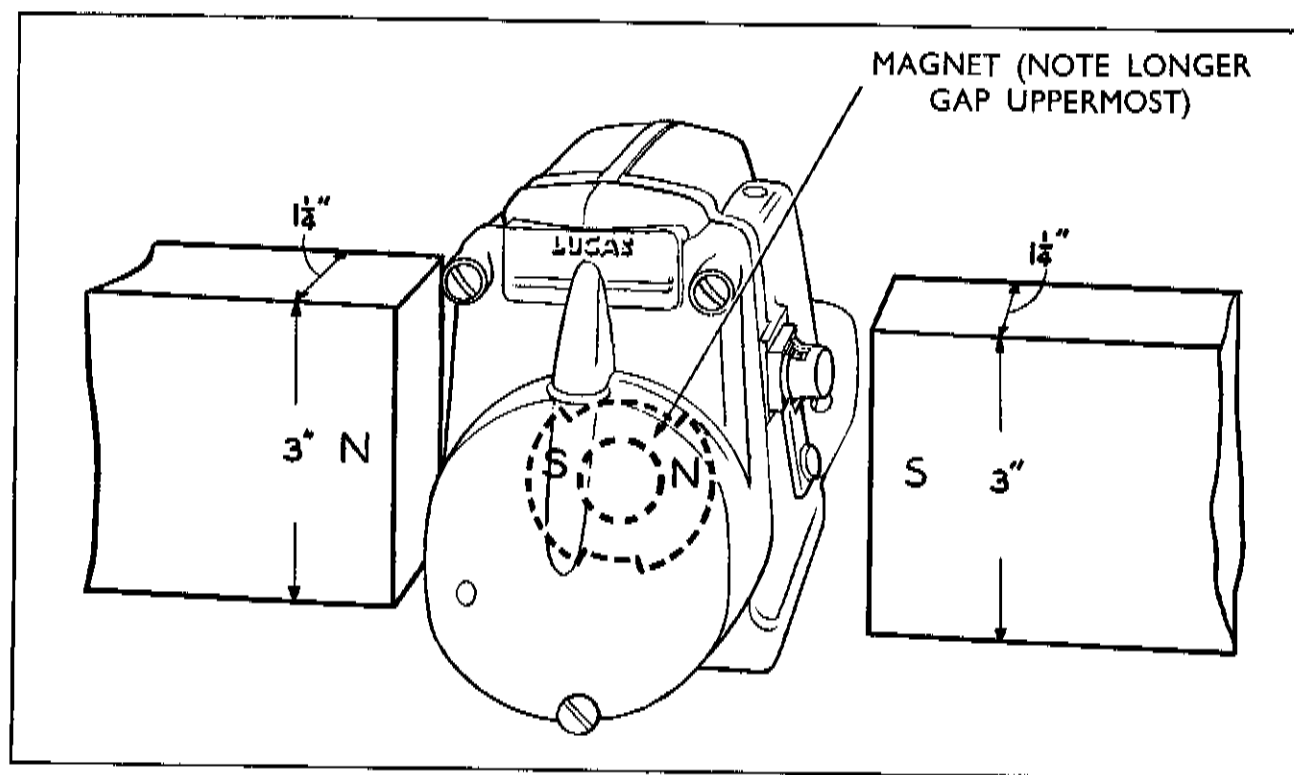


Fig. 4

Typical arrangement for remagnetising magnetos of Group II showing magneto model SR1 and blocks



# LUCAS WORKSHOP INSTRUCTIONS

Check polarity of the magneto and magnetiser. Place the magneto and blocks in position so that unlike poles of magneto and magnetiser are adjacent. Refit the moulded cover and operate the magnetiser.

(iii) Rotating Magnet Magnetos: Twin-and-Four-Cylinder Models RF2, RF2F, RF4, RF4F.

The rotor poles must be aligned with the stator pole pieces. To ensure this, turn the driving shaft so that its keyway is horizontal. Place the magneto and blocks in position so that unlike poles of magnet and magnetiser are adjacent. Operate the magnetiser, **KEEPING THE ROTOR KEYWAY HORIZONTAL**. N.B. Where large numbers of RF models are handled the use of a dummy impulse starter is recommended. This spare impulse starter should be marked so that by aligning the mark with the starter cover securing screw the correct rotor position for remagnetisation (i.e. rotor pole shoes aligned with stator pole pieces) is obtained automatically. The starter must be gripped to restrain the rotor from turning whilst re-magnetising.

## 2. GROUP II

(a) **Comprises:**

Rotating magnet magnetos:

Models SR1, SR2, SR4 (with or without prefix K or suffix F).

(b) **Blocks:**

$1\frac{1}{2}$ " x 3" section, plain-ended.

(c) **Procedure:**

Remove the impulse starter, if fitted. If large numbers of model SR magnetos with impulse starters are handled, it is advisable to use a dummy impulse starter as described in the case of Group 1 opposite.

(i) Single-Cylinder Magnetos: Models KSR1, SR1, SR1F.

Remove the moulded cover and turn the rotor until the longer of the two gaps between its poles is seen to be at the top. Check polarity of the magneto and magnetiser. Place the magneto and blocks in position so that unlike poles of magneto and magnetiser are adjacent. Refit the moulded cover and operate the magnetiser.

(ii) Twin-and-Four Cylinder Magnetos: Models KSR2, SR2, SR2F, KSR4, SR4, SR4F.

Remove the moulded cover and turn the rotor until its poles are seen to be aligned with the stator pole pieces. Refit the moulded cover and place the magneto and blocks in position on the magnetiser platform. Operate the magnetiser.

## 3. GROUP III

(a) **Comprises:**

Rotating armature magnetos: models KIF, KVF, K2F.

(b) **Blocks:**

$1\frac{1}{2}$ " x 3" section, with ends radiused as shown in Fig. 5.

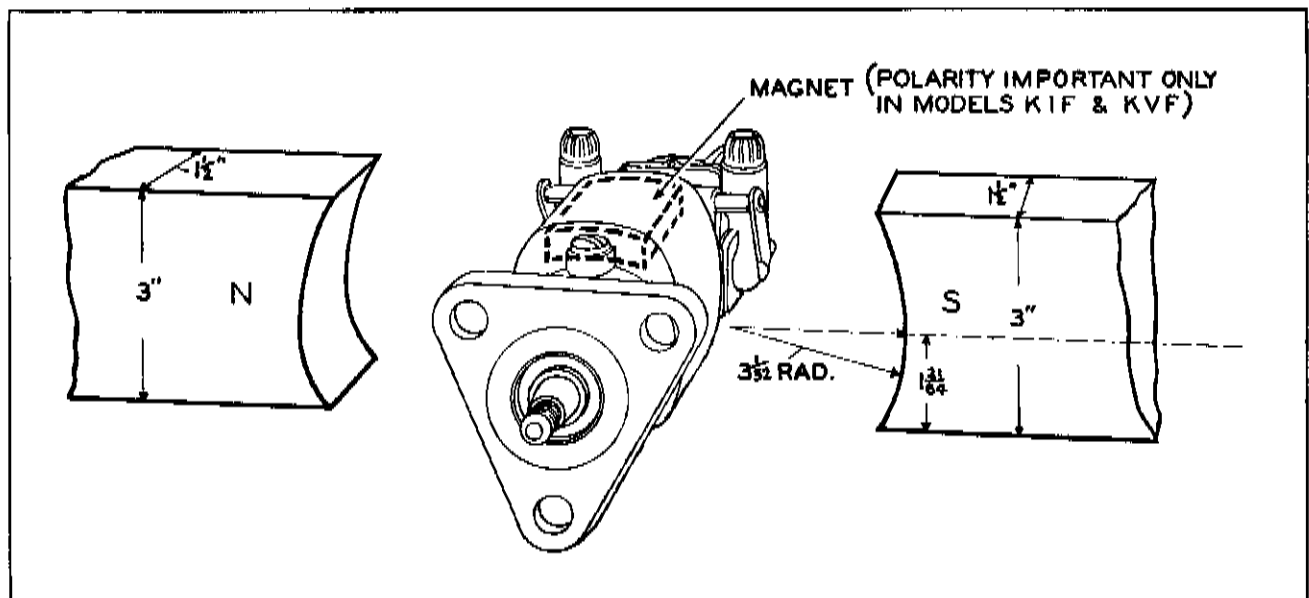


Fig. 5

Typical arrangement for remagnetising magnetos of Group III showing magneto model K2F with two special blocks



# LUCAS WORKSHOP INSTRUCTIONS

## (c) Procedure:

### (i) Single Cylinder Magneto, Model K1F.

Check polarity of the magneto and magnetiser and place the magneto in position so that unlike poles of magneto and magnetiser are adjacent. Arrange the blocks to give a good magnetic circuit and operate the magnetiser.

### (ii) Twin Cylinder Magneto, Model KVF.

Check polarity of the magneto and magnetiser and place the magneto in position so that unlike poles of magneto and magnetiser are adjacent. Arrange the blocks to give a good magnetic circuit and operate the magnetiser.

### (iii) Twin Cylinder Magneto, Model K2F.

No special rule need be observed since, with these machines, performance is unaffected by magnet polarity. Arrange the blocks to give a good magnetic circuit and operate the magnetiser.

## 4. GROUP IV

### (a) Comprises:

Rotating armature magneto incorporated in Magdyno models MN2, MN1E, MO1, etc.

### (b) Blocks:

Two blocks of  $1\frac{1}{2}'' \times 3''$  section. One must be convex-ended (to fill the space normally occupied by the dynamo yoke). The other must be plain-ended for contact with the magneto base.

For magnetos having dowel pins in the base a flat mild steel plate will be required, drilled to clear these dowel pins. This plate, or extra block, is shown in Fig. 6.

### (c) Procedure:

Place the magneto on its side as shown in Fig. 6, then check polarity of the magneto and magnetiser. Place the magneto in position so that unlike poles of magneto and magnetiser are adjacent. Arrange the blocks to give a good magnetic circuit and operate the magnetiser.

## 5. GROUP V

### (a) Comprises:

Rotating magnet 'vertical' magnetos:

Models 4VR, 6VR, (with or without suffix A or S); Model 8VRSF.

### (b) Blocks:

These camshaft-speed 'vertical' magnetos require two blocks or plates about two inches square each having a circular recess to accommodate the bare shaft extension. The block or plate to be placed against the contact breaker assembly must have a central hole  $\frac{7}{8}''$  deep and  $\frac{5}{8}''$  dia. The block or plate to be placed against the drive end must have a central hole  $\frac{3}{4}''$  deep and  $\frac{9}{16}''$  dia.

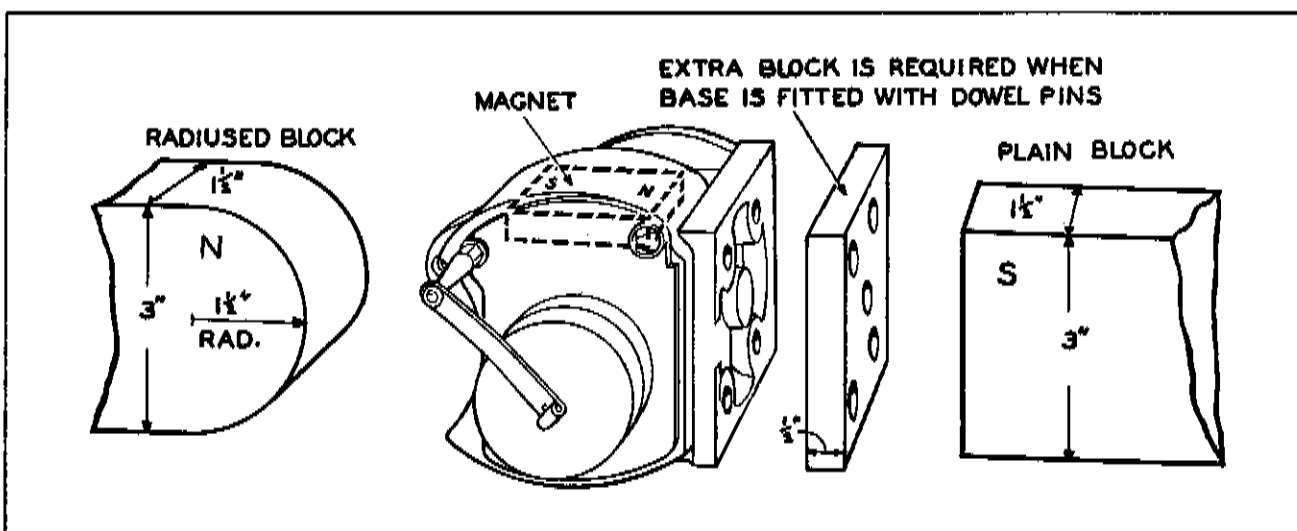


Fig. 6

Typical arrangement for remagnetising magnetos of Group IV showing magdyno model MO1 with dynamo removed



# LUCAS WORKSHOP INSTRUCTIONS

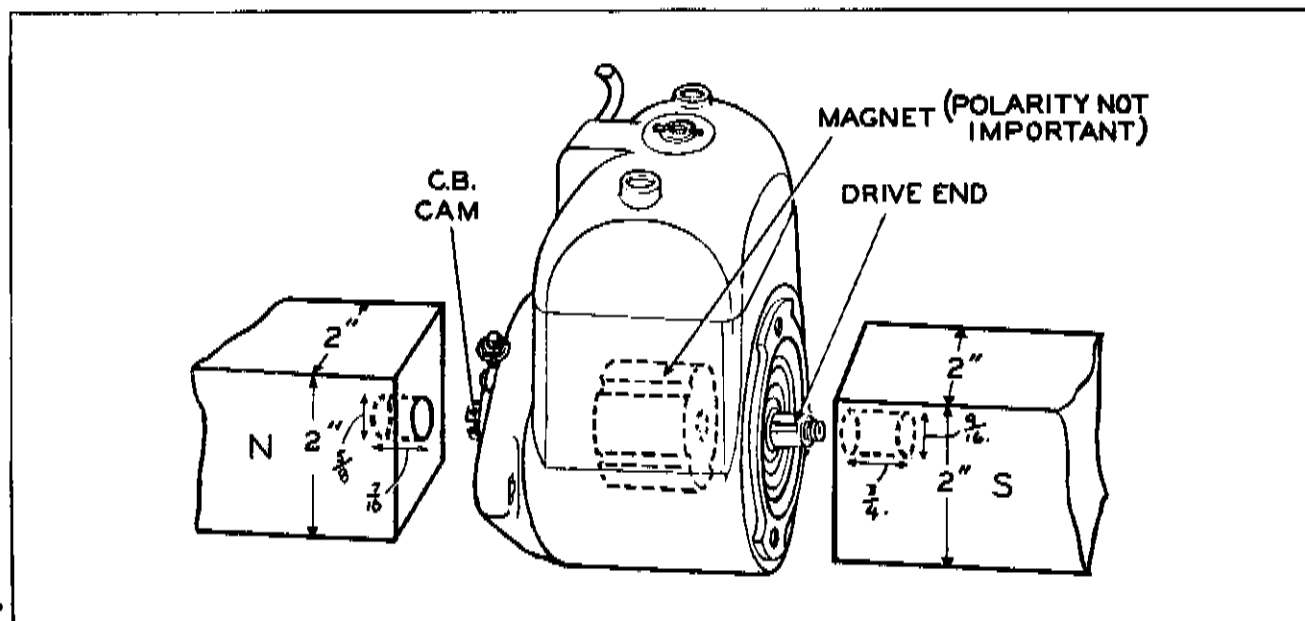


Fig. 7

Typical arrangement for remagnetising magnetos of Group V showing magneto model 4VR and blocks

### (c) Procedure:

Before magnetising, the distributor cover and h.t. rotor arm must be removed from the upper end, and the lower part of magneto body containing impulse starter or auto advance mechanism from the other, (as Fig. 7). Place the magneto on the magnetiser platform and arrange the blocks as illustrated. Operate the magnetiser.

## 6. GROUP VI

### Inductor Generator: Model IA45.

The rotor must not be removed from the stator, otherwise the magnets in the latter will become demagnetised.

The Inductor Generator calls for very special attention if remagnetisation should become necessary and, therefore, if the rotor is to be removed for any reason, it is strongly recommended that keepers be fitted across the magnets in the stator (see Fig. 8a.) thus preventing demagnetisation.

If it is necessary to carry out bench work, such as the replacement of stator coils, be sure to replace the rotor (or fit a dummy rotor) before taking the keepers off the stator. By this means, the need for remagnetisation will be avoided.

If these precautions are not observed, it will be necessary to return the complete unit to the Works, in order to restore its original performance.

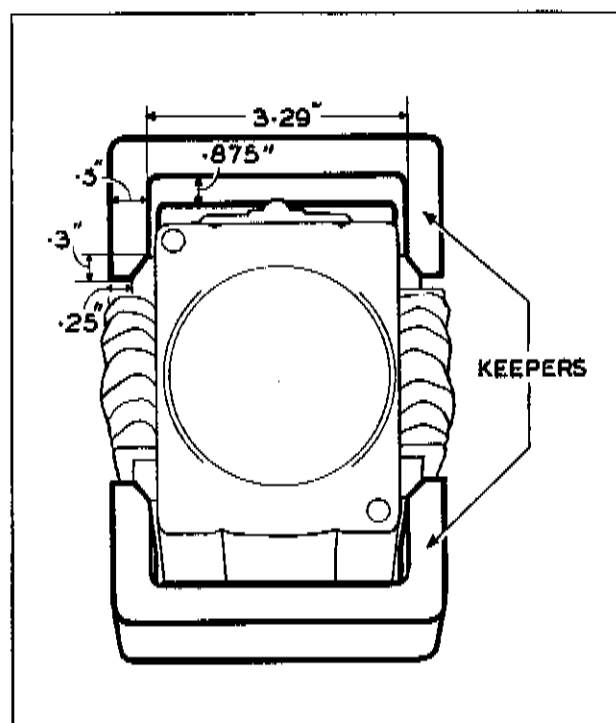


Fig. 8a

Showing keepers fitted to model IA45 inductor generator before removal of rotor





# LUCAS WORKSHOP INSTRUCTIONS

However, in an emergency, the magnets can be partially remagnetised with the magnetiser specified — but the output of the machine will not reach its original designed value.

### Blocks:

The two blocks required for this 'first aid' treatment are of 3" x 1½" section, with the 1½" edges chamfered to locate with the laminated cores of the stator coils.

### Procedure:

The stator contains two magnets which are to be separately remagnetised.

Leaving the rotor inside the stator, lay the generator flat on the magnetiser platform with the contact breaker assembly uppermost and the terminal board furthest away from the operator (see Fig. 8b). It will be seen that both magnets must be remagnetised in the same direction with respect to the stator. This calls for a two-stage operation. The arrangement for remagnetising the magnet furthest from the operator is shown in full line and labelled Position I; arrange the generator thus and operate the magnetiser. Then, to remagnetise the magnet nearest to the operator, arrange the generator as shown in broken line and labelled Position II. Operate the magnetiser.

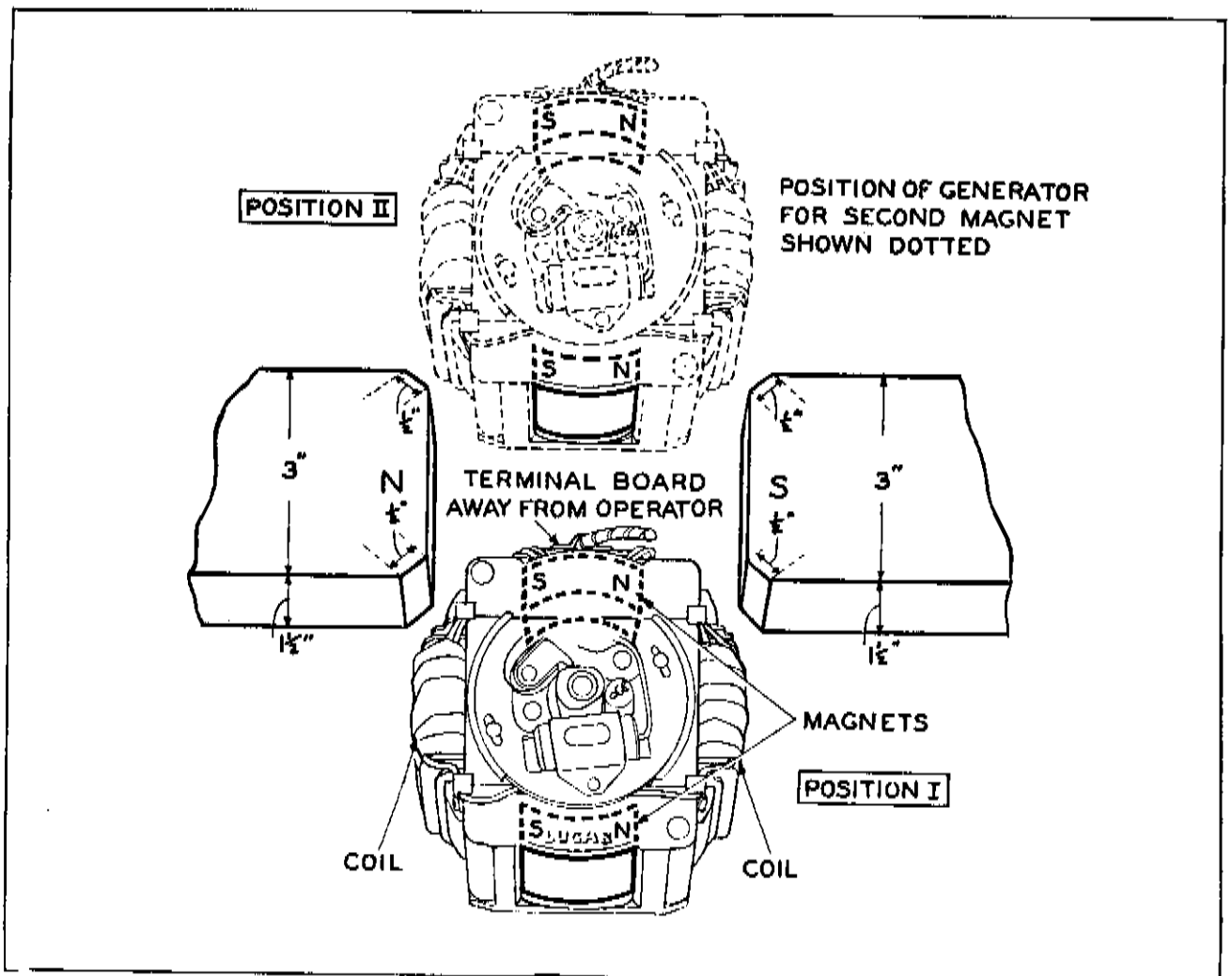


Fig. 8b

Typical arrangement for remagnetising model IA45 inductor generator

