

The Installation & Care of



MAGNETOS.

Models E06 - E04 - F04

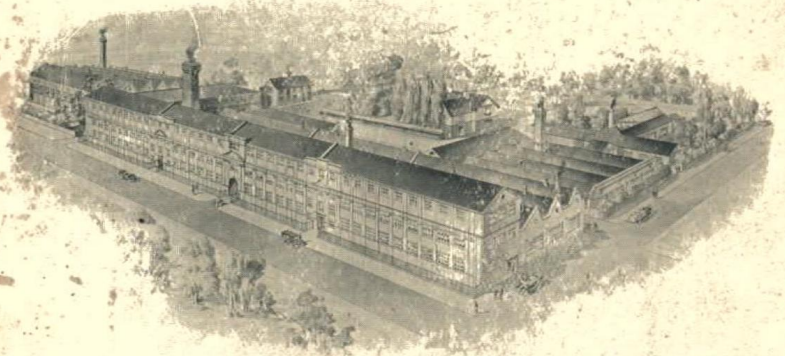
With Moveable Extensions
to the Pole Shoes.

NORTH & SONS LTD.

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The British-Made

WATFORD MAGNETOS



NORTH & SONS, LTD.

Governing Director R. B. NORTH.

The Watford Speedometer & Magneto Works.

WHIPPENDELL ROAD, WATFORD.

Telephones: 622 & 623 Watford. Telegrams: "Aeromags, Watford."

Registered Offices - - 14 SOHO SQUARE, LONDON, W.1

Telephone: 1346 Gerrard. Telegrams: "Aeromags, Westcent, London."

Description of New Models of Watford Magnetos

The latest models, E.O.6, E.O.4, and F.O.4, the first of which is illustrated in this booklet show a marked advance in magneto design, in that with these models a spark of equal intensity is obtained at all points in the range of advance.

This effect is not obtained at the sacrifice of efficiency when the spark is fully advanced, but the efficiency usually obtained with the spark fully advanced, is obtained in these models with the spark fully retarded or at any point in the range from full advance to full retard.

These models will spark over a standard $5\frac{1}{2}$ m/m gap in air at low speeds with the spark fully retarded, and the voltage necessary to spark at such a gap is between 6000 and 7000, but we do not recommend the setting of the electrodes at the sparking plug at more than .014 in.

The advantage in starting by hand is very considerable as the spark can be fully retarded to prevent any danger of backfire, with the certainty of obtaining an efficient spark.

The advantage is also found when starting by means of an electric starter, as with the spark retarded, the engine will run at lower speeds and the work of the electro motor is considerably reduced.

An engine will run on one of these magnetos at the lowest speed at which efficient carburation can be obtained.

We are able to maintain the advantages described, and at the same time, to give a considerably increased range of advance in the larger models, where the size of the distributor block permits of it, and have standardised a range of 45° for the Model EO4, and of 60° for the Model EO6, giving respectively 45° and 40° range of advance on the crank shaft, the reduction on the six-cylinder model as compared with the range of advance on the magneto being due to the fact that, on a six-cylinder engine the magneto runs at one-and-a-half times the speed of the crank shaft.

The construction of the new models is shown in the illustration on page five.

The pole shoes are provided with moveable extensions consisting of two segments of readily magnetisable material built up by means of rings of non-magnetic material into the form of a sleeve which is interposed between the pole shoes and the armature, and the

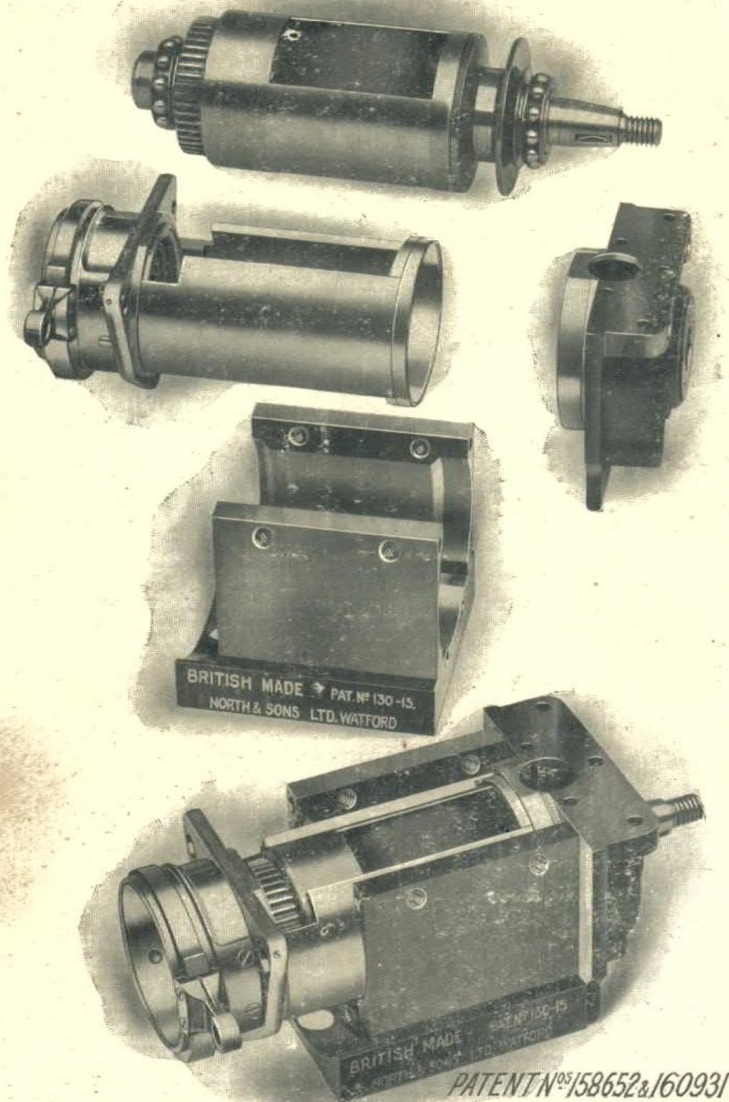
segments making contact with the pole shoes, it follows that the magnetism flowing through the pole shoes flows also through the segments.

In a magneto with a rotating armature the greatest intensity of spark is obtained when the reversal of the magnetic flux in the armature and the interruption of the primary circuit by the contact breaker bear a certain definite angular relation to each other. In a magneto with fixed pole shoes the reversal of the magnetic flux occurs at a definite point in the movement of the armature, whereas the point of rupture of the primary circuit varies with the position of the spark advance lever, its relation with the reversal of the magnetic flux is correct at one position only and the spark loses its intensity at all other points, being at its worst when fully retarded.

In the new construction, movement of the spark advance lever not only alters the position at which the primary circuit is interrupted, but as the lever is fixed to the sleeve containing the pole shoe extensions, these are moved through the same angle, and the reversal of the magnetic flux bears the same relation to the interruption of the primary circuit, and the conditions are such as to produce a spark of equal intensity at any point in the combined movement of pole shoe extensions and point of interruption, or in other words, in the range of the spark advance lever.

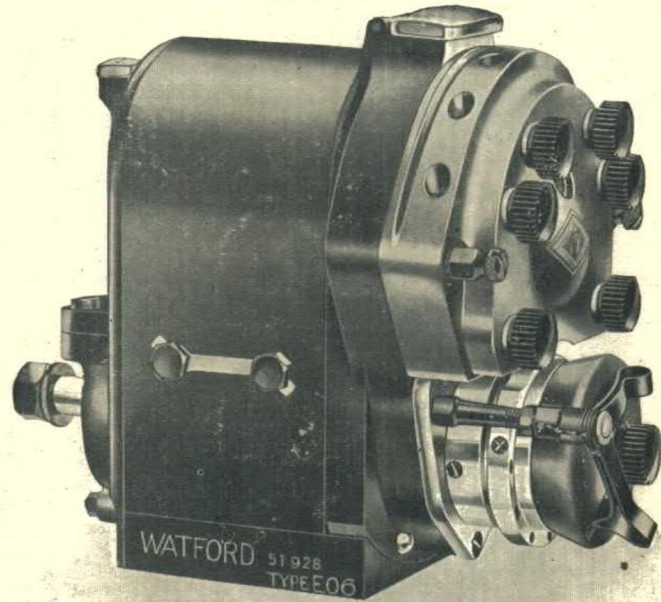
Details of New Type Watford Magneto

With moveable extensions to the pole Shoes described in the preceding pages.



WATFORD MAGNETOS.

With moveable extensions to the pole shoes.



The range of models with moveable extensions to the pole shoes includes the Model EO6 illustrated above, for six cylinder engines; and two Models EO4 and FO4 for four cylinder engines, the difference between these two being in the overall dimensions and in the range of advance

The Fitting of the Magneto

Magnetos are machined on the bases with extreme care within fine limits to ensure perfect alignment, and it is essential that the surface on which the base rests should be perfectly flat, and should be within .002" of the nominal height.

The magneto may be fixed either by means of a strap over the top of the magnet, in which case dowel pins may be screwed into the tapped holes in the base in order to secure correct alignment, or the machine may be fixed to the platform by means of studs or set screws fitting into these holes.

PERFECT ALIGNMENT IS ABSOLUTELY ESSENTIAL.

Speed of Magneto with relation to the Engine

The four-cylinder models give two sparks per rotation and must run at the same speed as the crank-shaft.

The six-cylinder models also give two sparks per rotation of the armature, and must run at one and a half times the speed of the crank-shaft.

Timing

The crank-shaft should be slowly turned by hand until the piston of the first cylinder is in the position

towards the end of the compression stroke corresponding to the firing position with the spark fully advanced. The position at which the best result is obtained varies slightly with different makes of engines, and in some cases is marked on the fly-wheel.

The magneto spindle should be turned by hand in the direction indicated by the arrow on the cap until the figure one is just visible through the window in the distributor block. The lubricator cap at the distributor end of the magneto should be raised, and through a small glazed window under this cover the teeth of the distributor gear wheel can be seen. The spindle should then be turned quite slowly until, when the figure one reaches the centre of the window, a tooth of the wheel on which a red mark is painted reaches a position where the mark is exactly in line with a red line painted on the under side of the glass.

One half of the coupling must be placed in position on the magneto spindle and the other half on the motor spindle. One of these should be keyed to the spindle, and the other free to rotate.

In a case where the flywheel is not marked; set the piston of the first cylinder in the dead top position on the compression stroke. Arrange couplings as already described, and remove contact breaker cover and place timing lever in fully retarded position. Turn magneto spindle in the direction indicated by arrow until the figure one is

visible through the window in distributor block. The fibre heel of the contact breaker lever should rest on the cam, that is the platinum points should be just opening.

With the crank-shaft and the magneto spindle in the positions described, the magneto should be placed in position, and the free portion of the coupling secured to its shaft without altering the position of either spindle.

The magneto should be fixed either by bolts or by a strap over the magnet, and the cables connected to the plugs.

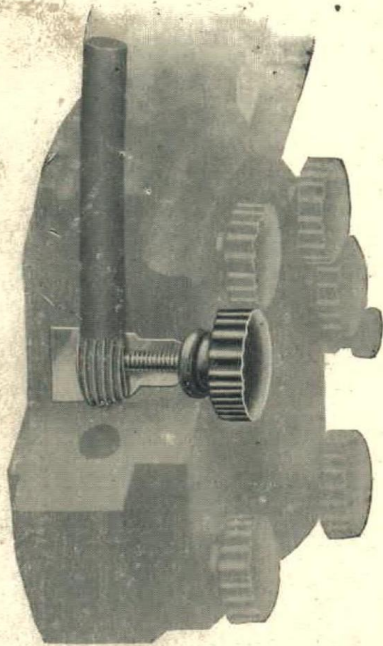
The terminal to which the cable from the first cylinder should be connected is the upper one on the right side when looking on the distributor end of the magneto. The order in which the others follow is clockwise when looking at the distributor end in the case of a right-hand magneto (one turning to the right as seen from the driving end), and anti-clockwise in the case of a left-hand magneto.

This refers to the order in which the carbon distributor brush comes into contact with the segments in the distributor block, and not to the order in which the cylinders fire, which order varies in different makes of engines, and it will be understood that the connections to the cylinders will be in the order in which they fire.

The Method of connecting the Cables to the Terminals of the Distributor Block

will be seen from the illustration following

The insulating material is removed from the wire for about one-third of an inch, and the strands of wire bent back over the rubber as shown; the terminal screw with insulated head is unscrewed until the point of the screw is withdrawn from the cable fairway.



The end of the cable is then put into the fairway and pushed down until stopped by the metal segment, and the screw with insulated head screwed in until the point pierces the insulation of the cable and passes between the strands of the wire. It should be screwed down until the flexible washer under the head of the screw is compressed, when a connection is formed which is thoroughly protected from moisture.

Adjustment of Tension on Contact Breaker Cover

In this style of magneto the contact breaker cover is held by two springs, as shown in the illustration of the complete magneto on page 6.

These springs have their ends formed differently, one to fit into a groove and the other into a circular recess in the cover.

They not only hold the cover in position but give sufficient tension to prevent any movement of the sleeve, forming the moveable pole shoe extensions, under magnetic reaction.

The necessary tension is very slight, and can be conveniently adjusted when on the engine to give sufficient tension without interfering with the movement of the controls, and the correct adjustment can be readily ascertained when the engine is running.

This adjustment is obtained by screwing the nut, on which the springs are mounted, in the required direction, and when it has been made this nut is prevented from any accidental movement by tightening the lock-nut under it.

Care of the Magneto

The ball bearings of the magneto are packed with grease when assembled, and the machine will run for a very long period without further lubrication.

In the case of magnetos for aircraft, where the aeroplane flies at every imaginable angle we do not provide any means of lubricating without dismantling, but in the case of magnetos for car engines we find that there is a demand for a convenient means of lubricating, and we therefore provide means by which the bearings can be oiled. Under the cap at the distributor end of the magneto will be found two small wells for oil, from which ducts are carried to the bearings, and under the cap at the driving spindle end of the machine is a further oil well. It is not intended that these wells should be filled with oil, and it is of the utmost importance that only the very smallest amount of oil (six drops in each well is sufficient) should be used in these places, and that no oil whatever should be used on any other part of the machine.

The Contact Breaker

should be examined occasionally to see that it is in good condition.

The inspection cover can be released by turning on their stud the two springs holding it (see page six.) It is then possible to examine the contact breaker. The opening between the platinum screws when the contact is broken—that is when the fibre pad in the contact lever rests on the cam—should not exceed .014". This can be adjusted by screwing in or out the long platinum screw and it is necessary before altering this screw to release the lock

nut which must be tightened up again after the adjustment is made.

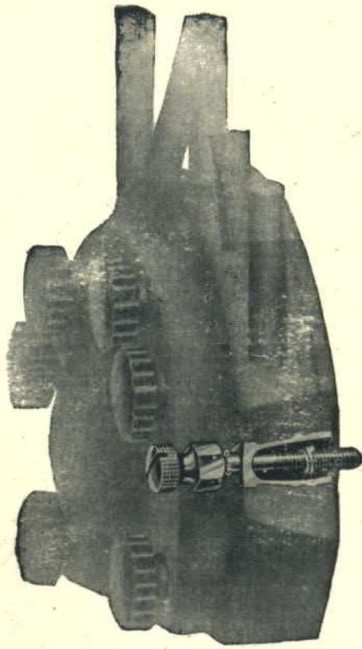
In the event of the necessity arising to remove the contact breaker to put in a new contact screw, it is only necessary to remove the centre bolt but in replacing the contact breaker it is essential to see that the key projecting from the cone at the back of the disc is in the key-way in the armature spindle.

Distributor Block.

It is advisable to remove the distributor block occasionally in order to see that the track of the carbon brush is clean, as in the event of a trail of carbon dust connecting two segments of the distributor it may be sufficient to cause a spark in the wrong cylinder.

Carbon dust can generally be removed by means of a soft dry cloth, but if the deposit is excessive it may be removed by petrol, in which case it is necessary after cleaning the track to wipe it with a slightly oiled cloth in order to prevent excessive wear of the brush, which would grind away rapidly on the surface as left from the petrol.

The distributor block is secured as shown in the illustration on page 14 by two screws passing through bronze bushes. These screws are provided with a hexagon and a slot, and the head is knurled. The screw can therefore be tightened by means of either a screw-driver or a spanner, and before the final tightening can be readily



turned by the fingers. A coil of wire is placed round the screw threads at a point where it does not interfere with the use of the screw, and this prevents the screw being mislaid or lost while the distributor is off the magneto.

Causes of Faulty Ignition

In the event of Irregular Firing

It is necessary in the first place to examine the sparking plugs.

It is possible for the plugs to become short circuited by the fusion of the points or by carbon deposit. On the contrary, it is possible that the points may be set too far apart, particularly in an engine in which the compression is high.

The distance between the electrodes should not exceed .014"; if they are set too far apart the spark will occur at the safety gap.

It is not sufficient test to see that a spark occurs with the plug removed from the cylinder, as it is not then affected by compression

A sudden stoppage of the ignition may result from the short circuiting of the low tension cable attached to the terminal on the inspection cover of the contact breaker. This can be detected readily by disconnecting this cable from the terminal.

Irregular firing may result from the contact breaker not being in perfect condition, and the details to which attention may be required are explained on page 14.

A similar result may occur from the formation of carbon deposit on the track of the distributor brush, and in this event the carbon dust should be removed as explained on page 13.

No attempt should be made to dismantle the magneto further than has been described, and if further repairs are required it should be returned to the works.

SPARE PARTS for WATFORD MAGNETOS

When ordering spares, kindly quote number, description, and direction.

Models			Description	£ s. d.		
EO6	EO4	FO4		£	s.	d.
2-B	2-B	2-B	Bolt for magnet (2-BA thread)			2
2-C	2-C	2-C	Locking piece for bolt 2B			1
4-1	4-1	4-1	Screw for end plate ($\frac{3}{8}$ " x 2BA)			1½
115	115	115	Screw for earthing brush 20-Z with carbon and spring	2	0	
115-A	115-A	115-A	Screw for earthing brush 20-Z without carbon and spring	1	0	
134	134	134	Cam for cam cage	3	0	
106-C	106-C	106-C	Screw for fixing cam			2
20-AO	20-AO	20-AO	Contact breaker for left-hand magneto	2	10	0
20-XO	20-XO	20-XO	Contact breaker for right-hand magneto	2	10	0
20-C	20-C	20-C	Contact lever with platinum contact screw	1	4	0
20-T2	20-T2	20-T2	Platinum screw for contact lever			9 0
20-S2	20-S2	20-S2	Platinum screw (long) for screw carrier			9 0
20-K	20-K	20-K	Spring for contact lever			3
20-B2	20-B2	20-B2	Auxiliary spring			1½
20-U	20-U	20-U	Screw for returning spring			1
20-N	20-N	20-N	Lock nut for contact screw 20-S2			3
20-E2	20-E2	20-E2	Spring washer for contact screw 20-S2			1
20-O	20-O	20-O	Screw (short) for fixing screw carrier, with washers			3
20-V	20-V	20-V	Screw, screwing into screw carrier			3
20-L	20-L	20-L	Screw carrier for left-hand magneto. Without platinum contact screw	3	9	
20-Y	20-Y	20-Y	Screw carrier for right-hand magneto. Without platinum contact screw	3	9	
20-S	20-S	20-S	Mica insulation			3
20-W	20-W	20-W	Bolt for fixing contact breaker	1	2	
20-Z	20-Z	20-Z	Carbon earthing brush for contact breaker			6
20-J2	20-J2	20-J2	Spring for end tension on lever brush			3

SPARE PARTS for WATFORD MAGNETOS

When ordering spares, kindly quote number, description, and direction.

Models.			Description	£ s. d.		
EO6	EO4	FO4		£	s.	d.
121	121		High tension pick-up complete	15	0	
		111	High tension pick-up complete	14	0	
21-D	21-D	21-D	Carbon brush pick-up to distributor arm			1 0
21-E	21-E	21-E	Carbon brush pick-up from slip ring			1 0
121-A	121-A	121-A	Screw for pick-up			2
30-1	30-1	30-1	Screw for end plate ($\frac{11}{16}$ " x 2BA)			2
30-3	30-3	30-3	Screw for end plate ($\frac{13}{16}$ " x 2BA)			3
32-	32-30	32-30	Screw for dust cover ($\frac{3}{8}$ " x 2BA)			2
143	143	143	Inspection cover (for contact breaker)	7	0	
118-B	118-B	118-B	Short circuiting terminal complete	2	8	
35	35	35	Terminal knob (short circuiting)	1	0	
139	139	139	Stud, with springs for holding contact breaker cover	2	3	
74-E	56-C	56-C	Terminal screw with insulated head for distributor block	1	0	
67	67	67	Dust cover	10	0	
67-A	67-A	67-A	Cap (covers lubricating hole)	2	6	
67-B	67-B	67-B	Screw for lubricator cover			3
68	68	68	Control lever	3	9	
68-A	68-A	68-A	Screw for control lever			1
76	76	76	Bolt for clamping end plates			3
76-A	76-A	76-A	Nut 2-BA for clamping rod			1
76-B	76-B	76-B	Locking piece for No. 761			1
81			Distributor block	2	0	0
	56		Distributor block	1	15	0
		10	Distributor block	1	10	0
84-L	84-L		Distributor rotor arm with carbon brush and spring	1	0	0
84-R	84-R		Distributor rotor arm with carbon brush and spring	15	0	
		11-L				
		11-R				

Cases of the parts most likely to be required as spares are supplied for each model of magneto.

These cases contain a high-tension pick-up, rotor arm with brush for distributor, contact breaker, contact breaker cover and a selection of brushes, screws and smaller parts. The prices are as follows:—

Set of spares in case for Model EO6 Magneto	£5	17	6
" " " " EO4 "	£5	17	6
" " " " FO4 "	£5	10	0