

The Original
BOSCH

★
BOSCH
MAGNETOS
"ZU4" "ZU6"
"ZF4" "ZF6"
FOR FOUR AND
SIX CYLINDER
ENGINES



TRADE



MARK

 ROBERT BOSCH 

BOSCH

MAGNETOS



"ZU4"

"ZU4", "ZU6", "ZF4" and "ZF6"
for four and six cylinder engines

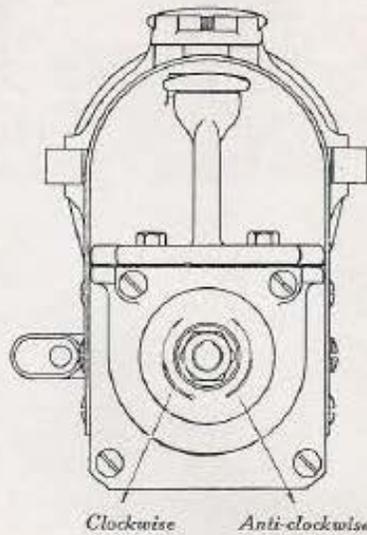


ROBERT BOSCH MAGNETO COMPANY INC.
123 WEST 64TH STREET, NEW YORK CITY

Direction of Rotation.

Delays in delivery will be avoided

if it is borne in mind that it is essential to specify the direction of rotation required; that is, whether the armature is to rotate clockwise or anti-clockwise, the magneto being viewed from the shaft end as illustrated.

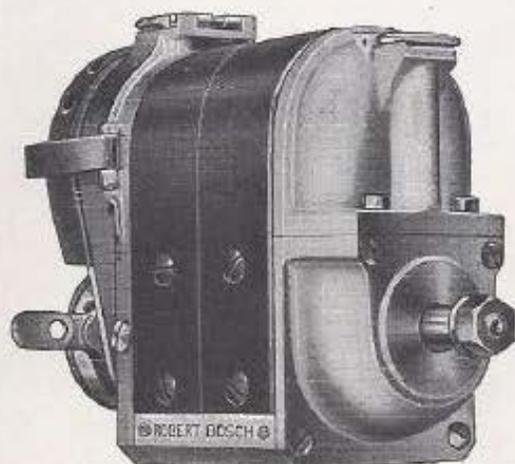


Clockwise Anti-clockwise

Spare Parts.

Orders for spare parts should be accompanied by the type symbol and serial number of the magneto, which will be found engraved on the base plate or oil hole cover on interrupter end plate of the instrument.

Bosch Magneto Types "ZU4", "ZU6", "ZF4" and "ZF6".



**Absolute
Reliability:**

The maximum of reliability is guaranteed by the perfect insulation of the internal conducting parts and the construction of the external connections, through which a leakage of current is entirely prevented. Furthermore, the enclosed construction absolutely prevents the entrance of dirt and moisture. The quality of the material used, the very high standard of workmanship and design are also factors in producing an instrument that is reliable in the highest possible degree.

Accessibility:

The parts which are subject to wear in the normal course of operation are easily accessible, without the use of tools, for the purpose of inspection and adjustment.

**High
Electrical
Efficiency:**

The efficiency of the apparatus is such that a highly satisfactory ignition spark is produced at a low rotative speed and at any position of the control arm. Easy starting and satisfactory operation under closed throttle conditions are thus assured.

Adaptability:

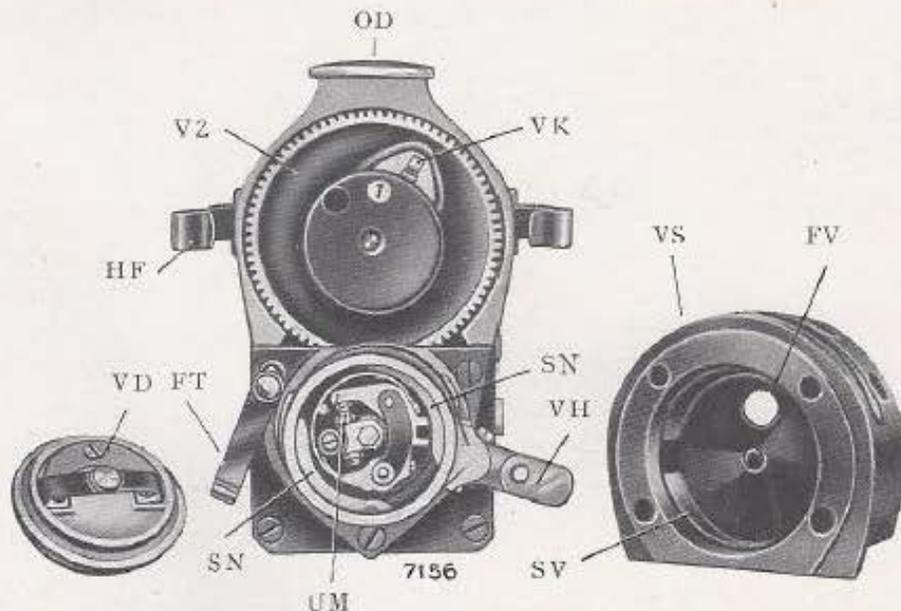
The application of the instrument to any construction of motor is rendered possible by a construction that permits the control arm to be set in any desired position. Through this arrangement the control connections may be made without difficulty.

Note.

The Bosch Magneto types "ZU4", "ZU6", "ZF4" and "ZF6" are suitable for 4 and 6 cylinder engines. The types "ZU4" and "ZU6" with fixed ignition are used for engines up to 105 mm bore and 150 mm stroke, those with variable ignition for engines with a bore up to 100 mm and 150 mm stroke. The types "ZF4" and "ZF6" with fixed ignition are used for engines up to 80 mm bore and 120 mm stroke, those with variable ignition for engines with a bore up to 75 mm and 120 mm stroke. If however, the stroke of the engine is more than 1½ times the above mentioned bore, in every case the next larger type of instrument is to be used.

Brief Description.

The Bosch Magneto types "ZU4", "ZU6", "ZF4" and "ZF6" produce a high tension or jump spark current, this current being generated in the winding of the rotating armature without the use of a separate induction coil.



The armature rotates between the pole shoes of strong steel magnets which form a powerful magnetic field; it is wound in two sections, one of which is the primary winding, consisting of a few turns of thick wire, the other being the secondary winding composed of a large number of turns of fine wire. The high tension current is produced by the interruption of the primary current, by means of the interrupter at the proper moment. At every half turn of the armature such an interruption takes place; so that a high tension current is produced in the secondary winding twice per armature revolution. The high

tension distributor of the magneto supplies the current to the various spark plugs on the motor, and the spark jumps across the electrodes in the shape of an arc.

The variation of the timing of the ignition is arranged on the magneto itself in such a manner that, by altering the position of the interrupter housing which carries the steel cams that operate the interrupter, the interruption of the primary circuit is made to occur early or late as desired.

Driving Speed and Timing of the Ignition to the Motor.

Since the magneto only produces a spark with the armature in a certain position, and since the gases must only be ignited with the piston in a certain position, it is necessary that the magneto be positively driven, preferably by means of gears or couplings, and the speed is to be in accordance with the number of cylinders of the motor. During each revolution of the armature of the types "ZU 4" and "ZF 4" which are suitable for 4 cylinder motors (4 cycle) 2 sparks are produced. The motor requires 4 sparks per two revolutions of the crankshaft, therefore the ratio of gearing between the crankshaft and the magneto shaft must be equal to 1 : 1, that is, the armature must be rotated at the same speed as the crankshaft of the motor.

On the types "ZU 6" and "ZF 6" which are suitable for six cylinder motors (4 cycle) 2 sparks are also produced during each revolution of the armature, whereas the motor, in 2 revolutions of the crankshaft, requires 6 sparks. The ratio of the gearing between the armature shaft of the magneto and the crankshaft of the motor must, therefore, with these magnetos be equal to 3 : 2 that is, the magneto must be driven at $1\frac{1}{2}$ times the speed of the crankshaft of the motor.

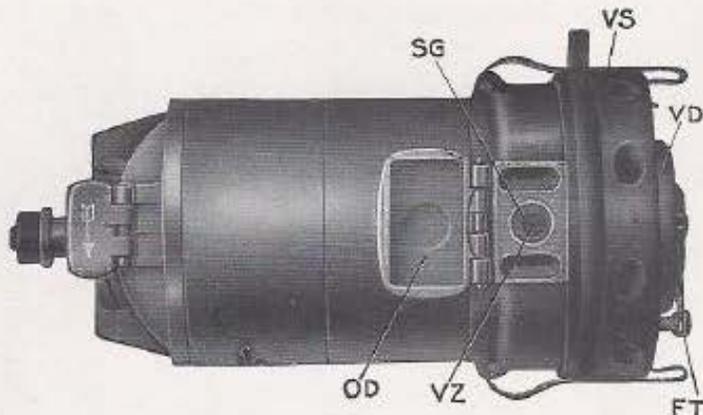
For the purpose of properly timing the magneto, the same is fixed to a magneto bracket on the motor and the driving member (gear or coupling) is placed on the armature shaft. It is either fixed to a taper by means of a nut, or fastened by means of a key. In the first case, the gear, or the coupling part respectively, is mounted loosely upon the armature shaft before the timing of the magneto to the motor has been effected, whilst in the second case and especially when using a cross coupling or a flexible coupling, the part in question should at once be securely connected to the armature shaft by means of a key. However, in both cases, the part which is to be connected with the engine shaft must at first be loosely mounted and tightened up only after the magneto has been timed.

The motor must now be slowly turned by hand in its normal working direction until the piston of Nr. 1 cylinder, near the end of its compression stroke, has reached the position of maximum advance at which the motor gives its best results. This position is usually marked on the flywheel. It is advisable to choose as Nr. 1 cylinder that which is positioned nearest to the radiator.

Types "ZU4" and "ZU6" with variable ignition.

The armature must now be rotated in the direction of the arrow on the front oil cover until the figure 1 appears at the window **FV** of the distributor disc **VS**.

The oil cover **OD**, which is positioned above the distributor disc **VS**, is now lifted in order to observe the timing adjustments through the inspection window **SG**. Through this window the distributor gear **VZ** can be seen. When the armature of the magneto is in such a position that the figure 1 is visible



at the window **FV** of the distributor disc **VS**, one tooth which is marked by a red notch will be noticeable amongst the teeth showing through the inspection window **SG**. The armature shaft must then be turned until this notch registers exactly with the stationary mark on the inspection window, which indicates the correct position of timing. The driving element which, prior to timing, has been loosely mounted, must now be fastened; care being taken to move neither the armature shaft nor the shaft driving it.

It has been found by experience that for normal automobile motors, a maximum advance of 30° is satisfactory, and accordingly, the "ZU4" magnetos are arranged so that they give a range of variation on the magneto shaft of 30° , which, in relation to the crankshaft corresponds to a variation of about 30° .

The magneto type "ZU6" permits a variation of the ignition of 35° measured on the shaft, which, in relation to the crankshaft corresponds to a variation of 24° .

Types "ZF4" and "ZF6" with variable ignition.

The "ZF4" magnetos are arranged so that they give a range of variation on the magneto shaft of 20° , which, in relation to the crankshaft corresponds to a variation of 20° . The magneto type "ZF6" permits a variation of the ignition of 20° measured on the shaft, which, in relation to the crankshaft corresponds to a variation of about 14° .

Types "ZU4", "ZU6", "ZF4" and "ZF6" with fixed ignition.

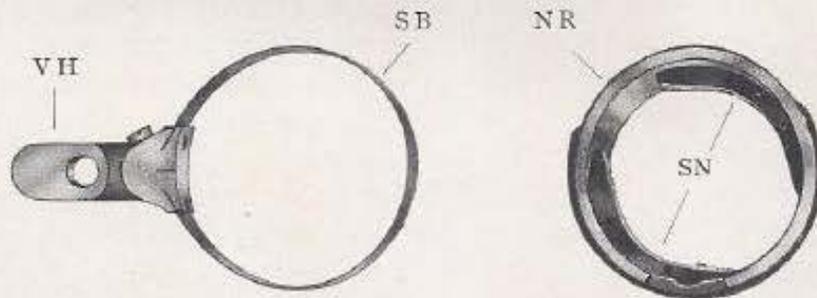
These types with fixed ignition must be timed in accordance with the above instructions, i. e., the piston of Nr. 1 cylinder must be set at a point on the compression stroke equivalent to the amount of advance required. When the engine is in this position the magneto can be fixed and the gear tightened after the distributor has been set as previously described.

It may be pointed out that an advance of 25° (measured on the flywheel) is usually given to normal engines with fixed timing. There is a risk of back fire if a greater amount of advance than this is allowed.

As a matter of fact the amount of lead that can be given to the piston on the up stroke before top dead centre is reached, varies with different types of engines. Information as to the correct timing of the magneto can only be given in degrees measured on the flywheel, although of course the actual distance of the piston from top dead centre must be measured in millimeters or fractions of an inch. It is sometimes the practice, however, for manufacturers to give the amount of advance by stating the distance of the piston from the end of the compression stroke when ignition occurs. It is therefore useful to refer to a table from which the number of fractions of an inch of advance can be obtained, if the advance in degrees and the stroke of the piston are known. (See diagram on page 15.)

Arrangement of the Control Arm.

The position of the control arm VH can be adapted in the simplest manner to the arrangement of the rods for changing the time of ignition.

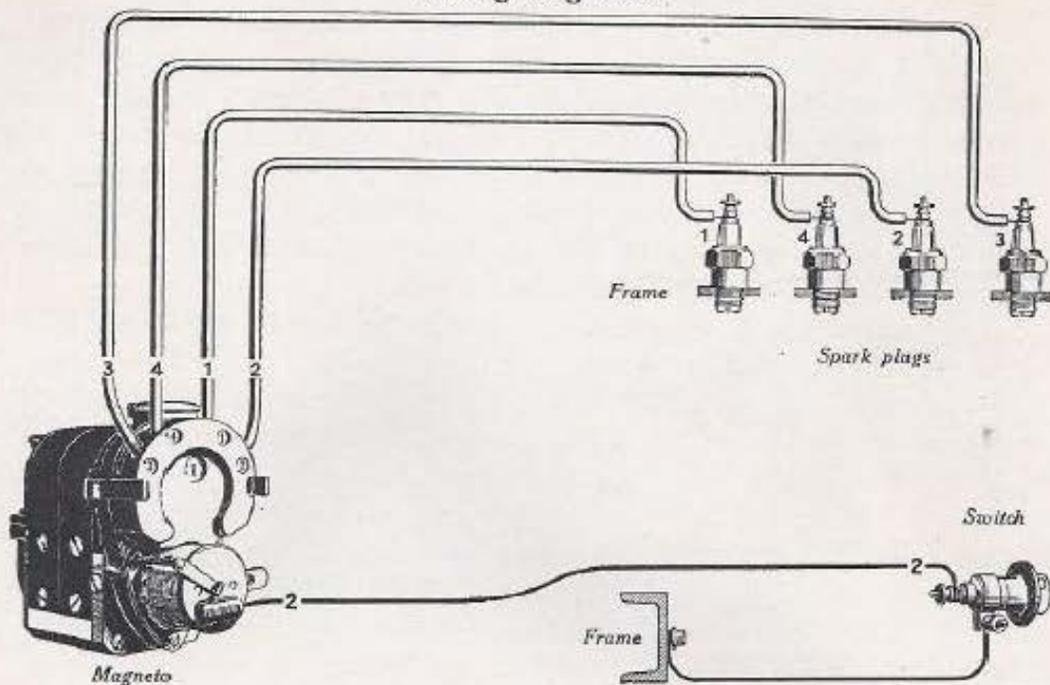


The arm VH is fastened to the interrupter housing NR carrying the cams SN by a metal strap SB, which is tightened by a screw. The control arm VH can therefore be fastened on the interrupter housing in any position desired, so that the arrangement of the control rods is simplified as far as possible.

Cable Connections.

The next step after timing and coupling the magneto to the motor is to connect the distributor plate and the spark plugs as well as the short circuit terminal and the switch to each other by means of the cables.

Wiring diagram.



Fixing the cables to the distributor plate and the spark plugs.

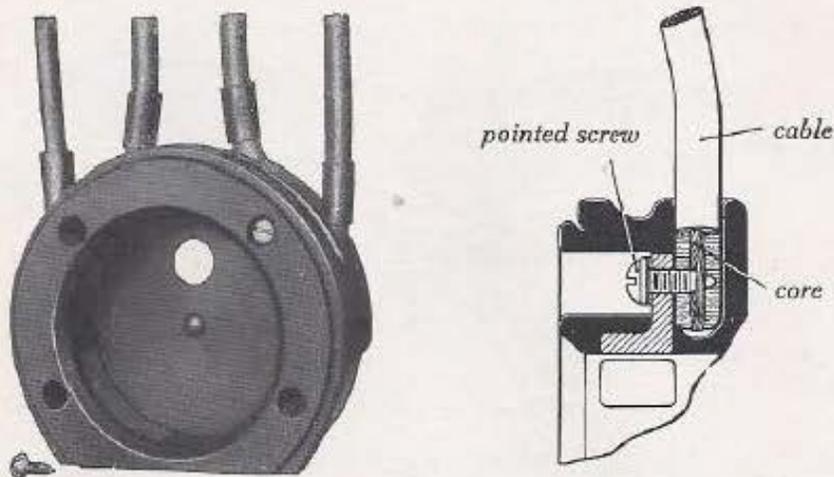
The distributor plate has the figures from 1 to 4 or 1 to 6 on it. Number 1 shows at the right hand top corner. In clockwise rotating magnetos the numbering, beginning from connection Nr. 1, continues in clockwise rotation and in magnetos of anti-clockwise rotation the numbering is continued in an anti-clockwise direction. The clockwise or anti-clockwise numbering on the distributor plate is done viewing the magneto from the distributor plate end.

In motors in which the cylinders are numbered according to their firing sequence, the correct installation of the cables is very simple. One end of a cable numbered 1 is connected to the distributor connection 1 and its other end to the spark plug of cylinder Nr. 1, cable Nr. 2 goes to the distributor connection 2 and to the spark plug of cylinder Nr. 2 and so forth.

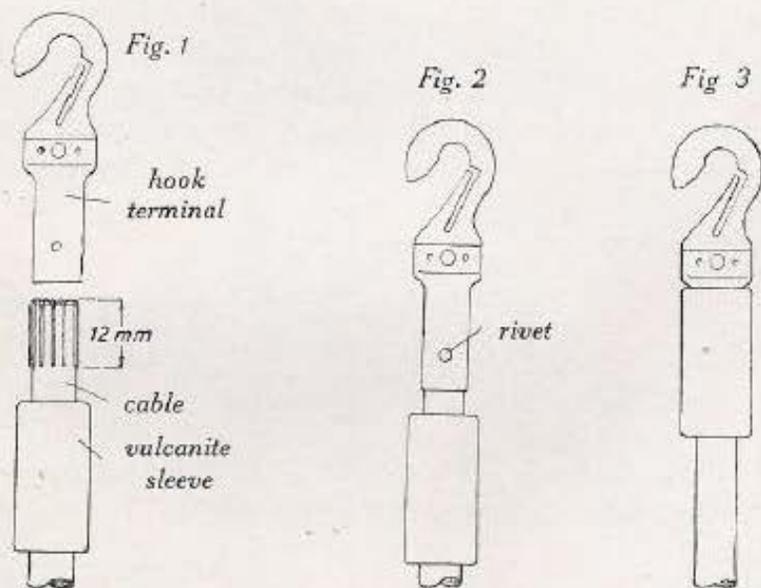
From the foregoing it will be seen, that the cables are not connected according to the arithmetic succession of the engine cylinders but according to the firing sequence of same.

It is important, that cables are not concealed in metal tubings. The cables are fastened to the distributor plate by means of cone-pointed cable fastening screws, for which purpose the distributor plate has to be removed from the magneto. The cable fastening screws, which are positioned in holes on the interior surface of the distributor plate, are then screwed back and the evenly cut ends of the cables without the removal of the cable insulation are pushed into the openings until they stroke against the bottom of same. The cable

fastening screws are then screwed down until their heads are firmly seated. The cone point of the cable fastening screw thus penetrates the insulation and

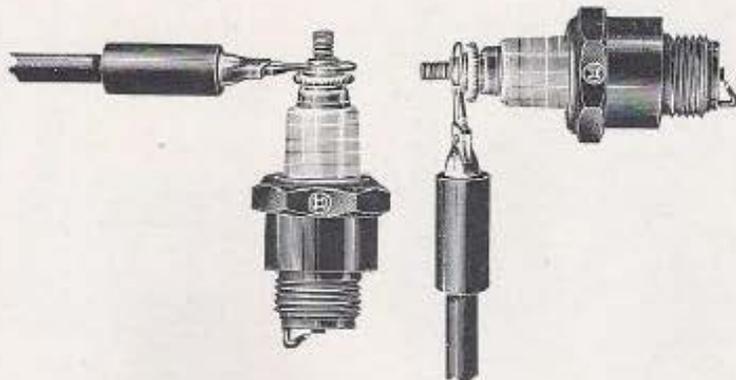


the core of the cables, as will be seen from the sketch, and thus produces a firm electrical connection between the cable and the distributor segment.



Fixing of the cables to the spark plugs may be effected either by eyelets (Bosch loop terminals) produced at the cable end and clamped under the spark plug nut, or by hook terminals (Bosch Rajah hook terminals) by means of which each cable, according to the arrangement of the spark plugs, is fixed or suspended respectively, to a small groove arranged on the spark plug nut.

The way of fixing the terminal to the cable end is shown in figs. 1 to 3 of the sketch. After the cable has then been properly secured by means of a rivet a vulcanite sleeve may be pushed over the cable shoe.

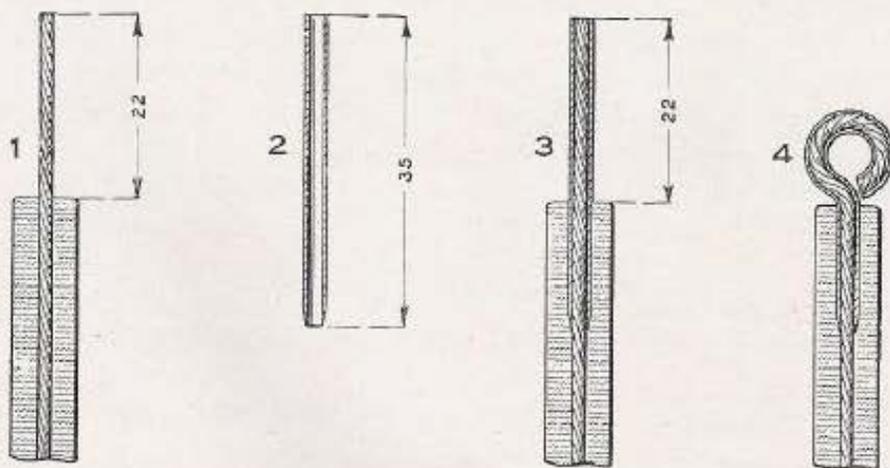


The Bosch "Rajah" hook terminal can be supplied by the Robert Bosch Co. and its distributors and service stations.

Loop terminals for high-tension cables.

Eyelets for fixing the cables to the spark plugs are produced in the following manner:

1. The core of the cable is to be laid bare for a distance of 22 mm (not more). This can be best accomplished by means of the Bosch terminal tool.
2. Apply small quantity of tallow to the end of small brass terminal.



3. Brass terminal to be slid over cable core and pushed into the insulation until the projecting end of brass terminal measures just 22 mm.
4. Bending into ring-fashion. This can best be done by means of the Bosch terminal tool.

Loop terminal for low-tension cables.

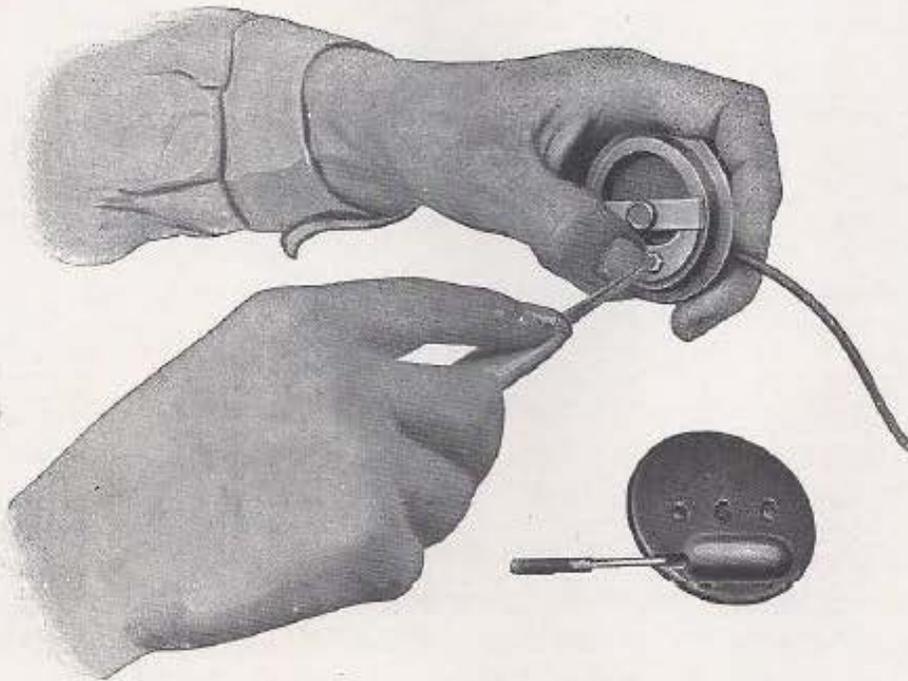
Making the eyelets for the low-tension cables (cable between magneto short-circuit terminal and switch) is effected in a manner similar to the aforesaid, except that the terminal having the expanded end should be pushed over the insulation.



Therefore, when ordering loop terminals, it should be stated whether they are intended for high-tension or for low-tension cables.

Fixing the cable between short-circuit terminal and switch.

One end of the short-circuit cable fitted with a loop terminal, is introduced into the hole of the interrupter end cap in the manner indicated by the figure below, and is fixed by means of a screw at the back of said end cap. The spring,



which ordinarily prevents the screw from turning, must be depressed when loosening or fastening the screw. The other end of the cable, which is provided with an eyelet, is then fastened by a nut to the switch terminal.

The magneto is now ready for work.

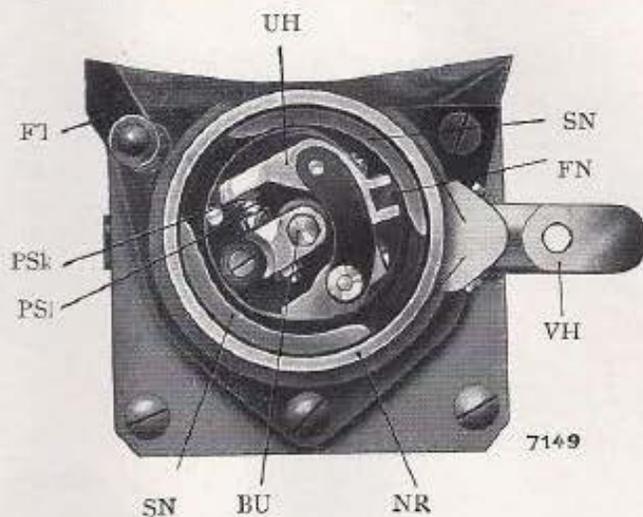
Care and Maintenance.

Care of the interrupter.

It is advisable to inspect the interrupter from time to time. The inspection of the interrupter requires the removal of end cap **VD**, which is secured to the interrupter housing by means of a holding spring **FT**. The interrupter lever **UH** should be moved for assurance that it is free on its pivot, and a test should be made of the distance between the platinum points. When the lever is depressed by one of the steel cams **SN**, the distance between the platinum points should not exceed 0.4 millimeters. The distance may be adjusted by the movement of platinum point **PSI**.

Should it be necessary to replace one of the platinum points or to attach a spare part, the interrupter may be more completely exposed by removing the interrupter housing **NR**. The interrupter itself may be removed by unscrewing the interrupter fastening screw **BU**.

When replacing the interrupter, care must be taken that the key on the interrupter disc fits exactly into the keyway on the armature shaft, and care must be exercised when replacing the interrupter housing.



Care of the distributor parts.

Distributor plate **VS** should be removed occasionally for inspection as to the presence of carbon dust that wears off the carbon brushes. This dust may form a connection between the distributor segments, and in consequence cause a spark to occur in the wrong cylinder. Carbon dust that has collected on the distributor should be wiped out with a cloth, the cloth being moistened with gasoline should the carbon have become caked. After cleaning with gasoline, the inside of the plate should be given a very light film of oil to prevent excessive wear of the brush and the distributor plate.

Lubrication of the magneto.

The armature of the magneto is fitted at both ends with ball bearings which require only very little lubrication. The oil should not be too thin, and the magneto should be lubricated at regular intervals according to the mileage travelled (every 1000 miles). The distributor gear is provided with a plain bearing, which is oiled by means of a felt wick and requires, therefore, more lubrication than the ball bearings of the armature. The size of the oil holes is an indication of the amount of lubrication required; the bearing of the distributor gear is, therefore, fed by a larger oil hole. It has been found by experience, that when the motor is in daily use, the oil holes must be filled with a suitable quantity of good quality oil once every two weeks. When the magneto is put in operation for the first time, the lubrication should be a little more liberal, filling the oil holes three times will be sufficient for this purpose.

It is of the utmost importance that no oil gets on the platinum points of the interrupter. The burning of the oil between the interrupter points would cause very quick wear of the platinum, and in addition to this, since oil is a non-conductor, the magneto would work irregularly.

Safety Spark Gap.

In order to protect the insulation of the armature and all other parts from injury due to excessive voltage, a safety spark gap is provided to permit the passage of the current to ground without injury. The current will pass across the safety spark gap in case a high tension cable is disconnected, if the spark gap is too great, or if for any other reason the spark plug circuit is open. Discharges should not be permitted to pass through the safety spark gap for any great length of time, however. This should be particularly guarded against if the motor is operated on a second or auxiliary ignition system. When the motor is operated on such a system, the magneto should be grounded in order to prevent the production of high voltage current.

Detection of Faults.

In case of defective ignition, it must be determined whether the fault is in the magneto or in the spark plugs. It may be pointed out that in general, when only one cylinder misses, the fault is in the spark plug.

The more common defects of spark plugs are as follows:

1st. Short-circuit at the spark gap, due to small metallic beads which are melted by the heat of the intense spark and form a conducting connection between the electrodes. This defect is easily ascertained, and may be remedied by removing the metallic beads.

2nd. If the gap between the spark plug electrodes is too great, the spark will jump across the safety gap on the magneto. In such a case, when the spark plug is unscrewed from the cylinder the spark will jump across the electrodes of the spark plug, and not across the safety spark gap. This does not signify that the distance between the electrodes is correct, for it must be borne in mind

that open air has a lower resistance than the compressed air or gas existing in an engine cylinder. The distance between the electrodes when under compression in the cylinders must, therefore, be less than is required in the open air. The correct gap is approximately 0.4 to 0.5 mm.

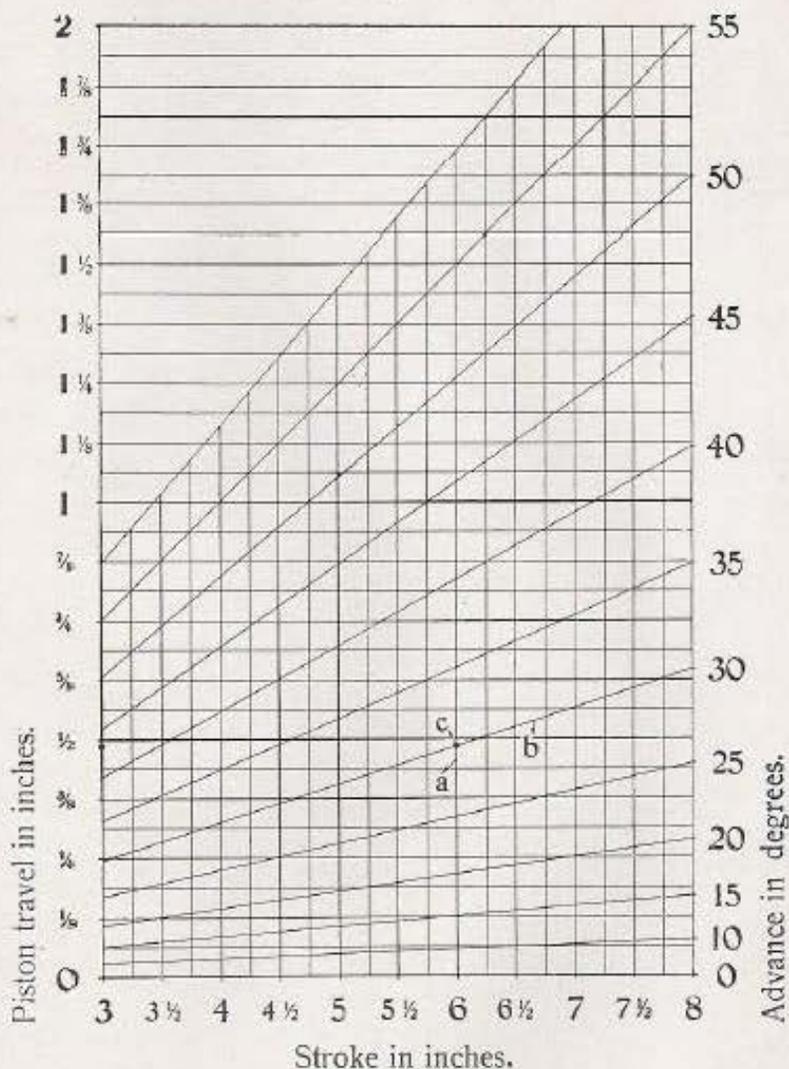
3rd. Fouling of the spark plug. The danger of fouling is reduced to a minimum in the Bosch spark plug. If fouling should occur, the parts exposed to the burning gases may very readily be cleaned by removing the spark plugs from the cylinder. The spark plug cables must be tested, and special attention should be paid to ascertaining that the insulation is not injured in any way. The metal terminals of the cables must not come into contact with any metal parts of the motor or with any metal parts of the magneto, except the proper terminal nuts.

Ignition fails suddenly. A sudden failure of ignition indicates a short-circuit in the low tension cable, either through a defect in the cable, through a faulty connection at the switch, or through the presence of dirt or moisture. This may be tested by removing the grounding cable from the interrupter end cap and endeavouring to start the engine on the magneto. If the engine runs with this wire disconnected, but stops when the wire is connected, it may be determined that there is a faulty insulation or other defect through which the low tension current escapes to ground. It is also advisable to examine the distributor carbon brush **VK** to ascertain if it is in good condition. This brush may be exposed by removing distributor plate **VS**.

Irregular firing. Irregular firing is usually caused by the improper working of the interrupter, and this part should be examined. It should be seen that the interrupter lever moves freely on its pivot; that the interrupter fastening screw **BU** is properly tightened; and also that the steel cams **SN**, as well as the two platinum points **PSk** and **PSl**, are properly secured in position. Furthermore, the platinum points should be inspected for the correctness of their adjustment, and they should be so set that they are 0.4 millimeters apart when the interrupter lever is depressed by one of the cams. The platinum points should be clean and true to one another, and any oil, grease, or dirt that is deposited on them should be removed. If the interrupter lever does not move freely on its pivot, as is occasionally the case, particularly with new magnetos, the hole through the fibre bushing that forms the bearing may be reamed out. This work should be very carefully performed, however, and excessive reaming should be carefully guarded against.

If this examination of the magneto has not led to the discovery of the defect, and it is absolutely impossible to start the motor, the timing of the magneto to the engine should be carefully verified. If it is found to be correct, the magneto should be returned to the Robert Bosch Magneto Company Inc., New York, to one of its branches, or to any authorized Robert Bosch distributor or service station.

Diagram.



Determining the Advance.

The piston travel of an engine is easily determined, and the determining of the rotation of the crankshaft in degrees, corresponding to any desired piston travel, may be ascertained from the accompanying diagram.

In this diagram the relation between the crank and the connecting rod length is as 1:4.5. In the diagram the vertical lines numbered at the bottom give the stroke of the engine in inches, the rotation of the crankshaft in degrees being indicated by the slanting lines and the figures at the right. The figures on the left, and the horizontal lines indicate the piston travel in inches. As an example in the use of the diagram, it may be desired to find the piston travel for an ad-

vance of 30° on a motor of 6 inches stroke. The vertical line for the desired stroke may be identified by the figures at the bottom of the diagram, and this vertical line may be followed upward until it cuts the diagonal line indicating the desired number of degrees, which is 30° in the present case. The horizontal line nearest this point should be followed to the left, and in the present instance it will be seen to indicate about $\frac{1}{2}$ ". This figure of $\frac{1}{2}$ indicates the advance in inches corresponding to a rotation of 30° of the crankshaft.

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| HABANA (Cuba) | Montalvo y Eppinger, Ave de Belgica 10 | RIO DE JANEIRO | Steinberg y Cia., 31/33, Avenida Rio Branco |
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| MELBOURNE AND SYDNEY | Robert Bosch Supply and Service Co. Pty. Limited, Melbourne 256/258, Latrobe Street Sydney 199, Castlereagh Street | WELLINGTON (New Zealand) | James J. Niven & Co., Ltd., 152, Wakefield Str. |
|-------------------------|---|--------------------------|--|

"These branches and agencies possess well-equipped workshops fitted with all appliances and tools for repairing and mounting Bosch productions. They employ specially trained mechanics, who have come from the Bosch workshops or were taught there, and they hold permanent stocks of Bosch parts and accessories. To ensure satisfactory results, we recommend that repairs should only be put into the hands of these branches and agencies."

