

AMERICAN BOSCH PRODUCTS

REPAIR INSTRUCTIONS FOR AMERICAN BOSCH U TYPE SERIES MAGNETOS

FOR ONE- TWO- FOUR AND SIX-CYLINDER ENGINES

TYPES OF U MAGNETOS AND THE DISTRIBUTION OF CURRENT



Fig. 1
Type U-1 Magneto

The Type U-1 magneto shown above is designed for use on one cylinder engines. It has one collector brush mounted horizontally in a brush holder affixed to the side of the magneto. A single high tension cable conducts the current from the brush holder to the engine spark plug and a spark is delivered once in each revolution of the armature at the moment when the contact points on the interrupter open.

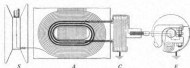


Fig. 2
High Tension Circuit Diagram

The Type U-2 magneto is identical to the U-1 in construction except that it has two collector brush holders, one mounted on each side of the magneto. This instrument produces two sparks in each revolution of the armature. Figure 3 shows a cross sectional end view of the Type U-2 magneto. In this

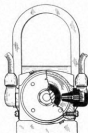


Fig. 3
Type U-2 End View

type the collector ring groove is provided with a sectional metal segment to which the end of the armature secondary circuit is connected. The metal segment acts not only as a current collector, but also as a distributor because the segment alternately comes into contact with, and delivers high tension current to one of the two collector brushes at every 180° revolution of the armature. High tension cables from the two brush holder terminals connect the collector brushes with the two spark plugs of the engine cylinders.

The Type U-4 is designed for use on four cylinder engines. The method of distributing the spark in this type can be seen by referring to the details

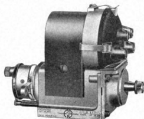


Fig. 4
Type U-4 Ed. 1 Magneto

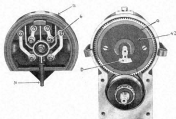


Fig. 5

Type U-4 Magneto Showing Method of Spark Distribution

shown in Figure 5. The distributor plate and collector brush holder are moulded into one unit. A metal connecting piece moulded into the distributor plate carries the current from the collector brush to the brush in the center of the plate. A metal segment (D) located in a hard rubber disc which is screwed to the distributor gear, conducts the current from the center brush and distributes it to each of the four distributor terminals when the distributor plate is secured to the magneto.

The gear on the armature drives the distributor gear and their relative setting is so arranged that the metal segment "D" is in contact with one of the four distributor terminals at the time when the contact points are just opening. Current is consequently delivered by the armature, conducted by the slip-ring, and collector brush to the center brush of the distributor plate, thence to the segment "D", and the distributor brush resting thereon. From there the current is conducted through the high tension cable to the engine spark plug where it discharges a spark.



Fig. 6

Type U-4 Ed. 2 Magneto

The magneto illustrated in Figure 4 is a type U-4 Ed. 1. The type U-4 Ed. 2 shown in Figure 6 is identical with that shown in Figure 4 with the

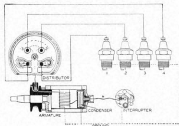


Fig. 7

Circuit Diagram Type U-4 Magneto

Note: Spark plugs must be connected in accordance with firing order of engine.

exception of the distributor plate. The U-4 Ed. 2 is considered standard but some users prefer the Ed. 1 type of distributor plate.

The complete circuit of a Type U-4 magneto is illustrated in Figure 7.

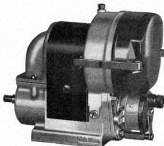


Fig. 8

Type U-6 Magneto

The type U-6 magneto, shown in Figure 8, is designed for use on six cylinder engines. On this type the distributor plate is mounted on the interrupter end of the magneto and the current is conducted from the brush holder to the distributor plate by means of a rotor which distributes the current to each of the distributor terminals.

The circuit diagram in Figure 9 shows the rotor in position to deliver a spark to the spark plug connected with the No. 1 terminal.

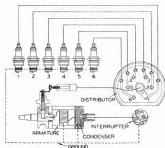


Fig. 9
Circuit Diagram Type U-6

Note: Spark plugs must be connected in accordance with firing order of engine.

MAJOR ASSEMBLIES

The vital working parts of a magneto are contained in three main assemblies: the magneto frame, the armature, and the interrupter. While the construction of the individual types of U magnetos varies to some extent, the function of the major parts in each type is the same.

Magneto Frame

The magneto frame is the housing which supports all the other parts of the magneto. One of the end plates on each type is cast into the frame and on the types U-4 and U-6 the gear housing also forms a part. A single horse shoe magnet is used on all the U types which is fastened to the frame with two screws.

Complete Armature

The armature contains the main electricity producing parts—the laminated core, the windings and the condenser. The armature for a type U-4 magneto is shown in Fig. 10.

The wound core, or winding (1) is supported by the drive shaft (29) at one end and at the opposite

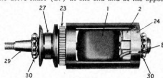


Fig. 10
Complete Armature of Type U-4 Magneto

end by the rear shaft assembly (24). The condenser (2) is partly housed in the armature rear shaft. The two primary leads of the winding are fastened to the clips on either side of the condenser and the grounding lead is soldered to the rear shaft at the position indicated by the letter "B." The armature gear (23) on the type U-4 magneto is mounted on the drive shaft as illustrated. On the type U-6 magneto the gear is mounted on the armature rear shaft.

Complete Interrupter

The interrupter, or circuit breaker (16 Fig. 11) is a mechanical device employed for opening and closing the primary circuit. It consists of a disc (33) upon which the stationary contact block (34) and the movable interrupter lever (35) are mounted.



Fig. 11
Interrupter and Interrupter Housing

The adjustable or long contact screw is threaded into the contact block and the other one (short) to the interrupter lever. The lever is operated by a cam (36) affixed to the inner side wall of the interrupter housing (19). A keyed hub (F) on the interrupter disc fits into a keyway provided in the end of the armature rear shaft. The interrupter fastening screw secures the entire interrupter assembly to the armature rear shaft.

CONSTRUCTION DETAILS

Types U-1 and U-2 Magnetos: The type U-1 magneto is shown completely disassembled in Fig. 12. The type U-2 magneto contains the same parts

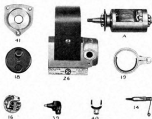


Fig. 12
Type U-1 Magneto Disassembled

but has two brush holders (39)—one mounted on each side of the magneto frame.

The shaft end plate on these types is cast integral with the magneto frame and holes are provided thru which the collector brush contacts with the collector ring on the armature. The cross sectional view shown in Fig. 13 illustrates the method used for securely holding the high tension cable in the brush holder.



Fig. 13

Cross Sectional View of Brush Holder

To replace a high tension cable, remove the spring clip (40) which holds the brush holder in place. Cut the end of the cable off square, push it into the brush holder until it reaches the spiral insert, then turn the brush holder to the right until the cable is securely fastened.

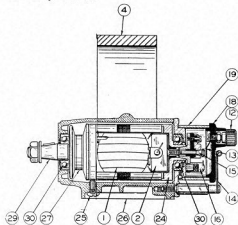


Fig. 14

Type U-1 and U-2 Sectional View

- | | |
|---------------------------------|-------------------------------|
| 1. Armature wound core. | 19. Interrupter housing. |
| 2. Condenser. | 24. Armature flange— |
| 3. Magnet. | condenser end. |
| 4. End cap terminal nut. | 25. Ground brush with |
| 5. End cap contact spring. | holding screw. |
| 6. Holding post and spring. | 26. Magneto frame. |
| 7. Interrupter fastening screw. | 27. Collector ring. |
| 8. Interrupter complete. | 29. Driving shaft and flange. |
| 9. End cap. | 30. Ball bearings—either end. |

Type U-4 Magneto: The simplicity of construction of the Type U-4 magneto is immediately apparent. Figure 15 shows the Type U-4 magneto completely disassembled. It contains but eight major assemblies: magneto frame, armature, distributor gear, distributor plate, interrupter, shaft end plate, interrupter housing and end cap.

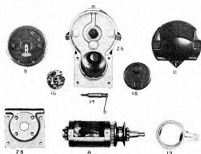


Fig. 15

Type U-4 Magneto Disassembled

The main part of the magneto frame is an aluminum die casting with the pole-shoes and bronze combination ball race holder and interrupter housing fit ring cast in. The magnet (4 Figure 16) is fastened to the frame by means of two screws located on opposite sides. The distributor plate holding springs (32 Figure 16) fit into recesses provided on the frame and are held in position by the magnet. The only oil cup provided is located on top of the magneto frame.

The distributor gear bearing (8 Figure 16) is slightly eccentric and is lightly pressed into the frame so that it may be turned until an accurate adjustment between the distributor gear and armature gear has been accomplished. A stamped circular steel plate (20 Figure 16) locks the bearing in position.

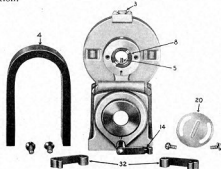


Fig. 16

Type U-4 Magneto Frame Disassembled

The holding post and spring (14 Figure 16) holds the interrupter housing and the end cap in place.

The function of the distributor plate and the distributor gear has been explained previously under the heading "Distribution of Current." The shaft end plate contains the outer ball race and supports the drive end of the armature. The end cap primarily serves as a cover for the interrupter and also provides a means for grounding the magneto. Since one end of the primary is already grounded and the ungrounded end of the primary passes through the interrupter fastening screw, this screw presents a

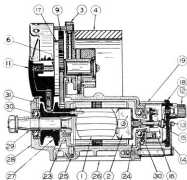


Fig. 17

Type U-4 Sectional View

1. Armature wound core.
- Note: Complete armature consists of the parts indicated by the following reference numbers 29, 27, 1, 2, and 24.
2. Condenser.
3. Oiler.
4. Magnet.
5. Oil wick.
6. Distributor brush.
7. Distributor clamp spring.
8. Distributor gear bearing.
9. Distributor gear.
10. Distributor plate terminal screw.
11. Distributor plate.
12. End cap terminal nut.
13. End cap contact spring.
14. End cap holding post and spring.
15. Interrupter fastening screw.
16. Interrupter complete.
17. Distributor gear insulation plate.
18. Magneto end cap.
19. Interrupter housing.
20. Distributor gear bearing lock.
21. Armature gear.
22. Armature flange—condenser end.
23. Grounding brush with holding screw.
24. Magneto frame.
25. Collector ring.
26. Drive shaft end plate.
27. Driving shaft and flange.
28. Ball bearings—either end.
29. Collector brush.

NOTE: The numbers given above are for reference only. Do not use these reference numbers when ordering parts, but refer to the Type U Parts List at the back of the book.

means for short circuiting the primary circuit. This is generally done through a contact spring, affixed to the magneto end cap, which rests against the head of the interrupter fastening screw. The terminal on the end cap is generally connected by a cable to a grounding switch but in some instances the grounding device is incorporated in the end cap.

Type U-6 Magneto: The construction of the type U-6 magneto varies from the type U-4 mainly in that the distributor plate is mounted on the interrupter end instead of directly above the collector, and that the jump-spark type of distributor plate is used. The type U-6 magneto is shown completely disassembled in Figure 18.

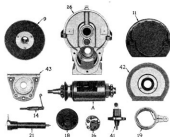


Fig. 18

Type U-6 Magneto Disassembled

Figure 19 shows the type U-6 magneto viewed from the shaft or driving end with the waterproof hood (22) and brush holder (41) removed. The shaft end plate is cast integral with, and is a part of, the magneto frame. The collector brush contacts with the collector thru the hole in the top of the shaft end plate and the brush holder is secured to

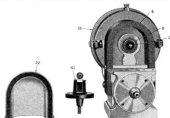


Fig. 19

Type U-6 Magneto viewed from Driving End

the end plate by means of two screws. A felt packing placed between the magnet (4) and the frame (26), and one on the waterproof hood prevents the entrance of dust, dirt or moisture.

The distributor gear bearing (8) and the distributor gear shaft is shown in the center of the

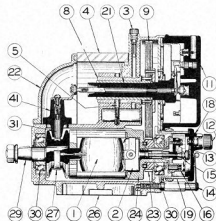


Fig. 20

Cross-sectional view Type U-6 Magneto

NOMENCLATURE

1. Armature wound core.

Note: Complete armature consists of the parts indicated by the following reference numbers, 29, 27, 1, 2, and 24.

2. Condenser.
3. Oiler.
4. Magnet.
5. Oil wick.
8. Distributor gear bearing.
9. Distributor gear.
11. Distributor plate.
12. End cap terminal nut.
13. End cap contact spring.
14. End cap holding post and spring.
15. Interrupter fastening screw.
16. Interrupter complete.
18. Magneto end cap.
19. Interrupter housing.
21. Distributor rotor.
22. Waterproof hood.
23. Armature gear.
24. Armature flange—condenser end.
26. Magneto frame.
27. Collector ring.
29. Driving shaft and flange.
30. Ball bearings—either end.
31. Collector brush.
41. Collector brush holder.

Note: The numbers given above are for reference only. Do not use these reference numbers when ordering parts, but refer to the service parts list.

frame. The distributor rotor (21) extends thru the magneto inside of the distributor gear shaft, and revolves with it. A plunger on the end of the rotor makes a permanent contact with the carbon contact attached to the collector brush holder.

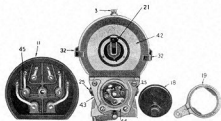


Fig. 21

Type U-6 Magneto viewed from Interrupter End

In Figure 21 the interrupter end of the magneto is shown with the distributor plate (11), end cap (18) and interrupter housing (19) removed. The dust plate (42) protects the inside mechanism from dust, dirt and moisture. The dust ring and the rotor, as well as the parts shown removed, are easily accessible and can be removed and replaced without the use of any tools.

The distributor plate holding springs (32) can be removed by withdrawing the split pins located on the back of the gear housing. The stop plate (44) serves as a stop for the interrupter housing in connection with the timing range.

The distributor plate has vertical cable outlets and the cables are secured by means of the cable fastening screws (45) located on the inside of the distributor plate. See cross-sectional view Fig. 20.

HOW TO DISASSEMBLE TYPE U MAGNETOS

It is important that the various parts of the magneto are removed in the proper sequence to avoid damage to the internal mechanism. Follow the sequence given for disassembling each type.

Types U-1 and U-2 Magnetos:

1. Remove the grounding brush screw (25 Fig. 14) from the base plate of the magneto.
2. Remove the safety gap screw located in the shaft end of the magneto housing.
3. Remove the collector brush holder (39 Fig. 12).
Note: The type U-2 magneto has two safety gap screws and two brush holders.

4. Remove the end cap (18 Fig. 14) and the interrupter housing (19 Fig. 14).
5. Withdraw the interrupter fastening screw (15 Fig. 14) and remove the complete interrupter (16 Fig. 14). See Fig. 22.
6. Withdraw the holding post and spring (14 Fig. 14) and the two fastening screws and remove the rear end plate.
7. Remove the complete armature.

Type U-4 Magneto:

1. Remove the grounding brush screw (25 Fig. 17) from the base of the magneto.
2. Remove the safety gap screw from the shaft end plate.
3. Swing the spring on the holding post aside and remove the end cap and the interrupter housing.
4. With Tool No. 339 used as shown in Fig. 22, withdraw the interrupter fastening screw (15 Fig. 17), and remove the interrupter (16 Fig. 17).

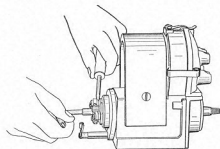


Fig. 22

Showing method of removing Interrupter with Service Tool No. 339

5. Press the two holding springs aside and remove the distributor plate, *using care that the collector brush and brush holder are not damaged.*
6. Withdraw the four fastening screws and remove the shaft end plate.
7. Take hold of the armature and distributor gear and carefully pull both parts out together.
8. Should it be necessary to replace the distributor gear bearing, first remove the lock plate by withdrawing the two fastening screws and then press the bearing out with a bench press.

Type U-6 Magneto:

1. Remove the waterproof hood (22 Figs. 18 and 20) and the collector brush holder (41 Figs. 18 and 20).
2. Remove the two grounding brush screws (25 Fig. 21) located on either side of the magneto.
3. Swing the spring on the holding post aside and remove the end cap (18 Fig. 21) and the interrupter housing (19 Fig. 21).
4. Withdraw the interrupter fastening screw (15 Fig. 20) and remove the interrupter (16 Fig. 20). See Fig. 22.
5. Press the two holding springs aside and remove the distributor plate (11 Fig. 21), rotor (20 Fig. 21) and dust plate (42 Fig. 21).
6. Withdraw the two fastening screws and the holding post and spring (14 Fig. 20) and remove the rear end plate (43 Fig. 21).
7. Remove the distributor gear (9 Fig. 18), and armature (A Fig. 18).

HOW TO ASSEMBLE TYPE U MAGNETOS

Types U-1 and U-2 Magnetos:

1. Carefully slide the armature into the frame.
2. Assemble the end plate and secure it with the two fastening screws, and the holding post and spring.
3. Place the interrupter in position, making sure that the key on the hub is properly seated in the keyway in the rear shaft, and then secure it with the interrupter fastening screw.
4. Replace the interrupter housing and the end cap and clamp the holding spring over it.
5. Assemble one or both collector brush holders.
6. Replace one or both safety gap screws and the grounding brush screw.

Type U-4 Magneto:

1. Place the distributor gear in mesh with the armature gear in the position in which the parts are to be placed in the magneto.
2. Refer to Fig. 23. Note the punch marks on the distributor gear with the letters "C" and "A" over them. For clockwise rotation place the *beveled tooth* on the armature gear directly opposite

the punch mark "C"; for anticlockwise rotation place the beveled tooth opposite the punch mark "A." (The direction in which the magneto is designed to run is indicated by an arrow on the lower part of the shaft end plate. The rotation of the magneto is always determined from the driven end).

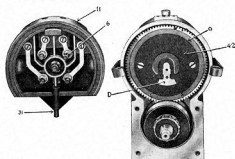


Fig. 23

Showing Gear Setting for Type U-4 Magneto

3. With the gears meshed in the proper position, place the armature and distributor gear in the magneto. A felt oil wick extending thru the lower part of the distributor gear bearing may prevent the distributor gear shaft from sliding into the bearing. If this difficulty is experienced, hold the oil wick down as illustrated in Fig. 24.

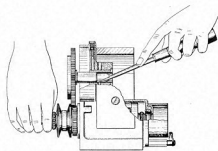


Fig. 24

Assembling Armature and Distributor Gear
Type U-4 Magneto

4. Assemble the shaft end plate and securely tighten the four fastening screws.
5. Place the interrupter in position, making sure that the key on the hub is properly seated in the keyway in the rear shaft, and secure it with the interrupter fastening screw. (See Fig. 22).

- 6.* If the distributor gear bearing has been replaced, it will be necessary at this point to adjust it so that the distributor gear and armature gear will mesh freely and run quietly. The outside surface of the distributor gear bearing is eccentric and a slight turn to the right or left raises or lowers the bearing and thereby permits an accurate adjustment of the gears. When this adjustment has been made, replace the locking plate and secure it with the two fastening screws.

7. Assemble the interrupter housing and end cap and clamp the holding spring over it.
8. Put the distributor plate in position and secure with the two holding springs.
9. Replace the grounding brush.

* Note: For early models only. The current types U-4 magnetos have a concentric distributor bearing and no adjustment is necessary.

Type U-6 Magneto:

1. Insert the armature into the frame. One tooth on the armature gear is slightly beveled. Revolve the armature until this beveled tooth is on top.
2. Assemble the distributor gear and shaft assembly. Insert a screw driver from the shaft end of the magneto and hold down the oil wick (5 Fig. 20) while the distributor gear shaft is being placed into the bearing.
3. Now refer to Fig. 25. Note the punch marks with the letters "A" and "C" on the outer edge of the distributor gear. If the magneto is designed to run in a clockwise direction, line up the beveled tooth on the armature gear with the mark designated by the letter "C" on the distributor gear. In Fig. 25 the gears are shown lined up for anticlockwise rotation. (The direction in which the magneto is designed to run is designated by an arrow on the lower part of the waterproof hood (22 Fig. 20). The rotation of the magneto is always determined from the driven end).
4. Assemble the rear end plate (43 Fig. 21) and secure with the two screws and the holding post and spring. The interrupter housing stop plate (44 Fig. 21) assembled to the rear end plate is shown in the proper position for anticlockwise rotation. For clockwise rotation reverse the stop plate. The letters "A" and "C" stamped on either side of the lug on the stop plate designate the position in which the plate should be placed for either rotation.

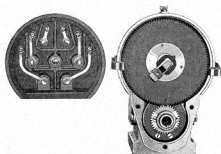


Fig. 25

Type U-6 Magneto Showing Gear Setting for Anticlockwise Rotation

5. Place interrupter in position making sure that the key on the hub is properly seated in the keyway in the rear shaft. Secure it with the interrupter fastening screw.
6. Assemble the interrupter housing and end cap and clamp the holding spring over it.
7. Place the dust plate (42) in position as shown in Fig. 21 and insert the rotor. Turn the rotor and press in until it engages with the plate on the distributor gear.
8. Assemble the distributor plate and clamp the holding springs over it.
9. The gasket which is placed underneath the collector brush holder should be covered with a coating of varnish before assembling.
10. Assemble and secure the collector brush holder and the waterproof hood.
11. Replace the two grounding brushes on either side of the magneto.

Assembling the Armature—All U Types:

First place the insulations around the condenser in the following order: the insulating washer, the linen insulating strip and then the paper insulating strip.

See that the hard rubber bushing is in place in the center hole of the armature rear shaft. Press the condenser carefully into the rear shaft so that the insulations are not damaged.

On types U-1, 2 and 4 make sure that the condenser is placed into the rear shaft so that the insulated terminal will be on the same side of the armature as the high tension lead, then pass the grounding lead to the opposite side of the armature

and solder it to the rear shaft as indicated in Fig. 10. On the type U-6 magneto a grounding strip is provided which is fastened to the rear shaft by means of a small screw.

After the condenser has been installed assemble the rear shaft to the wound core and fasten it with the four screws. Solder the two primary leads of the wound core to the lugs provided on each side of the condenser. Replace the armature drive shaft and secure it with four fastening screws. All the screws holding the rear shaft and drive shaft should be staked to avoid any possibility of their becoming loose.

Replace the armature gear and secure it with the fastening screws provided. On the type U-6 magneto the beveled tooth of the armature gear must be placed opposite from the keyway in the rear shaft.

Put the secondary wire from the wound core into the recess in the collector ring and press the collector on the shaft. Assemble the inner ball races and ball cages.

GENERAL INFORMATION

Driving Method: Since the magneto produces an ignition spark only at certain definite points in the rotation of the armature, it must be connected to the engine in such a manner that the spark is available always at the instant when required in the cylinder, i.e., about top dead center of the compression stroke. The magneto, therefore, must be positively driven from the engine by some method which eliminates slippage; coupling drive is preferable but gear drive can be used. Belt or friction drive cannot be used.

Driving Speed: The type U-6 magneto must be driven at one and one-half times engine speed for six-cylinder four-cycle engines and three times engine speed for six-cylinder two-cycle engines.

The Type U-4 must be driven at engine speed (crank shaft speed) for four-cylinder, four-cycle engines, and at twice engine speed for four-cylinder, two-cycle engines.

The Type U-4/2, 360°, is intended to be operated at engine speed on two-cylinder, four-cycle engines, the cylinders of which fire alternately every 360° revolution of the crank shaft; for two-cylinder, two-cycle engines, this type must be driven at twice engine speed. The type U-4/2, 180°, for two-cylinder, four-cycle engines, the cylinders of which fire at intervals of 180° and 540°, must be operated at engine speed.

The Type U-2 must be driven at half engine speed (cam-shaft speed) for two-cylinder, four-

cycle engines where the cylinders fire alternately every 360° revolution of the crank shaft; for two-cylinder, two-cycle engines, this type must be driven at engine speed.

The Type U-1 must be driven at camshaft speed for single-cylinder, four cycle engines, and an engine speed for single-cylinder, two-cycle engines.

Direction of Rotation: The Type U magnetos are designed to run in two directions, that is, clockwise or anticlockwise, as viewed from the shaft end of the magneto. The direction in which each magneto is designed to run is indicated by an arrow on the shaft end of the magneto.

Safety Spark Gap: In order to protect the armature and other current carrying parts, a safety spark gap is provided.

Under ordinary conditions, the current will follow its normal path to the spark plug, but if for any reason the electrical resistance in the secondary circuit is increased to a high point, as when a cable becomes disconnected or a spark plug gap too wide, the high tension current will discharge across the safety gap.

The current should never be allowed to pass across the safety spark gap for any length of time, and if the engine is operated on a second or auxiliary ignition system, the magneto must be grounded in order to prevent the production of high tension current. The snapping sound by which the passage of the current across the safety gap may be noted should always lead to an immediate search for the cause of the difficulty.

Timing Range

The magneto interrupter housing is arranged so that it may be rotated through an angle of about 15° to 35° with respect to the armature shaft. The movement of this housing in one direction or the other causes the interrupter lever to strike the steel cams earlier or later in the revolution of the armature, the spark occurring correspondingly earlier or later in the stroke of the piston.

The spark can be advanced by moving the interrupter housing, by means of the timing control arm, in the direction opposite the rotation of the armature, and can be retarded by moving the interrupter housing in the same direction as the rotation of the armature. The armature rotation is indicated by an arrow on the shaft end of the magneto.

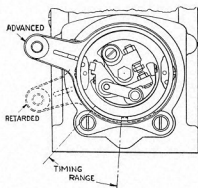


Fig. 26

Illustrates Position of Timing Arm—Advanced and Retarded on Clockwise Magneto.

It is very important that a magneto has the correct timing range for the particular characteristic of the engine on which it is used, in order to obtain proper operating results. If the complete magneto or the interrupter housing is replaced, make sure that the replacement magneto or housing has identically the same timing range.

Timing the Magneto

With the average four or two-cycle engine, the proper operating results are obtained by timing the magneto as follows:

FOR TYPES U-4 AND U-6: The crank shaft is rotated to bring the piston of No. 1 cylinder (in automobile practice this is the cylinder nearest the radiator) exactly on top dead center of the compression stroke, and the piston is to be maintained in that position. The magneto is then to be secured to the bracket or bed on the engine, and the control arm on the interrupter housing placed in the fully retarded position.

With that done, the distributor plate should be removed by releasing the two catch springs, thus exposing the distributor gear. The cover of the magneto interrupter housing is also to be removed to permit observation of the interrupter.

The armature should then be rotated by means of the exposed distributor gear in the direction in which it is to be driven until the platinum interrupter contacts are just about to separate, which occurs when the interrupter lever begins to bear against one of the steel interrupter cams.

The armature should be held in that position while the magneto drive is connected to the engine, due care being taken that the piston of No. 1 cylinder is still exactly on top dead center of the compression stroke. The installation is completed by replacing the interrupter housing cover and distributor plate, and connecting the cables between the magneto and spark plugs.

FOR TYPES U-1 AND U-2: These types should be timed to the engine in the same manner as described above for the types with gear driven distributor, except that on the U-2, one of the brush holders should be removed in order to determine which of the cables should be connected to No. 1 cylinder. If the segment in the collector is in a position to come in contact with the brush on the brush holder which has been removed, connect the cable from this brush holder to the spark plug in No. 1 cylinder. Otherwise connect the cable from the brush holder on the opposite side. On the U-1 and U-2 the armature can be rotated from the interrupter end instead of by the distributor gear.

To time a magneto equipped with an impulse coupling, set No. 1 cylinder in top dead center position of the compression stroke, and revolve the armature until the coupling is released from the arrester plate; when this occurs, rotate the armature backward until the interrupter lever again crosses the cam and the points are just closing or, when rotated in the proper direction, the points are just opening. With the above setting attained, proceed in the same manner as you would with a magneto not equipped with an impulse coupling.

EXACT MAGNETO TIMING: The above instructions are for general purposes only and apply principally to variable ignition. **FOR MOST EFFICIENT OPERATION OF THE INDIVIDUAL ENGINE, ALWAYS FOLLOW THE IGNITION TIMING INSTRUCTIONS ISSUED BY THE MANUFACTURER OF YOUR ENGINE.**

When fixed spark ignition is used, the timing must be done with the piston in a position 15° to 40° before top dead center (ACCORDING TO MAKER'S SPECIFICATIONS) to procure maximum efficiency. Correct timing, as recommended by the engine manufacturer, is generally indicated on the flywheel. **ALWAYS FOLLOW ENGINE MAKER'S INSTRUCTIONS.**

NOTE: If the magneto is equipped with an American Bosch Adjustable Impulse Coupling, this coupling should be taken apart and cleaned once a year. Do not oil or grease coupling. If not protected by an engine hood, keep it covered.

CARE AND MAINTENANCE

Aside from keeping the magneto clean externally, practically the only care required is the oiling of a single plain bearing supporting the shaft of the distributor gear. This bearing should receive not more than two or three drops of oil every 500 miles, or 100 hours' operation, applied through the oil duct located on top of the magneto. Any good, light engine oil may be used for this purpose. The types U-1 and U-2 magnetos require no oiling whatsoever.

The interrupter is intended to operate without lubrication, and as oil on the platinum interrupter contact will prevent good contact, cause sparking and burning, as well as misfiring, care should be exercised to prevent the entrance of oil to these parts.

Starting the Engine

When cranking an engine equipped with a Type U magneto as sole ignition, the spark lever may be safely advanced about one-third, or even one-half on starter equipped engines, and in this position will permit easier starting.

TROUBLE SHOOTING

Ignition difficulties may be divided into two main classes, one, the most common, due to spark plugs and cables, and the other, due to the magneto. In case of defective ignition, therefore, it must first be determined whether the fault is in the magneto or elsewhere.

In general, when only one cylinder misfires, the fault is in the spark plug, the most common plug difficulties being as follows:

Plug Gap Too Wide: The distance between the electrodes of the spark plugs varies according to the individuality of the engine, but normally this distance should not be less than .02". On the other hand, too wide a gap increases the electrical resistance, and interferes with the proper generation of current at low speed.

Plug Short Circuited: This is usually caused by a cracked or porous insulator, or by fouling of the electrodes or insulator. Any of these conditions will cause misfiring by permitting the current to stray from its intended path.

Cables: Misfiring of one cylinder, either continuous or intermittent, may be due also to a chafed or broken cable or a loose cable connection. The cables should be carefully examined, special attention being paid to the insulation. The metal terminals of the cable must not come into contact with any part of the magneto except the terminals on the distributor plate and end cap or any metal parts of the en-

gine except those designated as being correct according to the instructions given.

Ignition Fails Suddenly: A sudden failure of ignition may indicate a short circuit in the low tension cable, due to a defect in the cable, to a faulty connection at the switch or to the presence of dirt or moisture. A test for trouble in the switch or low tension cable can be made by removing the cable from the grounding terminal on the end cap and endeavoring to start the engine on the magneto. If the engine runs with this wire disconnected, but stops when the wire is connected, it is evident the magneto is in good order and that the trouble is due to some fault in the switch or grounding wire permitting the low tension current to escape to ground.

Irregular Firing: If the cables and plugs are in good condition, and yet the ignition is irregular, the trouble is probably with the magneto, and the interrupter should be carefully examined. It should be seen that the interrupter lever moves freely on its pivot, that the hexagon headed fastening screw in the center of the interrupter is properly tightened, and also that the two interrupter contacts are properly secured in position.

If the interrupter lever does not move freely on its pivot, which is sometimes possible, particularly with new magnetos, the hole in the fibre bushing in which the lever pivots, may be slightly enlarged by means of a reamer or small round file; this work, however, should be carefully done as very little reaming accomplishes the desired result.

Interrupter Contacts: The interrupter contacts should be examined for the correctness of their adjustment, and they should be so set that they are separated by a distance of 0.4 of a millimeter (about

1/64th inch) when the interrupter lever is resting on either of the segments in the interrupter housing. The strip of steel attached to the magneto adjusting wrench, which is furnished with each magneto, is to be used as a gauge for this distance. The adjustment of the platinum interrupter contacts may be made by loosening the lock nut of the long contact screw, which passes through the interrupter contact block, and turning the hexagon head of the screw itself with magneto adjusting wrench. When the adjustment is made, care should be taken to tighten the lock nut firmly. The contacts of the interrupter should be clean and in proper alignment. If any oil, grease or dirt is deposited on them it can be removed by drawing a piece of cloth or paper between them while they are together or, if they are pitted too much, a cloth dampened with gasoline may be used. If the latter method is used care must be taken that the points are absolutely dry before attempting to operate the magneto.

The interrupter may be taken out as a unit by removing the interrupter housing and removing the hexagon headed fastening screw in the center of the interrupter with the magneto adjusting wrench.

Insulating Parts: It sometimes happens that brush holders and other insulating parts of the magneto are damaged through accident or carelessness. These parts should also be carefully examined for possible disarrangement or damage of the insulation which might permit leakage of current. In order to prevent leakage by the brush holders, distributor plate or other insulating parts, it is necessary to clean them occasionally with a soft cloth saturated with gasoline. After cleaning these parts the magneto should not be operated until it is thoroughly dry.