What is a Magneto
and
How Does it Work?

from Automotive Essentials
by Ray F. Kuns
revised edition: 1950

HIGH-TENSION-MAGNETO IGNITION

Units of the System. The high-tension magneto is self-contained. X~batteries, coils, distributor, or other units are used separately from the magneto. It generates the primary current, breaks it, induces the high-tension jump spark in the secondary winding, sends the current to the distributor board, and from the distributor board to the individual spark plugs and cylinders. The high-tension magneto is the most compact ignition device ever used for automobile-engine ignition. While displaced almost entirely by battery ignition, for pleasure-car use, it is in strong favor for trucks, tractors, and for many marine installations. A study of ignition devices is not complete without some consideration given to the high-tension magneto. Magneto ignition is used for single-cylinder, four-cycle industrial engines and for two-cycle outboard engines. These units are illustrated and explained in later chapters.

Principles of the High Tension Magneto. The principles of current generation and induction are no different in the magneto than in the battery. The permanent magnets create or set up a magnetic field, and the magnetic flux thus set up is cut by the windings of the magneto armature which carries the primary and secondary windings.

Driving the Magneto. The ignition instruction stand, illustrated in Figure A, represents a skeleton engine where the first crankshaft throws the piston, the two cams, and two valves, and the complete magneto-ignition system for a four-cylinder engine. Owing to the construction of the magneto armature, the magneto must be driven in exact time with the engine in order to make use of the magneto current at its fullest wave value. In a four-cylinder motor, the magneto armature is turned at crankshaft speed. It puts out a spark each half revolution, two sparks per revolution, four sparks for two revolutions which is the time in which all four cylinders are fired. In a six-cylinder magneto and engine, the armature must turn out six sparks in the same time. Accordingly, it is driven at 1½ times crankshaft speed, and thus, while the engine shaft turns twice, the magneto armature turns three times and delivers six sparks. For an eight cylinder, the magneto armature is driven at twice crankshaft speed. Either gear (as shown in this model) or chain drive may be used, but the ratio of the gears must be in the order given, in order to have the correct speed relations. In the magneto illustrated herewith the windings are on the armature and are rotated within a magnetic field. It is also possible to have the magnetic field in the armature and rotated within stationary windings.

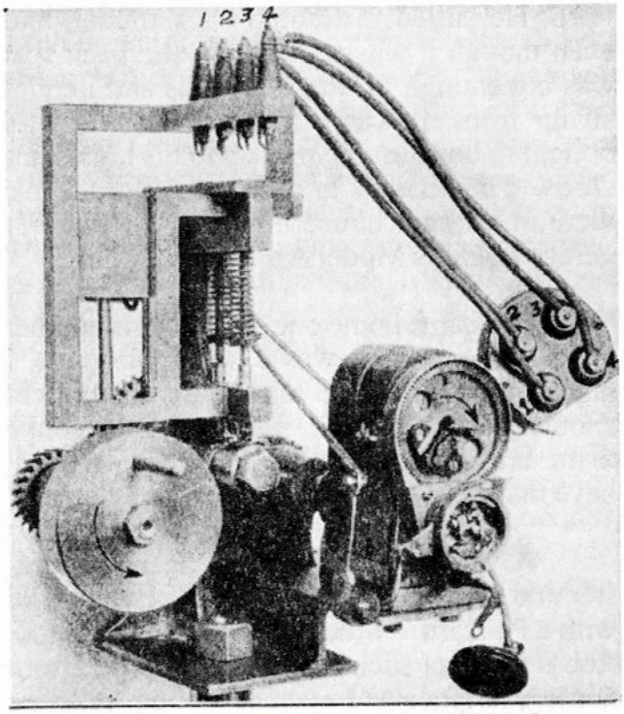

Figure A *Distributor board and breaker box, cover removed*

The Construction and Function of Magneto Parts. Figure B illustrates the parts of the magneto shown on the instruction stand, Figure A. Magnetos are built up on a frame consisting

of the base and pole shoes 1, and the magnets 6, 6. The armature 16 is the important moving part of the magneto. It is made with a metallic core shaped like the letter H. This type magneto is known as the H or shuttle-armature type. The H part of the armature is first wound with a few turns of primary wire similar to the primary winding of the coil. One end of this winding is connected to the insulated one of the breaker points, and the other end is grounded. When the magneto turns and allows the breaker points to come together, current will be generated and will flow in the primary circuit. This current is low tension, and corresponds to the battery or generator voltage. It is possible to generate this current because the magneto armature is mounted and turning in the position indicated by 1 in the pole shoes and base mounting. By referring to the magneto magnets (6) in Figure B, the nature of the lines of force flowing across the magneto poles from north to south poles may be visualized. The pole shoes of 1, which fit closely around the armature, serve to strengthen the magnetic field or flux. The result is that as magneto-armature poles come into close contact with the pole shoes, the magnetic flux flows from the north pole, through the armature shoe, through the armature core, and out through the opposite side of the armature to the south pole. While doing this, the windings are cutting and being cut by the lines of force and current induced within the primary winding which is run to the breaker points as suggested above.

The breaker points are mounted on a back. See 13 of Figure B and Figure C, where the breaker parts are termed interrupter parts. The breaker is mounted on the gear end of the magneto armature, within a breaker box. In the breaker box 12, Figure B, are mounted two cams or blocks. When the block on the movable breaker arm strikes one of these blocks, it has the effect of separating the contact points and interrupting or breaking the primary current.

As the primary current is broken, the lines of force about the core of the magneto armature collapse. As they collapse, they cut the secondary winding about the core, and a high-tension spark is produced just as in the case of the induction coil. However, there is an added feature in the magneto which helps to increase the strength of the secondary current, and this is the fact that the secondary winding is being moved rapidly in the magnetic flux flowing through the space occupied by the armature. This serves to prolong the length of time the high-tension spark flows.

While the primary winding, the breaker points, and the condenser, which are mounted within the armature end, all serve to generate, direct, and break the primary circuit, and while the secondary winding produces the high-tension current to fire the fuel charges in the engine cylinders, there are other parts which must be introduced to carry or direct the high- tension spark to the proper plugs at the proper time.

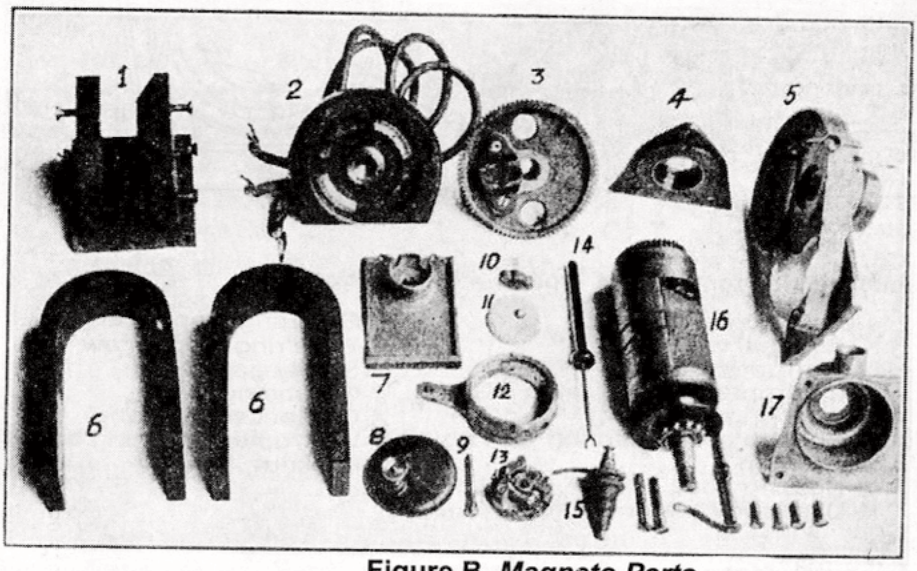

Figure B ***Magneto Parts***

The breaker points are timed to open and produce the needed spark at the proper time with reference to the position of the pistons within the en-

gine. In Figure A, it will be noted, the engine is in firing position, and the breaker points have just separated. The spark thus produced is carried along the winding until it is led to the collector ring of the armature, which is shown at 16, Figure B, and at D, Figure C. From this point it is led (distributed) through the brush 15, Figure B, to the pencil 14, and thence to the center of the distributor board 2, Figure B. The brush 10 fits into the brush mounting on the gear 3. When the distributor board is placed over the gear and brush 3, it will be seen that the brush connects the center contact with one of the four outer contacts of 2, and since each of these outer contacts is connected with a high-tension wire which leads to a spark plug (Fig. A), it will be seen that the high-tension current is thus directed to the proper plug.

In Figure A, the engine is on the t.d.c. compression stroke, cylinder No.1 and the points in the breaker box have just broken, and the spark lever is fully retarded. The spark, developed at this instant, is conducted to the collector ring, through the pencil to the center of the distributor board, and it will be seen that the brush is in position to lead the spark to the contact marked 1 on the outside of the distributor board. It will also be noted that the high-tension wire or cable from this contact runs to spark plug No.1. Considering the direction of rotation of the distributor gear, it will be noted that the next contact to come under the brush wi11 be No.2, and the wire is led to plug No.2. The next contact to come under the brush will be No.3, and this wire runs to plug No.4; the final contact to come under the brush will be No.4, and this wire runs to plug No.3.

S.K.

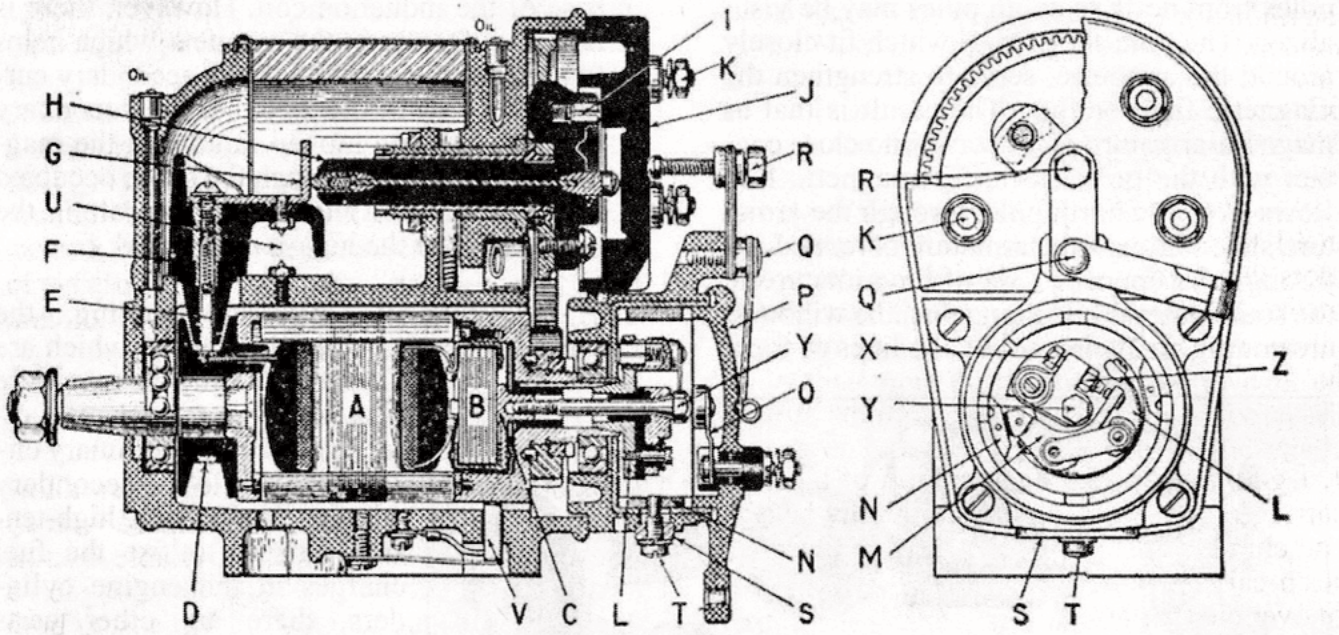

Figure C- Sectional and Front View of Type AT-4 Brush Magneto

A-Armature
B-Condenser
C-Condenser connection plate
O-Collector ring
E- Collector brush
F- Collector brush holder
G-Conducting plate
H-Distributor rotating brush holder
I- Distributor brush
J-Distributor plate
K-Terminal nut
L-Interrupter disc
M-Interrupter lever
N-Cam ring and earn
O-Endcap contact spring with brush
P-End cap
Q-Holding post
R-Distributor fastening screw
S-Cam ring stop screw plate
T -Cam ring stop screw
U-Safety gap
V-Grounding brush
X-Contact screw (long)
V-Interrupter fastening screw
Z-Locknut

Figure C *Magneto in Cross Section*