Course in Gas Engineering

This Course will consist of a series of practical talks on the theory and practice of the gas, gasoline and oil engine. They will be simple, illustrated where necessary, and of such a nature that the gas engine owner may easily adapt them to his daily engine work.

LESSON IX.

Mechanical Forms of Generators, Dynamos and Magnetos.

Mechanical forms of current producers have the advantage over primary and secondary batteries in that the energy required by them is derived directly from the engine they operate. Hence current will be produced as long as and only when desired. The other forms of generators depend upon sources of energy entirely extraneous to the engine plant, and the supply of current is therefore not in any sense automatic, which would be the ideal condition. The terms dynamo and magneto have been variously used. Some writers designate by "dynamo" any generator having electro-magnets serving to establish the magnetic field, and by "magneto" any machine employing permanent magnets for this service. Others define the difference as existing in the kind of current produced, a dynamo furnishing direct, i. e., continuous current, while a magneto produces alternating, i. e., pulsating, current. Whatever definitions

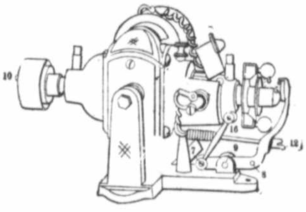

Fig. 1

adhered to, it should be remembered that in either machine the current is produced by an electrical conductor cutting the magnetic field. The current is produced in exactly the same way, and for exactly the same reason, as that established in the secondary winding of a spark coil. In this case the conductor of electricity is wound upon a piece of metal, called an armature, which is rapidly rotated in a magnetic field. It makes no difference whether this field is produced by permanent magnets or by electro-magnets. If there are a number of such conductors upon the armature, and the current induced in each is properly collected by a so-called commutator upon the armature shaft so as to be practically continuous in its flow through the external circuit, we have what is generally called a dynamo. On the other hand, if the current in the external circuit rises to a maximum value and then dies out to give a maximum value next in the oposite direction, the machine is generally known as a magneto. While in all dynamos and most magnetos the armature constantly rotates in one direction, it should be stated that in all magnetos this is not at all necessary. Thus in the Simms Bosh magneto, the armature is stationary, and only a sleeve surrounding the armature is rapidly oscillated in the magnetic field. It would be beyond the scope of this lesson, however, to discuss all the possible modifications, and the reader is hence referred to the works upon this subject.

In general, the small dynamo used for ignition purposes is driv-

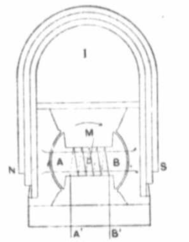

Fig. 2

en by means of a friction wheel from the fly-wheel of the engine. There is then no current available from the dynamo when the engine is started, and it becomes necessary to use a battery of some kind for the first minute or two, switching in the dynamo when it is up to speed. This scheme has the disadvantage that the battery is sometimes left in the circuit and the dynamos have been known to burn out under excessive engine speeds. A device called the Auto Sparker, Fig. 1 overcomes these difficulties. This little dynamo is fitted with a centrifugal governor which controls the position of the friction wheel on the fly-wheel rim, so that even at starting the armature rotates rapidly enough to furnish starting current. This does away with an auxiliary battery. As the engine speeds up, the governor of the dynamo acts to keep the armature speed constant, independent of the diameter of the fly-wheel or the engine

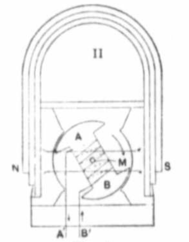

Fig. 3

speed. By adjusting the governor tension spring, it is possible to control the speed of the dynamo to get any current between 1 and 3 amperes and any voltage between 3 and 10 volts.

Regarding magnetos, the following description of the action of a magneto, together with the explanation of the method of connecting it up, is taken from a catalogue of the Holley Bros. Company, of Detroit. For clearness and simplicity this description can hardly be improved upon.

"A magneto, so far as its essential parts are concerned, is a very simple thing. It consists of a U-shaped piece of special steel, which is permanently magnetized; in other words, a common horseshoe magnet and a rotating armature. The armature consists of a soft iron core of approximate H cross-section as viewed along the shaft upon which it is supported and on which it is designed to rotate. The magnet, to the free ends of which are affixed soft iron arc-shaped pole pieces, and the armature core with the sides of the H correspondingly are shaped, is shown in vertical section in Fig. 1. In the slot formed in the armature core by the sides of the H, wire is wound in turns lengthwise of the armature shaft. So much for the construction of the elementary magneto. In order to understand how it generates in its armature,

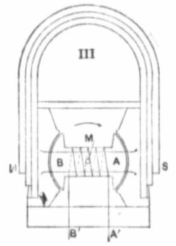

Fig. 4

when turned, an electric current, it is necessary to remember one law of physics, namely: Whenever a wire is wound about a magnetized soft iron core and the magnetism of the core suddenly dies out, there will be a tendency for a current to be produced in the wire. A familiar example of the working of this last is found in the operation of the common jump-spark coil. Here we have a core made of soft iron wires and around it is wound a great many turns of fine wire, the ends of which are connected to a spark plug. The core is also wound with a coil of wire which is supplied with current from a battery, and when this current is flowing the core is magnetized. When the current from the battery is interrupted, the magnetism in the core suddenly dies out, and, in accordance with the law above stated, a tendency is created for a current to flow in the fine wire coil which is connected to the spark plug and this 'induced' current jumps at the plug.

"In order to explain how the iron core of the magneto armature with its winding is magnetized and how the magnetism of the core is caused suddenly to die out, it is necessary to refer to four diagrams of Figs. 2-5, showing the armature in different positions of rotation with respect to the pole pieces. In diagram (1) the armature is represented with the two ears of its core in close proximity to the faces of the pole pieces. The space between the pole pieces is thus almost completely filled or bridged with iron, and magnetism passes from one pole piece to the

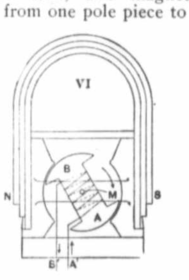

Fig. 5

other through the armature core, thoroughly magnetizing it. Next consider diagram (11). Here the armature is shown rotated into such a position that one edge of the armature core is just leaving the vicinity of one of the pole pieces. As soon as this position is passed, the space from pole piece to pole piece is no longer filled with iron, but with air which is not a conductor of electricity. Thus very little magnetism passes from one pole piece to the other and the core is no longer traversed by the magnetic influence and suddenly ceases to be magnetic. This is exactly the condition prescribed by the above quoted law for the production of a current, and, in fact, when the armature in its rotation leaves position (11), there is a sudden impluse of current produced in the wire of the armature which dies away after the armature rotates a little beyond this position. In position (III), the conditions of armature magnetization existing in position (I) are reproduced, except that the armature has changed ends in respect to the pole pieces and the magnetic influence passes through it in the opposite sense, charging it oppositely, so that when the magnetism is discharged in position (IV) the current will be in the opposite direction through the wire of the armature winding. As the armature is turned upon its shaft, there are thus produced, in each complete rotation, two rather short impulses of current of opposite direction nearly corresponding with the instants at which the armature heads, so to speak, 'part company' with the pole pieces and are half a revolution apart. During the remain-

Continued on page 90