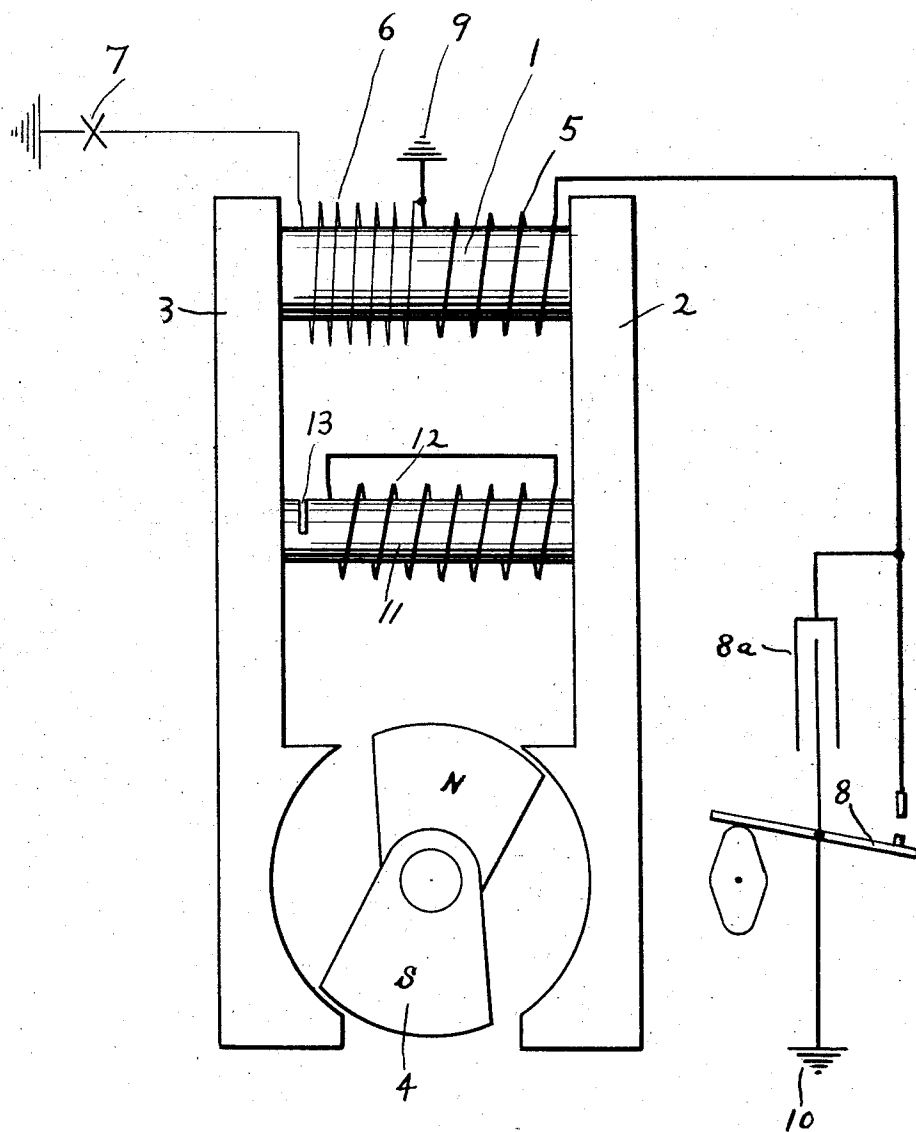


H. H. GORDON.
AUTOMATIC FLUX CONTROL FOR IGNITION SYSTEMS.
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AUTOMATIC FLUX CONTROL FOR IGNITION SYSTEMS.

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To all whom it may concern:

Be it known that I, HAYNER H. GORDON, a citizen of the United States of America, residing at Washington, in the District of Columbia, have made new and useful Improvements in Automatic Flux Controls for Ignition Systems, of which the following is a full and complete specification, reference being had to the accompanying drawing, which forms part of this specification.

This invention relates broadly to structure in which an electric current is generated, or set up in a winding by subjecting the same to a variation in magnetic flux, and relates more particularly to the provision of automatic means for regulating the rate of flux change independently of the means that produces the flux change.

This invention also relates more particularly to high tension magnetos of the type which comprise a high tension winding, and a low tension or choke winding superimposed upon a core which is subjected to a variable magneto motive force. In such structure a flux change is impressed upon the core, which change has a variable rate which approaches a sharp maximum twice each revolution of the rotor, in the usual two pole magneto. The flux change however is opposed by the choke winding, which is normally short circuited, and which as soon as a flux change tends to take place in the core, sets up a counter magneto motive force which tends to resist such change. At points of maximum rate of impressed flux change the choke winding is suddenly opened by some external means such as a circuit breaker and the hitherto repressed flux change is permitted to take place in the core, thereby setting up a potential in the high tension winding with a consequent breaking down of the spark gap to which the high tension winding is connected. The spark thus formed continues to burn in the form of an arc, for the breaking down of the spark gap has closed the high tension winding or circuit and the current flowing in this winding has a regulative effect upon the flux change taking place in the coil.

This type of magneto operates very satisfactorily at low or normal speeds but when it operates at the extremely high rate of speed demanded in the modern eight or twelve cylinder motors the intensity of the flux change becomes so great as to cause over-

heating from eddy currents set up in the magneto core structure and from the high current density of the short circuited choke winding. Also in a magneto which is designed to give a good spark when starting, when rotated at the extremely high speed demanded, the spark becomes so hot that the sparking points of the plugs are soon burned out or become overheated causing pre-ignition, and in addition the counter magneto-motive force set up by the choke winding at extremely high speed causes serious complications in the armature reaction of the magneto. The low tension or make and break magneto is also subject to the same effect, its action being substantially the same as that just set forth, with the exception that no high tension winding is used, the terminals of the low tension or choke winding, being connected directly to the spark producing terminals.

It is the general object of this invention to provide a structure in which the time constant of an electrical circuit acts to automatically regulate the magnetic flux change in a current producing coil, the flux regulating means being independent of the flux change producing means.

It is a further object of this invention to provide means for automatically controlling the rate of flux change in the core which supports the choke and secondary windings, irrespective of the speed of the magneto.

It is a further object of this invention to provide a magneto which may be operated satisfactorily at high speeds without excessive heating and armature reaction.

Further objects of this invention will appear from the following disclosure.

For the purpose of rendering the invention more clear, reference is had to the accompanying drawing, in which is shown one embodiment of the same. In the drawing a core 1 is connected to pole pieces 2 and 3, the core having wound thereon a primary or choke winding 5 and a secondary winding 6. The choke winding 5 has one end grounded at 9, the other end of the same being connected to the ground at 10 through the interrupter mechanism 8 across the terminals of which is connected the usual condenser 8^a. One end of the secondary 6 is grounded at 9 the other end being connected to the spark plug 7. A magnetized rotor 4, the magnetic energy of which may either be fur-

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nished by electromagnetic or permanent magnetic means, revolves between the ends of the pole pieces 2 and 3 and furnishes the means for providing the variable magnetic motive force to cause a flux change to take place in the core 1.

Connecting the pole pieces 2 and 3 is a supplementary core 11, having wound thereon a short circuited winding 12, the magnetic area of the core 11 being easily regulated or controlled by means of a saw cut 13. The winding 12 should normally be so proportioned in size of wire and number of turns as to have a larger time constant or "electrical inertia" than the choke winding 5, but if desired any well known type of regulative inductance may be employed in circuit with the winding 12; this could either be done by using a selective switch to vary the number of turns in winding 12, or by using some form of external regulation.

The operation is as follows: As the magnetized rotor 4 revolves there will be impressed upon the pole pieces 2 and 3 a variable flux change which will reach a sharp maximum twice each revolution of the rotor. As soon as magnetic flux change tends to take place in the cores 1 and 11, the choke windings 5 and 12 on these respective cores immediately build up in the cores a counter magneto motive force so that very little flux change will take place in these cores. When the rotor 4 is in a position to produce the maximum flux change the choke winding 5 is opened by means of the circuit breaker 8 and the hitherto repressed flux change is allowed to take place in the core which thereby sets up a current in the secondary winding 6 with a consequent spark at the spark gap 7. As long as the maximum rate of flux change induced in the core is of relatively low value, the only flux change that will take place in core 11 will be approximately that sufficient to supply 12R loss of the winding 12, the change of flux through core 11 being resisted. As the rate of flux change increases, however, the maximum voltage useful in coil 12 to set up a current which in turn sets up a counter magneto-motive force cannot reach to such a high proportionate value. A larger proportion of flux will therefore pass through the core 11, and the higher the rate of speed at which the magneto rotor 4 is driven the larger the leakage of the flux through the core 11 will become, the core 11 thereby acting as a sort of safety valve for the magnetic flux and automatically keeping the flux change in the core 1 within certain limits, depending upon the relation between the inductance in the choke winding circuit, and the coil 12.

Attention is also called to the fact that at extremely high magneto speeds the counter magneto motive force set up by the coil 12 will tend to reinforce the flux change tak-

ing place in the core 1, upon the opening of the circuit breaker 8 thereby giving to the closed magnetic circuit formed by the cores 1 and 11 and the pole pieces 2 and 3 sufficient energy to properly function after the rotor has passed the maximum flux change in these positions.

This accumulative reinforcing action will also have a tendency to negative the energy absorbing effect of the condenser 8^a.

What I claim is:

1. In a magneto, the combination with two pole pieces, and a source of magnetic energy, of a rotor adapted to set up a variable magnetic flux in said pole pieces, a core connecting said pole pieces together, said core having wound thereon a choke winding, a supplementary core connecting said pole pieces together and a flux controlling winding upon said supplementary core, the time constant of said flux controlling winding being of greater value than the time constant of the choke winding, the choke winding thereby functioning to prevent any substantial flow of magnetic lines of force through the supplementary core when the rate of magnetic flux change in said pole pieces is below a predetermined value.

2. In a magneto, the combination with two pole pieces and a source of magnetic energy, of a rotor adapted to set up a variable magnetic flux in said pole pieces, a core connecting said pole pieces together, said core having wound thereon a secondary winding and a choke winding, a supplementary core connecting said pole pieces together, a short circuited flux controlling winding upon said supplementary core, the time constant of said flux controlling winding being of greater value than the time constant of the choke winding.

3. In a system for the generation of electrical energy, the combination with a source of magnetic energy, of a core, a current producing winding upon said core, means for producing a variation of magnetic flux in said core, a magnetic leakage path subjected to said magnetic flux variation for shunting a portion of the magnetic flux around said core and a winding for controlling the resistivity of said leakage path to flux variation.

4. In an ignition system for internal combustion engines, a spark producing winding, means operated by the engine for producing a periodic change of magnetic flux in said core to energize said winding, a magnetic shunt path of fixed reluctance also subjected to the periodic magnetic flux change for controlling the rate of flux change in said core, and a winding on said shunt path, said winding forming a portion of a circuit having a fixed time constant.

5. In an ignition system for an internal combustion engine, the combination of a

core, windings upon said core, means producing a variation of magnetic flux in said core, a circuit interrupter driven in synchronism with the engine and connected in series
5 with one of the windings on said core, a condenser connected across the terminals of the circuit interrupter, a magnetic leakage path of fixed reluctance for shunting a portion of the magnetic flux around said core,
10 and having wound thereon a winding of fixed time constant functioning to reinforce the magnetic flux change in the core when the engine is running above a certain speed.

6. In an electrical system in combination, a winding, means for producing a periodic
15 change of magnetic flux at variable frequencies in said core, a magnetic leakage path subjected to said periodic flux change for shunting a portion of the magnetic flux
20 around said winding, and means for rendering said leakage path more effective at predetermined frequencies.

In testimony whereof I hereunto set my hand.

HAYNER H. GORDON.