Oct. 13, 1925. 1,557,201

J. H. HUNT

IGNITION APPARATUS

Filed March 21, 1925

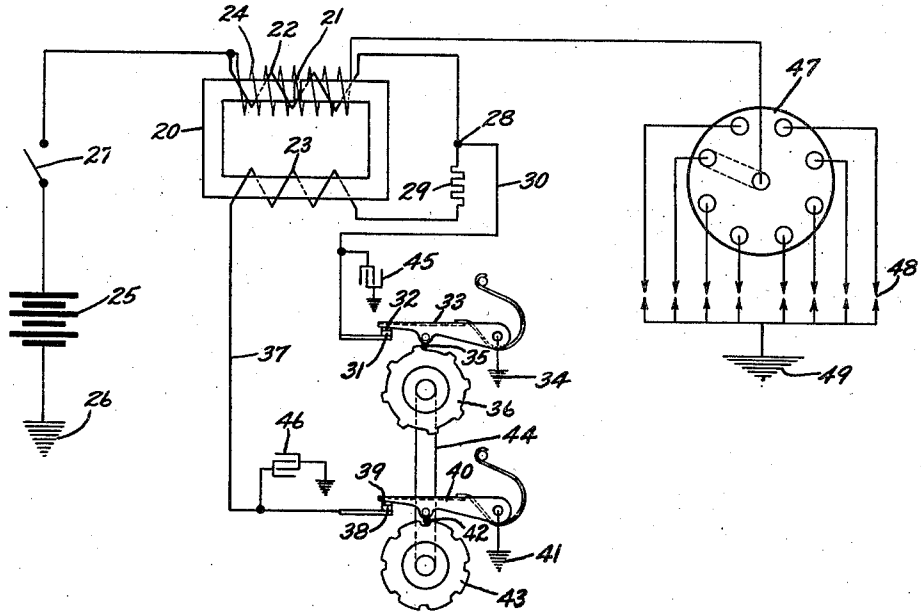

Fig. 1

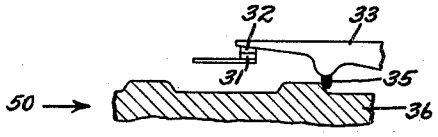

Fig. 2

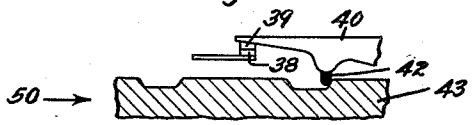

Fig. 3

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UNITED STATES PATENT OFFICE.

JOHN H. HUNT, OF DAYTON, OHIO, ASSIGNOR TO GENERAL MOTORS RESEARCH CORPORATION, OF DAYTON, OHIO, A CORPORATION OF DELAWARE.

IGNITION APPARATUS.

Application filed March 21, 1925. Serial No. 17,363.

To all whom it may concern:

Be it known that I, JOHN H. HUNT, a citizen of the United States of America, residing at Dayton, county of Montgomery, State of Ohio, have invented certain new and useful Improvements in Ignition Apparatus, of which the following is a full, clear, and exact description.

This invention relates to ignition apparatus for multi-cylinder internal-combustion engines, and includes among its objects certain improvements in the ignition apparatus disclosed in Hunt Patent #1,374,205, issued April 12, 1921. The ignition system of the patent comprises a source of current, an ignition coil having a primary and secondary, and a timing device which first connects the current source only with a portion of the primary in order to secure rapid building up of current and energy of the coil, then connects all the turns of the primary in series with the coil in order to secure an automatic transformation or reduction of the current in the coil to a lower value, and then for interrupting the flow of current through the primary windings in order to secure a sparking impulse in the secondary of the coil.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a wiring diagram disclosing a form of the invention, and

Figs. 2 and 3 are fragmentary views illustrating the operation of the timing mechanism.

Referring to the drawings, 20 designates a magnet core of the C-type, having a continuous iron magnetic path except for an air gap 21. A primary winding 22 surrounds the air gap 21 and a portion of the core 20 which is adjacent the air gap and a primary winding 23, surrounds only a continuous portion of the iron magnetic path. By reason of the air gap 21, the primary 22 will be made lower in inductance than the primary 23, although the number of turns in both primaries may be the same. The coil includes a secondary 24, which surrounds the air gap 21 and is, therefore, inductively related to both primaries. A battery or other current source 25 is grounded at 26 and connected by a switch 27 with one end of primary 22, having its other end connected with the terminal 28 which is connected through resistance 29 with the primary 23 and is connected through wire 30 with a timer contact 31. Timer contact 31 cooperates with contact 32 carried by a breaker lever 33, grounded at 34 and carrying a cam follower or rubbing block 35, which cooperates with an engine-driven cam 36.

Primary 23 is connected by wire 37 with timer contact 38 which cooperates with a timer contact 39 carried by a lever 40 which is grounded at 41 and carries a rubbing block 42 which cooperates with an engine driven cam 43. Numeral 44 indicates an engine-driven shaft connected with the cams 36 and 43. A condenser 45 parallels the contacts 31 and 32; and a condenser 46, the contacts 38 and 39. One end of the secondary 24 is grounded through the battery and the other end connected with a distributor 47 for distributing sparking impulses to the various spark plugs of the engine, the spark plugs being indicated at 48 and grounded on the engine frame, as indicated by ground connection 49.

In Figs. 2 and 3, the cams 36 and 43 are indicated by developments of their surfaces in order to show more clearly the sequence of operation of the breaker levers 33 and 40. The cams are moved clockwise, as viewed in Fig. 1, or in the direction of the arrows 50 in Figs. 2 and 3. It is evident that contacts 31 and 32 will be closed before contacts 38 and 39 are closed and that the contacts 31 and 32 will be opened before contacts 38 and 39 are opened. The timing mechanism, therefore, causes first, the coil 22 only to be connected with the current source or battery 25. Current and energy of the coil will increase at a rapid rate due to the relatively low inductance of the winding 22. While contacts 38 and 39 are closed and after contacts 31 and 32 are opened, the coils 22 and 23 will be connected in series with the battery, thus materially reducing, by an auto-transformer effect, the amount of current in the primary circuit to a value which is safe for the ignition timer contacts. Finally, the contacts 38 and 39 are separated, while contacts 31 and 32 are maintained out of engagement,

in order to completely interrupt the flow of current through the primary circuit and thus cause a sparking impulse to be induced in the secondary 24, for producing a spark at one of the plugs 48.

By placing that portion of the primary circuit which is employed to build up the energy of the coil, around the air gap, the inductance of that portion would be substantially below that which it would have if no air gap were present. By thus reducing the inductance in this portion of the primary circuit, the energy of the coil can be built up more rapidly and hence sparking impulses can be obtained in a more rapid succession than heretofore. In other words, the presence of the gap within the coil 22 permits the use of more turns in the coil 22 than would be possible if a continuous iron core were used. Hence the quantity of m. m. f. which can be built up within a specified time is much greater than possible when no gap is present. One form of the present invention was tested, in which the primary windings 22 and 23 had the same number of turns. Coil 22 was found to have about one-half the inductance of coil 23.

While the form of embodiment of the invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. An ignition system comprising, in combination, a current source, an ignition coil having primaries of different inductances, and a secondary inductively related to both primaries, and timing mechanism for causing one primary only to be connected with the current source, then both primaries in series with the source, and then for interrupting the current to the primaries.

2. An ignition system comprising, in combination, a current source, an ignition coil having primaries of different inductances, and a secondary inductively related to both primaries, and timing mechanism for causing only the primary of lower inductance to be connected with the current source, then both primaries in series with the source, and then for interrupting the current to the primaries.

3. An ignition system comprising, in combination, a current source, an ignition coil including an iron magnetic circuit core and an air gap, primaries surrounding said core, one of them enclosing the air gap, a secondary inductively related to both primaries, and timing mechanism for causing only the primary which encloses the air gap to be connected with the current source, then both primaries in series with the source, and then for interrupting the current to the primaries.

4. An ignition system comprising, in combination, a current source, an ignition coil including a C-shaped magnetic core providing a continuous iron core portion and a portion including an air gap, a primary on the continuous portion, a primary enclosing the air gap, a secondary inductively related to both primaries, and timing mechanism for causing only the primary which encloses the air gap to be connected with the current source, then both primaries in series with the source, and then for interrupting the current to the primaries.

5. An ignition system comprising in combination, a current source, an ignition coil including a C-shaped magnetic core providing a continuous iron core portion and a portion including an air gap, a primary on the continuous portion, a primary enclosing the air gap, a secondary enclosing the air gap; and timing mechanism for causing only the primary which encloses the air gap to be connected with the current source, then both primaries in series with the source, and then for interrupting the current to the primaries.

In testimony whereof I hereto affix my signature.

JOHN H. HUNT.