J. H. HUNT.

IGNITION SYSTEM.

APPLICATION FILED JULY 11, 1918. RENEWED MAY 14, 1919.

1,374,205. **Patented Apr. 12, 1921.**

2 SHEETS—SHEET 1.

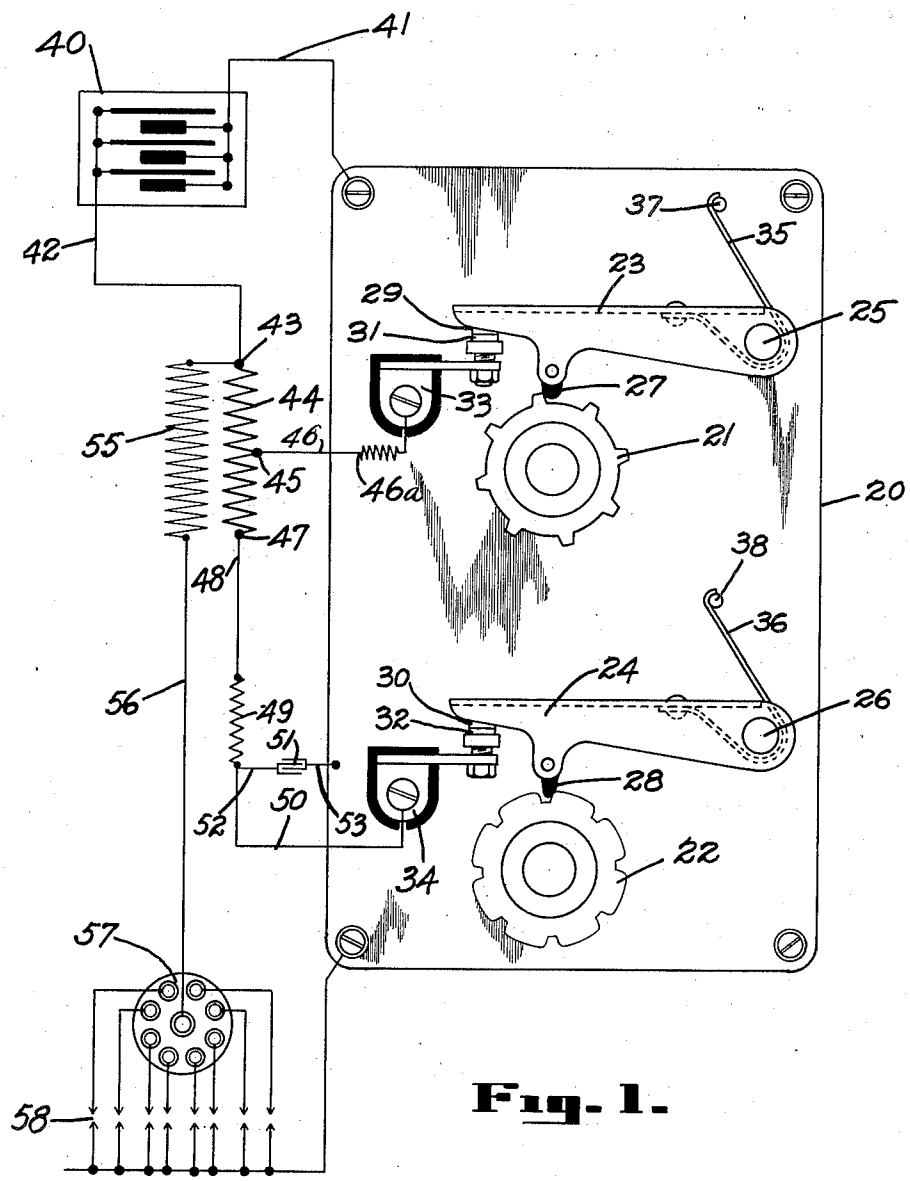


Fig. 1.

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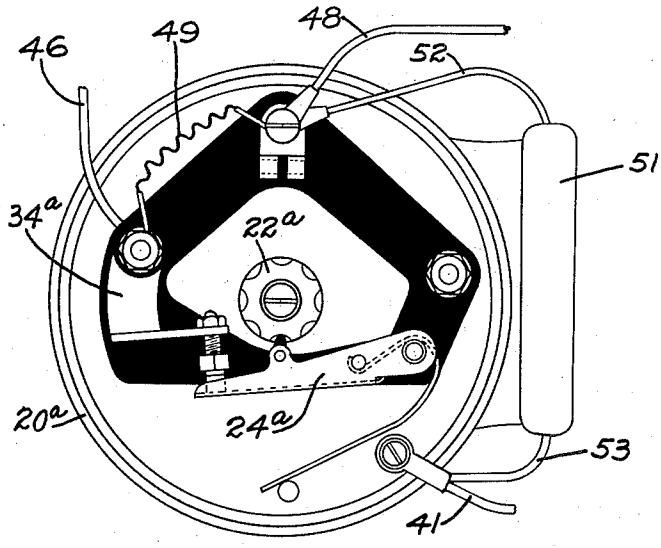


Fig. 2.

Fig. 4.

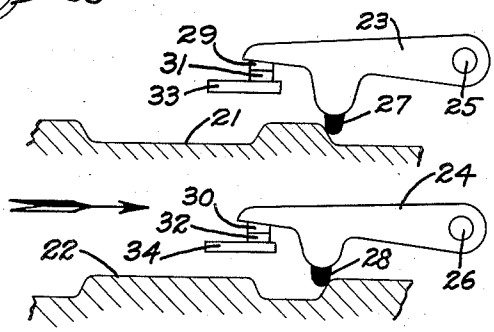


Fig. 5.

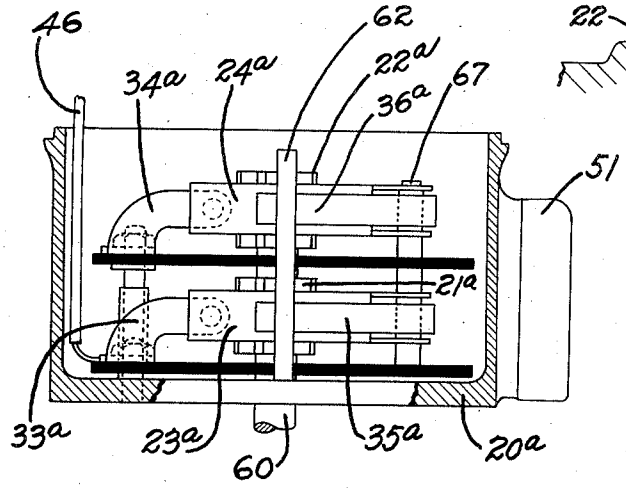


Fig. 3.

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UNITED STATES PATENT OFFICE.

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IGNITION SYSTEM.

1,374,205. Specification of Letters Patent. Patented Apr. 12, 1921.

Application filed July 11, 1918, Serial No. 244,371. Renewed May 14, 1919. Serial No. 297,156.

To all whom it may concern:

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

This invention relates to ignition systems for engines of the internal-combustion or explosion type, and has for an object the provision of an ignition system which is particularly adapted for high speed multi-cylinder engines, in which a large number of sparking impulses per second are required.

Other and further objects of the present invention will be apparent from the following description of a preferred embodiment thereof, reference being had to the accompanying drawings.

In the drawings:—

Figure 1 is a diagrammatic plan view of mechanism included in the present invention together with a wiring diagram;

Fig. 2 is a plan view of a form of the timer mechanism included in the present invention;

Fig. 3 is a side view thereof, certain parts being broken away for the sake of clearness; and

Figs. 4 and 5 are plan views of developments of portions of the timer cams, showing breaker arms coöperating therewith.

Referring to the drawings, 20 designates a base of conducting material which in actual practice would be a timer cup grounded upon the frame of an internal-combustion engine. Cams 21 and 22 are mounted for rotation upon base 20, and are connected by gearing (not shown), so as to be driven at the same rate of rotation by the engine. Breaker arms 23 and 24 are pivotally mounted upon posts 25 and 26 respectively, and carry cam followers 27 and 28 which coöperate with cams 21 and 22 respectively. At the outer free ends of arms 23 and 24 are mounted contacts 29 and 30 which coöperate with stationary contacts 31 and 32, respectively, which are adjustably mounted upon brackets 33 and 34, respectively, which are supported by but insulated from the base 20. Springs 35 and 36 bearing at one end upon posts 37 and 38, respectively, and connected at the other end with arms 23 and 24, respectively, serve to oppose the action of the cams which effect the separation of the stationary and movable contacts.

40 designates a battery or other source of current having terminal 41 connected with base 20, and terminal 42 connected at 43 with primary winding 44 of an ignition coil. The center point 45 of winding 44 is connected by means of wire 46, and resistance 46^a with bracket 33, and the end 47 of winding 44 is connected by means of wire 48 with resistance 49, the other end of which is connected by means of wire 50 with bracket 34. Condenser 51 is connected by means of wires 52 and 53 to wire 50 and base 20. The secondary winding 55 of the ignition coil has one end thereof grounded upon base 20 through battery 40, and the other end thereof is connected by means of wire 56 with distributer unit 57 which serves to distribute the sparking impulses to the various spark plugs of the engine (not shown). While spark plugs are usually grounded on the engine, they are shown in Fig. 1 diagrammatically grounded upon metallic base 20.

In the preferred embodiment of the invention shown in Figs. 2 and 3, 20^a designates a timer cup of the usual construction upon which is mounted for rotation a centrally disposed shaft 60 carrying cams 21^a and 22^a in superimposed relation. Coöperating with cams 21^a and 22^a are breaker arms 23^a and 24^a, respectively, mounted upon pivot post 61. Arms 23^a and 24^a carry movable contacts which coöperate with stationary contacts adjustably mounted upon bracket 33^a and 34^a, respectively, supported by the timer cup 20^a but insulated therefrom. Springs 35^a and 36^a coöperating with post 62, mounted upon the base of timer cup 20^a, serve to maintain breaker arms 23^a and 24^a, respectively, in proper relation with their respective cams. The various connections between the timer mechanism described and condenser 51 supported thereby, and other elements of the ignition system are the same as shown by the wiring diagram, already described.

The operation of the device is as follows:

For the sake of convenience the breaker arms 23 and 24 and parts coöperating there-

with, will be known as breaker No. 1 and breaker No. 2, respectively. Referring particularly to Fig. 4 and Fig. 5, it will be seen that the lobes of cams 21 and 22 are so designed, and the relation of the cams is such that breaker No. 1 will be closed a longer period of time relative to the closing period of breaker No. 2; that breaker No. 2 will close just before breaker No. 1 opens; and that breaker No. 2 will open just before the closing of breaker No. 1, so that there will be an interval during which both breakers will be closed and both breakers will be open. Assuming breaker No. 1 to have just closed, breaker No. 2 being open,—current from the battery will flow through wire 42 to point 43 of primary winding 44, out through center 45, through 46 to bracket 33, across contacts 31 and 29, through arm 23 to base 20, and back through wire 41 to the battery. Breaker No. 1 having been closed a certain length of time during which the current, passing through the primary included between points 33 and 35, has built up to a certain value, breaker No. 2 will close, and, on account of the presence of resistance 49, a small part of the battery current will be deviated from point 45, and will flow through primary winding included between points 45 and 47, through wire 48 to resistance 49, through wire 50 to bracket 34, across contacts 32 to arm 24, through base 20, and thence to wire 41 to battery 40. A very short time after breaker No. 2 closes breaker No. 1 will open. The overlapping of the closing periods of breaker No. 1 and breaker No. 2 is made as small as possible, but sufficient to insure breaker No. 2 being closed when breaker No. 1 opens. Upon the opening of breaker No. 1, the current from the battery will flow through all the windings of the primary 44; and by virtue of the magnetic field created by the current in the primary, the current in the primary will be automatically transformed to approximately one-half of its former value.

It is apparent from the foregoing description, that energy can be stored up very rapidly by first sending through a part of primary circuit of the coil a larger current than can be safely carried by contacts made of available contact materials. Then after the coil has been sufficiently energized, the current is automatically transformed, without reducing the energy in the coil, to a value which can be safely handled by the contacts. By the process described of storing up energy, transforming the current, and releasing the energy to give the sparking impulse, the coil can be operated to give a succession of sparking impulses at twice the speed of the ordinary coil in which the building up process takes place with all the primary turns in use.

Another advantage of the ignition system embodying the present invention, resides in the fact that the ignition coil will do the work of two coils operating alternately. As a result, there is a considerable saving of material and labor in the manufacture, and a reduction in the space requirements for the present ignition system, over that required for a system using two coils.

While I have shown primary windings of the ignition coil divided into equal parts, it is to be understood that the winding may be divided in other proportions so as to attain a different rate of increase in the primary current.

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

What I claim is as follows:

1. In an ignition system, the combination with a source of current; of a device for accumulating spark impulse energy, and also for transforming the current passing through it; of electric circuits for connecting the device with the source of current; and circuit controlling means for controlling the passage of current through the said device to produce the energy accumulating operation, and to produce the current transforming operation, and for interrupting the passage of current to said device whereby the spark impulse energy is released.

2. In an ignition system, the combination with a source of current; of an induction coil having a primary winding; a circuit including a certain portion of said primary winding; a circuit including a larger portion of said primary winding; and means for causing successively the closing of the first circuit, the closing of the second circuit, the opening of the first circuit, and the opening of the second circuit.

3. In an ignition system, the combination with a source of current; of an induction coil having a primary winding; a circuit including one-half the total primary turns; a circuit including all of the primary turns; and means for causing successively the closing of the first circuit, the closing of the second circuit, the opening of the first circuit, and the opening of the second circuit.

4. In an ignition system, the combination with a source of current; of an induction coil including a primary winding; a timing device connected with the coil and the source of current, said timing device including pairs of coöperating contacts for opening and closing separate circuits, the first pair of contacts being in a circuit which provides for the passage of current through a certain number of the primary turns, and the second pair of contacts being in a cir-

cuit which provides for the passage of current through an increased number of primary turns, said timing device also including means for separating the first pair of contacts at a time when the second pair of contacts are closed, and separating the second pair of contacts while the first pair of contacts are still open; and means for causing the closing of the contacts a certain time after separation.

5. In an ignition system, the combination with a current source and an ignition coil; of circuits connecting the battery with different portions of the ignition coil, each circuit including a pair of coöperating contacts; and means for actuating said contacts in recurrent sequence to interrupt first one circuit and then the other.

6. In an ignition system, the combination with a current source and an ignition coil; of circuits connecting the battery with different portions of the ignition coil; and means for opening and closing said circuits in recurrent sequence, said circuits having an overlapping closed period.

7. In an ignition system, the combination with an ignition coil and a source of current; of devices for controlling the creation of sparking impulses at relatively high frequency in said coil, said devices including a plurality of pairs of contacts connected with unequal portions of said coil, and including means for effecting the closing and opening of said pairs of contacts successively and in the same order.

8. In an ignition system, the combination with an ignition coil and a source of current; of devices for controlling the creation of sparking impulses at relatively high frequency in said coil, said devices including a plurality of pairs of contacts connected with unequal portions of said coil, and including means for effecting the closing and opening of said pairs of contacts successively and in the same order, the pair of contacts first to close in the order of closing being connected with the smaller portion of the coil.

9. In an ignition system, the combination with a source of current; of an ignition coil; means including coöperating timer contacts controlling the delivery of current to said coil for effecting in recurrent sequence the flow of relatively large amount of current to the coil to obtain a rapid storing of energy for sparking purposes, the reduction of the current without reducing the energy in the coil in order that said contacts will not carry excessive current at time of separation, and finally the interruption of current in said coil to produce a sparking impulse.

10. The method of operating an ignition coil at high speed, consisting in permitting the flow of a relatively large amount of electric current through a portion of the coil in order to obtain a rapid accumulation of energy; then in reducing the current in the coil without reducing the energy in the coil; and then in interrupting the current in the coil to produce a sparking impulse.

11. The method of controlling the creation of sparking impulses at relatively high frequency in an ignition coil which consists in permitting the flow of a relatively large amount of current through a certain portion of the coil to lessen the time of storing of energy in said coil; then, without interrupting the current flow entirely, causing a flow of current through a larger portion of said coil in order to reduce the current without reducing the energy in said coil; and then in interrupting said current flow whereby to release said energy and to generate a sparking impulse.

In testimony whereof I affix my signature.

JOHN H. HUNT.

Witnesses:
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WARREN SCHMIEDING.