Oct. 12, 1926. 1,603,071

H. R. DAVIES

STARTING AND IGNITION SYSTEM

Filed May 31, 1921

Fig. 1

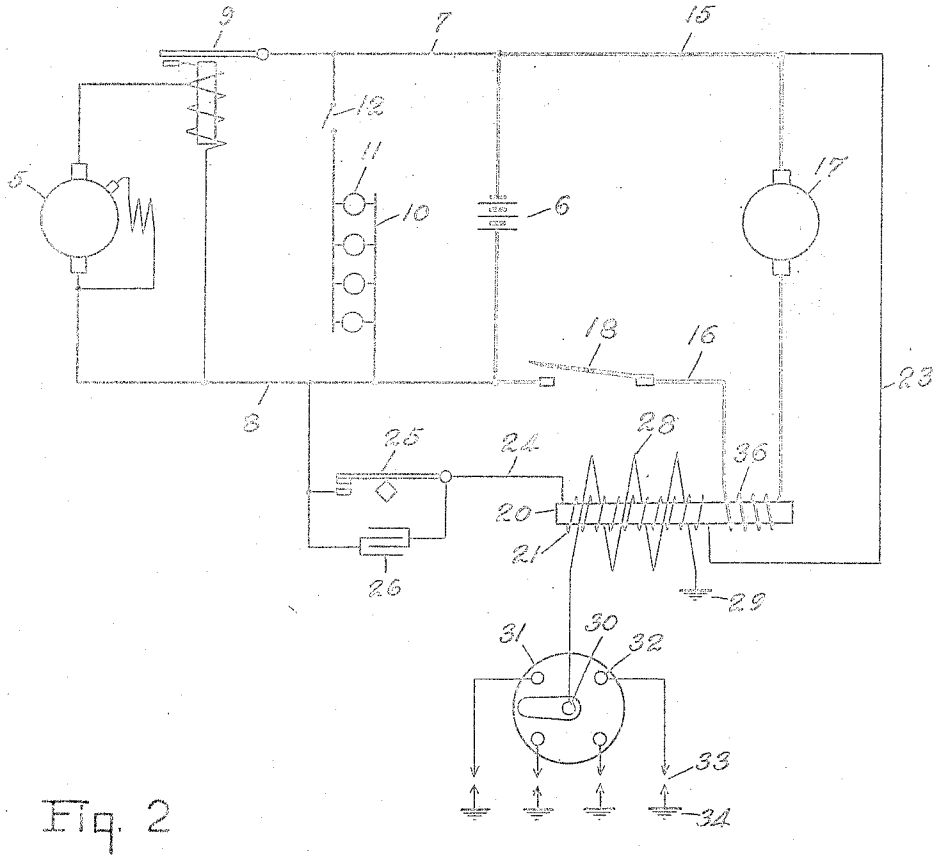
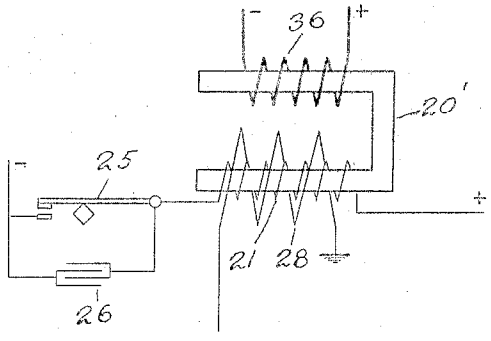


Fig. 2



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UNITED STATES PATENT OFFICE.

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STARTING AND IGNITION SYSTEM.

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This invention relates to starting and ignition systems for internal combustion engines wherein the same battery is employed to supply energy for starting the engine and for operating the ignition system.

In systems at present in common use where a storage battery is employed to operate an electric motor for starting the engine and the same battery supplies energy to the ignition system of the engine the heavy demand made upon the battery by the starting motor frequently causes an abnormally low potential across the battery terminals with the result that the ignition spark is weak and inefficient. This difficulty is all the more present in cold weather when the battery is less active due to its lower temperature and when the engine being cold naturally starts harder, due to a variety of causes.

An object of this invention is to provide means for partially, if not wholly, compensating the ignition system for the voltage drop of the battery due to the operation of the starting motor. Other and more particular objects will appear hereinafter as the description proceeds.

The present invention contemplates the provision of means whereby during normal running of the engine the induction coil supplying the ignition spark will operate in the usual manner but during the operation of the starting motor will have its effect augmented in an effort to compensate for the voltage drop of the battery. This result is accomplished by providing an auxiliary winding in circuit with the starting motor and arranging it adjacent the induction coil and in such a manner that its flux tends to interlink the secondary winding in a reverse direction to that of the primary winding. Preferably the number of ampere-turns of the primary winding and of the auxiliary winding are substantially the same.

In the drawing Figure 1 is a diagrammatic representation of the appartus and circuit arrangement of my invention and Fig. 2 illustrates a modification.

Referring to Fig. 1, a generator 5 of the third brush type is shown connected to a storage battery 6 by wires 7 and 8 in the circuit of which is a cut-out 9 having the usual series and shunt windings. A load circuit 10 is also shown connected to the wires 7 and 8, consisting of lamps 11 controlled by the switch 12. Connected also to the storage battery 6 by means of wires 15 and 16 is a dynamo-electric machine 17 comprising a series starting motor, the circuit of which is controlled by a starting switch 18. An induction coil having a core 20 has its primary winding 21 connected by means of wires 23 and 24 to the wires 15 and 8, respectively, and in series with the primary winding is shown a cam-operated interrupter 25, about which is bridged a condenser 26. The secondary winding 28 of the induction coil is grounded at one end as at 29 and has its opposite end connected to the distributor arm 30 of a distributor 31 which, in the form illustrated, has four points 32, each of which connects with a spark gap 33, representing a spark plug, and then to ground 34. As clearly shown in Fig. 1 of the drawing, the core 20 of the induction coil has an extension at one end which serves to carry a winding 36 which is connected in series with starting motor 17 and switch 18. This winding 36 preferably has approximately the same number of ampere-turns as the primary winding 21 and inasmuch as the current carried thereby is very much greater than the current taken by the primary winding when the interrupter contacts are closed, the actual number of turns of the winding 36 are comparatively few in number. A most important feature of this invention is that the direction of the current in the winding 36 is such that the flux produced thereby is opposed to the flux produced by the primary winding 21.

In the operation of the device shown in Fig. 1 when the starting switch 18 is closed and when the interrupter 25 closes the primary ignition circuit the two windings 21 and 36 produce magnetic fluxes in their respective portions of the core 20 in opposite directions and if the ampere-turns of the two windings are substantially equal, as is preferable, the fluxes produced by these two windings are substantially equal and opposite. At the instant that the interrupter 25 opens the circuit of the primary winding the flux produced thereby immediately collapses while the flux of the winding 36, being no longer opposed, tends to extend more or less through the entire length of the core and induces in the secondary winding a potential in the same direction as that

induced by the collapsing primary flux. The effect, therefore, of providing this additional winding 36 on the core of the induction coil and in series with the starting motor is to increase the effect of the primary winding, producing a higher secondary potential and consequently a hotter spark at the spark plugs.

Although the winding 36 is shown in Fig. 1 as being located upon an extension of the core and as displaced axially from the primary and secondary windings, it is obvious that if desired the core extension may be omitted and the auxiliary winding may surround that part of the core carrying the primary and secondary windings.

In the modification illustrated by Fig. 2 the same apparatus is employed and connected as in Fig. 1 with the exception that the core extension is turned through 180° forming a U-shaped core 20' with the primary and secondary windings 21 and 28, respectively, carried by one arm of the core while the auxiliary winding 36 is carried by the other arm. The primary winding and the auxiliary winding are connected as in the preceding form to produce opposing fluxes in the core and are preferably of approximately the same number of ampere-turns. The operation of this form of the invention is similar to that of Fig. 1 and will therefore not be again described.

Inasmuch as the invention herein disclosed is susceptible of various other embodiments and as various changes might be made in the embodiment set forth, it is to be understood that all matter described above or shown in the accompanying drawing is to be interpreted as illustrative only, and not in a limiting sense.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In an electric starting and ignition system for an internal combustion engine, a starting motor for said engine, a battery, circuit connections between said battery and said motor, an ignition coil comprising a core, a primary winding and a secondary winding, said primary winding being connected to said battery and said core having an extension at one end thereof, and an auxiliary winding on said extension connected in series with said motor, the polarity of said auxiliary winding being reversed to that of the primary winding.

2. In an electric starting and ignition system for an internal combustion engine, a starting motor for said engine, a storage battery, circuit connections including a starting switch between said motor and said battery, an ignition coil having a core, a primary winding thereon, an interrupter, circuit connections between said battery, interrupter and primary winding, a secondary winding inductively related to said primary winding, said core having an extension at one end and a third winding thereon connected in series with said motor and said starting switch, the polarity of said winding being opposed to that of the primary coil.

3. In an electric starting and ignition system for an internal combustion engine, a starting motor for said engine, a storage battery, circuit connections including a starting switch between said motor and said battery, an ignition coil having a core, a primary winding thereon, an interrupter, circuit connections between said battery, interrupter and primary winding, a secondary winding inductively related to said primary winding, said core having an extension at one end and a third winding thereon connected in series with said motor and said starting switch, said winding being wound in such direction on the core as to oppose magnetically the induction of the primary.

In testimony whereof I affix my signature.

HENRY R. DAVIES.