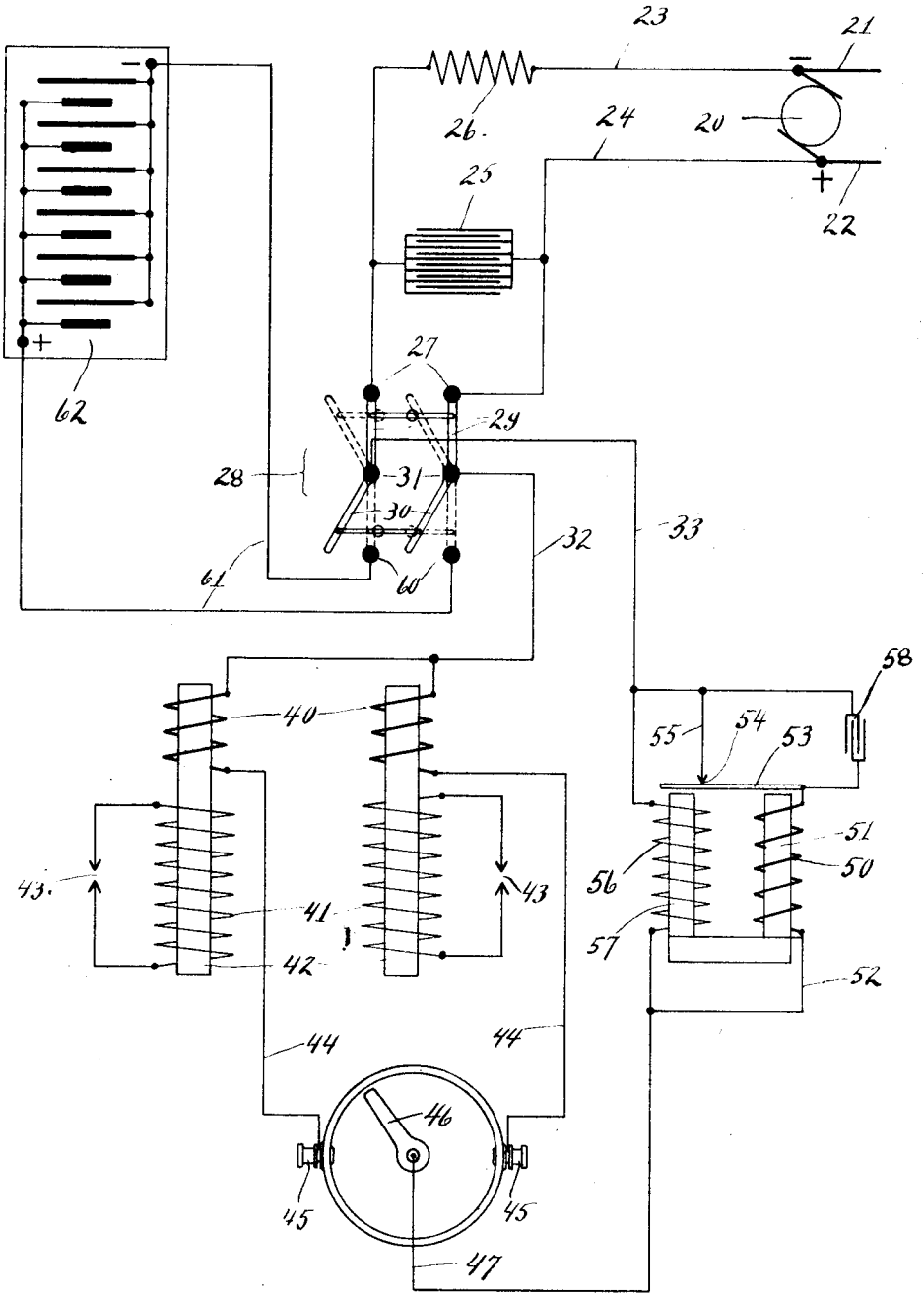
C. F. KETTERING.

IGNITION SYSTEM.

APPLICATION FILED NOV. 8, 1910.

1,170,275. Patented Feb. 1, 1916.



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IGNITION SYSTEM.

1,170,275. Specification of Letters Patent. Patented Feb. 1, 1916.

Application filed November 8, 1910. Serial No. 591,242.

To all whom it may concern:

Be it known that I, CHARLES F. KETTERING, a citizen of the United States, residing at Dayton, county of Montgomery, and 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 improvements in ignition systems, and has among its objects to provide an ignition system in which the primary source of energy for the ignition device is obtained from any commercial circuit, which circuit may be in fact supplied by the engine itself that is run by the ignition system.

A peculiar adaptability of this improvement resides in its possible use for high voltage circuits, and also wherein the generating source or the circuit itself is highly inductive. The difficulty usually attendant in such forms is the firing or burning of the primary contacts and timer. This firing is aggravated when the engine is used with high compression, such as for producer gas, or natural gas, particularly as applicable to high power engines. In such cases a very high voltage secondary is desirable and is ordinarily used. It is to meet these conditions that the present invention is devised.

Among other objects is also to have the apparatus applicable to a wide range of voltage of the primary source of energy. Also to arrange the system in such manner that a low voltage auxiliary source of current, for example storage battery or dry cells, may be used as an alternative source of supply.

Other advantages will be apparent as ensuing from the improvements described herein.

With these and incidental objects in view, the invention consists in the novel arrangement of parts, a preferred form of embodiment of which is shown in the drawings accompanying and forming part of this specification.

The figure is a diagrammatic view showing the circuits and arrangement of apparatus, embodying my improvements.

The high voltage source of current 20 is supplied from a generating or other suitable apparatus of a variety of well known forms. The lead wires 21, 22, shown in heavy lines leading from the generator, represent the main line of this circuit, supplying the desired working current. The current for the energizing of the ignition apparatus is shunted off from this generator, as presently described. It is to be understood that instead of shunting off this current from a generating circuit an ordinary electric light line may be used as the main source of power, the wires 21, 22, in such case representing the feed wires of the electric light line.

From the main source of current 20 there are led two wires 23, 24. These wires lead to the opposite sides of the elements of a condenser 25. A resistance coil 26 is placed in circuit with the line 23. From the condenser 25 lead-wires extend to the switch terminals 27 of a hand switch 28. This switch comprises two separate pairs of contact levers, namely, the upper 29 and the lower 30, said pairs being independently operable for the purposes later described. Assuming that the upper pair of levers 29 are in the position shown in full lines in the figure, and that the lower pair 30 are likewise in full line position, it will be seen that the switch terminals 27 are thereby connected with the middle terminals 31, and thereby connected with the lead wires 32, 33. The lead wire 32 extends to the ignition coils and timer, and the lead wire 33 extends to the locking-coil interrupter, these parts being now to be described.

There are two ignition coils shown, adaptable for use to produce the sparks in a two-cylinder engine, it being of course understood that this system is applicable to any number of ignition coils and cylinders, as an ignition system for explosive engines. These ignition coils comprise a primary coil 40 and a secondary coil 41, wound upon the cores 42. The gaps 43 represent the spark plugs. These primary coils 40 are connected by wires 44, to the terminals 45 of the timer. The revolving arm 46 of the timer makes contact in turning with the terminals 45, and said arm is connected by wire 47 with the locking-coil interrupter now to be described. This interrupter comprises a low resistance coil 50 wound upon the core 51 and connected at one end by the wire 52 to the wire 47; and at the other end connected to the movable armature 53 which normally makes contact at the point 54 which is connected by a wire 55 extending to the aforesaid wire 33.

Shunted around this low resistance coil is a high resistance locking-coil 56 wound upon the core 57. A condenser 58 is placed across the make and break point 54 in the usual manner. This locking-coil interrupter is described more in detail in my co-pending application Ser. No. 548,921, filed March 12, 1910, to which reference may be had for a more detailed description. In the operation of this interrupter, when the current flows through the wire 33, and the interrupter and the wire 47, the low resistance coil 50 pulls down on the movable armature 53 and breaks the circuit at the point 54. The high resistance or locking-coil 56, being shunted around the low resistance coils holds the armature 53 locked downward. This produces a single breaking impulse in this circuit. It will be understood that the current flows through this interrupter when the timer arm 46 reaches one or the other of its terminals 45. In this case the current is established through one or the other of the primary coils 40, and it is also established through the interrupter which then operates to break the primary current at the point 54. This produces a breaking impulse in the primary 40 and thereby induces the necessary current in the secondary coil 41, sufficient to produce a spark at the gap 43.

The operation of these devices in connection with the other parts of the apparatus will now be described. The condenser 25 is in a shunt circuit across the main source of current supply 20. The nature of the action of this condenser is as a sort of reservoir for storing up energy from the main source of current supply which as suggested may be of substantially high voltage. Then when the condenser is thus charged, and the timer 46 makes contact with one of the terminals 45, this completes the circuit through the primary induction coil and through the make-and-break device or locking coil interrupter comprising the coils 50 and 56. This permits the condenser to discharge through the ignition circuit which is connected with the opposite terminals of the condenser and embraces the induction coil, the make-and-break device, and the timer as above explained. The energizing of the low resistance coil 50 and the high resistance coil 56 causes the breaking of the contact at the point 54 so as to break the current through the low resistance coil and send the necessary impulse through the primary 40 of the induction coil to produce the necessary spark. The high resistance coil 56 remains in series in the circuit and holds the armature 53 locked down until the current is broken at the timer.

The resistance 26 is located in the above described condenser circuit between the condenser and the main source of current. This resistance is of such extent as to prevent too much current from flowing from the high voltage source of current 20 directly through the ignition circuit when the timer makes its contact. At the same time this resistance 26 is preferably proportioned to the circuit conditions in the ignition circuit to effect the proper charging of the condenser between the successive discharges of the condenser when the timer arm 46 makes successive contacts with the terminals 45.

It will be seen that the condenser 25 acts as a storage reservoir in which the energy from the main source of current is stored. But this voltage of the condenser and the energy stored in the condenser are dissipated through the ignition circuit when the condenser is discharged by the contact of the timer, and the breaking of this ignition circuit by the interrupter merely has to act against this condenser discharge current and not against the main source of current with its high voltage. The condenser then becomes charged again during the period of transit of the timer arm, 46, to the next succeeding contact terminal, 45, the resistances and circuit condition being proportioned to effect this as above explained. It will be seen that with this arrangement the particular form of locking coil interrupter which I have used, as a preferred form has in itself some peculiar adaptability in combination with the other devices, although other forms of interrupters might be used. The peculiar adaptability referred to is that the locking coil or high resistance coil, 56, remains in series in the ignition circuit after the low resistance coil is cut out, so as to maintain the general high resistance of the entire circuit and to lessen the current in the ignition circuit through which the condenser has discharged, the result being to aid in diminishing sparking at the timer.

In order to provide an auxiliary source of current for the ignition circuit, the switch arms, 30, may be connected with the terminal, 60, as shown in dotted line positions in the figure, and the switch arms, 29, may be disconnected from the terminals, 27, by movement to the dotted line position in the figure. This connects the storage battery, 62, through the wires, 61, to the terminal, 60, and permits the energizing of the ignition circuit from this alternative source.

While the form of mechanism herein shown and described is well adapted to accomplish the objects of the invention, it is to be understood that other forms may be used all coming within the scope of the claims which follow.

What is claimed is as follows:—

1. In an ignition system, the combination with a main source of current of relatively high voltage and amperage, of a condenser circuit having a condenser shunted across the main current source; an ignition circuit

unsuitable for a continued flow of high voltage and high amperage from said source of current connected with the opposite terminals of said condenser, said ignition circuit embracing an induction coil and an interrupter device, and a timer; the voltage of the main source of current being greater than that suitable for the conditions of the ignition circuit, and a resistance located in said condenser circuit between the condenser and the main source of current, said resistance being proportioned to the circuit conditions in the ignition circuit to effect the proper charging of the condenser between the successive discharges by the timer.

2. In an ignition system, the combination with a main source of current of a relatively high voltage and amperage, of a condenser circuit having a condenser shunted across the main current source; an ignition circuit unsuitable for a continued flow of high voltage and high amperage from said source of current connected with the opposite terminals of said condenser, said ignition circuit embracing an induction coil, a timer, and an interrupter device, said interrupter comprising a high resistance locking coil in series in the ignition circuit and a low resistance breaking coil shunted around the high resistance coil through the armature contact breaker; and a resistance located in said condenser circuit between the condenser and the main source of current, said resistance being proportioned to the circuit conditions in the ignition circuit to effect the proper charging of the condenser between the successive discharges by the timer.

3. The combination with a direct current source of a relatively high voltage and amperage, and a suitable work circuit connected therewith; of an ignition system including a circuit unsuitable for a continued flow of high voltage and high amperage current, said ignition circuit having a making and breaking device for intermittently closing and opening said circuit; a condenser bridged across the said work circuit and connected with the ignition system; and a resistance in series with said work circuit, so proportioned that it will reduce the amperage of the flow of current to the condenser, to meet the conditions of the condenser and the elements of the ignition system.

4. In an ignition system, the combination with a plurality of sources of current, one of said sources of current being of low voltage and comparatively low amperage, the other source of said current being of comparatively high voltage and high amperage; circuit connections adapted to be connected to each of said sources of current; an induction coil; a timing device; and means for connecting the induction coil and timer with either of the said sources of current; and a proportioned resistance operable to be cut into said circuit connections, in series with the high voltage and high amperage source of current, when said source is connected to the induction coil and timer.

In testimony whereof I affix my signature in the presence of two subscribing witnesses.

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Witnesses:

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