Aug. 27, 1935. A. J. REES 2,012,581

IGNITION SYSTEM

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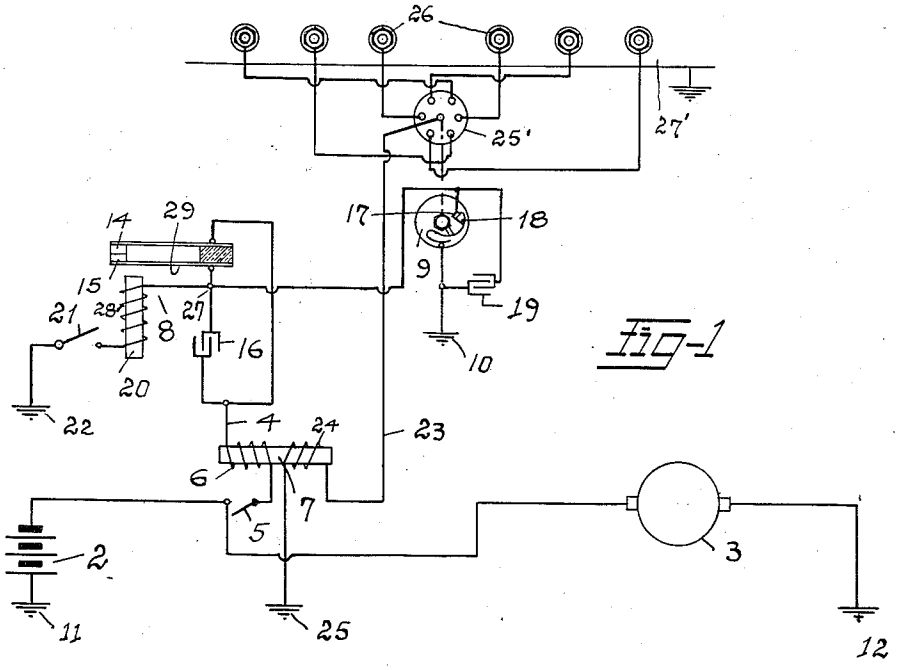


Fig-1

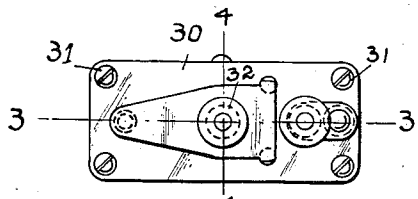


Fig-2

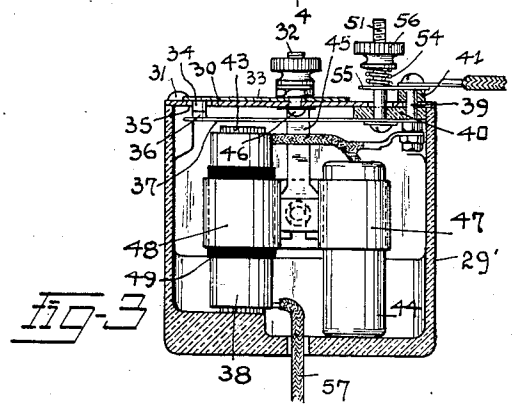


Fig-3

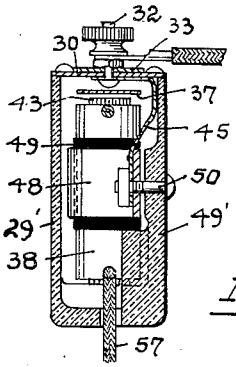


Fig-4

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IGNITION SYSTEM

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2 Claims. (Cl. 123—148)

The present invention relates broadly to ignition systems for internal combustion engines and more specifically to ignition systems having two sources of electrical energy, such as a generator and a battery embodied in a single system to produce a current in the spark circuit. In these systems the generator energizes, in connection with a spark coil system, the engine during normal operation, whereas, the battery together with the spark coil system furnishes the energy to the spark plugs of the engine during starting operations and when the generator is rotating slowly and producing less current than the current supplied by the battery. The spark coil system in these circuits commonly includes an induction coil, a timer, and a mechanical interrupter. The primary winding of the induction coil, the timer and the interrupter are connected to the so called low voltage current circuit, which is directly connected to the battery and generator, whereas the distributor is connected to the high voltage branch of the ignition circuit which includes the secondary winding of the coil. The high voltage sparks produced by ignition systems of the type just described are caused by the momentarily induced current in the secondary winding of the induction coil upon breaking of the primary circuit by the interrupter. The breaking of the primary circuit creates self-induction and reactance in the interrupted primary winding thus causing flashing or sparking at the interrupted contacts of the interrupter. As this flashing is hard on the contacts of the interrupter, spark arresting means, such as a condenser, are connected across the contacts of the interrupter for absorption of the extra or self-induced current. The excessive use of these spark arresting means often causes leakage and break down of the same in addition to the burning of the interrupter contacts etc. thereby making proper working of the ignition system impossible.

It is the primary object of the present invention to provide an arrangement of circuits and apparatus, whereby the engine can be easily started even though the contacts of the interrupter are in poor condition from burning or pitting. This desideratum according to the invention, is obtained by connecting an electrically responsive vibrator unit with the ignition circuit. This unit is cut into the low voltage branch of the ignition circuit and so related thereto that the mechanical interrupter merely times the action of the vibrator, whereas the breaking of the current flowing in said low voltage branch takes place between the movable contacts of the vibrator unit.

The contacts of the mechanical circuit breaker or interrupter merely effect synchronization of the circuit breaking action of the vibrator unit with respect to the breaking action of the contacts of the mechanical interrupter and thus effect proper timing of the ignition circuit operating with the vibrator unit.

Another object of the invention is to provide a vibratory unit of compact and simple construction adapted to be connected to ignition circuits of the type referred to.

The foregoing and further objects of the invention will more readily be understood from the following description of my invention, as illustrated in the accompanying drawing, in which:

Figure 1 shows in diagram my invention as employed in connection with a single wire ignition system for a six-cylinder motor, the diagram showing a generator and a battery as the source of energy;

Figures 2, 3 and 4 shows a vibratory unit adapted to be readily connected to the ignition circuit of an automobile; thus Figure 2 is a plan view of the unit; Figure 3 a longitudinal transverse section on line 3—3 of Figure 2; and

Figure 4 is a vertical section on line 4—4 of Figure 2.

Referring now to the drawing the single wire ignition circuit for a six-cylinder engine shown in Figure 1 embodies a battery 2 and a generator 3 adapted to be connected in parallel with the low voltage branch circuit 4 of the ignition circuit by an ignition switch 5. Low voltage branch circuit 4 includes primary coil 6 of ignition coil 7, an electrically responsive interrupter or vibrator mechanism 8 and the common rotary interrupter 9, which latter is grounded at 10, to close the cycle of the circuit with grounds 11 and 12 of battery 2 and generator 3 respectively. The normally closed contacts 14 and 15, of vibrator mechanism 8, are connected across by a condenser 16, and the contacts 17 and 18 of rotary interrupter 9 are connected across by a condenser 19, to overcome flashing at these contacts caused by self induction and reactance during interruption or breaking of low voltage circuit 4.

The electrically responsive interrupter or vibrator mechanism 8 is actuated by an electro-magnet 20, connected to the low voltage branch circuit at line tap 27, and to ground at 22, through a switch 21, adapted to control the operation of the electro-magnet 20.

The high voltage branch 23 of the ignition circuit embodies secondary coil 24 of ignition coil 7, which coil 24 is grounded at 25 and connected to rotary distributor 25'. Distributor 25' controls the circuits for spark plugs 26, connected to ground through motor body 27', thus closing the cycle of the branch or circuit 23.

When the interrupter 9 and its condenser are in proper working condition the current in low voltage branch circuit 4 flows from battery 2 or generator 3, as the case may be according to the speed of the generator, through switch 5, primary winding 6, closed contacts 14 and 15 of electrically responsive vibrator 8, contacts 17 and 18 of interrupter 9 and then through ground back to the battery or the generator. A periodical interruption of circuit 4, which creates a flow of current in the high voltage circuit 23, is effected between contacts 17 and 18 of interrupter 9.

When the condenser 19 leaks or is broken down the low voltage branch circuit 4 leaks at 10 and the interrupter shunted with respect to the ground connection does not operate. In this case the ignition circuit is inoperative. To overcome such inoperativeness switch 21 is closed to cut in the electrically responsive interrupter 8 into the low voltage circuit 4. Now under the assumption that the contacts 17 and 18 are closed, the current in circuit 4 flows from battery 2 or generator 3, whatever the case may be through switch 5, primary winding 6, closed contacts 14 and 15 and closed contacts 17 and 18 through ground back to the battery or generator. Current also flows at line tap 27 through coil 28 of electro-magnet 20 and then through ground back to the battery or generator, but the rate of this current is negligible because the resistance of coil 28 is high and the current of course follows the line of least resistance. The magnetic force induced by the low current flowing through electro-magnet 8 is insufficient to separate contacts 14 and 15 from each other, contact 15 being carried by the armature 29 of electro-magnet 8, but when the contacts 17 and 18 of rotary interrupter are opened, the current flowing through coil 28 of electro-magnet 8, and the magnetic force of said magnet is increased so that the armature 29 is attracted and the circuit between contacts 14 and 15 is interrupted in synchronization with the opening of contacts 17 and 18 of rotary interrupter 9. Consequently the high voltage current in the high voltage banch circuit 23 is properly timed and therewith the spark of the respective spark plug 26.

It can readily be seen that sparking between contacts 17 and 18 is entirely eliminated, and that the periodical movements of contact 18 synchronize the electrically responsive interrupter 8 with interrupter 9. As previously stated switch 21 controls the operation of interrupter 8, and when open disconnects the electro-magnet 20 from low voltage circuit 4. The contacts 14 and 15 of said interrupter are normally closed and lead the current to interrupter 9.

The auxiliary vibratory unit previously described may be built into the ignition circuit of an automobile or it may be added to the ignition circuit in the form of an accessory box conveniently placed where desired. Such an accessory box, see Figures 2, 3 and 4 of the drawing, comprises a casing 29', made of fiber or other suitable insulating material. The top of this casing 29' is formed by a metal plate 30, which supports the entire vibrator unit and is secured to the casing by means of screws 31. Thus plate 30 mounts a connecting post 32, electrically connected with a bracket 33. This bracket carries at one end a contact point 34 which extends through an opening 35 in plate 30 below the lower surface of said plate for contact and cooperation with a second contact point 36, which is mounted on the armature 37 of an electro-magnet 38. This armature, which consists of a yieldable spring steel blade is mounted on plate 30 by means of bolt 39, which bolt is extended through a wide opening in said plate and insulated therefrom by insulation blocks 40, 41, insulating the bracket 33 and armature 37 from each other. Bolt 39 forms a contact post for contact 36 and armature 37 and is electrically connected with the coil of an electro-magnet 38, the pole piece 43 of which is upwardly extended opposite said armature 37. Bolt 39 is also electrically connected with the inner plate of a condenser 44, having its outer plate electrically connected with connecting post 32 by means of a bracket 45, riveted to said post at 46. This bracket is provided with two half circular clamping arms 47, 48 which rigidly support the condenser 44 and the electro-magnet 38. A fiber cylinder 49, enclosing electro-magnet 38 insures proper insulation between the coil of said electro-magnet and the arm 48 of bracket 45, the lower portion of which is rigidly secured to the side wall 49' of casing 29' by means of a bolt 50, which bolt is extended through said wall. Armature 37 is yieldingly drawn upwardly, to insure proper contact between points 35 and 36, by means of a bolt 51, which is slidably extended through a large opening in plate 30 and a guiding passage in block 40. The upward movement of this bolt is effected by a compression spring 54, seated upon a bracket 55, and engaging an adjusting screw 56 threadedly connected with the upper end of bolt 51. The bracket 55 is secured to block 41 by the bolt 39. The screw 56 permits adjustment of the tension of spring 54 which controls the movement of armature 37 against attraction by electro-magnet 42. In practice the thus described vibratory box is connected to an ignition circuit by linking post 32 with the low voltage circuit between ignition switch 5 and interrupter 9, connecting bolt 39 with one contact, for example contact 17, of the distributor 9, and uniting the free end 57 of the coil of the electro-magnet 42 with one pole of switch member 21 (see Figure 1). Member 21 is preferably mounted on the instrument board of the automobile.

Having thus described my invention, what I claim is:

1. In an ignition system a low voltage current circuit and a high voltage current circuit, inductively coupled to the low voltage circuit, said low voltage circuit including in series a source of current supply, the primary winding of an induction coil, the contacts of an electromagnetically operated energy vibrator, and the contacts of a normal circuit interrupter, and including in parallel with the normal circuit interrupter the coil of said emergency vibrator, for synchronizing the circuit breaking action of said emergency vibrator, and said normal circuit interrupter.

2. In an ignition system a low voltage current circuit and a high voltage current circuit, inductively coupled to the low voltage circuit, said low voltage current circuit including a source of current supply, the primary winding of an induction coil, the contacts of an electromagnetically operated emergency vibrator and the contacts of a normal circuit interrupter, and including in par-

allel with said normal circuit interrupter the coil of the electromagnetically operated emergency vibrator, and switching means controlling the energizing of the coil of said emergency vibrator, said switching means controlling individual and joint breaking of said low voltage current circuit by said normal circuit interrupter and said emergency vibrator, and said ignition system synchronizing the circuit breaking action of said emergency vibrator with the action of said normal interrupter.

ADAM J. REES.