April 8, 1930. J. L. ARTHUR 1,753,913

SWITCH CONTROL

Filed Dec. 29, 1928

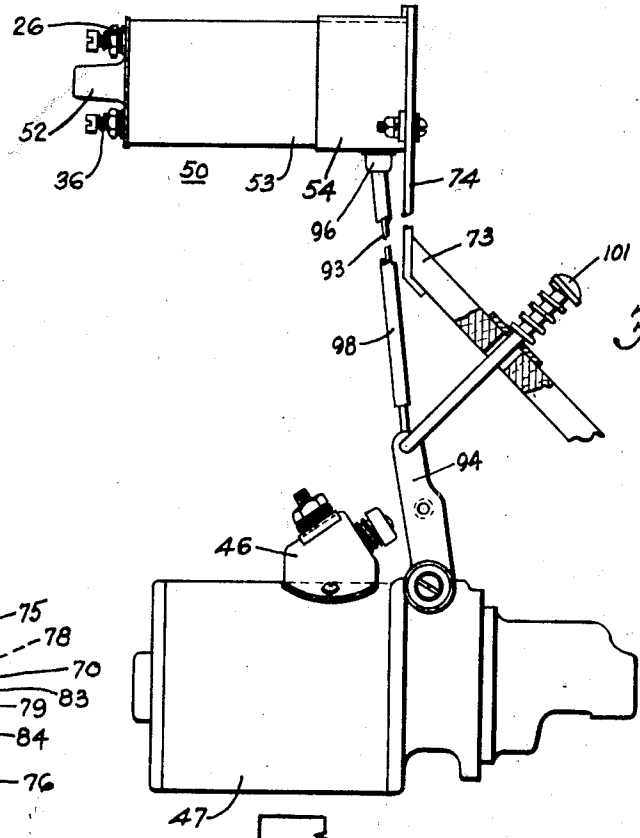


Fig. 1.

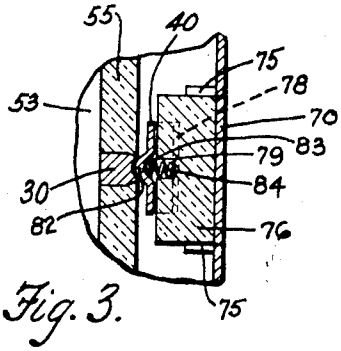


Fig. 3.

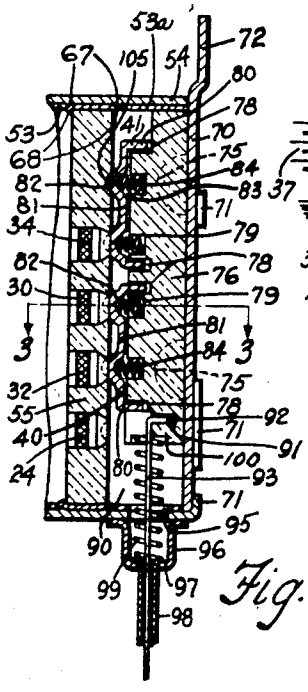


Fig. 2.

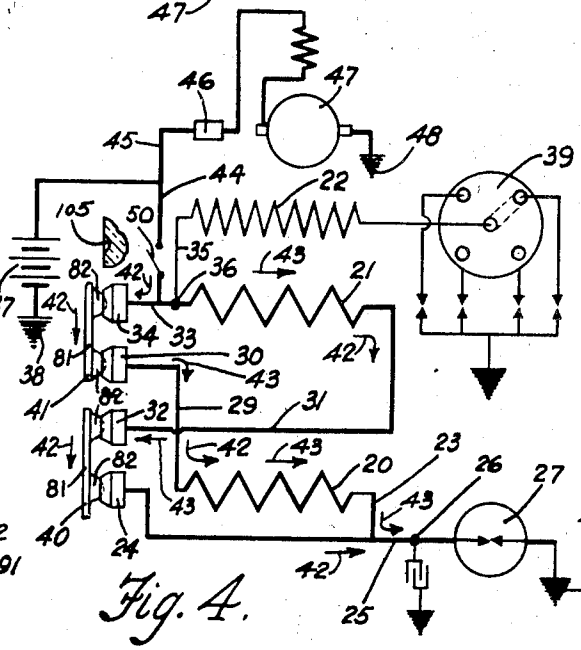


Fig. 4.

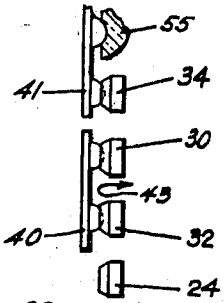


Fig. 5.

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UNITED STATES PATENT OFFICE

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SWITCH CONTROL

Application filed December 29, 1928. Serial No. 329,239.

This invention relates to electric switches and particularly to a switch adapted for use in connection with ignition apparatus disclosed in my copending application, Serial No. 198,682 filed June 13, 1927, in which the apparatus comprises an ignition coil having two primary windings which are connected by a suitable switch either in parallel with a storage battery or other current source or in series therewith.

This apparatus can be used advantageously in the electrical system of an automobile in which a storage battery, charged by a generator driven by the automobile engine, is used to supply current during the cranking of the engine to the ignition apparatus, and generally to the starting apparatus where an electric starter is used.

In cases where the battery is partly discharged or the starting apparatus considerably drains the battery, thus reducing its voltage substantially below normal, sufficient ignition coil energy can be obtained for ignition purposes while cranking if the ignition primary windings are connected in parallel with the battery in order to reduce the total resistance of the ignition primary circuit.

Where ignition current is supplied by a generator at normal voltage during the running of the engine, the primary windings should be connected in series in order to increase the resistance of the primary circuit and prevent an abnormal flow of current through the ignition coil while the engine is running. Therefore, the switch which controls the ignition circuit is supplemented by a second switch connected to the windings and that has a "start" position in which the primary windings are connected in parallel, and a "run" position in which the windings are connected in series with the battery.

One of the objects of the present invention is to provide an improved switch for controlling the ignition apparatus of the application referred to. More particularly it is an object to provide a switch operable simultaneously with a movable part of the starting motor or switch so that it can be moved to either the "start" or "run" position; and to provide a switch in which means are employed for moving the switch operating member from its "start" to "run" position automatically when the movable part of the starting motor or switch is released. This feature provides for automatically reducing the current in the primary circuit of the ignition system and relieves the operator of the necessity to return the shifting switch to "run" position after the engine becomes self operative, otherwise, the contact points of the ignition circuit breaker are likely to become oxidized.

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 embodiment of one form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a view in elevation of an assembly including my invention.

Fig. 2 is a fragmentary view of an ignition coil showing in section an adaptation of my invention.

Fig. 3 is a detail of a part of my invention, being a section on the line 3—3 of Fig. 2.

Fig. 4 is a wiring diagram illustrating the use of the present invention.

Fig. 5 is a detail showing of certain parts of Fig. 4, in shifted position.

With particular reference to the drawings the ignition apparatus with which the present device is particularly adapted to be used, will first be described with reference to Fig. 4. The ignition coil has two primary windings 20 and 21 which are inductively related to a secondary winding 22. Winding 20 is connected by wire 23 with a switch contact 24 and by wire 25 with a terminal 26 which is connected with an ignition timer 27 grounded at 28. The winding 20 is also connected by

wire 29 with a switch contact 30. The winding 21 is connected by a wire 31 with a switch contact 32 and by a wire 33 with a contact 34, and also with a terminal 36 to which one end of the secondary 22 is connected by wire 35. Terminal 36 is connected with a battery 37 grounded at 38. The other end of the secondary 22 is connected with an ignition distributor 39.

The switch includes movable contacts 40 and 41, which are shown in detail in Figs. 2 and 3, and when moved to the position shown in Fig. 4, known as the "start" position of the switch or the position occupied by it during the cranking of the engine, the primary windings 20 and 21 will be connected in parallel with the battery. The arrows 42 designate the direction of the current flow so that these parallel circuits may be clearly apparent. After the engine has become self-operative, the switch is automatically moved to the "run" position to move the contacts 40 and 41 into the position shown in Figs. 2 and 5. Then the switch connects the primary windings 20 and 21 in series with the battery to increase the resistance of the primary circuit and to reduce the current therein to normal value. The series connection of the windings 20 and 21 is clearly indicated by the arrows 43 in Figs. 4 and 5. It will be noted that the connections are so made that the coils 20 and 21 also act cumulatively regardless of how they are connected with the battery.

The battery lead 44 from the terminal 36, includes an ignition switch 50 of any preferred form but usually embodies one of the lock type. A starting motor circuit 45 is connected to the electric source 37, in parallel relation to the ignition circuit just described, and includes a starting switch 46, connecting the electric source 37 with the starting motor 47, which may be grounded at 48.

As shown structurally in Fig. 2, the coils 20, 21 and 22, the ends of which are supported by non-conducting bodies located centrally within a metal case 53, have their associated contacts 24, 30, 32 and 34 moldably secured within the terminal supporting member 55. One of the bodies as 52 is embedded in insulating compound within the case 53, this compound having been poured while molten into the case before the member of insulating material is inserted within the case 53. The member 52 includes a cable-receiving sleeve and insulatingly, supports the terminals 26 and 36. The sleeve comprises a metal lining electrically connected by a pin with the core upon which the inside turn of the secondary 22 is grounded by a lead, all of which appears in my application referred to above.

The switch for controlling the circuits of the ignition coil is housed within a case provided by the case cover 55 which forms the base of the switch and a tubular extension 53ª of the case. The base 55 is secured to the case by spinning into the case two annular grooves 67 to form on the inside of the case two annular ridges 68 between which the base 55 is confined. The front wall of the switch is provided by the frame member 70, which is retained by the case 53ª as by spot welding or otherwise securing thereto a sleeve member 54, having one edge thereof provided with the tongues 71 which are bent against the frame 70, as illustrated in Fig. 2.

The frame member 70 is provided with attaching ears 72 acting as a means to support the coil assembly 50 upon some part of the vehicle body structure 73, here representing the floor board of the cab. The attachment may be accomplished by any desired means as the supporting bracket 74 fixed to the floor boards and standing uprightly to support the assembly 50 in the desired position. The member 70 provides a support and guide member for the shifting switch, and is formed with the upstruck ears 75, as indicated in Figs. 2 and 3, to form a guide way for the movable contact carrier 76.

The movable contact member 76 comprises a substantially rectangular block of moldable insulating material, and has one face thereof provided with the recesses 78, and the wells 79, which cooperate to retain and to resilient support the contact members 40 and 41 hereinbefore referred to. The contact members 40 and 41 are practically identical in structure, and are substantially of U formation providing the seating lugs 80 at each of the bridge members 81. The bridge portion 81 is embossed as at 82 to provide substantially semi-spherical contact points on one side of the member and with the depressions 83 on the reverse side. The contact members 40 and 41 are so designed that the lugs 80 will be freely received in the recesses 78 of the members 76 and be capable of movement therein, and so that the depressions 83 will lie substantially over the wells 79. A compression spring 84 is placed in the well so as to seat within the depressions 83 and tend to urge the contacts away from the supporting block 76.

It will be noted upon reference to Fig. 2 that the coil case 53, head member 55, and bracket member 70, define a chamber 90 providing a switch housing. In this switch housing is disposed the movable contact carrying member 76 supporting the contacts just described, so that the carrier 76 may be moved longitudinally between the guide members 75 to a second position in which the contacts 40 and 41 will stand in relation to the coil terminals 24, 32, 30 and 34 as illustrated in Fig. 4.

Means are provided for moving the switch contacts 40 and 41 from the position illustrated in Fig. 2 to that position diagrammatically illustrated in Fig. 4, and include the recess 91 in one end of the member 76, for the

reception of the angular extension 92 of the Bowden wire 93, which wire leads to some operative part of the starting mechanism herein illustrated as the switch actuator 94. The members 53 and 54 of the coil structure are provided with aligned apertures 95 which open into the chamber 90 in position for the passage of the Bowden wire 92. Substantially covering the aperture 95 and firmly fixed to the member 54, is provided the spring cup 96 having a central aperture forming a swivel connection with the flared end 97 of a Bowden wire tube 98. The aperture 95 and the interior of the cup 96 are of sufficient size to house a compression spring 99 which encircles the Bowden wire 93 and is seated in a recess 100 in the end of the member 76, and which spring normally maintains the switch contacts in the relation as illustrated in Fig. 2.

The operation of this device is apparent from the consideration of Figs. 1 and 2 of the drawing and it is obvious that the depression of the starting pedal 101, in its course to close the circuit of the starting switch 46, will move the switch actuator 94, and thereby pull upon the Bowden wire 93 against the spring 99, to move the contact carrier 76 from the "run" position as appears in Fig. 2, to the "start" position diagrammatically shown in Fig. 4. As soon as the motor becomes self operative, or as soon as the starter operating member 101 is released the Bowden wire 93 is also released, which permits a pedal return spring 102 and the spring 99 to return the contact carrier 76 to the "run" position illustrated in Fig. 2.

The contacts of the coil changing switch are kept bright and in an efficient operating condition and good electrical contact is always insured by providing the coil contacts 24, 30, 32 and 34 with the depressed surfaces 49 for the reception of the contact points 82, of the members 40 and 41. The springs 82, resiliently supporting the contacts 40 and 41 in their seating engagement with the carrier 76, are continually urging the contacts 40 and 41 against the terminal supporting member 55 and therefore insure that the spherical embossments 82 of the contacts will fall into the depressions 49 of the coil terminals when the contacts are properly aligned therewith as by means of the Bowden wire 93 and the return spring 99. This means of carrying the contact members 40 and 41 provide floating contact members which ride over the higher portions of the terminal plate 55, between the coil contacts which it carries. Where it is so desired the member 55 may be provided with a dummy contact depression 105, for cooperative seating of the contact member 41, when the coil changing switch is in the "run" position as shown in Figs. 2 and 5.

By reference to Figs. 2, 4 and 5 it will be noted that the coil contacts 24, 30, 32 and 34 are so placed in the terminal member 55, and that the contact members 40 and 41 are of such dimensions relatively, that one or more of the contact members 40, and 41 will always cooperate with the coil contacts to establish one or the other of the relations of the coil windings. Thus in the "run" position, the member 40 cooperates with coil contacts 30 and 32 to establish the series relation of the primary windings, while in the "start" position, the member 40 cooperates with the coil contacts 24 and 32, and the member 41 cooperates with the coil contacts 30 and 34, to connect the primary windings in parallel relation.

While the form of embodiment of the present 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. In an electrical system for use with internal combustion engines, the combination with, a source of electric current and engine starting means energized thereby, of an ignition circuit also energized from said source and automatic means for decreasing the normal resistance of said ignition circuit coincidentally with the energization of said engine starting means, comprising a sectionally divisible primary coil, and means for instituting the energization of the engine starting means, and operable to change the relation of said primary coil sections.

2. In an electrical system for use with internal combustion engines, the combination with, a source of electric current and engine starting means energized thereby, of an ignition circuit also energized from said source and automatic means for decreasing the normal resistance of said ignition circuit coincidentally with the energization of said engine starting means, comprising a sectionally divisible primary coil, a multiple circuit switch interposed between the coil sections and means for instituting the energization of the engine starting means, and operable to change the relation of said primary coil sections.

3. In an electrical system for use with internal combustion engines, the combination with, a source of electric current and engine starting means energized thereby, of an ignition circuit also energized from said source and automatic means for decreasing the normal resistance of said ignition circuit coincidentally with the energization of said engine starting means, comprising a sectionally divisible primary coil, a multiple circuit switch interposed between the coil sections and means for instituting the energization of the engine starting means, and operable upon said switch to change the relation of said coil sections.

4. In an electrical system for use with internal combustion engines, the combination with a source of electric current and engine starting means energized thereby, of an ignition circuit also energized from said source and automatic means for decreasing the normal resistance of said ignition circuit coincidentally with the energization of said engine starting means, comprising, a sectionally divisible coil in said circuit, a multiple circuit switch interposed between said coil sections, and means for instituting the energization of the engine starting means, and operable upon said switch to change the relation of said coil sections.

5. In an electrical system for use with internal combustion engines, the combination with a source of electric current and engine starting means energized thereby, of an ignition circuit also energized from said source and automatic means for decreasing the normal resistance of said ignition circuit coincidentally with the energization of said engine starting means, comprising, a sectionally divisible coil in said circuit, a multiple circuit switch interposed between said coil sections, and means for instituting the energization of the engine starting means and operable upon the switch to alter the relation of said coil sections.

6. Ignition apparatus for internal combustion engines comprising, a current source, an ignition circuit including a coil having a plurality of primary windings, a switch for connecting the windings in parallel for engine starting ignition and in series for engine running ignition, and means for automatically operating the switch during the starting operation.

7. Ignition apparatus for internal combustion engines comprising, a current source, an ignition circuit including a coil having a plurality of primary windings, a switch for connecting the windings, in parallel for engine starting ignition and in series for engine running ignition, and means operable upon the switch for changing the relation of the windings, consequential to engine starting and engine running ignition.

8. Ignition apparatus for internal combustion engines comprising, a current source, an ignition circuit including a coil having a plurality of primary windings, a switch for connecting the windings, in parallel for engine starting ignition and in series for engine running ignition, and means operable upon the switch for automatically insuring a parallel relation of said windings during engine starting and a series relation during engine running.

9. In a starting and ignition system for gas engines, a motor for revolving the engine shaft at starting, an energy source connected to said motor, an ignition coil comprising two primary windings connectible to said source in either series or parallel relation, a starting switch for the motor circuit, a multiple circuit switch for the ignition circuit, interposed between the primary windings, and means acting automatically in accordance with the operation of the starting switch for altering the relation of the coil windings.

10. In a starting and ignition system for gas engines, a motor for revolving the engine shaft at starting, an energy source connected to said motor, an ignition coil comprising two primary windings connectible to said source in either series or parallel relation, a starting switch for the motor circuit, a multiple circuit switch for the ignition circuit, interposed between the primary windings, and means connecting the starting switch operative with the multiple circuit switch for altering the relation of the coil windings upon manipulation of the starting switch.

11. In a starting and ignition system for gas engines, a motor for revolving the engine shaft at starting, an energy source connected to said motor, an ignition coil comprising two primary windings connectible to said source in either series or parallel relation, a starting switch for the motor circuit, a multiple circuit switch for the ignition circuit, interposed between the primary windings, and capable of connecting the primary windings in either series of parallel relation, and means connecting the starting switch operative with the multiple circuit switch for altering the relation of the coil windings upon manipulation of the starting switch.

12. In a starting and ignition system for gas engines, a motor for revolving the engine shaft at starting, an energy source connected to said motor, an ignition coil comprising two primary windings connectible to said source in either series or parallel relation, a starting switch for the motor circuit, and means for automatically controlling the relation of coil sections, during starting and running of the engine.

13. In a starting and ignition system for gas engines, a motor for revolving the engine shaft at starting, an energy source connected to said motor, an ignition coil comprising two primary windings connectible to said source in either series or parallel relation, a starting switch for the motor circuit, and means for automatically controlling the relation of coil sections, during starting and running of the engine, comprising a multiple circuit switch interposed between and connected to the primary windings, and means connecting the interposed switch with the operative of the starting switch, to be operable simultaneously therewith.

14. In a starting and ignition system for gas engines, a motor for revolving the engine shaft at starting, an energy source connected to said motor, an ignition coil comprising

two primary windings connectible to said source in either series or parallel relation, a starting switch for the motor circuit, and means for automatically controlling the relation of coil sections during starting and running of the engine, comprising, a multiple circuit switch connected to the primary windings, and capable of establishing either relation of the windings, and means connecting the multiple circuit switch with the operative of the starting switch, to be operable simultaneously therewith.

15. The apparatus defined in claim 13, in which the means connecting the interposed switch and the operation of the starting switch includes a Bowden wire.

16. The apparatus defined by claim 14, in which the parallel relation of the primary windings is automatically established upon closing of the starting motor circuit and the series relation is automatically established upon the opening of said circuit.

17. Ignition apparatus for internal combustion engines comprising, a current source, an ignition circuit including a coil having a plurality of primary windings, a switch for connecting the windings in parallel for engine starting ignition and in series for engine running ignition, and means for automatically operating the switch during the starting operation, including a Bowden wire connection between the said switch and an operative of the engine starting mechanism.

18. An ignition coil having a divisible primary winding, both sections of which are used in starting ignition and running ignition of said engine, a cranking motor and energized circuit for starting said engine, means for altering the relation of the sections of the said primary winding relative to the circuit of which they are included, and means to correlate the altering of said winding sections with the closure of said cranking motor circuit.

19. In an electrical system for use with internal combustion engines, the combination with a source of electric current and engine starting means energized thereby, of an ignition circuit also energized from said source, said ignition circuit including an ignition coil having a sectionally divisible primary winding, said sectional winding being connected in series for running ignition and operable for parallel connection during starting ignition, means for altering the relation of said sectional windings from series to parallel relation coincident with the energization of said engine starting means.

20. Ignition apparatus for internal combustion engines comprising, a current source, an ignition circuit including a coil having a plurality of primary windings, means for connecting each of said windings in parallel with the other or others for engine starting ignition, and for connecting each of said windings in series with the other or others for engine running ignition, and means correlating the windings, connecting means with the engine starting operation, whereby the primary windings will be automatically connected in parallel relation for engine starting and in series relation for engine running ignition.

In testimony whereof I hereto affix my signature.

JAMES L. ARTHUR.