

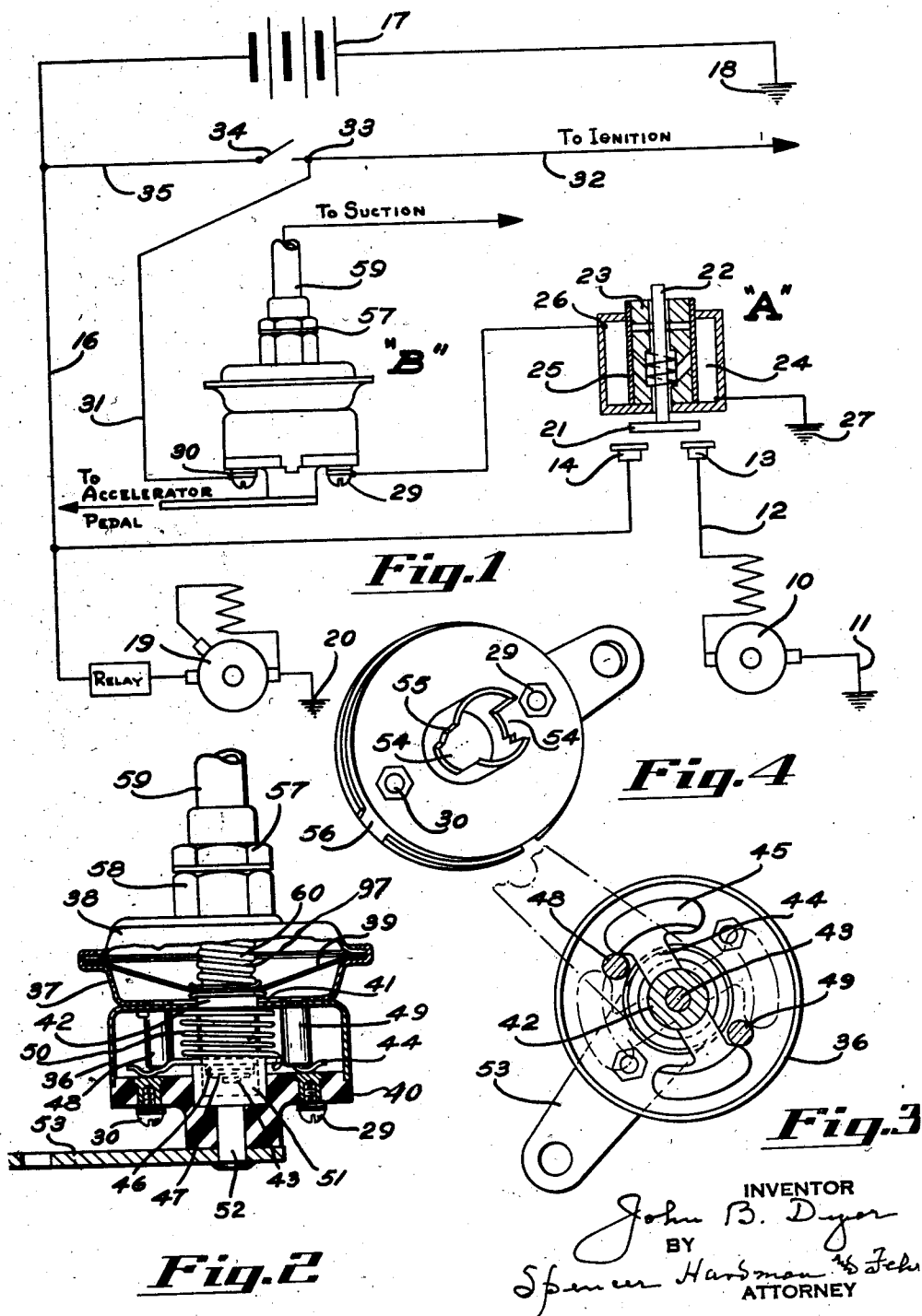
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AUTOMATIC SWITCH

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## AUTOMATIC SWITCH

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This invention relates to apparatus for controlling the operation of starting devices for internal combustion engines, and more particularly those of automotive vehicles. In devices of this character heretofore, no means have been provided which are operated by some of the control devices of the vehicle, such, for instance, as the clutch pedal or accelerator pedal and which, when operated, cause the starting motor to become operative to crank the engine, while means have also been provided operable by the engine itself when running under its own power to cause the starting motor to become inoperative and to prevent its being rendered operative as long as the engine continues to run. These prior devices have generally included a switch which is adapted to be closed by the control member above referred to, and is adapted to be opened by engine suction, which becomes effective when the engine is running under its own power, whereby the starting motor is rendered inoperative and is prevented from becoming operative so long as the engine continues to run.

This application is a division of my copending application Serial No. 643,375, filed November 19, 1932.

It is the principal object of this invention to provide an improved switch which is maintained primarily for use in a control system of the type referred to and which is so constructed that it is closed manually, and automatically opened by engine suction and is provided with means to prevent its closing as long as the engine continues to run, even if the engine suction drops to a point approximating zero. While it is understood that this switch is designed primarily for use in a control system of the type described, it will be understood that such switch is of general application in any relation where it is desired to employ a switch operated jointly by manual control and a vacuum.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing wherein a preferred embodiment of the present invention is clearly shown.

In the drawing:

Fig. 1 is a wiring diagram of one form of a control system of the character described, in which a switch constructed according to the present invention is used.

Figs. 2, 3 and 4 are detailed figures of control switches.

Referring to Fig. 1, the starting motor 10 is mounted at 11. As illustrated, the starting mo-

tor is adapted to drive the engine through the medium of the well-known Bendix drive (not shown), but it will be understood that other types of starter drives can be employed with the control switch which forms the subject of this invention. For instance, the well-known overrunning clutch type of starter drive could be used equally well as the Bendix drive. The motor 10 is connected by a wire 12 with one fixed contact 13 of a magnetic switch indicated in its entirety by the letter A. The other fixed contact 14 of this switch is connected by a wire 15 with a wire 16 leading from a battery 17 grounded at 18 to the generator 19, which is grounded at 20, as indicated. Cooperating with the fixed contacts 13 and 14 is a movable contact 21 carried by the armature 22 of a solenoid comprising a winding 24, the movable contact being held in open position by a spring 25, while a housing 26 encloses the winding. When this magnetic switch is closed, current will flow from the battery through the wires 16, 15, switch A, and wire 12 to the starting motor and from the starting motor through wire 11 to ground and from the ground back to the battery through the wire 18, thus closing the circuit of the starting motor and causing the latter to operate.

The magnetic switch is adapted to be closed upon closing of the ignition switch and another switch indicated in its entirety by the letter B and controlled jointly by the action of the accelerator pedal which controls the quantity of mixture supplied to the engine and by engine suction. The switch B is closed by manual operation of the accelerator pedal and is caused to open when the engine is running under its own power and is maintained in open position as long as the engine continues to run by means more fully described hereinafter.

In order that the magnetic switch A may be controlled in the manner aforesaid, one end of the winding 24 is grounded at 27 and the ungrounded end of said winding is connected by a wire 28 to one fixed contact 29 of the switch B. The other fixed contact 30 of the switch B is connected by a wire 31 to a wire 32 leading from the fixed contact 33 of the ignition switch to the ignition system of the engine, while the movable contact 34 of said ignition switch is connected by wire 35 with the wire 16 leading from the generator to the battery.

Obviously when the ignition switch is closed and the switch B is in closed position, current will flow from the battery through wires 16 and 35, the ignition switch, wires 32 and 31, the

switch B and wire 28 to the winding 24, from said winding through the connection 27 to ground and through the connection 18 from ground to the battery. Thus the closing of the ignition switch and the switch B causes the magnetic switch A to become energized to move the contact 21 into engagement with the contacts 13 and 14 to close the circuit of the starting motor, as previously described. When either the ignition switch or the switch B is open, the magnetic switch is de-energized and the starting motor comes to a stop, the switch B being opened by action of engine suction as will now be set forth. The switch B comprises a sheet metal housing 36 which may be supported in any desirable manner. Riveted or otherwise secured to this housing is a diaphragm chamber formed by two cup-shaped metal shells 37 and 38 suitably flanged and joined together so as to form a fluid-tight joint with a diaphragm 39 secured between the flanges. The housing 36 is grounded at one end by a circular block of insulating material 40 which supports the contacts 29 and 30 above referred to.

Secured to and supported at one end by the diaphragm 39 in any suitable manner and extending through an opening 41 in the housing 36, is a cylindrical element 42 having a spindle 43 projecting from its opposite end.

Pivotally mounted on the spindle 43 is a movable contact member 44 having arcuate contact surfaces 45 formed thereon which are adapted to be moved into engagement with the contacts 29 and 30 when the member 44 is rotated by means later described. The contact member 44 is held flat against the closed end of the cylindrical member 42 by washers 46 and a locking clip 47 which engages a groove, (not shown) in the spindle 43. Posts 48 and 49 are secured in the housing 36 on opposite sides of the member 42 and act as stops to limit the movements of the contact member 44, while a helical spring 50 is connected at one end to the post 48 and at its other end to the contact member 44, so that the spring tends to hold the contact member 44 in its normal switch open position.

In order to move the contact member 44 into engagement with the fixed contacts 29 and 30, there is provided a sleeve 51 which is closed at one end, the closed end fitting within a suitable recess in the insulating material 40, while projecting therefrom is a spindle 52 journaled in said insulating material and having secured in any suitable way at its outer end an operating arm 53 which is adapted to be connected in any suitable manner to the accelerator pedal or some member operated thereby. This sleeve 51 is provided with slots 54 which embrace the movable contact member 44 when the device is assembled and shoulders 55 are provided on one side of each of these slots for a purpose to be specified later. The member 40 of insulating material may be held in place in any suitable manner and may have notches 56 formed in its periphery which receive suitable tangs (not shown) projecting from the housing 36 and adapted to be bent over the face of the member 40.

A nipple 57 is threaded in the hexagonal projection which is integral with and extends from the shell 37, while a flexible suction conduit 59 of suitable material such as copper tubing, is suitably connected to the nipple 57 and extends to a point on the intake conduit of the engine located between the carburetor throttle and the engine intake ports. Received within the inner

end of the nipple 57 and extending into the diaphragm chamber so as to engage the diaphragm is a helical spring 60, which normally holds the contact member 44 in engagement with the inner face of the insulating material 40 at all times other than when the engine suction moves the diaphragm against the pressure of said spring, or when the shoulders 55 are effective to hold the contact member out of engagement with the insulating material as will be more fully explained hereinafter. A flanged, cylindrical member 62 is received within the spring to limit the movement of the diaphragm under the influence of suction, the flange on such member being positioned by the spring and the diaphragm.

The operation of this switch is relatively simple and is substantially as follows. When the engine is stopped, the parts are in the position shown in Fig. 2, the contact member 44 occupying the position shown in full lines in Fig. 3 and with the contact surfaces 45 out of engagement with the contacts 29 and 30, but in engagement with the surface of the insulating material 40, as clearly shown in Fig. 3. Upon movement of the operating arm 53 in a clockwise direction from the full line to dotted line position of Fig. 3, the contact surfaces 45 are moved into engagement with the contacts 29 and 30. If the ignition switch has been previously closed, current will then flow from the battery through the path previously described, including the ignition switch and the switch B, which is in closed position, through the winding of the magnetic switch to energize the latter and cause the closing of the starting motor switch as previously described. During the entire movement of the accelerator pedal from closed to full open throttle position, as indicated by the full and dotted line positions of the arm 53 in Fig. 3, the contact surfaces 30 would remain in engagement with the contacts 29 and 30 unless the contact member 44 be pulled away from the surface of the insulating material 40. Accordingly, the engine suction is utilized to move the contact member in a direction normal to the surface of the insulating material 40 to accomplish the opening of the switch. The suction is not sufficient to overcome the pressure of the spring 60 during the cranking of the engine by the starting motor, but as soon as the engine is running under its own power, the suction becomes great enough to move the contact member 44 as described and the starting motor is immediately rendered inoperative.

Under some operating conditions when the load is very heavy and the throttle wide open, the suction might be insufficient to hold the contact member 44 in its open position and the pressure of the spring 60 might cause the closing of the switch which would result in the operation of the starting motor while the engine was still running. To prevent this action the shoulders 55 are provided. When the engine is stopped, the contact member 44 lies at the bottom of the slots 54 and remains in such position when any member is moved to switch closed position. When the engine suction operates to move the member 44 toward the open ends of the slots 54 as soon as said member moves beyond the shoulders 55, the spring 60 moves the member 44 in a counterclockwise direction so that if the suction falls, said member will rest upon the shoulders 55 until the arm 53 is returned to its initial position, when the member 44 will be moved into engagement with the posts 48 and 49 and after engagement of said mem-

ber with the posts, further movement toward initial position of the arm 53 will cause disengagement of the member 44 from the shoulders 55 and pressure of the spring 60 will then force the member 44 into the bottom of the slots 54 which is the initial position of said member 44.

While the 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. A switch comprising a fixed contact, a movable contact rotatably supported, means for rotating the movable contact to bring said contact into engagement with the fixed contact in order to close the circuit controlled by said switch, means for moving said movable contact bodily in a direction substantially normal to the contacting surface of the fixed contact and out of engagement therewith to open said switch, means for reversely rotating the movable contact after the switch is opened, and means for preventing movement of said movable contact into engagement with the fixed contact after such rotation.

2. A switch comprising a fixed contact, a movable contact rotatably supported, means for rotating the movable contact to bring said contact into engagement with the fixed contact in order to close the circuit controlled by said switch, means for moving said movable contact bodily in a direction substantially normal to the contacting surface of the fixed contact and out of engagement therewith to open said switch, means for reversely rotating the movable contact after the switch is opened, and means for preventing movement of said movable contact into engagement with the fixed contact after such rotation until the means for rotating the movable contact is restored to its original position.

3. A switch comprising a fixed contact, a movable contact rotatably supported, means for rotating the movable contact to bring said contact into engagement with the fixed contact in order to close the circuit controlled by said switch, means for moving said movable contact bodily in a direction substantially normal to the contacting surface of the fixed contact and out of engagement therewith to open said switch, means for reversely rotating the movable contact after the switch is opened; means for preventing movement of said movable contact into engagement with the fixed contact after such rotation and means operable by the means for rotating the movable contact upon its return to original position to render said preventing means ineffective.

4. A switch comprising a fixed contact, a movable contact rotatably supported, means for rotating the movable contact to bring said contact into engagement with the fixed contact in order to close the circuit controlled by said switch, means for moving said movable contact bodily in a direction substantially normal to the contacting surface of the fixed contact and out of engagement therewith to open said switch and a latch device adapted to engage said movable contact to prevent its movement toward the fixed contact after the opening of the switch.

5. A switch comprising a fixed contact, a movable contact rotatably supported, means for rotating the movable contact to bring said contact into engagement with the fixed contact in order to close the circuit controlled by said switch, means for moving said movable contact bodily in

a direction substantially normal to the contacting surface of the fixed contact and out of engagement therewith to open said switch, a latch device adapted to engage said movable contact to prevent its movement toward the fixed contact after the opening of the switch, and means whereby the latch is only disengaged to permit the switch to be closed after the means for rotating the movable contact has been returned to normal position.

6. A switch comprising a fixed contact, a movable contact rotatably supported, means for rotating the movable contact to bring said contact into engagement with the fixed contact in order to close the circuit controlled by said switch, means for moving said movable contact bodily in a direction substantially normal to the contacting surface of the fixed contact and out of engagement therewith to open said switch, a latch device adapted to engage said movable contact to prevent its movement toward the fixed contact after the opening of the switch, and means for moving said movable contact into engagement with the latch device after the said contact has been moved away from said movable contact.

7. A switch comprising a fixed contact, a movable contact rotatably supported, means for rotating the movable contact to bring said contact into engagement with the fixed contact in order to close the circuit controlled by said switch, means for moving said movable contact bodily in a direction substantially normal to the contacting surface of the fixed contact and out of engagement therewith to open said switch, a latch device adapted to engage said movable contact to prevent its movement toward the fixed contact after the opening of the switch, and means for moving said movable contact into engagement with the latch device after the said contact has been moved away from said movable contact and for holding the movable contact in engagement with said latch device until the means for rotating said movable contact has been returned to its normal inoperative position.

8. A switch comprising a fixed contact, a movable contact rotatably supported, means for rotating the movable contact to bring said contact into engagement with the fixed contact in order to close the circuit controlled by said switch, means for moving said movable contact bodily in a direction substantially normal to the contacting surface of the fixed contact and out of engagement therewith to open said switch, a latch device adapted to engage said movable contact to prevent its movement toward the fixed contact after the opening of the switch, means for moving said movable contact into engagement with the latch device after the said contact has been moved away from said movable contact and for holding the movable contact in engagement with the latch device during the return movement of the means for rotating said movable contact, and means for disengaging the contact from the latch device when said rotating means reaches its initial position.

9. A switch comprising a fixed contact, a movable contact rotatably supported, means for rotating the movable contact to bring said contact into engagement with the fixed contact in order to close the circuit controlled by said switch, means for moving said movable contact bodily in a direction substantially normal to the contacting surface of the fixed contact and out of engagement therewith to open said switch, a latch device

adapted to engage said movable contact to prevent its movement toward the fixed contact after the opening of the switch, and a spring for moving said movable contact into engagement with the latch device after the said contact has been moved away from said movable contact.

10. A switch comprising a fixed contact, a movable contact rotatably supported, means for rotating the movable contact to bring said contact into engagement with the fixed contact in order to close the circuit controlled by said switch, means for moving said movable contact bodily in a direction substantially normal to the contacting surface of the fixed contact and out of engagement therewith to open said switch, a latch device adapted to engage said movable contact to prevent its movement toward the fixed contact after the opening of the switch, and a spring for moving said movable contact into engagement with the latch device after the said contact has been moved away from said movable contact and

for holding the movable contact in engagement with said latch device until the means for rotating said movable contact has been returned to its normal inoperative position.

11. A switch comprising a fixed contact member, a movable contact member rotatably mounted and adapted to be rotated so that the surface of such movable contact which engages the fixed contact moves in a path which lies in the same plane as the surface of the fixed contact, manual means for rotating the movable contact to bring said contact into engagement with the fixed contact in order to close the circuit which is controlled by said switch and automatic means for moving the entire movable contact member bodily in a direction substantially normal to the plane in which the surface of the fixed contact lies to separate the fixed and movable contacts in order to open said switch.

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