May 9, 1950 J. G. JUHASZ 2,506,792

MAGNETICALLY OPERATED SWITCH

Filed May 21, 1945

Fig. 1.

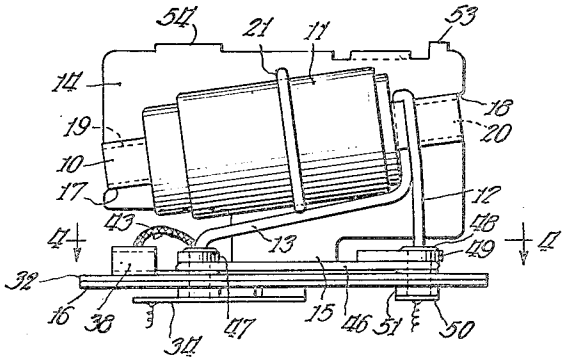


Fig. 2.

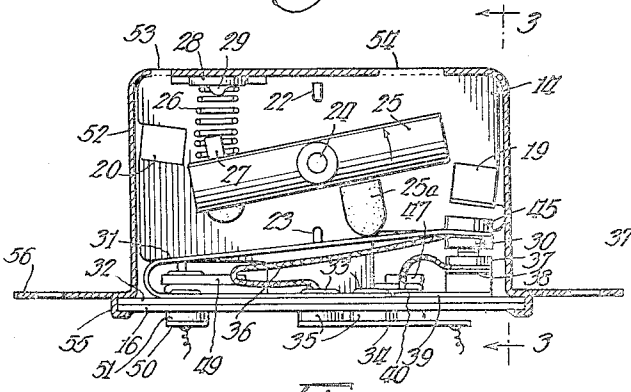


Fig. 3

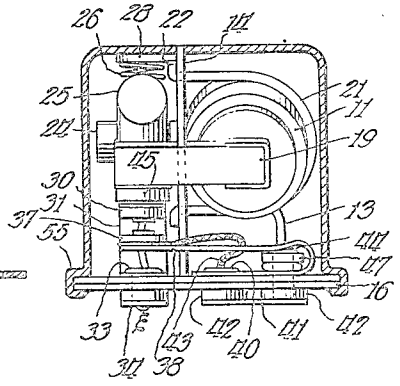


Fig. 4.

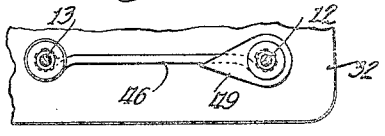
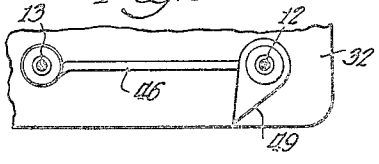


Fig. 5.



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MAGNETICALLY OPERATED SWITCH

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Application May 21, 1945, Serial No. 594,819

1 Claim. (Cl. 200—103)

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The present invention relates to switches, and particularly to a switch for connecting and disconnecting the starter winding of a split phase motor.

In my prior application, Serial #578,747, filed February 19, 1945, now Patent No. 2,438,609, March 30, 1948, for Circuit control device, I show a switch wherein the starter winding of the motor is placed in circuit and cut out of circuit by the utilization of an electro magnet which is in the circuit of the main winding for the motor. In that device I utilize a combination of an actuating armature which when attracted closes the starter winding control contacts. This actuating armature cooperates with a holding armature that is associated with the switch contact for the purpose of providing the proper control of the starter winding.

It is the principal purpose of this invention to provide in a switch such as that shown in my prior application, a means whereby the switch may be adapted to a wide range of starting and operating current in motors.

It is also a purpose of this invention to provide a novel contact arrangement in combination with the actuating armature and holding armature, whereby to prevent fluttering of the contacts as the current is dropped in the motor, or is at about the flow where the switch should open the starter winding contacts.

It is a further purpose of my invention to improve the construction and mounting of the parts of a switch of the character above referred to whereby danger of failure of the switch to operate is substantially reduced.

The nature and advantages of my invention will appear more fully from the following description and the accompanying drawings wherein a preferred form of the invention is shown. It should be understood, however, that the drawings and description are illustrative only, and are not to be taken as limiting the invention except insofar as it is limited by the claims.

In the drawings:

Figure 1 is a view in side elevation of a switch embodying my invention, the cover being removed.

Figure 2 is a view in side elevation of the switch showing the side thereof opposite that shown in Figure 1, and showing the cover in place.

Figure 3 is a sectional view taken on line 3—3 of Figure 2.

Figure 4 is a fragmentary sectional view taken on the line 4—4 of Figure 1, and

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Figure 5 is a view like Figure 4 but showing the parts in a changed position.

Referring now to the drawings, my invention is embodied in a switch of the character disclosed in my prior application. The switch comprises an electromagnet having a core 10 which is provided with a winding 11, the leads of which are shown at 12 and 13. The core and its winding are mounted on a central panel 14, which is made of a suitable non-magnetic material such as brass. This panel has its base portion 15 staked in and brazed or soldered to a base plate 16. The panel is notched at 17 and 18 to permit the active ends 19 and 20 of the core to project therethrough. The winding 11 is anchored in place by a binding strip or wire 21, that extends around the coil and has its ends fastened through the panel 14 and bent over as shown at 22 and 23. The panel 14 mounts a pivot pin 24 and an armature 25 is journaled on the pivot pin. The armature 25 is attracted by the pole pieces 19 and 20 of the core 10. This attraction is resisted by a spring 26. One end of the spring 26 fits over a projected pin 27 of insulating material which extends through the armatue 25 and is fixed therein. The other end of the spring bears against an ear 28 that is formed on the panel 14 and bent at right angle thereto. Ear 28 has a downward projection 29 for centering the end of the spring.

A movable contact 30 is carried on a spring 31 that is mounted on the base plate 16, but is insulated therefrom by a sheet 32 of insulating material. The spring 31 is held in place by two rivets 33, which extend through the sheet 32 and the plate 16 to mount a terminal strip 34. Insulating members 35 insulate the rivets and the terminal strip from the plate 16. A stranded flexible conductor 36 establishes the low resistance connection from the contact 30 to the terminal strip 34 through one of the rivets 33, which are hollow, so as to relieve the spring 31 from excessive current loads that would tend to destroy its resilience. A cooperating contact 37 is mounted in opposition to the contact 30 upon a spring 38, which is similar to the spring 31 but which extends crosswise of the switch. The spring 38 is provided with a laterally extending base portion 39 that is secured in place by a rivet 40. This rivet extends through and establishes connection with a strip 41 on the outside of the plate 16. This strip is insulated from the plate 16 by spacing rings 42. A flexible stranded conductor 43 extends from the contact 37 through the rivet 40 to the strip 41. The strip 41 is con-

nected by a rivet 44 to the terminal 13 of the winding 11.

A holding armature 45 is mounted on the spring 31 on the opposite side thereof from the contact 30. This holding armature cooperates with the armature 25 and the spring mounted contacts 30 and 37 to effectively control the opening and closing of the contacts in such a way as to minimize any arcing at the contacts, and to prevent fluttering of the contacts at the critical time when the attraction for the armature 25 is such that it is about to be released and allow the contacts to open. The armature 25 has a projection 25a of insulating material mounted thereon in position to engage the spring 31 and press it in a direction to bring the contacts 30 and 37 together as the armature 25 is attracted by the pole pieces 19 and 20. Now as the current in the main winding and in the leads 12 and 13 through the coil 11 drops, the attraction for the armature will eventually be so low that the springs 26 and 31 will cause the armature to move out of its attracted position. The parts are shown in Figure 2 at the instant when the armature 25 is about to move entirely out of position between the pole pieces 19 and 20. Any further movement of the armature in the direction of the arrow thereon will, of course, rapidly increase the gap between the armature and the pole pieces, and thus greatly reduce the attracting force. The spring 38 has, up to this point in the retraction of the armature, caused the contact 37 to follow the contact 30 so as to prevent breaking the circuit. However, the holding armature 45 will immediately be attracted at this instant so as to separate the contacts 30 and 37.

This switch must be capable of operating satisfactorily on a rather wide range of operating current and voltage. For example, split phase motors of about one-quarter horse power, that is, in the sizes ranging from one-sixth up to one-third horse power, many have an initial current of from fifteen to fifty amperes in starting, depending upon the type of motor, also the operating current in such motors may vary from slightly less than three amperes up to nearly seven amperes. Likewise the applied voltage on a particular motor may vary as much as fifteen percent in certain areas. If the switch is made for one hundred and ten volt operation, it may be installed in the motor that goes into an area where the regular voltage is one hundred and twenty volts. My present invention provides means whereby the switch is initially set for the particular motor and the particular voltage so that it will thereafter function correctly in the normal use of that motor under the voltage conditions to which it would be normally subjected.

In order to take care of the conditions mentioned in the preceding paragraph, I provide a shunt resistance 46 across the winding 11. This resistance is connected to the spring 38 and the lead 13 by being placed between the spring 38 and a washer 47 beneath the rivet 44. The resistance preferably is made of a Nichrome wire so that it will take about five or six amperes without getting real hot. The resistance of this wire increases rapidly as its temperature rises, so that it tends to direct more current through the winding 11 as it heats up. A standard 18 gauge wire is satisfactory for the one-quarter horse power motor switch. The end of the resistance 46 opposite to the spring 38 is held in place by a rivet 48 which also secures a short circuiting element 49, in place. The rivet 48 and the lead 12 are connected to a terminal strip 50 similar to the terminal strip 34. The terminal strip 50 is insulated from the plate 16 by insulating washers 51. Figures 4 and 5 of the drawings show how the element 49 is utilized to increase or decrease the effective length of the resistance 46. The element 49 is preferably made of copper, so as to have a high conductivity, and bears directly upon the resistance 46, but it can be rotated about the rivet 48 so as to cover more or less of the resistance.

The operation of the by-pass for the winding 11 is substantially as follows. When the initial current surge through the motor takes place it is sufficient to energize the pole pieces 19 and 20 so that they will attract the armature 25, and thus close the switch contacts 30 and 37. The initial movement of the armature 25 first bends the spring 31 because of the tendency of the holding armature 45 to remain in contact with the pole piece 19. Then the force of the spring 31 overcomes the attraction of the pole piece 19, and the contacts 30 and 37 are closed with a snap action. The high current surge is partially by-passed through the wire resistance 46, but it heats up and reduces the amount of the current by-pass. Now when the current flow through the motor falls off due to its speeding up, the by-pass cools and becomes more conductive, thus shunting a great amount of the current around the winding 11, and weakening the attraction of the electro magnet for the armature 25 until finally the armature starts to return to its open circuit position. When that happens the magnetic field in the pole pieces 19 and 20 drops rapidly, releasing the armature 25 and allowing the holding armature 45 to be attracted. As long as the current flow remains low the winding 11 will be substantially by-passed by the resistance 46, but if the motor is overloaded, the resistance 46 heats up, the magnet is again energized and throws the starter winding into circuit again. If the starting current for the motor is low, then the resistance of the wire 46 will be increased by moving the member 49 toward the position shown in Figure 5, thus reducing the amount of current by-passed. On the other hand if the motor has a high starting current the resistance 45 will be reduced by moving the member 49 toward the position shown in Figure 4.

In order to take care of voltage conditions above or below standard, member 49 is moved in the same fashion. More resistance is placed in the shunt where the voltage is lower, and less resistance is placed in the shunt where the voltage is higher. This insures adequate attraction of the armature 25.

The entire switch mechanism is enclosed by a cover 52, which is slotted in the top to allow prongs 53 and 54 on the panel 14 to project up through it. The lower edge of the cover is bent as shown at 55 so that it can be crimped around the plate 16. Ears 56 and 57 are provided on the cover, and these ears are slotted so that they may be used for mounting the switch in place.

From the foregoing description it is believed that the natures and advantages of my invention will be clear to those skilled in this art.

Having thus described my invention, I claim:

1. A current operated control device comprising, in combination, a coil in which the control current may flow, a core of ferro-magnetic material having spaced pole faces, an armature having end portions positioned to be attracted by said pole faces and moved into magnetic overlap-

ping spaced relation with said pole faces by the magnetic force due to current flow in said coil, a spring arm adjacent to said armature and having a contact thereon normally positioned adjacent to said core, said armature having means thereon engaging the arm and pressing it in a direction to move the contact away from the core as the end portions of the armature are moved into overlapping relation by increase of current flow in said coil, an auxiliary armature carried by said arm and positioned to be attracted to a portion of said core in a direction to oppose the movement of the contact away from the core, a second contact positioned to engage the first contact, upon movement of the spring arm and its contact away from the core, when the end portions of the first named armature start to overlap the pole faces, and spring means holding said second contact normally in the aforesaid position, said spring means being tensioned by movement of the first contact against the second contact as the end portions of the first named armature increase their overlap with the pole faces, and acting to aid the spring arm to move the

auxiliary armature into position to be attracted to the core when the end portions of the first named armature decrease their overlap with the core, said spring means serving to hold the second contact spaced from the contact on said spring arm while the auxiliary armature is attracted to the core.

JAMES G. JUHASZ.

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