Oct. 2, 1945. C. T. EVANS 2,385,779

ELECTROMAGNETIC CIRCUIT CONTROLLER

Filed July 12, 1943

Fig. 1

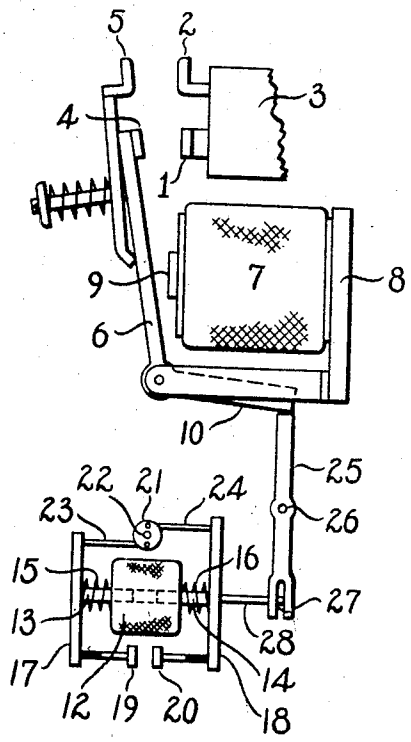



Fig. 2

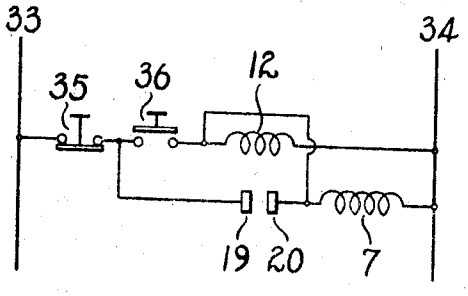
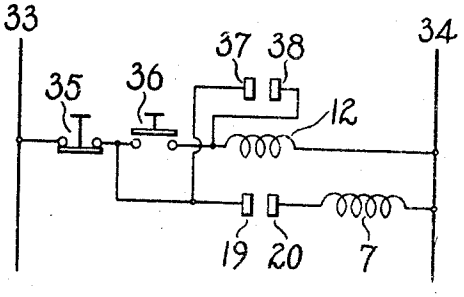



Fig. 3

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# UNITED STATES PATENT OFFICE

2,385,779

## ELECTROMAGNETIC CIRCUIT CONTROLLER

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4 Claims. (Cl. 175—375)

This invention relates to electromagnetic circuit controllers and is particularly applicable to those for use aboard ships or in other locations where severe shocks are likely to be encountered and where large switches are required.

As will be understood, the demand for switches to meet test for severe shocks extends to large switches as well as to small switches of the relay type of which several forms have been designed and developed to possess inherently the required characteristics to meet test of the aforementioned character. Also as will be understood, redesign of a complete line of switches of different sizes is both very costly and time consuming.

The test to be met does not require that the switch be restrained against momentary break of circuit but does require protection against more than momentary break and also against possibility of circuit making when the switch is supposed to be open, and the present invention has among its objects to afford the needed characteristics to a switch not inherently possessing the same, and by way of simple additions saving in both time and cost as compared with redesign.

Another object is to provide means to thus render shock proof switches subjected to control in various ways including the so-called 3 wire control affording low voltage protection.

Various other objects and advantages of the invention will hereinafter appear.

According to the present invention it is proposed to afford the needed characteristics to a switch not inherently possessing such characteristics through coordinating therewith one or another of the relatively inexpensive relays which have been designed to possess inherently the characteristics required to meet tests of the aforementioned character.

The accompanying drawing illustrates schematically and diagrammatically one embodiment of the present invention which will now be described, it being understood that the embodiment illustrated is susceptible of various modifications without departing from the scope of the appended claims.

In the drawing,

Figure 1 is a more or less schematic view of the switch and associated relay, and

Figs. 2 and 3 are diagrammatic views of different control circuits for the switch and relay.

Referring to Fig. 1, the switch schematically illustrated therein comprises stationary contacts 1 and 2 carried by a suitable fixed support 3 and cooperating movable contacts 4 and 5 carried by the armature 6 of a suitable electromagnet. The electromagnet as shown comprises a winding 7 carried by a magnetic frame 8 having a portion 9 constituting a supporting core for the winding 7. The armature 6 has an angular extension 10 which may be assumed to coact with part of the magnet frame 8 to limit outward movement of the armature 6 under the force of gravity to disengage contacts 4 and 5 from contacts 1 and 2. As will be understood, winding 7 is energizable to effect attraction of armature 6 for engagement of contacts 4 and 5 with contacts 1 and 2 and as will become apparent the switch might assume various forms other than that illustrated.

The associated relay selected for illustration (see Fig. 1) is of a form now in use and disclosed in a pending application assigned to the assignee hereof, Serial No. 493,811, filed July 8, 1943, by C. W. Kuhn. This relay briefly described comprises an electromagnet having a stationarily mounted winding 12, and axially aligned magnet plungers 13 and 14 therefor biased apart by springs 15 and 16, respectively, and adapted to be drawn together electromagnetically upon energization of winding 12. The plungers 13 and 14 carry respectively at their outer ends across bars 17 and 18 in turn respectively carrying contacts 19 and 20. These contacts are separated by the plungers 13 and 14 when moved apart and are engaged by attraction of the plungers upon energization of winding 12, the contacts being thus afforded rectilinear movements for engaging and disengaging. While in practice the contacts 19 and 20 preferably are additionally afforded limited rocking play against the bias of suitable springs, thus being yielding when brought into engagement, this detail has been omitted from the schematic showing. The floating structures comprising the plungers and the contacts carried thereby are preferably balanced and are interconnected to prevent at all times independent movements thereof and to subject them to counteraction one by another under shocks. This interconnecting means is shown as comprising a disk 21 having a fixed axis 22 and arms 23 and 24 which respectively link the cross bars 17 and 18 of the two plungers to the disk 21 at diametrically opposed points on the disk equally spaced from its axis. Also in practice the biased movements of the plungers are limited by suitable means not illustrated in the schematic showing. Such a relay, as aforeindicated, has been found to meet satisfactorily severe shock test regardless of direction of shock.

The aforedescribed relay is associated with the switch both mechanically and electrically. Considering the mechanical association the relay is used to control a latch to lock the switch in open position. This latch is shown schematically as comprising a double ended lever 25 having a fixed pivot 26, the upper end of the lever being adapted to underlie the extension 10 of the armature of the switch when the switch is open, and the lower end of the lever having a suitable connection 27 with the relay through a link 28. The arrangement is such that when the switch and relay are deenergized the relay plungers under their bias throw the lever 25 into interlocking relation with the switch to block closure thereof, whereas energization of the relay winding effects movement of the plungers to swing the lever 25 clear of the part 10 of the switch to permit the switch to close. When the switch is closed it is mechanically independent of the relay and is free to open upon deenergization of the switch winding 7 and may open under shock subject to restraint only by the magnetic pull of its electromagnet.

As will thus be apparent, the switch when opened with the relay deenergized is rendered shock-proof, or, in other words, is definitely insured against accidental closure, by the mechanical influence of the relay through the latch lever 25. To make the switch when closed sufficiently shock-proof to meet the aforementioned test which permits of momentary break of circuit by the switch the relay is used to afford a maintaining circuit for the switch winding 7 so long as closure of the switch is desired. This the relay will accomplish because it is inherently shock-proof and with the switch 7 supplied uninterruptedly with current if said switch opens under shock it will be quickly reclosed with at the most mere momentary interruption of circuit. Different ways in which the relay may be so utilized to protect the switch winding against interruption of supply of current to winding 7 are depicted in Figs. 2 and 3.

Referring to Fig. 2 which shows one form of so-called 3-wire control, the windings 7 and 12 are arranged to be supplied from a circuit 33—34 under the control of a normally closed push button switch 35 and a normally open push button switch 36. Supply of current to the winding 7 is dependent upon prior response of the relay to engage its contacts 19 and 20. When the push button switch 36 is closed it connects the relay winding 12 across the circuit 33—34 through the normally closed push button switch 35, whereupon said relay responds to connect winding 7 across said circuit through the normally closed push button switch 35. Thus energization of switch winding 7 is not dependent upon continued closure of the normally open push button switch 36 and relay contacts 19 and 20 when engaged shunt the push button switch 36, wherefore the relay winding 12 will remain energized upon release of push button switch 36. This provides for continued energization of winding 7 so long as the relay winding 12 remains energized, and as aforestated energization of the latter will be continuous regardless of shock, assuming continued normal voltage. Should abnormally low voltage occur the relay would, of course, release, deenergizing the switch winding 7, insuring against reenergization thereof pending restoration of normal voltage and pending reclosure of push button switch 36.

Referring to Fig. 3, the same also shows a so-called 3-wire control for the switch winding 7 comprising a normally closed push button switch 35 and normally open push button switch 36 like those of Fig. 2, but in this instance the relay is provided in addition to contacts 19 and 20 with other contacts 37 and 38, to afford separate maintaining circuits for the two windings. More specifically, contacts 19 and 20 control the circuit of the switch winding 7 just as in Fig. 2, whereas the relay contacts 37 and 38 establish for the relay winding 12 a maintaining circuit shunting the push button switch 36. This arrangement is in practice usually preferred to the arrangement shown in Fig. 2, and the additional relay contacts may comprise another set of contacts like contacts 19 and 20 or may comprise certain of the auxiliary contacts with which the relay of the type shown is commonly provided, preferably of that type disclosed in the aforementioned Kuhn application.

It will, of course, be understood that other forms of shock-proof relay may be substituted for the particular form shown for illustration.

What I claim as new and desire to secure by Letters Patent is:

1. The combination with an electromagnetic switch, likely under severe shock, when said switch is either energized or deenergized, to effect circuit commutation, of an electromagnetic relay of greater stability under like shock, and means coordinating said relay with said switch electrically and mechanically to enhance the shock proof characteristics of said switch when energized or deenergized.

2. The combination with an electromagnetic switch likely when energized or deenergized to effect circuit commutation under sever shock, of control means therefor comprising an electromagnetic relay having greater stability under like shock, said means locking said switch in a fixed position when said switch and said relay are deenergized and said means when said relay is energized maintaining said switch energized whereby any change in position of said switch when said relay is energized will be only momentary.

3. In combination, an electroresponsive switch, an electroresponsive relay having under severe shock, when energized or deenergized, greater stability than said switch, circuit connections rendering said relay and said switch responsive progressively with said switch under the control of said relay for initial and continued energization of said switch, and locking means under the control of said relay to restrain said switch in a fixed position under severe shock when said switch is deenergized.

4. In combination, an electroresponsive switch, an electroresponsive relay having under severe shock, when energized or deenergized, greater stability than said switch, circuit connections rendering said relay and said switch responsive progressively with said switch under the control of said relay for initial and continued energization of said switch, said circuit connections insuring against automatic reenergization of said relay and switch following deenergization thereof through drop in voltage, and locking means under the control of said relay to restrain said switch in a fixed position under severe shock when said switch is deenergized.

CLARENCE T. EVANS.