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ELECTRIC SWITCH

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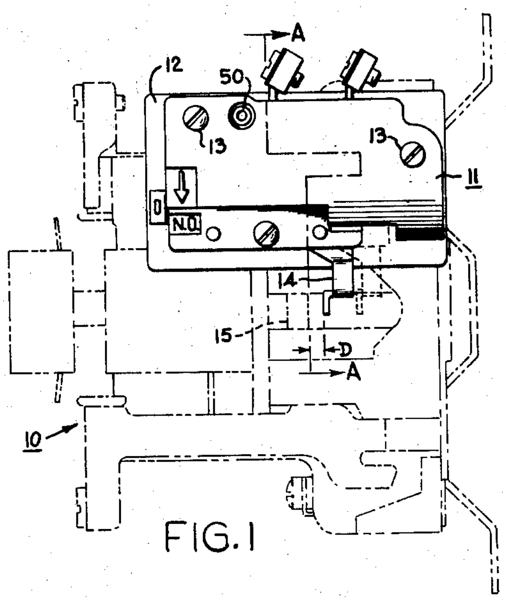

FIG. 1

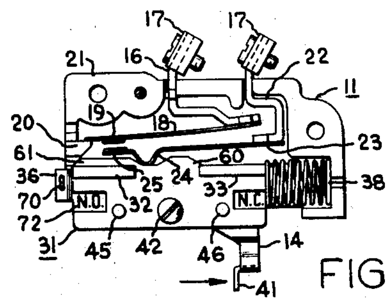

FIG. 2

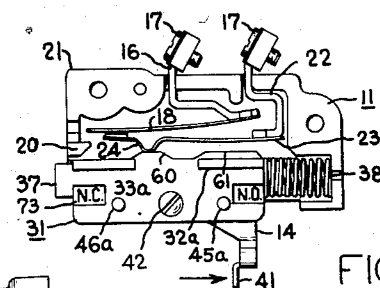

FIG. 3

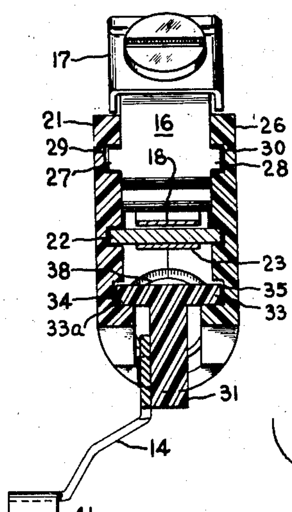

FIG. 4

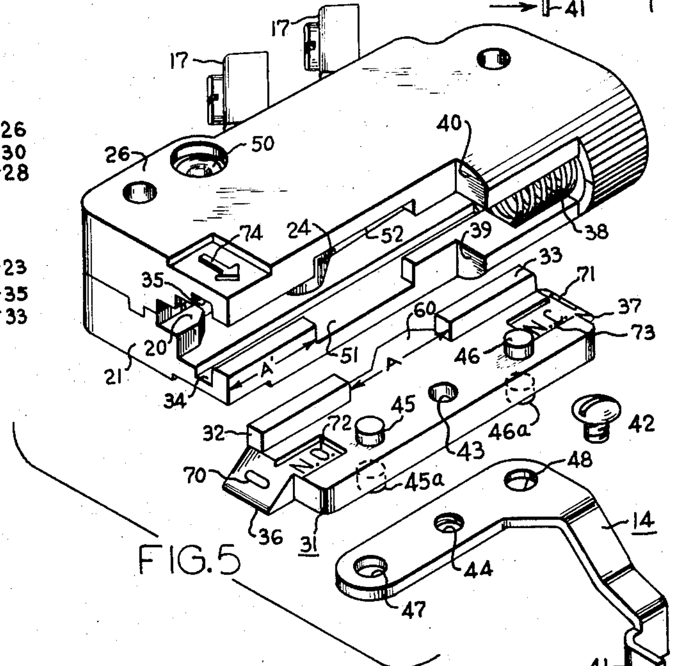

FIG. 5

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ELECTRIC SWITCH

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10 Claims. (Cl. 200—166)

Our invention relates to electric switches and in particular to that type of electric switch which is constructed to provide either normally open or normally closed contact operation.

In general, prior art switches of this type have required that the switch enclosing case be dismantled and that the contacts be manually reversed. This necessity for disassembly requires more complex structures and methods of construction and often results in increased size merely to provide the normally open to normally closed reversible feature.

In addition, attempts to adapt these prior art switching devices for use as auxiliary contacts or interlocks with electromagnetic starters have usually produced switches which are bulky, difficult to operate, and not possessing the reliability of the contactor itself. For example, such prior art devices have generally been designed to provide the same amount of interlock switch actuator travel as main contactor actuator travel thereby requiring a large switch which is complicated by the reversible contact feature. In order for the auxiliary switch to cooperate properly with the magnetic contactor it is desirable that it be small in size, easily installed and removed, and that it have reliability and ease of operation at least equivalent to that of the magnetic contactor.

It is therefore an object of this invention to provide an electric switch whose mode of contact operation can be reversed from normally open to normally closed without dismantling the switch enclosing case or the switch contacts.

Another object of this invention is to provide a switch which is small in size, easily manufactured with liberal tolerance both in assembly and mounting, and which provides economy of manufacture without sacrificing reliability of operation. It is a further object of this invention to provide an electric switch which utilizes only simple stamped and molded parts for its major components while achieving the desired small size and reliability.

It is a still further object of this invention to provide a switch having external indicating means which will positively identify the unoperated or normal position of the switch contacts.

In accordance with a preferred form of our invention, a switch is provided having a two piece molded insulating housing which supports the switch contacts and external terminals and which has an opening along two sides to admit and provide for movement of a contact actuator. The contact actuator has preformed cam surfaces thereon which engage a cam follower surface on one of the contact support structures. Movement of this actuator brings the cams into engagement with the contact support structure so as to regulate the contact movement. The reversibility from normally open to normally closed operation is simply obtained by the withdrawal and end-for-end reversal of the contact actuator.

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These and other novel features believed characteristic of the invention are set forth in the appended claims. The construction of a preferred embodiment of this invention together with further objects and advantages thereof may be easily understood, however, from the following description taken in conjunction with the accompanying drawings in which,

Figure 1 is an end view of an electromagnetic contactor with the switch in combination therewith;

Figure 2 is a side view of the switch with one part of the housing removed and the actuator arranged to provide normally open contact operation;

Figure 3 is a side view of the switch with one part of the housing removed and the actuator arranged to provide normally closed contact operation;

Figure 4 is a lateral cross section of the switch taken along the line A—A of Figure 1; and

Figure 5 is an exploded view of a preferred embodiment of this invention.

Referring now to Figure 1, the magnetic contactor **10** shown in dotted lines is representative of typical devices which can be utilized to actuate the switch of this invention and is more fully described in the co-pending application Serial No. 686,318 by James Burch and assigned to the assignee of the present invention. The switch **11** is secured to a mounting plate **12** by the screws **13**. The mounting plate **12** is fastened to the frame of the magnetic contactor **10** so as to position the switch **11** and its operating arm **14** for proper actuation by the projection **15** on the movable member of the magnetic contactor.

The terminal **16**, stamped from a suitable conducting material, has a screw fastener **17** at its outside end for accommodating the connection of a wire and has a conductive spring strip **18**, made from materials such as Phosphor bronze, attached by suitable means to its internal end. The strip **18** carries a contact **19** near the other end portion, which portion engages a shoulder **20** which is molded in the insulated housing **21**. The terminal member **22**, stamped from a suitable conducting material, also has a screw fastener **17** in its external end and has a spring strip **23** connected to its internal end. The spring strip **23** has a deformity or cam follower **24** formed intermediate its ends and has the contact **25** appropriately fastened at its free end. As is seen in the drawings, and particularly Figure 4, the terminal strip **16** and terminal strip **22** are held between the mating halves **21** and **26** of the housing through the engagement of the projections **27** and **28** in the slots **29** and **30**. These slots and projections serve to retain and position the terminal strips and are assisted in this function by the engagement of the walls of the slots formed in each half of the housing to admit the terminals.

The contact actuator shown generally at **31** has projections **32**, **32**_a_, **33** and **33**_a_ which engage slots **34** in the casing member **21** and **35** in the casing member **26**. This mating projection and slot arrangement guides the switch actuator **31** for longitudinal movement. The end projections **36** and **37** on actuator **31** serve to indicate the unoperated or normal position of the contacts **19** and **25** (as will be hereinafter explained) and also engage the spring **38** which biases the actuator **31** into the position shown in Figures 2 and 3. The spring **38** is retained in position by the shoulder **39** and **40** of the enclosure members **21** and **26** and the engagement of the tabs **36** or **37** with the spring member **38** serve to positively position the switch actuator relative to the spring.

The operating lever **14**, is secured to the actuator by the screw **42** which passes through the aperture **43** to engage the threaded opening **44** in the actuating lever. The cylindrical projections **45** and **46** (or **45**_a_ and **46**_a_) engage the apertures **47** and **48** thereby positively positioning the actuator arm relative to the contact actuator. As clearly shown in Figure 4, the operating arm **14** has an offset portion terminating in a bent-up tab **41**. The offset portion of the arm properly positions the tab **41** relative to the operating projection **15** of the associated magnetic contactor (see Figure 1) so that the operating force can be properly applied to the switch.

As is seen from the prior structural description, the assembly of the mating housing halves **21** and **26** serves to lock the terminals **16** and **22** into position within the housing thereby positioning the contact **19** relative to the contact **25**. The housing also holds the spring **38** captive within the defined surfaces and the housing halves may then be riveted together as is shown by the single rivet **50**.

Referring particularly to Figure 5, it is seen that the slots **34** and **35** in the housing members **21** and **26** extend to one edge of the housing. The slot **51** in the housing **21** extends from the slot **34** to the outside face of the housing and is dimensioned to partially define an opening equal in size to the projection **33***a*. The slot **52** also partially defines an opening equal in size to the projection **33**, such opening extending from the slot **35** in the housing member **26** to the outside edge. The distance "A" between the projections **32** and **33** is substantially equal to the distance "A" between the edge of slot **51** and the end of the housing. With the case thus dimensioned relative to the projections on the contact actuator, it can be seen that the actuator **31** may be inserted into the housing by moving it laterally so that the slots **52** and **51** mate with the projections **33** and **33***a* thereby placing the projections **32** and **32***a* external to the edge of the housing. Alternatively, end **37** of actuator **31** may be inserted into the housing front adjacent the open ends of slots **34** and **35**. Once the actuator has been so inserted into the housing, it may be moved longitudinally with the projections **32**, **32***a*, **33**, **33***a* in proper engagement with the slots **34** and **35**.

Referring particularly to Figures 2 and 3, it is seen that the contact actuator has two projections or cams **60** and **61** which extend into the switch housing. Figure 2 shows the spring **38** is expanded to its full dimension so that the contact actuator is in its normal or unoperated position. In this position, the cam follower **24** is positioned between the two cams **60** and **61** thereby allowing the spring force of the arm **23** to produce an open contact relationship between the contacts **19** and **25**. As the contact actuator **31** is moved in the direction of the arrow, the cam surface **61** is moved in the direction of the arrow and engages the cam follower **24** thereby forcing the contact **25** into engagement with the contact **19**. When the force is removed from the operating arm **14**, the spring returns the actuator to its normal or rest position allowing the contacts to open.

Figure 3 shows the contact actuator **31** reversed end-for-end from that of Figure 2 so that the normal or rest position of the contact actuator places the cam surface **60** in engagement with the cam follower **24** thereby forcing the contacts into engagement. Because the spring is in its normal unoperated position, the contact actuator establishes a normally closed contact relationship when the contact actuator has the orientation shown in Fig. 3. Movement of the contact actuator in the direction of the arrow disengages the cam surface **60** from the follower **24** allowing the normal spring bias of the contact arm **23** to open the contacts.

The slope and size of the cam surfaces **60** and **61** can be dimensioned and designed to produce any desirable contact tip velocity.

As is seen in the drawings, the rest position of the contact actuator **31** places either tab **36** or **37** in view external to the housing depending on the orientation of the contact actuator. This tab portion while performing the alternate function of engaging the spring, carries appropriate indicia shown at **70** and **71** to indicate the normal or rest position of the contacts. The portion of the actuator which extends laterally beyond the housing can also carry indicia **72** and **73** to indicate the unoperated contact position by virtue of their position opposite the arrow **74** on the housing **26**.

To reverse the orientation of the actuator end-for-end and thereby change from normally open to normally closed contact operation, it is necessary to move the actuator **31** to the left (see Figure 5) until the tabs **33** and **33***a* are lined with the slots **51** and **52**. This position also places the tabs **32** and **32***a* external to the switch housing so that the actuator may be laterally withdrawn therefrom. Removal of the screw **42** permits the operating arm **14** to be given a one-half revolution and mounted on the opposite side of the contact actuator **31**. The cylindrical projections **45**, **46** or **45***a*, **46***a* on the contact actuator **31** engage the apertures **47** and **48** in the actuator thereby positioning the operating arm **14** relative to the actuator **31**. The actuator is then reinserted into the housing and depressed until the tab **36** is engaged with spring **38**. The switch is then in condition for operation in a normally closed position as shown in Figure 3. This reversal feature has been accomplished without dismantling the housing or disturbing the contact arrangement.

When this switch is associated with a magnetic contactor as shown in Figure 1, the actuator arm **14** is positioned so that its rest position is displaced by the amount D from the rest position of the contactor actuator projection **15**. When the contactor is actuated, the projection **15** must travel the distance D before it engages the operating arm **14** and thus a smaller travel distance is required for the contact actuator than for the movable arm of the magnetic contactor. This reduced distance of travel permits the over-all size of the auxiliary switch member **11** to be considerably reduced in size and allows the contactor magnet to start up without the additional load of an auxiliary switch at the initiation of travel.

The improved switch structure enables the switch to be changed from normally open to normally closed contact operation without disturbing the magnetic contactor. It is merely necessary to withdraw the actuator **31** from the housing, reverse the switch actuator as was previously described and then reinstall the actuator **31** within the housing and the switch is ready for operation on the contactor frame.

It will thus be seen that we have provided a switch which can be used as an auxiliary contact or interlock for a magnetic contactor or similar application, which is small in size, which contains very few parts, and which provides simple, rugged and extremely reliable operation. Further, this improved switch enables either normally open or normally closed contact operation to be provided without the structural dismantling of the switch housing. All that is required to reverse the contact operation is the withdrawal and reversal of the contact actuator and the reversal of the contact actuator arm.

Although we have described a particular embodiment of our invention, many modifications may be made. It is to be understood that we intend by the appended claims to cover all such modifications that fall within the true spirit and scope of the invention.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. A switch comprising a housing having an elongated aperture therein, a pair of contacts within said housing having electrical connections extending outside of said housing, means for biasing at least one of said contacts away from the other of said contacts, an elongated movable contact actuator positioned in said elongated aperture and movable longitudinally therein, a captive spring within said housing at one end of said aperture for urging said contact actuator toward a normal position in said housing, said contact actuator being removable through the end

of said elongated aperture opposite said captive spring and reinsertable therein with a reversed end-to-end orientation, said contact actuator having cammed surfaces on longitudinal surfaces thereof, said cammed surfaces being positioned when said actuator has a first orientation relative to said housing to close said contacts against the force of said biasing means upon movement of said actuator from said normal position against the force of said captive spring and to permit said biasing means to open said contacts from a normally closed position upon movement of said actuator against the force of said captive spring when said actuator has a second orientation reversed end-to-end from said first orientation.

2. The switch set forth in claim 1 wherein said switch housing has a longitudinal aperture therein extending along a portion of two sides, and said contact actuator has a portion thereof extending laterally through said aperture beyond the edges of said housing and has an operating arm mounted on said laterally extending portion, said arm being detachably secured to said actuator so that it may be reversed in position when said actuator is reversed thereby maintaining the relative position of said operating arm and said housing the same.

3. The switch set forth in claim 1 wherein said housing has an aperture provided at one end and said actuator has a portion extending beyond said housing through said aperture when said actuator is in the unoperated position, said projection having indicia thereon to indicate the circuit relationship of said contacts when said switch is in the unoperated position.

4. The switch set forth in claim 1 including a spring positioned at one end of said housing and an additional projection at each end of said contact actuator, said projections being dimensioned to engage said spring and having indicia thereon to indicate the condition of the contacts whereby positioning said actuator to engage one said end projection with said spring allows said other end projection to extend beyond said housing to indicate the unoperated condition of said contacts.

5. A switch comprising a two piece molded insulating housing whose mating sides define a longitudinal aperture, a pair of contacts within said housing having electrical connectors extending outside of said housing, means for biasing at least one of said contacts away from the other, a longitudinally movable contact actuator having a portion which extends laterally through said longitudinal aperature to which the operating force is applied, and a spring biasing said actuator into an unoperated position, said actuator having an irregular longitudinal surface which engages said biased contact whereby movement of said actuator from its unoperated position will close said contacts when said operator is in a first position and will open said contacts when said actuator is in an end-for-end reversed position.

6. The switch of claim 5 wherein said longitudinal aperture extends into the top of said housing and said contact actuator has a projection at each end, each said projection dimensioned to engage said actuator bias spring, said projections having indicia thereon whereby the unoperated condition of said contacts is indicated external to said housing.

7. An auxiliary switch for an electromagnetic contactor comprising a split housing whose mating halves define a longitudinal aperture which extends along two sides of said housing, first and second terminals external to said housing, each having a portion extending into said housing, a first leaf spring having one end mounted on said first terminal within said housing, a first contact mounted at the other end of said first leaf spring, a second leaf spring having a cam follower intermediate its ends and one end mounted on said second terminal within said housing, a second contact mounted at the other end of said second leaf spring, said first and second leaf springs being mounted to place said contacts in opposite but displaced relationship, and a contact actuator mounted for sliding movement within said housing and having a portion extending through said longitudinal aperture, said actuator having a cam surface thereon engaging said cam follower on said second leaf spring whereby movement of said actuator in one position moves said contacts from the open to the closed position and movement of said actuator in an end-for-end reversed position allows said contacts to move from the closed to the open position.

8. A switch comprising a two piece molded insulating housing whose mating sides define a longitudinal aperture, a pair of contacts within said housing having electrical connectors extending outside of said housing, an elongated movable contact actuator positioned for sliding movement in said aperture, said contact actuator having first and second spaced projections on a longitudinal surface thereof, said projections being positioned to close said contacts from a normally open position upon actuator movement when said actuator has a first orientation relative to said housing and to open said contacts from a normally closed position upon actuator movement when said actuator has a second orientation reversed end-to-end from said first orientation, a captive spring mounted within said housing at one end of said elongated aperture for engaging said contactor at one end and biasing it toward a normal position, said contact actuator being removable through the opposite end of said elongated aperture for reversal of its orientation.

9. A switch comprising a two piece molded insulating housing whose mating sides define a longitudinal aperture, a pair of contacts within said housing having electrical connectors extending outside of said housing, an elongated movable contact actuator positioned for sliding movement in said aperture, said contact actuator having first and second spaced projections on a longitudinal surface thereof, said projections being positioned to engage at least one of said contacts and to move it in a direction substantially normal to the direction of movement of said actuator to close said contacts from a normally open position upon actuator movement when said actuator has a first orientation relative to said housing and to open said contacts from a normally closed position upon actuator movement when said actuator has a second orientation reversed end-to-end from said first orientation, a captive spring mounted within said housing at one end of said elongated aperture for engaging said contactor at one end and biasing it toward a normal position, said contact actuator being removable through the opposite end of said elongated aperture for reversal of its orientation.

10. The switch of claim 1 wherein said longitudinal aperture extends laterally along the side of said housing with slots formed in said housing for the guidance of said contact actuator, said contact actuator having lateral projections engaging said slots and wherein said housing has an enlarged portion in said longitudinal opening to permit lateral withdrawal of said contact actuator from said housing when said actuator projections are aligned with said enlarged portion of said longitudinal aperture.

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