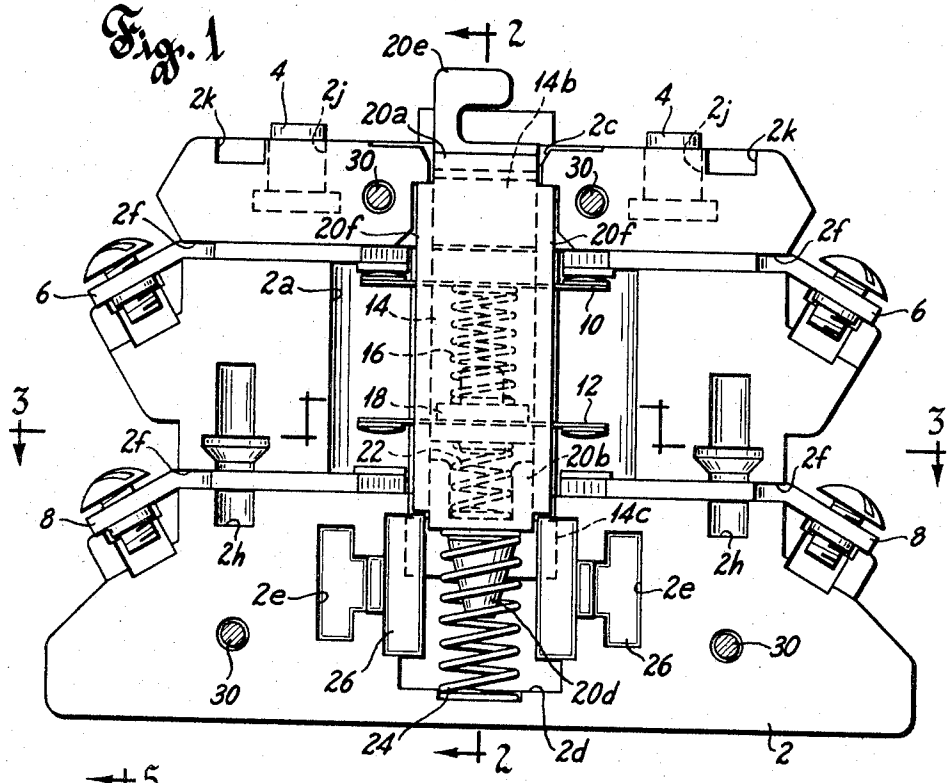
April 1, 1969 J. E. MADING 3,436,497

ELECTRICAL SWITCH HAVING A LOST MOTION OPERATOR ASSEMBLY

Filed Aug. 31, 1967 Sheet 1 of 2

Fig. 1



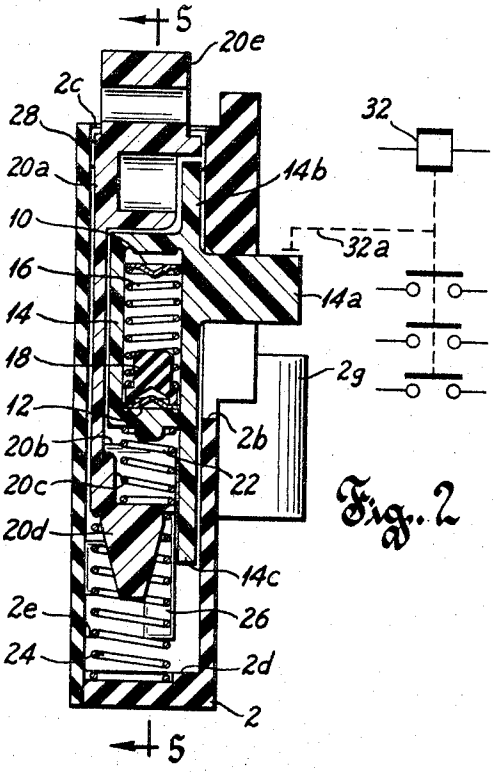
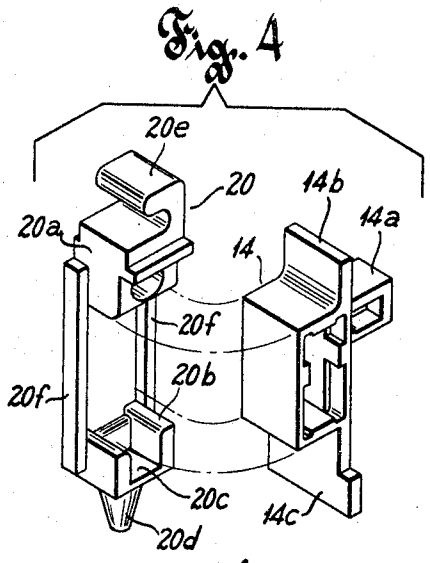


Fig. 2

Fig. 4



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Fig. 5

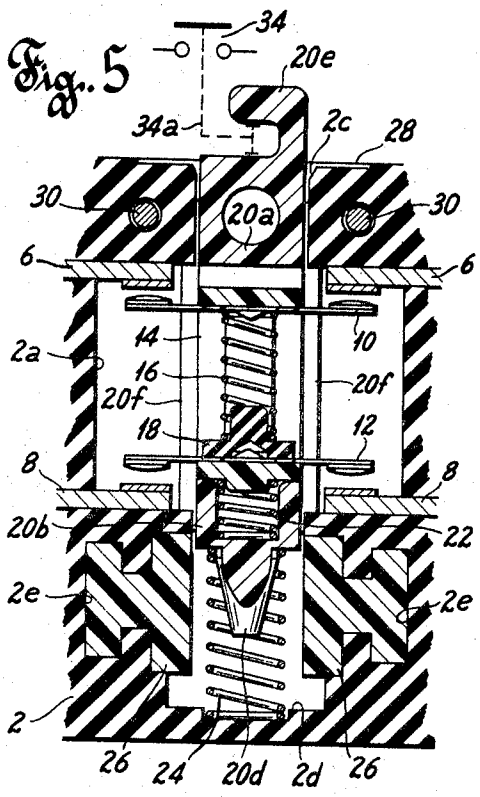


Fig. 6

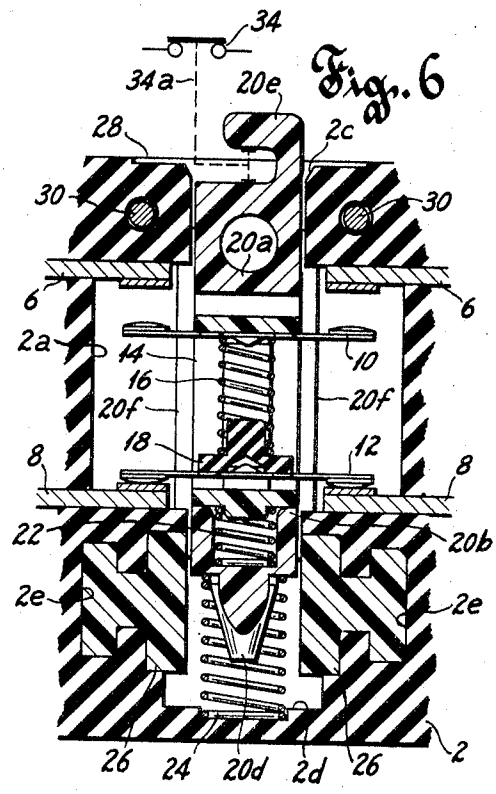
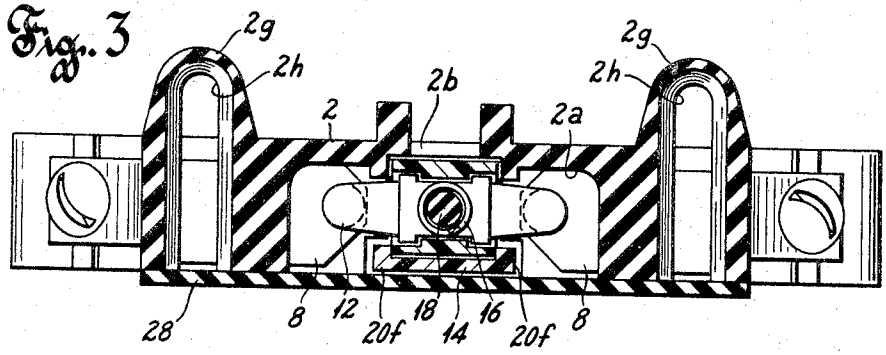


Fig. 3



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3,436,497

ELECTRICAL SWITCH HAVING A LOST MOTION OPERATOR ASSEMBLY

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Int. Cl. H01h 15/00
U.S. Cl. 200—16 6 Claims

ABSTRACT OF THE DISCLOSURE

An electrical switch unit having a linearly movable contact carrier adapted to be mechanically driven by an electromagnetic contactor armature assembly against light spring pressure in the early part of the armature stroke to immediately perform a contact function of an interlock and then drive a linearly movable spring biased slide bar to afford operation of shorter stroke auxiliary switches having their operators connected to the slide bar.

Cross-reference to related applications

The switch of this invention is particularly well suited to be used with electromagnetic switching devices of the type described and claimed in copending application Ser. No. 664,796, filed Aug. 31, 1967, and assigned to the assignee of this application. The particular manner in which such switches are mounted to and actuated by such devices may be found in said copending application and therefore have been dealt with only briefly herein.

Background of the invention

This invention relates to linearly operated electric switches and particularly those switches whose operators are utilized to actuate auxiliary, or add-on, switches. The switch of this invention is primarily intended to be used as an electrical interlock for electromagnetic contactors.

A common example of this type of switch is found in the C. F. Brauneck U.S. Patent No. 2,918,554, issued Dec. 22, 1959, wherein two sets of bridging contacts are carried by a single slide bar member. One set of contacts is normally closed to complete a circuit to another electromagnetic contactor, or to an alarm, or indicating device, and the other set of contacts is normally open, these contacts connecting the coil of the associated electromagnetic contactor around some momentary control device such as a pushbutton. The slide bar of this switch is moved by the armature of the contactor to reverse the contact operation, this movement being against the bias of the return springs for both the armature and interlock switches.

Since the strength of the contactor magnet is considerably weaker in the early part of the armature stroke, it has been necessary to cause the armature to engage the slide bar later in its stroke when the magnetic strength is sufficient to overcome the added return spring pressure of one or more interlocks. However, in certain applications, such as motor reversers, it is desirable to have the device which is controlled by the normally closed contacts function as close to the energization of the associated electromagnet as possible.

Summary

The switch of this invention has overcome the existent problems by providing a two-piece operator assembly. A contact carrier member of the two-piece operator assembly is moved against a light return spring pressure to open the normally closed contacts in the early part of the armature stroke. A slide bar is picked up later in the armature stroke when the magnetic strength is greater and is moved against its heavier return spring to actuate auxiliary switches which have their slide bars statically connected

to the slide bar of the interlock, thereby obviating the need for separate return springs for the additional switches and holding the overall return spring force to a minimum. The interlock may be designed to have its normally open contacts close either prior to or subsequent to the engagement of the slide bar, but it is usually desirable that they close simultaneously with the contacts of the associated contactor.

The two-piece operator assembly also allows the slide bar stroke to be held at a constant amount while the contact carrier member may be designed to travel greater or lesser amounts as dictated by the armature strokes of various size contactors. Thus, the same auxiliary, or add-on, switches may be used for all sizes of contactors.

It is therefore a primary object of the invention to provide a switch having a lost motion two-piece operator assembly which allows at least one set of contacts to be actuated early in the operator travel and against the bias of a light return spring pressure, while the contacts of auxiliary switches are operated later in the operator travel against the bias of a heavier return spring pressure.

Brief description of the drawings

FIGURE 1 is a front elevational view of the switch with a cover member removed therefrom;

FIG. 2 is a cross-sectional view taken along line 2—2 of FIG. 1;

FIG. 3 is a transverse sectional view taken along the irregular line 3—3 of FIG. 1;

FIG. 4 is an isometric view of the two members of the switch operator;

FIG. 5 is a fragmentary sectional view taken along line 5—5 of FIG. 2 and showing an intermediate position of the switch mechanism; and

FIG. 6 is a view like FIG. 5 but showing the switch mechanism in another position.

Description of the preferred embodiment

Referring to the drawings, the switch includes a molded insulating housing 2 which has a flat front surface as viewed in FIG. 1. This surface is provided with a plurality of interconnected depressions comprising a central cavity 2*a* having an opening 2*b* in the rear wall thereof to communicate between the cavity 2*a* and the rear exterior surface of the housing, an opening 2*c* communicating between the cavity 2*a* and the upper exterior surface of the housing, a second cavity 2*d* extending downwardly from cavity 2*a*, a pair of substantially H-shaped pockets 2*e* each formed to have one leg thereof communicate with a respective lateral edge of cavity 2*d*, and two pairs of slots 2*f* which communicate between the cavity 2*a* and opposite exterior sides of the housing.

Housing 2 is also provided with a pair of outwardly extending projections 2*g* on the rear surface thereof. Projections 2*g* have slotted openings 2*h* which extend between the upper and lower surfaces of the projections and are open to the front surface of the housing. As heretofore mentioned, the switch is particularly adapted for use with an electromagnetic contactor or the like and the extensions 2*g* serve as a mounting means for securing the switch to the side of such a device. The extensions mate with complementary formed recesses in the side of the contactor and screws are inserted through the slotted openings 2*h* from the upper surface of the extensions to take into threaded openings formed in the lower surfaces of the contactor recesses.

The upper surface of housing 2 is further provided with a pair of slotted pockets 2*j* (FIG. 1), which are open to the upper and rear surfaces of the housing. The lower portions of pockets 2j are formed in some straight-sided configuration, preferably rectangular, while the upper portions may be semi-circular. A pair of inserts

4 having cylindrical upper portions and rectangular lower flanges are pressed tightly into slots 2*j* from the rear of housing 2. Inserts 4 have threaded holes open to the upper surfaces thereof to receive the mounting screws of an auxiliary switch which may be mounted to the upper surface of the switch housing 2. A pair of recesses 2*k* are also provided in the upper surface to receive compelmental positioning bosses of the auxiliary switch.

A first pair of stationary contact members 6 are provided for the switch and are placed within the upper slots 2*f*. The members 6 extend at one end within the cavity 2*a* and have contact tips secured to the underside thereof to form a first alined pair of stationary contacts within the cavity. The opposite ends of members 6 extend beyond the respective opposite exterior sides of housing 2, these ends being provided with conventional wire securing means. A second pair of stationary contact members 8 are placed within the lower slots 2*f*. Members 8 are identical to members 6 with the exception that the contact tips are secured to the upper surface thereof to form the second alined pair of contacts within cavity 2*a*.

A pair of movable contact bridge members 10 and 12 are carried at the opposite ends of a window formed in a molded insulating contact carrier 14. Each bridge member has a conical projection formed thereon at its center which serves to position a helical compression spring 16 extending between the two bridges and biasing them against the ends of the window. An insulator 18 is disposed between bridge 12 and spring 16 to insulate the bridges from each other.

The carrier 14 has a projection 14*a* extending outwardly thereof to project through the opening 2*b* in housing 2. The carrier 14 is also provided with a pair of flat guide portions 14*b* and 14*c* extending from the top and bottom thereof and into the opening 2*c* and cavity 2*d*, respectively, to guide the carrier upon vertical reciprocal movement within the housing 2. The window of carrier 14 is provided with vertically extending ribs which complement an H-shaped configuration of the bridge members 10 and 12 and the insulator 18, as best seen in FIG. 3, to maintain proper alinement of the bridge members within the carrier.

A molded insulating slide bar 20 is provided to cooperate with contact carrier 14. As best seen in FIG. 4, slide bar 20 has upper and lower projecting portions 20*a* and 20*b* which define a space therebetween to receive the main body portion of contact carrier 14. The lower portion 20*b* is provided with a spring pocket 20*c* and a frusto-conical spring guide 20*d* which depends from the portion 20*b*. Upper portion 20*a* has a hook member 20*e* formed thereon which extends outwardly of the upper end of switch housing 2. Lateral wings 20*f* are provided on slide bar 20 to serve as guides for its reciprocal movement within housing 2. It may be seen that the space defined by the projections 20*a* and 20*b* is somewhat greater than the height of the contact carrier 14 to allow some travel of carrier 14 within the slide bar 20.

A helical compression spring 22 is disposed within the pocket 20*c* of slide bar 20 to bear against the underside of contact carrier 14 and bias it upward toward the portion 20*a*. Another helical compression spring 24 is disposed around the guide 20*d* to bear between the underside of slide bar portion 2*b* and the lower end of cavity 2*d* in housing 2 to bias the slide bar upwardly within the housing.

A pair of substantially H-shaped bearing members 26 are inserted within the pockets 2*e* of housing 2 to guide the lower end of slide bar 20. One leg of each bearing member 26 extends within the cavity 2*d* to bear against the lateral surface of portion 20*b* between the wings 20*f* and the lower guide 14*c* of contact carrier 14.

The switch assembly is completed by securing a flat insulating cover member 28 to the front surface of housing 2 with rivets 30 or the like. The cover 28 serves to hold the stationary contacts 6 and 8 and the bearing members 26 in place within housing 2 and also serves as a front guide for the slide bar 20.

In a typical application, the switch of the invention is secured to the side of an electromagnetic contactor 32, represented schematically in FIG. 2, in the manner aforedescribed. The projection 14*a* extends through an opening in the housing of contactor 32 to be engaged by some portion 32*a* of the armature assembly of the contactor. An auxiliary switch 34, represented schematically in FIGS. 5 and 6, is secured to the upper surface of housing 2 as earlier described. The auxiliary switch has a one-piece combined slide bar and contact carrier 34*a* which is provided with a hook portion extending out of its housing to interengage complementally with hook 20*e* of slide bar 20.

In the unoperated condition of the switch, and thus the similar condition of the contactor 32, the switch assumes the position shown in FIGS. 1 and 2, i.e., the member 10 bridges the stationary contacts 6 while the member 12 is free of contacts 8. The bridge of auxiliary switch 34 is also free of its contacts. It may be seen that in this unoperated condition the slide bar 20 is biased to its outermost position with respect to housing 2 by spring 24. Outward travel of slide bar 20 is limited by the upper ends of lateral wings 20*f* engaging overhanging portions of the upper wall of housing 2. Contact carrier 14 is biased upwardly within the slide bar 20 toward portion 20*a* by spring 22, but the upper position of the carrier in the particular embodiment shown in FIG. 2 is limited by the engagement of projection 14*a* with the upper end of opening 2*b*.

Energization of the operating coil of contactor 32 causes its armature to be attracted thereto, thus moving the contact bridges and portion 32*a* thereof. It is particularly important that the contactor armature have only a slight resistance to movement in the early part of its travel when the flux pattern is weak. Portion 32*a* moves the contact carrier 14 downward against the bias of spring 22 to cause the bridge member 10 to separate from the contacts 6. This movement occurs without moving the slide bar 20 and the contactor armature has only to overcome the resistance of spring 22 and its own return springs.

At this point the armature has traveled a sufficient distance to cause the flux pattern to become substantially greater, thus enabling the contactor magnet members to overcome greater spring resistance. In the embodiment shown in the drawings, the contact carrier 14 next abuts the upper surface of portion 20*b* of slide bar 20 to drive the latter downward against the bias of spring 24. Upon sufficient downward movement of slide bar 20 and carrier 14, the bridge member 12 engages contacts 8 to complete the circuit therebetween, as do the bridges of contactor 32 and auxiliary switch 34 with their respective contacts.

Thus, the circuit between contacts 6 has been broken early in the travel of the contactor armature without presenting a large resistive spring force at this stage of travel, and the circuits between contacts 8 and those of the auxiliary switch 34 have been completed in the later stages of armature travel when the magnetic strength is greater.

It should be noted that alternative designs may provide for the bridging of contacts 8 prior to engaging slide bar 20 by decreasing the initial distances between contact 8 and bridge 12, or by increasing the amount of lost motion travel of carrier 14. In any event, it is desirable to maintain the stroke of slide bar 20 at a constant length.

Another important feature of the lost motion travel between contact carrier 14 and slide bar 20 is that it allows the same auxiliary switches to be used on all sizes of contactors. As the contactors increase in rated capacities, their sizes also increase which in turn increase the lengths of their armature strokes. Since each contactor is provided with the maintaining switch and as many as

three auxiliary switches, it becomes very important to reduce the number of different auxiliary switches needed as much as possible. By increasing the distance between portions **20***a* and **20***b* of slide bar **20**, the travel of slide bar **20** to actuate the auxiliary switches may be held constant regardless of armature stroke.

It is to be understood that the switch of this invention is susceptible of various modifications without departing from the scope of the appended claims.

I claim:

1. An electric switch comprising, in combination; an insulating housing;

a cavity within said housing;

first and second openings in said housing communicating between said cavity and first and second exterior surfaces of said housing, respectively;

at least one pair of spaced stationary contacts mounted within said cavity;

a contact carrier member positioned for reciprocal movement within said cavity and having a portion projecting outwardly of said housing through said first opening;

electrically conductive bridging contact means mounted to said contact carrier and engaging one pair of spaced stationary contacts in one operating position of said contact carrier;

a slide bar disposed adjacent said contact carrier within said cavity, said slide bar being positioned for co-linear reciprocal movement with said contact carrier and relative to said contact carrier and said housing, said slide bar having a first portion extending through said second opening in said housing, means on said first portion for connecting said slide bar to an auxiliary switch operating means, and a second portion underlying said contact carrier to be engaged thereby upon movement of said carrier in one direction;

first spring means biasing said contact carrier against movement in said one direction;

second spring means biasing said slide bar against movement in said one direction; and

wherein an external force applied to said outwardly projecting portion in said one direction moves said contact carrier against the bias of said first spring means to effect contact actuation and subsequently to engage said second portion of said slide bar to move the latter in said one direction against the bias of said second spring means, said movement of said slide bar providing a contact actuating movement for a connected auxiliary switch operating means.

2. The combination according to claim **1** wherein said first and second exterior surfaces of said housing are adjacent surfaces disposed at substantially a right angle to each other and said means on said first portion of said slide bar are formed to connect with complementary formed means on the operating means of an auxiliary switch, thereby effecting responsive movement of said auxiliary switch operating means in directions normal to the plane of said second exterior surface.

3. The combination according to claim **2** wherein movement in said one direction comprises movement normal to the plane of said second exterior surface and in a direction from the latter surface toward an opposite exterior surface of said housing.

4. The combination according to claim **1** wherein said contact carrier is biased to said one operating position by said first spring means and wherein said bridging means disengages said one pair of stationary contacts upon movement of said carrier in said one direction prior to said carrier engaging said second portion of said slide bar.

5. The combination according to claim **4** together with a second pair of spaced stationary contacts mounted within said cavity and positioned to be engaged by said electrically conductive bridging means in a second operating position of said contact carrier.

6. The combination according to claim **1** wherein said first spring means extends between said second portion of said slide bar and said contact carrier.

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U.S. Cl. X.R.

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