Dec. 20, 1955 V. G. KRENKE 2,727,964

PLUNGER OPERATED SWITCH

Filed Jan. 26, 1952 2 Sheets-Sheet 1

Fig.1.

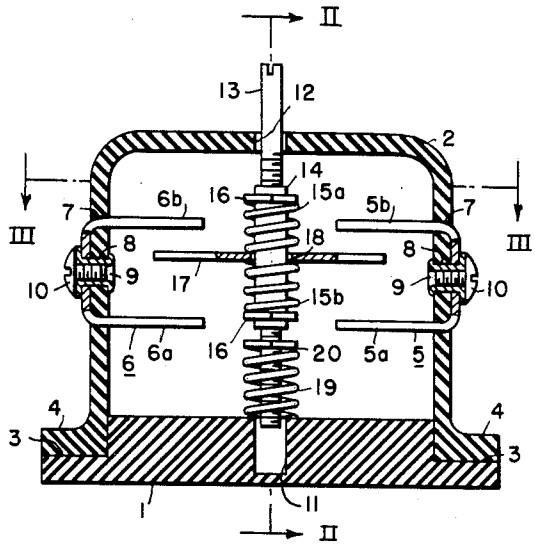


Fig.2.

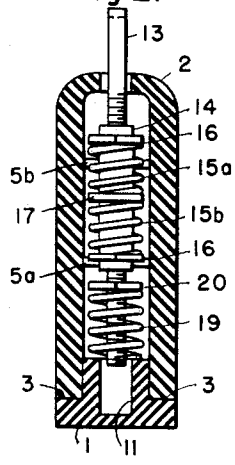
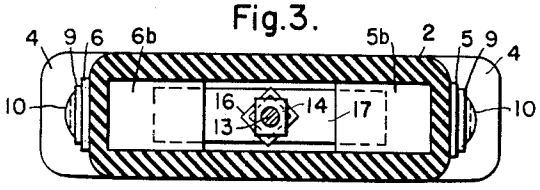


Fig.3.



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Fig. 4.

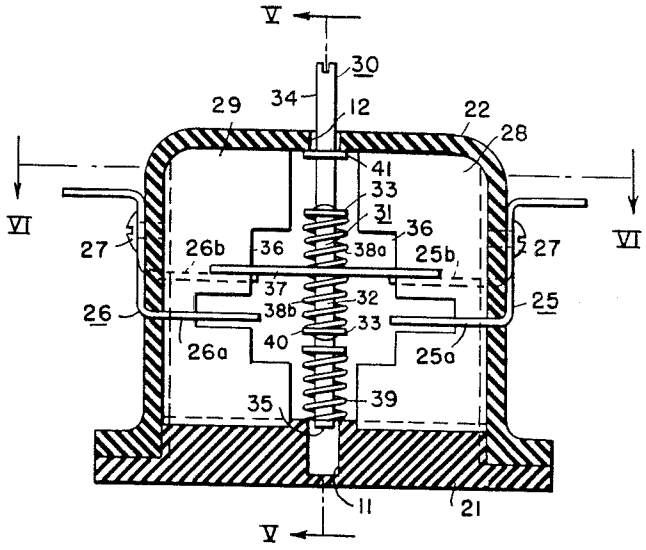


Fig. 5.

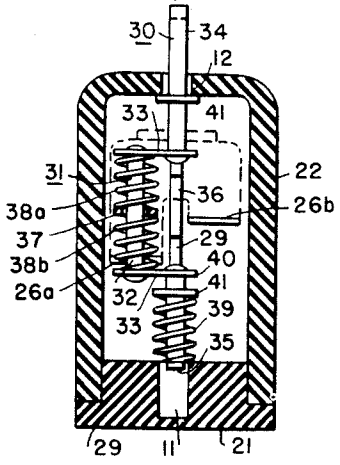
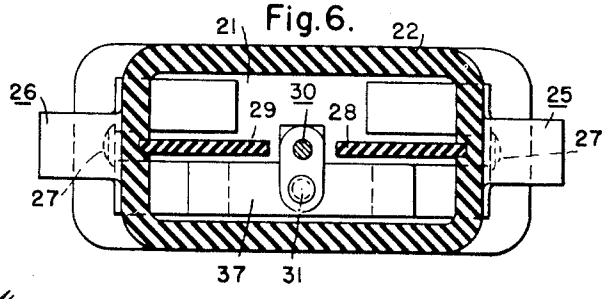


Fig. 6.



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PLUNGER OPERATED SWITCH

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This invention relates generally to electrical switching devices and more in particular to such devices which are known in the art as electrical interlocks.

Electrical interlock switching devices are required in numerous circuit applications. Depending upon the requirements of the switching operations, these interlocks may be utilized in normally closed or normally open circuit positions. As a consequence, in the past it has been customary to manufacture such interlocks in the normally open or normally closed contact position, and these were selectively utilized as required in the circuit system.

In order to minimize the number of parts required for such devices and in order to eliminate, if feasible, stocking of the two types of devices, efforts have been directed to the manufacture of an interlock which could be utilized selectively as a normally open or a normally closed switching device with a few minor adjustments at the time of installation. These efforts have, for the most part, resulted in assemblies which were too complicated to be practical and which required too much time to convert to the desired mode of operation.

Accordingly, one of the principal objects of this invention is to provide an electrical interlock which may be converted selectively for either normally closed or normally open switching operations without disassembling the device.

More specifically stated, it is an object of this invention to provide an electrical interlock of the character referred to which may be selectively adjusted for either normally closed or normally open switch operation by a simple adjustment of the operating plunger.

It is also a general object of this invention to provide an electrical interlock of the character generally referred to which is simple in its elements with regard to operational requirements, positive in its operation, and inexpensive to manufacture.

The foregoing statements are merely illustrative of the various aims and objects of this invention. Other objects and advantages will become apparent upon a study of the following disclosure, when considered in conjunction with the accompanying drawings, in which:

Figure 1 is a longitudinal sectional view of an electrical switching device embodying the principles of this invention;

Fig. 2 is a sectional view taken on the line II—II of Fig. 1 illustrating certain other details of this invention;

Fig. 3 is a sectional view taken on the line III—III of Fig. 1 and showing still further details of the embodiment of Fig. 1;

Fig. 4 is a longitudinal sectional view of a second embodiment of this invention;

Fig. 5 is a sectional view taken on the line V—V of Fig. 4 and illustrating certain additional details of the embodiment of Fig. 4, and

Fig. 6 is a sectional view taken on the line VI—VI of Fig. 4 illustrating still other details of this embodiment of the invention.

As noted in the opening statements of this specification this invention is directed to an electrical switching device or interlock which may be adjusted for either normally closed or normally open contact operation. One arrangement whereby this function may be accomplished is illustrated in Figures 1, 2 and 3. The assembly comprises a two-piece housing of electrical insulating material, including a base **1** and a cover **2**. The cover **2** is adapted to fit over and seat upon suitable shoulders **3** which are formed in the base, and to this end, the cover portion is provided with outwardly directed flanges **4** at each end thereof providing means for mounting the assembly on a suitable panel. The contact assembly of this arrangement includes a pair of U-shaped stationary contacts respectively designated **5** and **6**, the respective legs **5***a*, **5***b* and **6***a*, **6***b* of which fit through suitable openings **7** provided in the end walls of the cover **2**. The bight of each U-shaped contact fits against the outer face of the cover and is provided with an opening therethrough which coincides with an opening **8** in each end wall through which eyelets **9** are fitted to secure the respective contacts in position. Eyelets **9** are internally threaded to receive screws **10** by which external electrical connection with respective stationary contacts **5** and **6** may be made. The contacts are positioned with corresponding legs **5***a*, **6***a* and **5***b*, **6***b* in spaced confronting relation, the lowermost pair **5***a*, **6***a* occupying positions in substantially the same horizontal plane and the uppermost pair **5***b*, **6***b* being similarly disposed in a second horizontal plane spaced from the first.

The base **1** of the interlock housing is provided with a blind hole **11** and the cover is provided with a hole **12** extending therethrough in the top side. An externally threaded plunger **13** is slidably and rotatably mounted in the blind hole **11** in the base and the hole **12** through the cover, the upper end of the plunger projecting upwardly through the hole **12** to provide a point of operational engagement.

The complete plunger assembly includes an internally threaded sleeve **14** having a rectangular, or more specifically, a square cross-section, as will be seen by reference to Fig. 3. Sleeve **14** is provided with a pair of coaxially disposed springs **15***a* and **15***b*, the outer ends of which seat against spring clips or retainer washers **16** disposed adjacent the extremities of the sleeve **14**, and the inner ends of which seat against and resiliently support a moving contact **17**. Moving contact **17** is provided with a rectangular opening **18** therethrough centrally thereof of a configuration to slidably fit over the sleeve **14**, permitting axial displacement of the moving contact with respect to sleeve **14** upon the application of external force thereto, such as occurs upon engagement of the moving contact with respective stationary contacts. Moving contact **17** is of sufficient length to straddle the gap between the extremities of respective corresponding legs **5***a*, **6***a* or **5***b*, **6***b* of the stationary contacts, thereby upon engagement with said respective legs, establishing an electrical connection therebetween.

The plunger assembly is biased in one direction, upwardly as viewed in Fig. 1, by means of a compression spring **19** which is disposed about the plunger adjacent the bottom end thereof. The bottom end of this spring seats on the base about the blind hole **11** and the upper end of this spring abuts spring washer or nut **20** which is securely fitted to the plunger in a fixed position.

The arrangement illustrated in Figs. 1, 2 and 3 is shown in normally open contact position, thus to operate this electrical switch or interlock, downward force is applied to the upper end of plunger **13**, forcing the plunger assembly downwardly against the compression force of spring **19**, until the moving contact **17** establishes contact with the respective lower legs **5***a*, and **6***a* of the stationary contacts **5** and **6**, as viewed in Fig. 1. Travel of the plunger **13** beyond the point of contact between the moving contact and the respective stationary contacts, as described, results in compression of the upper contact supporting spring **15***a* to assure good contact engagement. When the plunger is released, both the upper spring **15***a* and spring **19** thrust the plunger upwardly until such time as the moving and stationary contacts disengage, at which time

spring 19 returns the plunger to the normally open position illustrated.

If it is desired to convert this assembly to a normally closed switching arrangement, this may be accomplished by the simple expedient of rotating plunger 13 in a direction to move sleeve 14 upwardly along the plunger as viewed, until such time as the moving contact 17 engages the respective uppermost contacts of the stationary contact assembly. Movement of sleeve 14 beyond this point may be continued to compress the lower spring 15*b* and assure firm normally closed engagement of the contacts. During this adjustment, rotation of the sleeve assembly with the plunger is prevented by the moving contact 17, which lies between the side walls of the cover 2, having a slight clearance therewith sufficient to assure relative sliding movement of this moving contact with respect to the side walls without binding, but not sufficient clearance to permit appreciable angular displacement of the moving contact during periods when the plunger 13 is being rotated. Inasmuch as the hole 18 is a neat sliding fit about the rectangular cross-sectional configuration of sleeve 14, this sleeve is locked to the moving contact and is prevented from turning with the plunger.

To operate the device in the normally closed contact position to open the contacts, it is merely necessary to apply a force to the plunger 13 sufficient to drive the plunger downwardly and separate the moving contact from the respective upper stationary contacts 5*b*, 6*b*.

Attention is invited to the fact that in this conversion of the device from normally open to normally closed contact position or the reverse, the axial position of the plunger with respect to the housing of the unit remains unchanged. As a consequence, devices intended to operate such a switching unit automatically may be manufactured identically the same when this device is employed, since the operating movement of the plunger for the switching unit is the same in either position of the contacts.

The second embodiment of this invention illustrated in Figs. 4, 5 and 6 accomplishes the same functional end in essentially the same manner, but by a different mechanical means. This switch unit embodies a base portion 21 fitted with a cover 22 of essentially the same configuration as that illustrated in Fig. 1. The stationary contact assemblies differ in their geometry from those of Fig. 1, and are essentially of Z-shaped configuration. These respective stationary contacts are designated 25 and 26 and are each provided with a pair of leg portions 25*a*, 25*b* and 26*a*, 26*b* which are respectively longitudinally spaced and laterally displaced with respect to plunger 30. Each pair of legs projects through suitable openings in the end walls of cover 22 into spaced confronting relation within the cover. These assemblies of stationary contacts are securable in any suitable manner to the cover as for example by screws 27 which clear through suitable holes in the contact portions lying against the end walls of the cover and threaded into suitably tapped holes in the cover.

In this assembly, the plunger 30 is of the shape of a crank, being provided with an offset crank portion 31 which is comprised of a pin 32 which is fitted between the crank arms 33, the remaining ends of which are connected to pins or shafts 34 and 35 respectively, constituting the shaft portion about which the plunger rotates. The base of the housing is again provided with the blind hole 11 and the cover is also provided with the hole 12 extending therethrough. Plunger shaft 35 is slidably and rotatably fitted into the blind hole 11 while the plunger shaft 34 at the upper end of the plunger is slidably and rotatably fitted through the hole 12.

The housing assembly in this embodiment of the invention is somewhat wider than that illustrated in Figs. 1 through 3 to accommodate the throw of the plunger assembly in each lateral position of the crank portion on the respective sides of the housing. The housing is divided into two parts by partitions 28 and 29 which define a longitudinally disposed barrier along the longitudinal center line of the housing. These partition sections 28 and 29 terminate adjacent the plunger assembly and are provided with respective notch configurations in these innermost ends at 36 to clear the crank portion 31 and the moving contact 37 whenever the plunger is depressed and rotated.

Moving contact 37 is supported between compression springs 38*a* and 38*b*, the outer ends of which abut the crank arms 33 and the inner ends of which abut and support moving contact 37 about the pin 32. The plunger assembly is maintained in the position illustrated in Figs. 4 and 5 by a compression spring 39 which is fitted about the lower shaft portion 35 of the plunger, abutting at its upper end a spring washer 40 secured to plunger shaft 35 and at its lower end seating about the blind hole 11. Upward movement of the plunger assembly is limited by a stop washer 41 which is secured to the upper plunger shaft. Washer 41 abuts the inner face of the top of cover 22.

As illustrated in Fig. 4, this switching device or interlock is positioned in normally open contact position, the moving contact being disposed on the same side of partitions 28 and 29 as respective cooperating stationary contacts 25*a* and 26*a*. In this position, downward movement of plunger assembly 30 moves the moving contact downwardly against the compression force of spring 39 into engagement with stationary contacts 25*a* and 26*a*. Continued plunger movement after contact engagement compresses the upper contact supporting spring 38*a*, assuring a firm contact engagement. When the plunger is released, springs 38*a* and 39 drive the plunger upwardly until the contacts disengage, at which time spring 39 completes the plunger movement to the position illustrated.

Conversion of this switching unit from normally open to normally closed contact operation is obtained by the simple expedient of depressing plunger assembly 30 to a position in which the moving contact 37 is adjacent the lower slotted portion of slot configurations 36. At this point, rotation of the plunger assembly 30 180° in either direction displaces moving contact 37 through a slotted opening 36 to the other side of partitions 28 and 29, at which time when the plunger is released, spring 39 biases the plunger assembly upwardly towards its inoperative position and engages moving contact 37 with respective stationary contacts 25*b* and 26*b*. This engagement is effected in view of the relative positioning of the moving contact 37 with respect to stationary contacts 25*b* and 26*b* in the vertical plane, these latter contacts being positioned lower than moving contact 37 when stop washer 41 abuts the inner face of the top portion of housing 22 to limit further upward movement. As a consequence, engagement of moving contact 37 with respective stationary contacts 25*b* and 26*b* obtains before the full limit of upward movement has been realized. The force of spring 39 is sufficient to drive the plunger upwardly to its upper limit against the force of spring 38*b*, thereby compressing spring 38*b* and assuring a firm contact engagement.

In this embodiment of the invention as in the previously described embodiment, it will be appreciated that again the plunger occupies the same normal position vertically for either normally closed or normally open contact operation, facilitating installations involving mechanical operation of the assembly. Moreover, in both embodiments of this invention, prearrangements of cabling and bus bars may be made without regard to differing electrical connections for normally open and normally closed switching devices, since the external electrical connections to the embodiments herein illustrated remain unchanged for either mode of operation.

While but two embodiments of this invention have been herein illustrated and described, it will be appreciated that various geometric configurations and mechanical expedients may be utilized to achieve the basic principles herein

set forth, all of which are deemed to be within the scope of those skilled in the art. Accordingly it is intended that the foregoing disclosure and the illustrations of the drawings shall be interpreted only as illustrative of the principles of this invention and not construed in a limiting sense.

I claim as my invention:

1. An electrical interlock comprising, a housing, a plunger rotatably and slidably mounted in said housing, a pair of stationary contacts mounted in said housing in positions axially spaced of said plunger, a moving contact support threaded on said plunger, a movable contact mounted on said support in a position between said stationary contacts, rotation of said plunger displacing said support and movable contact along said plunger between normally closed and normally open contact positions.

2. An electrical interlock comprising, a housing, a plunger rotatably and slidably mounted in said housing, a spring biasing said plunger in one direction in said housing to a normal position, a pair of stationary contacts mounted in said housing in axially spaced relation with respect to said plunger, a moving contact support threaded over said plunger, a movable contact, opposed springs coaxially disposed about said support supporting said moving contact therebetween in a position between said stationary contacts, rotation of said plunger moving said support and moving contact axially of said plunger between normally open and normally closed positions with respect to said stationary contacts.

3. An electrical interlock assembly comprising, a housing, a threaded plunger rotatably and slidably mounted in said housing, two pairs of stationary contacts, one pair mounted in each end of said housing in positions axially disposed of said plunger, a moving contact support threaded over said plunger, a moving contact, spring means biasing said plunger in one direction to a given position, a pair of springs coaxially disposed about said support supporting said moving contact therebetween, said moving contact extending between and being adapted to bridge respective stationary contacts in the same plane, rotative movement of said plunger axially displacing said support and moving contact between normally open and normally closed positions with respect to said stationary contacts.

4. An electrical interlock as recited in claim 3 wherein said support is of rectangular cross-section and said movable contact has a rectangular opening therein fitting about said support, said moving contact slidably fitting between spaced wall portions of said housing to prevent rotation thereof upon rotation of said plunger.

5. An electrical interlock comprising, a housing, a crank-shaped plunger slidably and rotatably fitted in said housing, a pair of stationary contacts mounted in said housing in positions laterally and axially displaced of said plunger, a moving contact mounted on the crank portion of said plunger, rotation of said plunger displacing said moving contact laterally thereof between said stationary contacts.

6. An electrical interlock comprising, a housing, a crank-shaped plunger slidably and rotatably mounted in said housing, a pair of stationary contacts mounted in said housing in a position laterally and axially displaced with respect to said plunger, spring means biasing said plunger in one direction to a given position in said housing, a moving contact, spring means coaxially disposed of the crank portion of said plunger and supporting said moving contact therebetween, rotation of said plunger displacing said moving contact laterally thereof between operative positions with respect to said stationary contacts.

7. An electrical interlock comprising, a housing, a crank-shaped plunger rotatably and slidably fitted in said housing, two pairs of stationary contacts, one pair mounted in each end of said housing in positions axially and laterally displaced of said plunger, a spring mounted moving contact on the crank portion of said plunger, said moving contact extending between and overlapping stationary contacts disposed in the same plane, rotation of said plunger displacing said moving contact laterally thereof between operative positions with respect to the stationary contacts.

8. An electrical interlock comprising, a housing, a crank-shaped plunger rotatably and slidably fitted in said housing, two pairs of stationary contacts, one pair mounted in each end of said housing in positions axially and laterally displaced of said plunger, respective stationary contacts on the same side of said plunger occupying positions in substantially the same horizontal plane, a partition projecting inwardly from each end of said housing and terminating adjacent said plunger, said partitions dividing said housing into two parts, one part including the lowermost two respective stationary contacts and the other part including the uppermost two respective contacts, a spring mounted moving contact on the crank portion of said plunger, said moving contact being of a length to overlap said respective stationary contacts in each part of said housing, said crank being normally disposed substantially at right angles to said portions positioning said moving contact in operative relation to the respective stationary contacts in one part of said housing, said partitions having notches therein at the ends thereof adjacent said plunger to clear said crank portion and said moving contact upon depression and rotation of said plunger to displace said moving contact from said one housing part to the other in operative relation with the respective stationary contacts in said other part.

9. Apparatus as recited in claim 8 in which said partitions divide said housing into two parts having a width corresponding to the width of said moving contact forming a guide for said moving contact excepting at that portion of said notch which clears said moving contact.

10. An electrical switch comprising, a housing, a pair of spaced stationary contacts mounted in said housing, a plunger rotatably and slidably mounted in said housing, movable contact means rotatably mounted on said plunger for movement between respective positions in one of which said movable contact means is spaced from one stationary contact and in the other of which said movable contact means is engaged with the other stationary contact by rotation of said plunger, and guide means in said housing receiving said movable contact means and defining a path for movement of said movable contact means substantially paralleling the longitudinal axis of said plunger and preventing said movable contact means from following rotation of said plunger.

11. An electrical switch comprising, a housing, a pair of spaced stationary contacts mounted in said housing, a plunger rotatably and slidably mounted in said housing, movable contact means rotatably mounted on said plunger for movement between respective positions in one of which said movable contact means is spaced from one stationary contact and in the other of which said movable contact means is engaged with the other stationary contact by rotation of said plunger, means comprising a part of said movable contact means resiliently mounting said movable contact means for movement in a direction axially of said plunger, and guide means in said housing receiving said movable contact means and defining a path for movement of said movable contact means substantially paralleling the longitudinal axis of said plunger and preventing said movable contact means from following rotation of said plunger.

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