

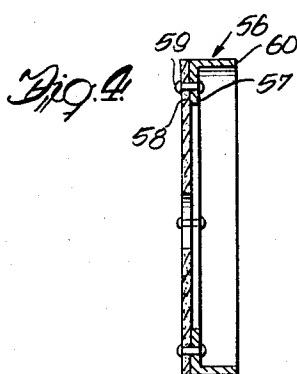
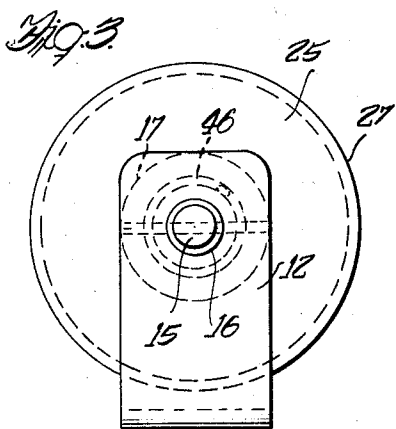
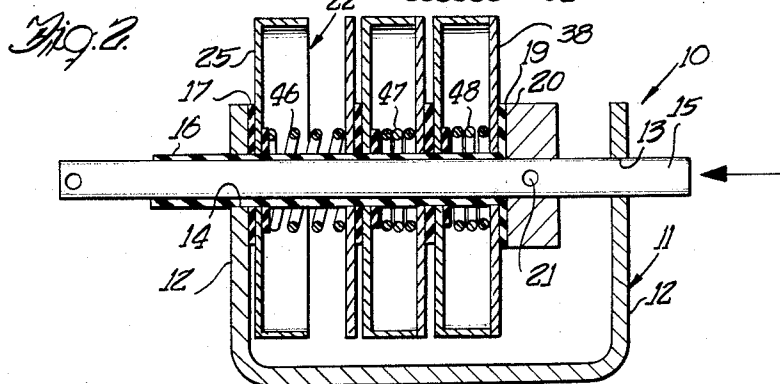
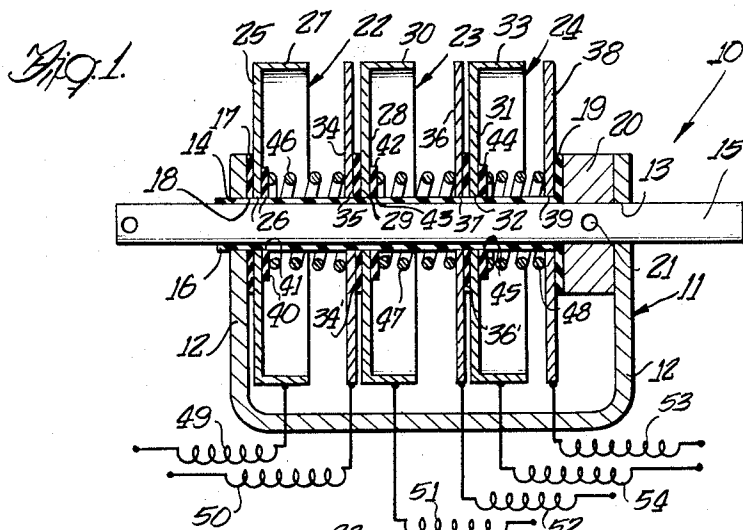
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MULTIPLE CONTACT ELECTRICAL SWITCH

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MULTIPLE CONTACT ELECTRICAL SWITCH

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This invention relates to electrical switches. More specifically the invention relates to a multiple contact electrical switch particularly useful in connection with heavy duty operation.

It is a prime object of this invention to provide an improved and greatly simplified electrical switch having a plurality of contacts which may be operated in sequence.

It is still another object of this invention to provide an improved multiple contact switch assembly particularly adapted for sequential operation, the assembly being such that additional switch elements and contacts may be readily added if desired.

It is still a further object of this invention to provide an improved heavy duty electrical switch with a plurality of switch elements and contacts which are normally kept in an open position by means of springs, the said springs having a varying modulus of strength whereby sequential operation results during the actuation of the switch, the springs being readily replaceable so that springs of equal strength can be utilized if simultaneous contact of all of the switch elements and contact elements is desired.

A more specific object is the provision of an improved heavy duty electrical switch comprising essentially a reciprocating elongated element carrying a plurality of switch elements and contacts, the said switch elements and contacts being separated by means of a plurality of springs having various strength factors, the said switch including a stop which is engageable by one of the switch elements during movement of the rod whereby the contacts will engage the switch elements in sequential operation.

These and further objects will become more readily apparent from a reading of the specification when examined in connection with the accompanying drawings:

Figure 1 is a cross sectional view through an improved electrical switch showing the contacts of the switch in an open position;

Figure 2 is a cross sectional view of the electrical switch shown in Figure 1, the said view showing a stage in sequential operation of the switch wherein two contact elements are shown in closed position;

Figure 3 is an end elevational view of the improved switch shown in Figures 1 and 2; and

Figure 4 is a cross sectional view through a switch element showing a modified construction.

Referring now particularly to Figures 1, 2 and 3, a multiple switch assembly is generally designated by the reference character 10. The multiple switch assembly 10 comprises a U-shaped frame or support 11 having laterally spaced support members 12 provided with aligned openings 13 and 14. An elongated actuating rod 15 is positioned to reciprocate with respect to the frame 11 through the aligned openings 13 and 14. A tubular electrical insulating member 16 is suitably threaded on the rod 15 to completely cover the same and to electrically insulate the said rod 15 with respect to the support members 12. The tubular member 16 may consist of fiber material and may be connected to the rod 15 by suitable bonding means.

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An electrical insulating washer 17 includes an opening 18 and the said washer 17 is supported on the rod 15 which is adapted to slide with respect to the opening 18. The washer 17 has limited sliding engagement on the rod 15 during movement of the rod 15 in one direction abutting the left support member 12 which, in effect, serves as a stop means. The tubular insulator 16 is also provided at one end with a washer 19 which serves as an electrical insulator with respect to a stop 20 secured to the rod 15 by means of a transversely extending pin 21.

A plurality of dish-shaped switch elements 22, 23 and 24 are slidably supported on the rod 15. The switch element 22 comprises a disk-shaped wall 25 having an opening 26 through which the rod 15 extends. The element 22 further comprises a peripherally extending annular flange 27 which serves as a contact. The dish-shaped switch element 23 comprises a disk type wall 28 having an opening 29 through which the rod 15 extends, the said element 23 also including a peripheral flange 30 which serves as a contact. The dish-shaped switch element 24 comprises a wall 31 having a hole 32 through which the rod 15 extends, the said wall including a peripherally extending flange 33 serving as a contact. The dish-shaped switch elements 22, 23 and 24 are spaced in longitudinally spaced relation on the rod 15. A contact plate 34 having an opening 35 is supported on the rod 15 between the switch elements 22 and 23. A contact element 36 having an opening 37 is positioned between the switch elements 23 and 24. A contact plate or element 38 is positioned between the switch element 24 and the stop 20. Electrical insulating washers 34' and 36' are respectively positioned between the contact plates 34 and switch element 23, and between the contact plate 36 and switch element 24. An electrical insulating disk 40 having an opening 41 is positioned immediately adjacent the wall 25 of the switch element 22. An electrical insulating washer 42 having an opening 43 is positioned against the wall 28 of the switch element 23. An electrical insulating washer 44 is positioned against the wall 31 of the switch element 24. The washer 44 includes an opening 45 through which the rod 15 is threaded. A plurality of coil springs 46, 47 and 48 are supported on the rod 15. The coil spring 46 is positioned between the switch elements 22 and the plate 34. The spring 47 is positioned between the switch element 23 and the contact element 36. The spring 48 is positioned between the switch element 24 and the disk 19 and stop 20. The coil springs are so positioned as to urge the switch elements and contact plates in a direction toward the stop 20. Thus the springs force the stop 20 against the right support 12 as shown in Figure 1.

Electrical conductors 49 and 50 are respectively connected to the switch element 22 and the contact plate 50. Electrical conductors 51 and 52 are respectively connected to the switch element 23 and contact plate 36. Electrical conductors 53 and 54 are respectively connected to the switch element 24 and the contact plate 38.

In the operation of the switch assembly shown in Figures 1, 2 and 3, actuation of the switch is obtained by moving the rod 15 in the direction of the arrow shown in Figure 2. The rod 15 may be moved in this direction by a solenoid (not shown), by a suitable governor (not shown), by a manual lever (not shown), or by any other suitable actuating means wherein the shaft 15 may be moved in the direction of the arrow.

If sequential operation of the switches 22, 23, and 24 is desired, then the spring 46 will be heavier having a heavier modulus of strength than the spring 47. Likewise the spring 47 will have a greater modulus of strength than the spring 48. Thus when movement of the rod 15 is in the direction of the arrow shown in Figure 2, the contact plate 38 will initially engage the flange 33 thus clos-

ing the electrical circuit made by conductors 53 and 54. Upon continued movement of the rod 15, the contact plate 36 will engage the flange 30 making connection between the conductors 51 and 52. Since the spring 46 is the heavier, the last to close will be the contact 34 with respect to the flange 27. Thus it can be seen that sequential operation of the switch is accomplished. By merely changing the springs to secure different strength factors, different sequences of operation can result. Or if all of the springs are of the same strength, simultaneous closing of all the circuits will be accomplished. While three switch elements and contact plates have been shown, it is, of course, readily apparent that many more may be assembled on a suitable frame with similar satisfactory operation. Furthermore, the switch may be constructed with only two switch elements and contact plates.

Another sequence of operation for instance could be had by constructing the spring 47, heavier than the other springs, the said springs 47 thus having a considerably greater strength factor. Thus upon operation of the rod 50 the switch element 23 and contact plate 36 would close last. Thus it can be seen that many different arrangements can be satisfactorily accomplished. If sequential operation is desired from a single source of electricity, the contact plates 34, 36, washers 34', 36' and the conductors 50, and 52 can be eliminated and the switch may be operated in sequence or in concert depending upon the strength of the springs employed.

The modification shown in Figure 4 shows a switch element 56 having an annular wall 57 to which an electrical insulating disk 58 is connected by means of rivets 59. The disk 58 may be of fiber or similar electrical insulating material. The wall 57 is also provided with a flange or annular contact element 60. This, and other similar arrangements can be used with this switch.

It can be seen in Figures 1 and 2 that in all instances the electrical conducting parts are suitably insulated from each other. Various devices, of course, can be included for achieving such insulation in different ways. It is readily now apparent that the objects of the invention have been fully achieved and that an improved heavy duty electrical switch has been provided. Changes and modifications may be made without departing from the spirit of the invention as disclosed or the scope thereof as defined in the appended claims.

What is claimed is:

1. A multiple electrical switch comprising a U-shaped support having a pair of laterally spaced generally aligned support members, a rod slidably supported on said support members, a tubular electrical insulator covering a portion of said rod and movable therewith, first and second dish shaped switch members slidably positioned on said tubular insulator in relative longitudinally spaced and coaxially aligned relation between said support members, each of said dish shaped switch members having peripherally disposed annular flanges providing contact surfaces, first and second contact disks slidably positioned on said tubular insulator in longitudinally spaced relation, said first disk being disposed between said first and second switch members and being electrically insulated with respect to said second switch member, a stop element on said rod between one of said support members and said second switch member, said second disk being electrically insulated from said stop and being positioned between said stop and said second switch member, a first spring positioned on said tubular insulator between said first switch member and said first disk, and a second spring on said tubular insulator between said second disk and said second switch member, said springs normally urging said disks in a first direction toward said stop, said springs having a different modulus of strength whereby during movement of said rod in a direction to compress said springs, said stop engages said second disk to move the same, and one spring is initially compressed to a

greater degree than the other spring whereby said disks are moved sequentially into contact with said contact surfaces of said first and second switch members.

2. A multiple electrical switch comprising a support, a rod slidably supported on said support, a tubular electrical insulator covering a portion of said rod and movable therewith, first and second dish-shaped switch members slidably positioned on said tubular insulator in relative longitudinally spaced and coaxially aligned relation, each of said dish-shaped switch members having peripherally disposed annular flanges providing contact surfaces, first and second contact disks slidably positioned on said tubular insulator in longitudinally spaced relation, said first disk being disposed between said first and second switch members and being electrically insulated with respect to said second switch member, a stop element on said rod disposed adjacent said second switch member, said second disk being electrically insulated from said stop and being positioned between said stop and said second switch member, a first spring positioned on said tubular insulator between said first switch member and said first disk, and a second spring on said tubular insulator between said second disk and said second switch member, said springs normally urging said disks in a first direction toward said stop, said springs having a different modulus of strength whereby during movement of said rod in a direction to compress said springs, said stop engages said second disk to move the same, and one spring is initially compressed to a greater degree than the other spring whereby said disks are moved sequentially into contact with said contact surfaces of said first and second switch members.

3. A multiple electrical switch comprising a support, a rod slidably supported on said support, a tubular electrical insulator covering a portion of said rod and movable therewith, first and second dish-shaped switch members slidably positioned on said tubular insulator in relative longitudinally spaced and coaxially aligned relation, each of said switch members having contact surfaces, first and second contact disks slidably positioned on said tubular insulator in longitudinally spaced relation, said first disk being disposed between said first and second switch members and being electrically insulated with respect to said second switch member, a stop element on said rod disposed adjacent said second switch member, said second disk being electrically insulated from said stop and being positioned between said stop and said second switch member, a first spring positioned on said tubular insulator between said first switch member and said first disk, and a second spring on said tubular insulator between said second disk and said second switch member, said springs normally urging said disks in a first direction toward said stop, said springs having a different modulus of strength whereby during movement of said rod in a direction to compress said springs, said stop engages said second disk to move the same, and one spring is initially compressed to a greater degree than the other spring whereby said disks are moved sequentially into contact with said contact surfaces of said first and second switch members.

4. A multiple electrical switch comprising a support, a rod slidably supported on said support, a tubular electrical insulator on said rod and movable therewith, first and second dish-shaped switch members slidably positioned on said tubular insulator in relative longitudinally spaced and coaxially aligned relation, each of said switch members having contact surfaces, first and second contact disks slidably positioned on said tubular insulator in longitudinally spaced relation, said first disk being disposed between said first and second switch members, a stop element on said rod disposed adjacent said second switch member, said second disk being positioned between said stop and said second switch member, a first spring positioned on said tubular insulator between said first switch member and said first disk, and a second spring

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on said tubular insulator between said second disk and said second switch member, said springs normally urging said disks in a first direction toward said stop, said springs having a different modulus of strength whereby during movement of said rod in a direction to compress said springs, said stop engages said second disk to move the same, and one spring is initially compressed to a greater degree than the other spring whereby said disks are moved sequentially into contact with said contact surfaces of said first and second switch members.

5. A multiple electrical switch comprising a support, an actuating member slidably supported on said support, first and second switch members slidably positioned on said actuating member in relative longitudinally spaced and coaxially aligned relation and being electrically insulated with respect to said actuating member, each of said switch members having contact surfaces, first and second contact disks slidably positioned on said actuating member in longitudinally spaced relation, said first disk being disposed between said first and second switch members, a first stop element on said rod disposed adjacent said second switch member, said second disk being positioned between said stop and said second switch member, a second stop element on said support engageable by said first switch member, a first spring positioned between said first switch member and said first disk, and a second spring between said second disk and said second switch member, said springs normally urging said disks in a first direction toward said first stop, said springs having a different modulus of strength whereby during movement of said actuating member in a direction toward said second stop to compress said springs, said first stop engages said second disk to move the same, said first switch member engages said second stop and one spring is initially compressed to a greater degree than the other spring whereby said disks are moved sequentially into contact with said contact surfaces of said first and second switch members.

6. A multiple electrical switch comprising a support, an actuating rod positioned on said support for relative reciprocation, said support including a first stop member, first and second switch elements slidably positioned on said rod, said first and second switch elements having contact surfaces extending transversely with respect to said rod, a first contact member positioned in sliding relation on said rod between said first and second switch elements, a second stop member on said rod, a second contact member slidably positioned on said rod between said second stop and said second switch elements, a first spring on said rod between said switch element and said first contact member, a second spring between second switch element and said second contact member, said springs normally urging said switch elements and contact member in a direction toward said second stop, said springs having a different modulus of strength whereby during movement of said rod and second stop toward said first stop, said first switch element engages said first stop and said contact members are moved in sequence into engagement with said contact surfaces.

7. A multiple electrical switch comprising a support, an actuating rod positioned on said support for relative reciprocation, said support including a first stop member, first and second switch elements slidably positioned on said rod, said first and second switch elements having contact surfaces extending transversely with respect to said rod, a first contact member positioned in sliding relation on said rod between said first and second switch elements, a second stop member on said rod, a second contact member slidably positioned on said rod between said second stop and said second switch elements, a first resilient member between said switch element and said first contact member, a second resilient member between second switch element and said second contact member, said resilient member normally urging said switch elements and contact member in a direction to-

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ward said second stop, said resilient member having a different modulus of strength whereby during movement of said rod and second stop toward said first stop, said first switch element engages said first stop and said contact members and second switch element are moved toward said first switch element whereby said contact members are moved in sequence into engagement with said contact surfaces.

8. A multiple electrical switch comprising a support, an actuating rod positioned on said support for relative reciprocation, said support including a first stop member, first and second switch elements movably positioned on said rod, said first and second switch elements having contact surfaces extending transversely with respect to said rod, a first contact member movably positioned between said first and second switch elements, a second stop member movably positioned on said rod, a second contact member movably positioned on said rod between said second stop and said second switch elements, a first resilient member between said switch element and said first contact member, a second resilient member between second switch element and said second contact member, said resilient member normally urging said switch elements and contact member in a direction toward said second stop, said resilient member having a different modulus of strength whereby during movement of said rod and second stop toward said first stop, said first switch element engages said first stop and said contact members and second switch element are moved toward said first switch element whereby said contact members are moved in sequence into engagement with said contact surfaces.

9. An electric switch comprising a support, an elongated member reciprocally positioned on said support, a first stop on said support, a first switch element supported on said elongated member for relative sliding movement and adapted to engage said first stop, a second switch element slidably supported on said elongated member in longitudinally spaced relation with respect to said first switch member, a first contact member slidably supported on said elongated member between said first switch element and said second switch element, first spring means urging said first contact member and said second switch element in a first direction away from said first stop, a second stop on said elongated member, a second contact member between said second stop and said second switch element, and second spring means urging said second contact element in the first direction, said spring means having a different modulus of strength whereby during movement of said elongated member in a second direction toward said first stop said second stop engages said second contact member, and said springs are compressed and said contact members make contact with said switch elements in sequence.

10. An electric switch comprising a support, an elongated member reciprocally positioned on said support, a stop on said support, a first switch element supported on said elongated member for relative sliding movement and adapted to engage said stop, a second switch element slidably supported on said elongated member in longitudinally spaced relation with respect to said first switch member, a first contact member slidably supported on said elongated member between said first switch element and said second switch element, first spring means urging said first contact member and said second switch element in a first direction away from said stop, a second contact member on said elongated member spaced from said second switch element, and second spring means urging said second contact element in the first direction, said spring means having a different modulus of strength whereby during movement of said elongated member in a second direction toward said stop said springs are compressed and said contact members make contact with said switch elements in sequence.

11. An electric switch comprising a support, an elongated member reciprocally positioned on said support, a stop on said support, a first switch element supported on said elongated member for relative sliding movement and adapted to engage said stop, a second switch element slidably supported on said elongated member in longitudinally spaced relation with respect to said first switch member, a first contact member slidably supported on said elongated member between said first switch element and said second switch element, first spring means urging said first contact member and said second switch element in a first direction away from said stop, a second contact member on said elongated member spaced from said second switch element, and second spring means urging said second contact element in the first direction, said spring means having a different modulus of strength whereby during movement of said elongated member in a second direction toward said stop said springs are compressed and said contact members make contact with said switch elements in sequence.

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gated member reciprocally positioned on said support, a stop on said support, a first switch element supported on said elongated member for relative sliding movement and adapted to engage said stop, a second switch element slidingly supported on said elongated member in longitudinally spaced relation with respect to said first switch member, a first contact member slidingly supported on said elongated member between said first switch element and said second switch element, first spring means urging said first contact member and said second switch element in a first direction away from said stop, a second contact member on said elongated member spaced from said second switch element, and second spring means

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urging said second contact element in the first direction away from said second switch element, whereby during movement of said elongated member in a second direction toward said stop said springs are compressed and said contact members make contact with said switch elements.

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