March 24, 1964 E. A. JONES 3,126,457

MULTIPLE SWITCHING ASSEMBLY

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FIG. 1.

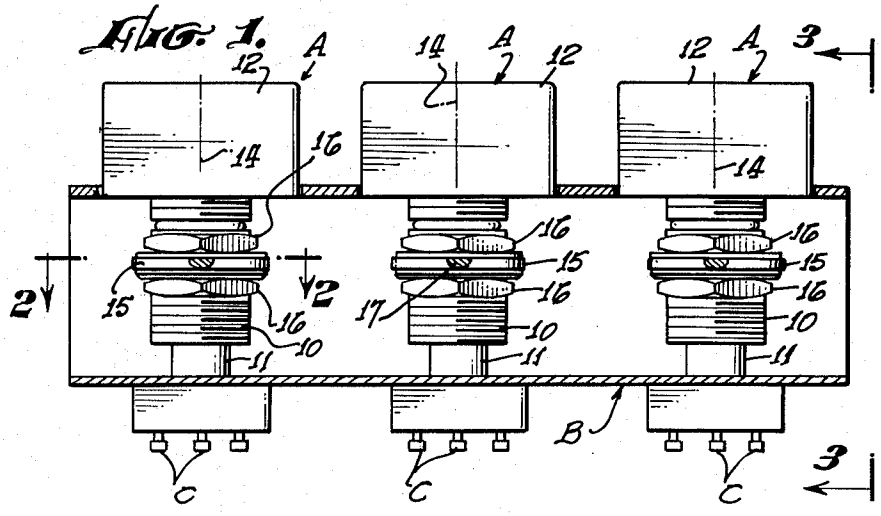


FIG. 2.

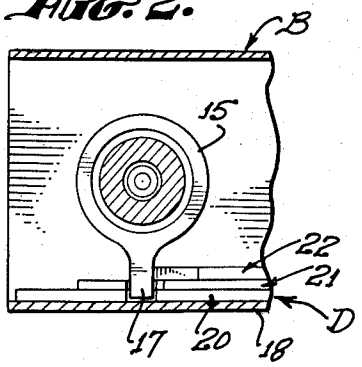
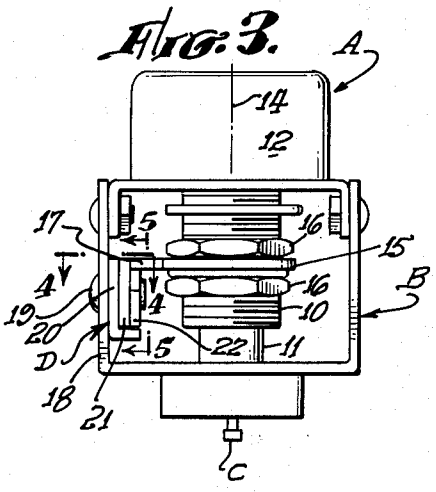


FIG. 3.



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FIG. 4.

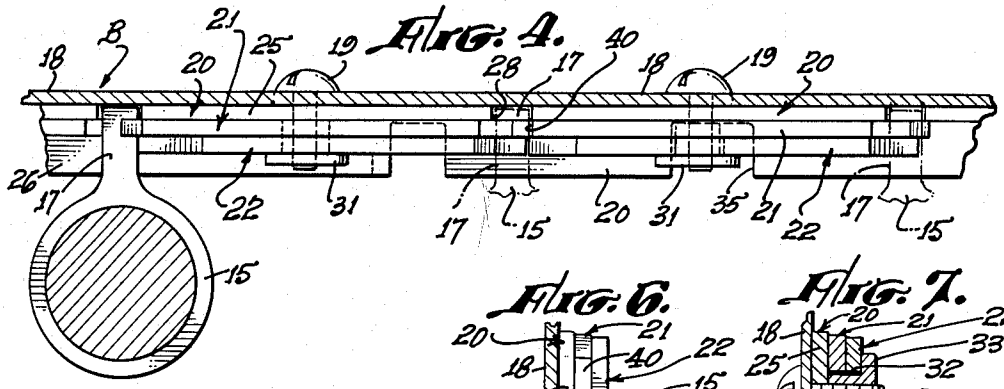


FIG. 6.

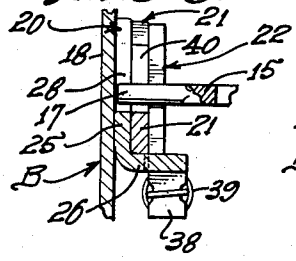


FIG. 7.

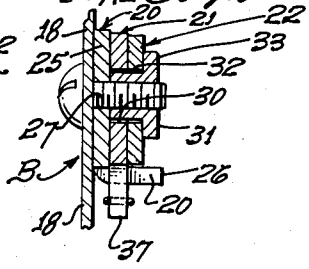


FIG. 5.

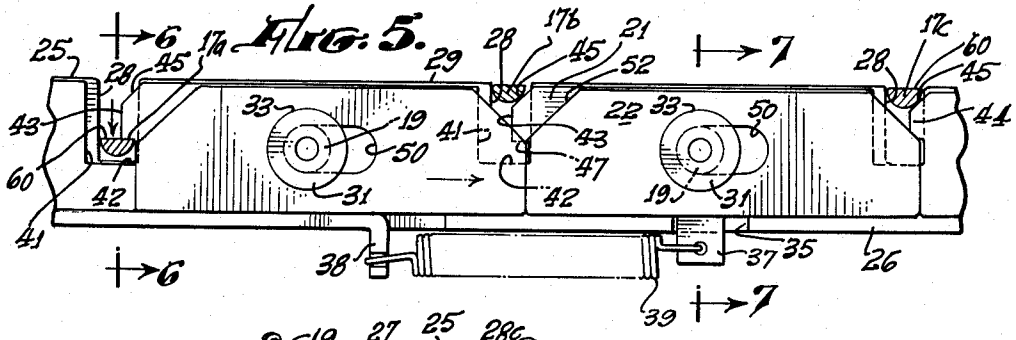
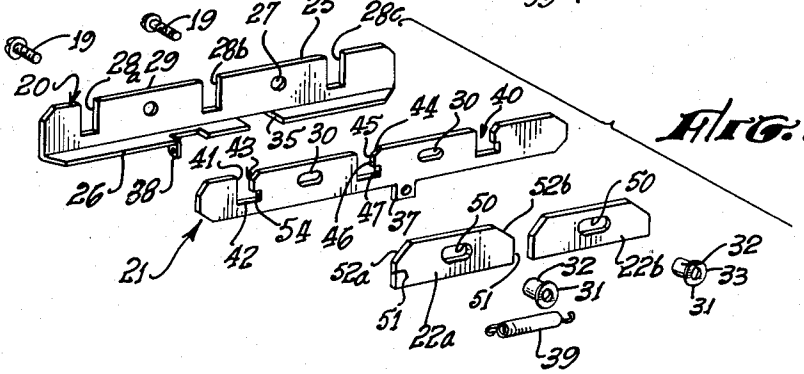


FIG. 8.



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3,126,457

MULTIPLE SWITCHING ASSEMBLY

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3 Claims. (Cl. 200—5)

This invention relates to electric switches and more particularly to an electric switch assembly utilizing a plurality of electrical switching units.

In many applications a plurality of electrical switches are so arranged and electrically connected that they must be operated in a given program or sequential series and it is necessary that no more than one switch be operable at the same time. That is, for example, in many types of control centers and complex electrical circuitry, it is necessary to utilize a large number of switches to carry out various functions of the circuit or the apparatus in such a manner that the operation of one switch must precede another. For many similar reasons it is imperative that a switching arrangement be utilized in which two switches cannot be operated simultaneously.

The present invention provides a gang switch whereby a plurality of electrical switching units are utilized in a single switching assembly in such a manner that only one of the switching units can be operated at a given time. The types of switches employed in connection with the present invention are push-type switches which are depressed to actuate. By means of the present invention the depression of one switch causes the release of any other previously depressed switch in the assembly and only one switch can be depressed at a time.

It is an object of the present invention to provide an electrical switching assembly in which a plurality of push-button type switches are utilized, whereby only one of the plurality can be actuated at a time.

It is another object of the present invention to provide such an electrical switching assembly which is simple in construction and positive in action.

Another object of the present invention is to provide an electrical switching assembly including a plurality of push-button type switches wherein the depression of one switch automatically releases a previously depressed switch of the plurality.

It is a further object of the present invention to provide such a switching assembly which includes a plurality of push-button type switches wherein an interlock in the apparatus retains a first switch in the down or actuated position until the first switch is released by the depression of a second switch in the assembly.

The novel features which are believed to be characteristic of the invention both as to its organization and method of operation, together with further objects and advantages thereof, will be better understood from the following description considered in connection with the accompanying drawings in which a presently preferred embodiment of the invention is illustrated by way of example. It is to be expressly understood, however, that the drawings are for the purpose of illustration and description only, and are not intended as a definition of the limits of the invention.

In the drawings:

FIGURE 1 is a view in elevation of a presently preferred embodiment of the present invention utilizing three push-button type switches as an illustrative embodiment;

FIGURE 2 is a partial view in section taken along line 2—2 of FIGURE 1;

FIGURE 3 is a view in elevation taken along line 3—3 of FIGURE 1;

FIGURE 4 is a plan view, partly in section, of the track assembly of the present invention taken along line 4—4 of FIGURE 3;

FIGURE 5 is a view in elevation corresponding to FIGURE 4;

FIGURE 6 is a view in section taken along line 6—6 of FIGURE 5;

FIGURE 7 is a view in section taken along line 7—7 of FIGURE 5; and

FIGURE 8 is an exploded view in perspective showing the various elements of the track assembly of the present invention.

Referring now to the drawings, three switches are utilized throughout the following specification as illustrative of the invention. It is to be understood that the present invention is equally applicable to any plurality of switches and that the use of three switches is illustrative only. The switches which are shown in connection with the present invention are of an illustrative type only, and other switches for carrying out various functions by way of a switch which is depressed for actuation or deactuation can also be used. Referring now to FIGURES 1, 2 and 3, the switching assembly of the present invention includes a plurality of push-button switches A which are positioned within the housing B. The switches act to actuate circuit elements connected to the switches by means of terminals C exteriorly of the housing. The switch includes in general a longitudinally movable section **10** and a stationary section **11**. In the embodiment shown the movable section **10** is affixed to the actuating button **12** of the switch and is movable along the center-line **14** of the switch. Thus, hereinafter the movable portion **10** of the switch is referred to as the plunger **10** while the stationary member **11** is referred to as the stem **11**. The switches shown are thus two position switches. For clarity and simplicity of discussion it will be assumed that the switches are "on"—"off" switches by which the circuit connected to the switch is actuated to an "on" position when the switch and plunger **10** are depressed and released to an "off" position when the switch and plunger are released to the up position as shown in FIGURE 1. It is to be understood, however, that the switches utilized in the switching assembly of the present invention can be employed to operate circuitry other than in an on-off manner. No electrical connections are shown to the various terminal C of the plurality of switches. In addition, for purposes of clarity of description, the movement of the switch plunger **10** will be described hereinafter as being vertical such that the plunger **10** is vertically movable with respect to the stem **11** and the plunger **10** acts as a female unit slidably engaged with the male unit **11**. It will be understood, of course, that the orientation is relative only.

Upon each of the plungers **10** of the plurality of switches there is affixed an actuating member **15** as shown in FIGURES 1, 2 and 3. In the presently preferred embodiment the actuating member is a ring-shaped member engaged upon the plunger by means of oppositely disposed lock nuts **16** at each side thereof. The actuating member **15** includes an integrally formed actuating arm **17** which extends radially therefrom a substantial distance. Thus, the actuating arm **17** moves from a first or upper position to a second or lower position when the switch is depressed and returns from the lower to the upper position when the switch is released. Retention of the actuating arm **17** in either the upper or lower position will retain the switch in the corresponding position since the actuating arm is affixed to the movable portion of the switch. In the embodiment shown, the housing B is rectangular in transverse cross-section with a forward housing wall **18**. Affixed to the forward wall is the track assembly D in accordance with the present invention.

The forward wall **18** is spaced from the center-line of the switch by a substantial distance and the actuating arm **17** is of sufficient length that it extends radially outward from the actuating member **15** by a distance substantially equal to, but less than, the distance to the inner surface of the forward wall **18**. The distance by which the wall is spaced outward from the switch is sufficient to accommodate the track assembly D affixed to the forward wall. Thus, as shown in FIGURE 3, the track assembly is connected by means of rivets **19** or other suitable affixing members.

Referring now particularly to FIGURES 3–5 the track assembly includes, in general, an actuating arm guide **20**, a locking slide **21** and a plurality of interlocking slides **22**. The actuating arm guide **20** is mounted stationarily with respect to the forward wall **18** of the assembly housing while the locking slide **21** and the interlocking slides **22** are movable with respect to the housing and actuating arm guide **20**. The actuating arm guide member **20** is an elongate member formed of metal plates or the like and is of substantially right angular transverse cross-sectional configuration with an upstanding wall **25** and a flange **26** at the lower edge thereof. The upstanding wall **25** is formed to be affixed to the front wall **18** of the housing and accordingly openings **27** are provided therethrough mateable with the bolts **19** or rivets which retain the track assembly on the forward wall **18** of the housing. Spaced longitudinally along the actuating arm guide member are a plurality of indentations **28** extending from the upper edge **29** of the upstanding wall vertically downward partially through the depth of the wall. The indentations **28** are spaced longitudinally at a distance corresponding to the actuating arms **17** of the respective switches in the assembly and the width of the indentations **28** are slightly greater than the width of the actuating arm. Thus, the actuating arms are movable vertically within the indentations **28** and the depth of the indentations is such that the actuating arm is freely movable from the upper to the lower position.

The locking slide **21** is an elongate plate-like member having a height substantially equal to the height of the upstanding wall of the flange **26**. The locking slide is resiliently mounted upon the actuating arm guide and is longitudinally movable with respect thereto. In the embodiment shown the required longitudinal movement is obtained by forming slots **30** in the locking slide which slots are alignable with the openings **27** through the wall **25** of the arm guide member **20**. The movement is obtained by forming the slots **30** of greater longitudinal extent than the fastening means which extend therethrough. Thus, in the embodiment shown, a bolt **19** is used with a nut **31** which includes a bearing shoulder **32** which extends from the retaining flange **33** (FIGURE 7) through the thickness of the interlocking slides and the locking slide **21**. The longitudinal extent of the opening **30** through the locking slide is therefore greater than the diameter of the bearing **32** by an amount substantially equal to the longitudinal movement of the locking slide which is desired. In order to resiliently mount the locking slide with respect to the actuating arm guide an indentation **35** is provided in the flange **26** and an ear **37** is formed at the lower edge of the locking slide extending downwardly therefrom by a distance greater than the thickness of the flange **26**. A second ear **38** is formed on the flange **26** to extend therebelow. Thus, a spring **39** mounted between the ears **37** and **38** in tension will urge the locking slide toward the ear **38**. The direction of movement due to the spring is therefore to the left in the figures. A plurality of indentations **40** are formed in the locking slide extending downwardly from the upper edge thereof. The indentations **40** are spaced apart in a mateable arrangement with the fixed indentations **28** of the actuating arm guide **20**. The indentations **40** are defined by a vertically extending edge **41**, a bottom edge **42** and a locking edge **43**. The bottom edge **42** defining the full width of the indentation is greater than the width of the indentation **28** in the actuating arm guide by an amount approximately equal to the amount of movement of the locking slide. The locking edge **43** includes an inwardly extending protrusion **44** having an inwardly and downwardly tapered upper face **45**, a substantially vertically extending face **46** and a downwardly facing shoulder **47**, which shoulder is spaced above the lower edge **42** of the indentation **40**. Although it is substantially vertically extending, the face **46** has a slight downward and outward taper in the presently preferred embodiment of about two percent for ease of release, as will become more apparent hereinafter. The distance between the vertical edge **41** of the indentation and the vertically extending face **46** of the protrusion is aproximately equal to the width of the indentation **28** in the actuating arm guide **20**, and is thus approximately equal to but greater than the width of the actuating arm **17** of the switch. The interdependency of the indentations **28** and **40** and the extent of movement by which the locking slide is moved relative to the actuating arm guide will be more apparent hereinafter in connection with the operation of the apparatus.

The interlocking slides are each elongate plate-like members which are mounted juxtaposed to the locking slide above the flange **26** of the actuating arm guide. The interlocking slides are each movable about one of the fastening means **19** and are of an elongate length determined by the distance between the indentations **28** and **40** of the actuating arm guide and locking slide respectively. Thus, the interlocking slides are of a height approximately equal to the height of the locking slide. Through each of the interlocking slides **22** there is provided a slot **50** substantially equal in length to the slot **30** through the locking slide. The interlocking slide **22** is longitudinally movable about the fastener bearing **32** in a manner similar to that described in connection with the locking slide above. The interlocking slides are independently movable along the assembly and are thus movable with respect to the actuating arm guide and with respect to the locking slide. The interlocking slides have a vertically depending end surface **51** and an outwardly and downwardly inclined end face **52** which is referred to hereinafter as the release face of the apparatus. The length of the interlocking slides are each equal to the distance between the vertical edge **41** of one indentation **40***a* in the locking slide and the vertical wall **54** beneath the shoulder **47** of the next adjacent indentation **49***b*.

The operation of the present invention can best be seen by particular reference to FIGURES 4 through 8 of the drawings. As discussed hereinbefore, the three actuating arms **17** of the respective three switches are normally urged by the switches themselves to the upper position. As shown in FIGURE 5, the actuating arm **17***a* is in the lower or actuated position while the actuating arms **17***b* and **17***c* are in the upper position. From the foregoing it can be seen that when one of the actuating arms **17***a* is pressed downwardly in the indentation **28** of the actuating arm guide it will urge the locking slide **21** to the right in the figures by the action of the arm upon the inwardly and downwardly inclined face **45**. Thus, when the plunger **17***a* is pushed downward in the indentation **28**, in order for it to progress downwardly, it causes the locking slide to be moved to the right against the action of the spring **39**. When the plunger has been depressed below the vertical edge **46** of the protrusion **44** the slide will again be urged to the left by the spring action and the plunger is retained in the downward position by the shoulder **47** acting upon the upper face **60** of the actuating arm **17**.

It can also be seen with reference to FIGURES 4 through 8 and particularly FIGURE 5, that by the downward movement of the actuating arm **17** the interlocking slide **22***a* has been forced to the right by the action of the actuating arm moving downwardly along the in-

clined release face **52** of the interlocking slide **22***a*. By the downward movement of the plunger and the corresponding movement to the right of the interlocking slide **22***a* and the slide **22***a* has been moved to the position at which it abuts the next adjoining interlocking slide **22***b*. The surface **52***b* of the interlocking slide **22***a* then blocks the indentations **28** and **40** beneath the actuating arms **17***b* and **17***c*. That is, the interlocking slides are of such length and are free to move through such a longitudinal distance that they may be separated by the width of a plunger arm but when so separated are abutted so that they can not be separated any additional amount sufficient for the entering of a second one of the actuating arms. Thus, to further illustrate, if the actutaing arm **17***b* is depressed it will move downward in the indentation **28***b* and **40***b* until it comes to rest against the inclined edge **45** of the locking slide. The downward force of the actuating arm then urges the locking slide to the right, thereby releasing the actuating arm **17***a* since the slide is moved sufficiently to remove the shoulder **47** from above the actuating arm **17***a*. Subsequently, the actuating arm **17***b* comes to bear against the release face **52***b* of the interlocking slide **22***a* and causes it to be urged to the left in FIGURE 5. The actuating arm **17***b* cannot descend into the actuated position of the switch until the interlocking slide has been moved sufficiently to the left to clear the indentation **28***b* and allow the vertical travel of the actuating arm **17***b* to the position beneath the shoulder **47** of the locking slide.

Accordingly, the interlocking slide **22***a* cannot move sufficiently far to the left to allow the depression of the second actuating arm **17***b* until the first actuating arm **17***a* has been moved upward to the upper position of the switch. When this upward movement of the actuating arm **17***a* has come about, the slide assembly is in a free condition and the actuating arm **17***b* will move the interlocking slide **22***a* to the left while simultaneously moving the locking slide **21** to the right until the actuating arm has passed beneath the vertical edge **46** of the indentation **40***b* of the locking slide. The locking slide is then moved to the left by the spring assembly. The shoulder **47** retains the actuating arm **17***b* in the downward position until the interlocking slides and locking slides are again moved to the position at which the actuating arm **17***b* can be moved upward.

Accordingly, it can be seen that the present invention provides a switching assembly by means of which a plurality of switches can be utilized, which switches are actuated by downward movement of the switch. The slide assembly prevents the simultaneous actuation of two switches and will not allow the actuation of a second switch until the first switch has been deactuated.

What is claimed is:

1. A multiple electric switch assembly comprising: a plurality of switches, each of said switches including a plunger section movable along the axis of said switch from a non-actuated to a depressed actuated position of said switch; a housing, said switches positioned upon said housing with the axes thereof substantially parallel; a radially extending actuating arm affixed to said plunger for movement therewith; a track assembly affixed to said housing, said track assembly including means for restraining the direction of travel of said actuating arms linearly from a non-actuated to a depressed position, a locking slide member and a plurality of interlocking members, said slide member comprising an elongate plate having an upper edge proximate said arms in the non-actuated position thereof, said slide member being longitudinally movable from a first to a second position transversely to the direction of movement of said arms, said slide member defining a plurality of indentations extending from said upper edge, each of said indentations being aligned with a respective one of said arms, said arm being mateable therewith and movable therein to the depressed position, said indentation defining a downwardly facing shoulder above said arm in the depressed position of said arm when said slide member is in the second position thereof; said interlocking members being movable transverse to the direction of movement of said arms, said interlocking members being longitudinally separable to define a space therebetween aligned with one of said indentations only and movable to define said space in alignment with each of said indentations selectively.

2. A multiple electric switch assembly comprising: a plurality of switches, each of said switches including a plunger section movable along the axis of said switch from a non-actuated to a depressed actuated position of said switch; a housing, said switches positioned upon said housing with the axes thereof substantially parallel; a radially extending actuating arm affixed to said plunger for movement therewith; a track assembly including an elongate guide member, an elongate slide member, and a plurality of elongate interlocking members in juxtaposed relationship, said slide member and said interlocking members being movable from a first to a second position with respect to said guide member, each of said members defining indentations extending from the upper edge thereof into which a respective arm of said plurality is movable, said indentations being aligned at said first position of said members, at said first position said interlocking members being longitudinally separable to a first position to provide a space aligned with one of said aligned indentations in said guide member and slide member, said interlocking members at said first position being of such length to span each of said remaining plurality of indentations; said slide member defining a downwardly facing shoulder engageable with said actuating arm in the depressed position thereof when said slide member is in said second position.

3. A multiple electric switch assembly comprising: a plurality of switches, each of said switches including a plunger section movable along the axis of said switch from a non-actuated to a depressed actuated position of said switch, a radially extending actuating arm affixed to said plunger for movement therewith, said arm having an upward substantially transverse bearing face and a convex-concave lower surface; a housing, said switches positioned upon said housing with the axes thereof substantially parallel; a track assembly including an elongate guide member, a juxtaposed elongate slide member, and a juxtaposed plurality of elongate interlocking members, said slide member and said interlocking members being movable from a first to a second position with respect to said guide member, said guide member and said interlocking member defining indentations extending from the upper edge thereof into which a respective arm of said plurality is movable, said indentations being aligned at said first position of said slide member, said indentations in said slide member each defining a downwardlly facing shoulder above said arm in the depressed position of said arm when said slide member is in the second position thereof, each of said indentations in said slide member defining an upwardly facing tapered surface such that said slide member is moved into said first position by said convex-concave surface of said actuating arm when said actuating arm is moved to the depressed position; said interlocknig members being a plurality of transversely movable members longitudinally separable to a first position to define a space therebetween aligned with one of said indentations of said guide member and said slide member, said space being substantially equal to the width of said arm, said plurality of interlocking members in said first position being in abutting contact where said space is not defined to close said indentations except said one indentation, said plurality being movable to a second position to define said space in alignment with each of said indentations selectively, each of said interlocking members having an upwardly facing tapered surface coactable with said convex-concave surface when one of said arms is moved to the depressed position.

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