June 23, 1970 J. R. BAILEY ET AL 3,517,140

PUSHBUTTON SWITCH MEANS

Filed Sept. 20, 1968 4 Sheets-Sheet 1

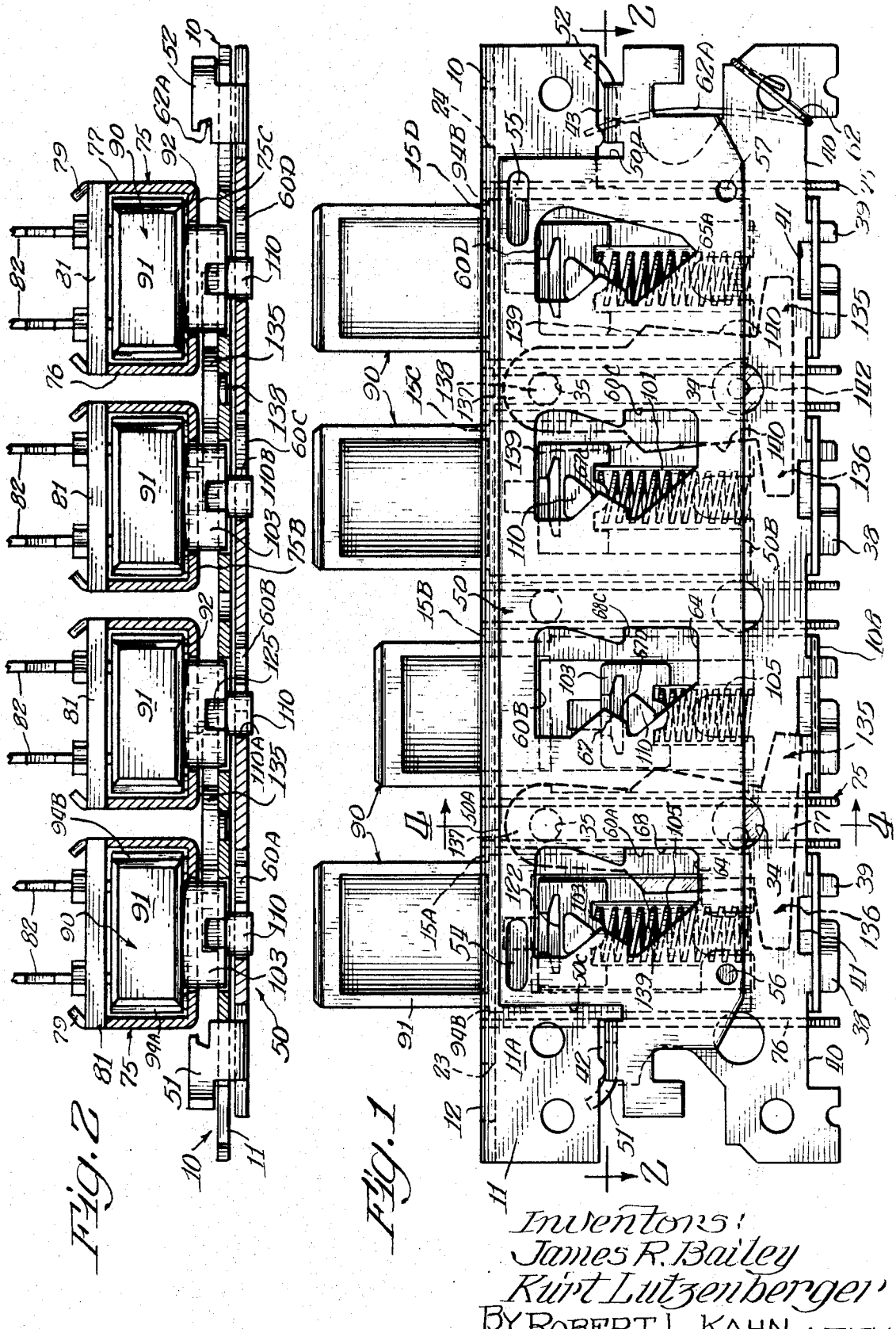

Fig. 1

Fig. 2

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PUSHBUTTON SWITCH MEANS

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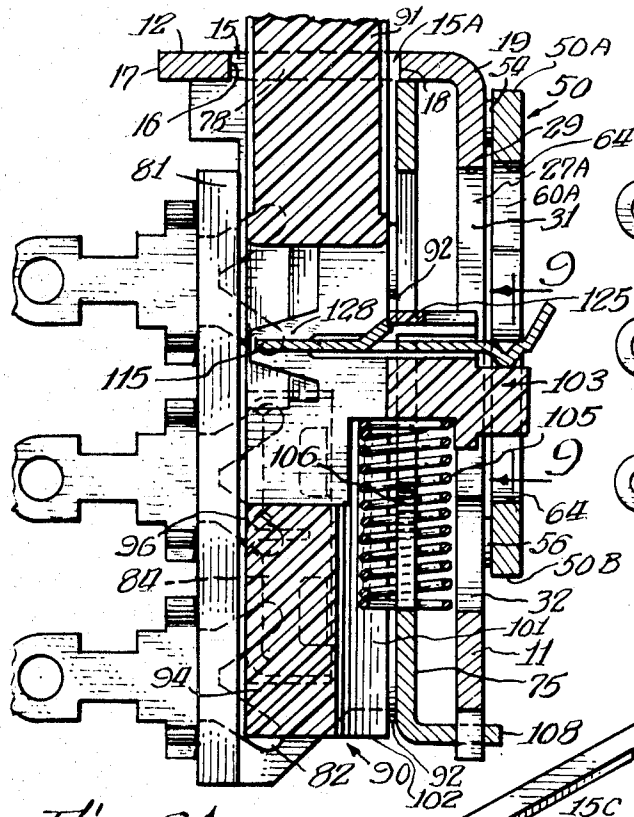

Fig. 6

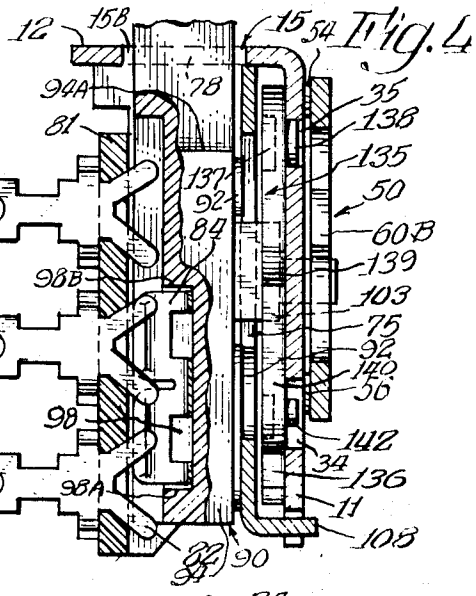

Fig. 4

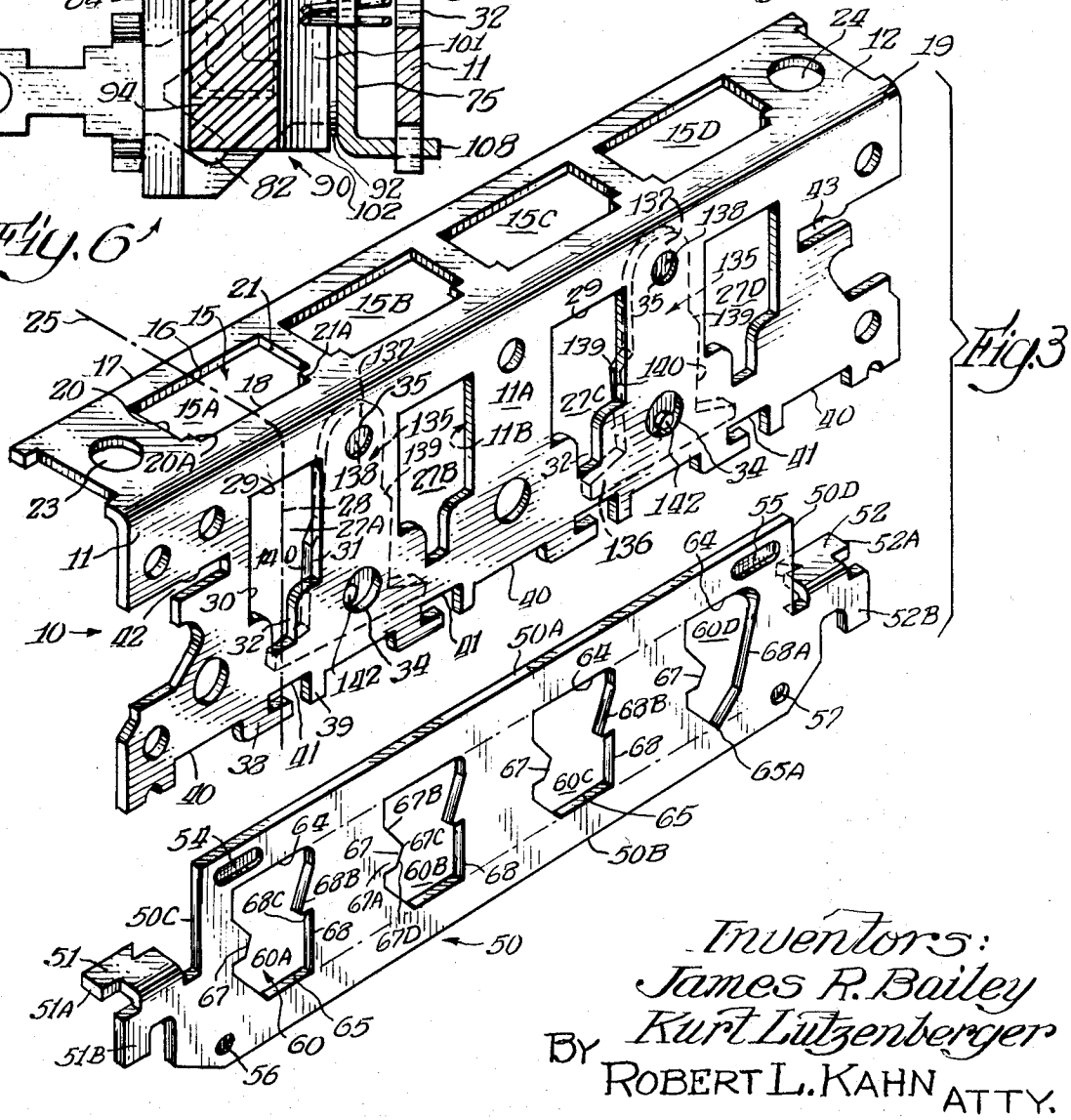

Fig. 3

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PUSHBUTTON SWITCH MEANS

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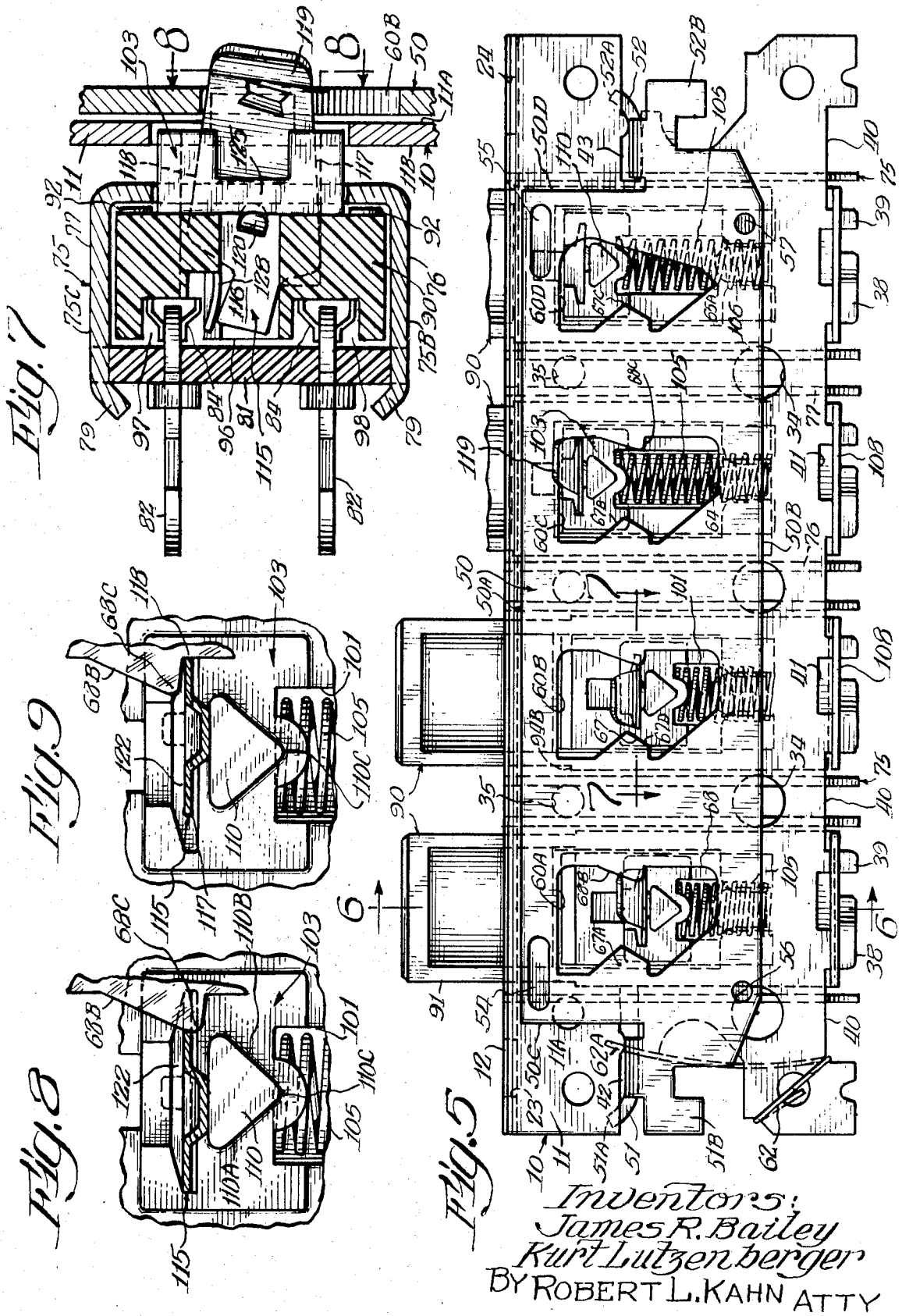

Fig. 7

Fig. 9

Fig. 8

Fig. 5

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PUSHBUTTON SWITCH MEANS

Filed Sept. 20, 1968 4 Sheets-Sheet 4

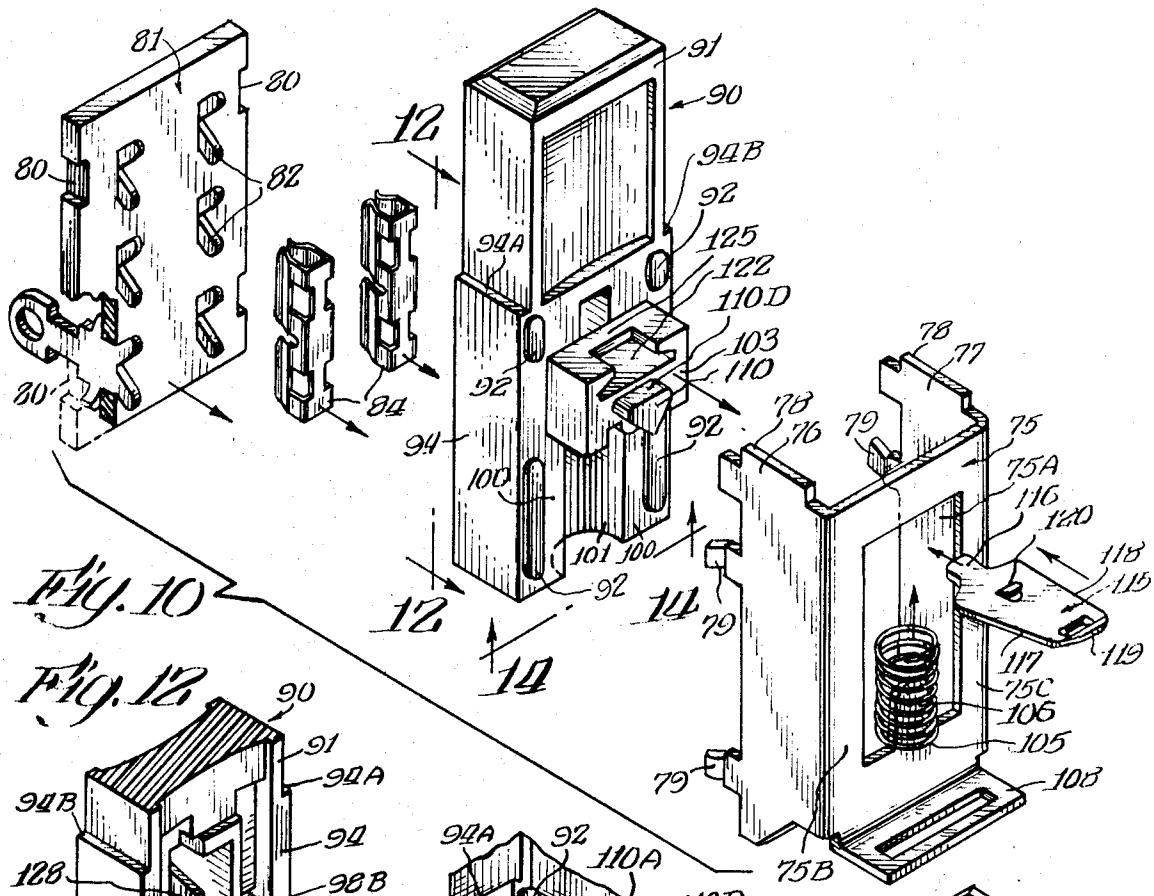
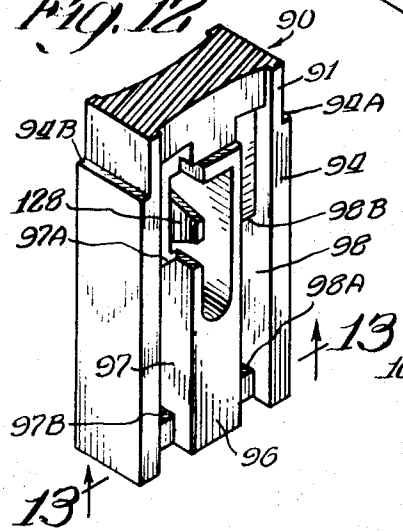


Fig. 10

Fig. 12



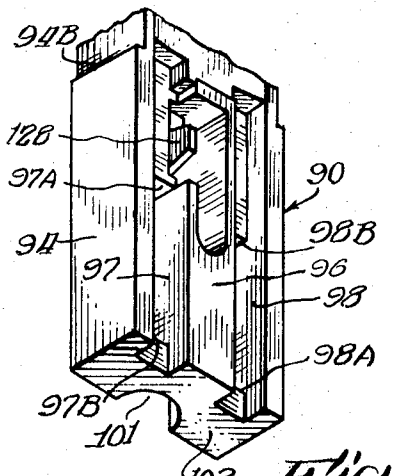


Fig. 13

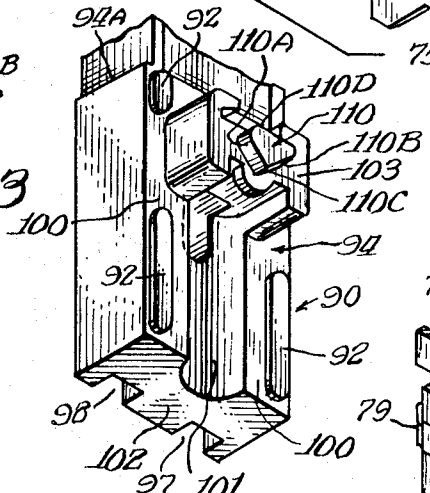


Fig. 14

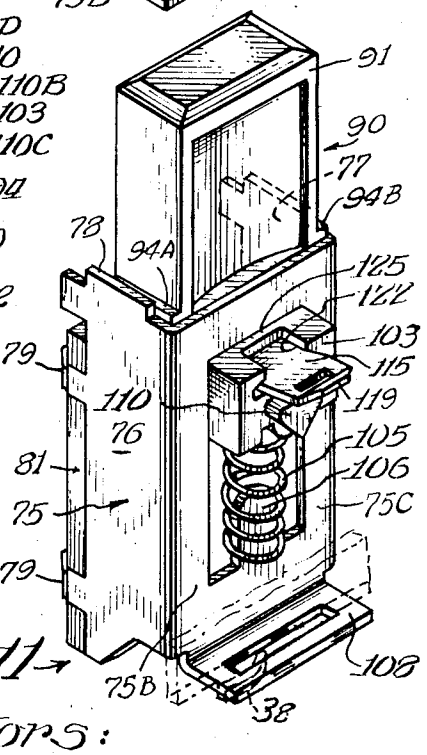


Fig. 11

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United States Patent Office 3,517,140 Patented June 23, 1970

3,517,140

PUSHBUTTON SWITCH MEANS

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Filed Sept. 20, 1968, Ser. No. 761,174
Int. Cl. H01h 9/26
U.S. Cl. 200—5 10 Claims

ABSTRACT OF THE DISCLOSURE

The pushbutton switch means described herein provides a construction which is sufficiently versatile so that a row of actuator rods may selectively have non-lock, all lock, interlock, lockout and release functions individually or mixed. Each actuator rod forms part of a self-contained switch assembly containing the switch contacts and bias spring and permits easy application of a switch assembly to the mechanism or removal therefrom. The mechanism includes a frame plate and latch plate relatively linearly movable over a limited range. A latch plate can have a normal biased position at either end of its travel range. The plates have windows and the latch plate window has two opposed cam shaped sides, one side being useful in most cases at one time. The actuator rod has one or two parts as desired for cooperating with one or other cam sides, the particular cooperation for most windows depending upon the bias direction. Individual lock-out members between adjacent stations may be applied selectively.

This invention relates to pushbutton switch means wherein separate switch modules are carried on a plate which has means cooperating with such modules for providing selective non-lock, interlock, accumulative lock, lock release and lock-out functions in desired combinations. A construction embodying the present invention is advantageous in that a switch module may be applied to or removed from a multi-switch assembly at any time. The various functions individually or in combination may be pre-selected for desired buttons when assembling the entire mechanism by utilizing prefabricated elements. As a result, special combinations of functions in a multi-switch means may be obtained by control of assembly of parts.

A switch module can accommodate different kinds of switch terminals without re-design of the entire module. This is an important consideration for switches used with printed circuits. A terminal board, carried by a switch module, supports fixed and movable switch contacts and imparts flexibility to selection and mounting of switch contacts, apart from the mechanism as a whole.

In a multi-switch embodying the present invention, the the pushbutton actuators are in line and each actuator forms part of the module and operates on the movable contacts of a switch module. A switch module is a self contained assembly having its own module base plate, pushbutton actuator, bias spring and actuator travel limiting means. In addition, the base plate and pushbutton actuator have means for cooperating with mechanical parts of or carried by the plate of the multi-switch means to provide for cooperation between a switch module and plate and between modules for providing support and overall, versatile multi-switch performance.

The mechanism for operating switch modules has structural features for obtaining desired cooperation between various portions thereof to obtain desired operating characteristics. Because of the versatility of such mechanism, the structure and operating characteristics are best described in connection with actual mechanism embodying the present invention.

In general, a base flanged plate has means for supporting switch modules, each such switch module having a longitudinally movable actuator. The base plate also has slidingly supported thereon a latch plate. Both plates have windows stamped out therefrom so shaped as to cooperate with switch modules. The base plate is so constructed as to accommodate lock-out means which, when present, functions to prevent simultaneous operation of more than one actuator. The high degree of adaptability of the mechanism as a whole endows the entire device, including switch modules, with excellent characteristics relating to operation, inter-changeability, removability and replacement of switch modules.

For a full understanding of the invention reference will now be made to the drawings wherein:

FIG. 1 is a front elevation of a construction embodying the invention, said construction having 4 switch operating pushbuttons with the second from the left being locked in depressed position and the latch plate being biased to the right.

FIG. 2 is a top plan view of the construction illustrated in FIG. 1, certain parts being cut away along line 2—2 of FIG. 1 for ease of illustration.

FIG. 3 is a perspective view from the front of the frame plate of the structure illustrated in FIG. 1 and latch plate disposed below the frame plate.

FIG. 4 is a section on line 4—4 of FIG. 1, the scale being substantially equal to that of FIG. 1.

FIG. 5 is a view generally similar to FIG. 1 but having the latch plate biased to the left and the push rods carrying a locking blade identified on a larger scale in FIGS. 10 and 11.

FIG. 6 is a view on line 6—6 of FIG. 5, the scale being substantially larger than FIG. 5.

FIG. 7 is a sectional detail on line 7—7 of the second button from the left on FIG. 5, this view illustrating the rocking action of blade 115.

FIG. 8 is a detail on line 8—8 of FIG. 7.

FIG. 9 is an enlarged detail on line 9—9 of FIG. 6 illustrating the camming boss carried by block part of the push rod construction.

FIG. 10 is an exploded perspective view of a switch assembly, push rod and housing and including as a part thereof a locking blade which may be applied to the push rod or not depending upon manufacturing specifications.

FIG. 11 shows as a complete assembly the various portions comprising the parts in FIG. 10.

FIG. 12 is a perspective view from one face thereof of the body of a push rod being taken in the direction of 12—12 in FIG. 10.

FIG. 13 is a perspective view from a different side in the direction line 13—13 of FIG. 12.

FIG. 14 is a perspective view of the push rod portion of FIG. 10, the view being taken in the direction of line 14—14 in FIG. 10.

Referring to the drawings, frame or base plate 10 consists of body portion 11 and flange portion 12. Base plate 10 is preferably of metal of sufficiently heavy gauge for the purpose required and has flange portion 12 bent at right angle to body portion 11. The length of base plate 10 (along the line of bend) will depend upon the number of switch modules to be carried. In practice, a base plate may be long enough to accommodate about 18 modules.

For convenience in designating the orientation of the base plate, flange 12 will be presumed to be horizontal and considered as the top with body 11 extending downwardly in a vertical plane. It is understood, however, that the entire mechanism may be mounted in any position. Body portion 11 of the base plate has obverse face 11A and reverse face 11B.

The length of base palte **10** will determine the number of stations to be accommodated and, in the example illustrated, four stations are provided. Flange **12** has opening or window **15** for each station, the individual stations being designated as **15A**, **15B**, **15C** and **15D**. The windows are all similar and for convenience only one will be described. Window **15A** has straight side **16** parallel to and laterally offset from free edge **17** of flange **12**. Opposite edge **16** of window **15A** is side **18** which is parallel to and laterally offset from fold **19** where flange **12** is bent over from body portion **11**. Window **15A** has transverse sides **20** and **21**. Small offsets **20A** and **21A** are provided where sides **18**, **20** and **21** would normally meet. These offsets cooperate with portions of a switch module for locking, as will be more fully explained later.

Flange **12** is provided with mounting apertures **23** and **24** adjacent the flange ends for attaching the base plate to a suitable panel or other support. It will be convenient to refer to center line **25** extending transversely across flange **12** between the midpoints of window sides **16** and **18** in connection with the construction of body portion **11** of the base plate. Adjacent windows are separated by metal or flange portion **12**, the amount of such metal being sufficient to maintain the flange strong.

Body portion **11** of base plate **10** has windows **27A** to **27D** inclusive for the four stations, each flange window being paired with a corresponding body window for a station. Center line **28** for each body window extends perpendicularly from fold **19** where center line **28** meets the fold line. Center lines **25** and **28** for a station may thus be considered as a continuous line. Windows **27A** to **27D** are similar. Window **27A** has top **29** which is somewhat below and parallel to the fold **19** and sides **30** and **31** parallel to each other, extending downwardly from fold **19** at right angles to top **29**. Window **27A** has its bottom portion shaped to provide downwardly extending slot **32** symmetrically disposed with reference to center line **28**. Disposed between adjacent slots **32** is circular aperture **34** whose center is substantially midway between center lines **28** of adjacent windows **27A** and **27B**, for example. In transverse alinement with the center of aperture **34** across body **11** of base plate **10** is circular aperture **35**. As will be explained later, apertures **35** and **34** accommodate inverted T members for lock-out action between adjacent stations.

The bottom part of body **11** is irregularly shaped to provide spaced tongues **38** (one such tongue per station), finger **39** with intervening straight edge portions **40** and **41** per station. The ends of body portion **11** are provided with horizontal alined slots **42** and **43** extending longitudinally of body portion **11**.

Supported on base plate **10** for longitudinal movement with respect thereto is generally flat metal latch plate **50** having top and bottom edges **50A** and **50B**. Latch plate **50** has a length corresponding to the number of switch stations for base plate **10**, in this particular instance there being four such stations. Latch plate **50** is disposed at obverse face **11A** of base plate body portion **11** and is provided at end portions **50C** and **50D** with tongues **51** and **52** bent to extend laterally therefrom. Latch plate **50** and tongues **51** and **52** are so proportioned that these tongues may travel in slots **42** and **43** of the base plate to support the latch plate in longitudinally slidable position. Tongues **51** and **52** can extend through slots **42** and **43** so that end portions **51A** and **52A** may be bent upwardly to slidably lock the latch plate to the base plate. Portions **51B** and **52B** making up part of the end portions of latch plate **50** remain in their originally flat condition, coplanar with the flat body of latch plate **50**.

To reduce sliding friction between latch plate **50** and the solid top portion of body **11** of the base plate, embossings **54** and **55** near top edge **50A** and **56** and **57** near the bottom edge **50B** are provided. These embossings extend toward base plate face **11A** and serve to limit the area of sliding contact between the latch plate and the base plate. If the base plate and latch plate have substantially more stations than indicated, more embossings along the length of latch plate **50** may be provided at spaced intervals of say about four or five stations. Embossings **54** and **55** are shown as elongated in shape along the length of latch plate **50** while embossings **56** and **57** are circular. The relative shapes and dimensions of these embossings may vary.

The location of embossings **54** and **55** on the one hand and **56** and **57** on the other hand are such as to be opposite solid metal of base plate body portion **11** near the top or bottom of face **11A** when the latch plate is in installed position. The lateral offset due to such embossings may be quite small, of the order of several thousandths of an inch and is just enough to permit easy movement of the latch plate with reference to the base plate. Latch plate **50** is provided with windows **60**, there being one window per station, each window being designated by letters A to D inclusive in conjunction with numeral **60**.

Latch plate **50** is normally biased to an end position from which it is movable toward the other end position. The travel range of latch plate **50** with respect to base plate body portion **11** will be determined by the depth of slots **42** and **43** and the dimensions of tongues **51** and **52**. In general, the travel range of latch plate **50** is less than the dimension of a station as measured along the length of the latch plate or body portion **11**. Latch plate **50** is biased to either end position (the selected end position depends on the functions desired) by suitable means such as spring wire **62** having a portion looped about irregular bottom part of base plate body portion **11** near an end thereof, spring wire **62** extending upwardly along reverse face **11B** of base plate body portion **11** with the free wire end portion **62A** resting against an edge of tongue **51** (or **52** as may be the case) for biasing the latch plate to desired end position. Any other spring means for biasing the latch plate may be provided.

Latch plate windows **60A** to **60C** inclusive correspond respectively to stations located by windows **15A** to **15C** inclusive of base plate flange portion **12**. Such latch plate windows are similar and each of these three windows is adapted to register more or less with corresponding windows **27A** to **27C** respectively at all times as will be apparent later. Window **60D** differs somewhat in shape from windows **60A** to **60C** inclusive, because of its release function.

Since windows **60A** to **60C** inclusive are similar; one of such windows will now be described. Referring specifically to window **60A**, top edge **64** extends generally parallel to the length of latch plate **50** and may register with top edge **29** of base plate window **27A**. Latch plate window **60A** has bottom edge portion **65** generally parallel to top edge **64** but somewhat shorter in length. Bottom edges **65** of latch plate windows **60A**, **60B** and **60C** in the assembled position of latch plate **50** on base body plate portion **11**, will be about level with or somewhat above the top of the shoulders forming slot **32** in base plate window **27A**.

Latch plate window **60D** has top edge **64** alined with the remaining top edges of the windows and has pointed tip **65A**, in line along the length of latch plate **50** with bottom edges **65**. The shape of window **60D** is dictated by its release function.

All windows **60A** to **60D** inclusive have corresponding sides **67** similarly shaped while windows **60A** to **60C** inclusive only have corresponding opposite sides **68** of similar shape. Window **60D** has opposite side **68A** shaped differently from windows **60A** to **60C** inclusive because of the release function imparted thereto.

Window sides **67** of latch plate windows **60A** to **60D** inclusive are similar and each includes portions **67A** having inwardly sloping parts **67B** terminating in tip **67C**

and continuing with downwardly and outwardly sloping parts 67D. The shape of side 67 of each latch plate window is such as to provide a primary cam edge which will cooperate with a portion of an actuator to be described for causing latch plate 50 to be moved in the direction of tongue 51. For convenience, the shape of side 67 will be designated as cam edge although, as will be apparent later, the side of the window acts more like a cam follower than a cam. For the present it is sufficient to note that when latch plate 50 is biased in the direction of tongue 52, window side 67 will function to cause latch plate 50 to move against its bias for unlocking previously locked stations and for locking an actuator cooperating with the particular window considered.

Side 68 of latch plate windows 60A to 60C inclusive has portion 68B extending inwardly to provide locking shoulder 68C. End latch plate window 60D has inwardly sloping side 68A as illustrated for release purposes only. In all instances, latch plate window sides 68 and 68A may be considered as secondary cam surfaces. Excepting for latch plate window side 68A at the end window, the remaining latch plate window sides 68 are useful when latch plate 50 is biased in the direction of lug 51. With such a bias, the latch plate should be urged toward lug 52 for release action. This will be more fully explained later in connection with a modified form. The distance between sides 67 and 68 for each window is great enough so that only one latch plate window side of each latch plate window will come into play, depending upon the direction of bias of latch plate 50.

A switch assembly for a station includes base plate 75, preferably of metal, having sides 76 and 77 extending away from the base plate. Sides 76 and 77 are similar and each has projecting lugs 78 dimensioned to fit at sides 20 and 21 of each window in flange 12 of base plate 10. Switch assembly base plate 75 has fingers 79 extending from the free edges of sides 76 and 77 for engaging slots 80 in insulating contact supporting plate 81 and locking the same to the assembly base plate. Insulating plate 81 carries fixed contacts 82 of desired shape, such contacts being provided with soldering lugs for connection to wires. Fixed contacts 82 cooperate with movable spring contacts 84 having suitable shape for providing contact action when contacts 84 are moved along the length of fixed contacts 82. Movable contacts 84 have a generally U shape and the axis of travel of these contacts is lengthwise of such contacts and normal to the U section thereof. The nature of the fixed and movable contacts will depend upon the desired switch properties and may assume a wide variety of forms as desired.

Movable contacts 84 are operated by actuator 90 having rectangular finger piece portion 91 which normally projects upwardly from flange portion 12 of the base plate for travel longitudinally of the actuator, perpendicular to the plane of flange 12. Actuator 90 has a number of bearing bosses 92 for limiting the area of surface contacting switch assembly base plate 75. Switch assembly base plate 75 has window 75A bounded by side portions 75B and 75C, these latter side portions having the inside surfaces thereof actually engaged by actuator bosses 92 for reducing friction.

Actuator 90 includes body portion 94, below finger portion 91, somewhat wider (the dimension along the length of base plate flange 12) than finger portion 91 to provide shoulders 94A and 94B. Shoulder portions 94A and 94B, in the installed position of a switch assembly, normally should be just below the bottom surface of base plate flange 12 when an actuator is in its top position. Actuator 90 has contact engaging face 96 opposite portion 75 of the switch assembly base plate. Face 96 of actuator 90 has two laterally spaced longitudinal recesses 97 and 98, the ends of which are defined by steps 97A and 97B for recess 97 and steps 98A and 98B for recess 98. The dimensions of recesses 97 and 98 are proportioned to accommodate loosely the backs of movable contacts 84. The arrangement is such that two movable contacts are coupled to actuator 90 for longitudinal travel therewith. The depth of recesses 97 and 98 permits parts of face 96 of the actuator to ride along the surface of insulating base plate 81 of the switch proper when movable contacts 84 travel longitudinally thereof for switch action. As illustrated here, movable contact 84 is long enough to bridge two longitudinally adjacent stationary contacts (extending along the length of a movable contact) so that one movable contact can operate as a single pole double throw switch. Other switch arrangements may be provided, as desired.

Body portion 94 of actuator 90 has face 100 containing friction reducing bosses 92 previously described. Face 100 has semi-circular bed 101 extending longitudinally of the actuator from bottom 102 of the actuator and disposed midway between the actuator sides. Bed 101 extends for a substantial part of the length of actuator portion 94 and the top end of bed 101 is defined by block 103 extending laterally from face 100 of actuator 90. Bed 101 has an arcuate transverse section for accommodating part of the coils of helical bias spring 105 having one end disposed about tongue 106 extending upwardly from the bottom edge of window 75A of switch assembly base plate 75. The upper end of spring 105 rests against block 103 and serves to bias actuator 90 to its top position. Switch assembly or switch module base plate 75 has apertured locking flange 108.

Block 103 has laterally projecting camming boss 110 whose sides 110A and 110B meet at edge 110C. Block 103 is thick enough to project through window 75A of switch assembly base plate 75, the sides of block 103 riding along the sides of window 75A. Camming boss 110 extends outwardly from block 103 a sufficient distance so that when a switch module is installed in base plate 10, camming boss 110 will extend in the window of a latch plate. Side 110A or 110B may cooperate with an appropriate side of a latch plate window, depending upon the direction of latch plate bias, if the window is end window 60D, as will be explained later. The shape of boss 110 is such that flat top 110D may engage a shoulder of side 67 of a latch plate window, under appropriate conditions for locking an actuator in a down or locked position.

Boss 110 itself is normally not adapted to cooperate at any time with side 68 of a latch plate window, except for end window 68D. In order to have locking action for sides 68 of windows 60A to 60C inclusive, an auxiliary means is provided. Such auxiliary means comprises thin blade 115, preferably of metal, having narrow tip 116 at the bottom thereof, sides 117 and 118 tapering toward each other as they approach top 119 and laterally extending locking lug 120 toward the bottom of the body portion near tip 116. Blade 115, when used, is slipped into slot 122 of actuator block 103, such slot being located transversely of the actuator and above boss 110. Slot 122 extends through portion 94 of the actuator body and has web 125 extending transversely of the block to cooperate with lug 120 to lock blade 115 in an inserted position against withdrawal. Blade 115 is narrower than slot 122 and can rock therein, the direction of rocking being edgewise of the blade and transversely of actuator 90.

Blade 115 is biased by suitable means so that the blade normally leans toward the right of actuator 90 as viewed from the camming boss side of the actuator. While various means may be provided for biasing blade 115, a convenient means consists of flexible spring fin 128 forming part of the original casting or molding making up actuator 90. Fin 128 has its width extending generally parallel to the length of actuator 90 and is normally adapted to engage edge 112 of blade 115 for urging the blade toward side 68 of latch plate windows 60A to 60C inclusive.

Blade 115 may be so dimensioned that an actuator provided with such blade may or may not lock in the down position when the bias of the actuator plate is toward latch plate tongue 52, as illustrated in FIG. 2. Such an

arrangement has the latch plate biased toward the right as seen in FIG. 2 (to use latch plate window side **67**) without having any actuator lock.

When bias spring **62** is in the position illustrated in FIG. 5, latch plate window side **67** is too far to the left and no longer cooperates with camming boss **110**. Sloping side **110**A of boss **110** will not contact any part of side **67** of a latch plate window. Latch plate window side **68** cooperates with blade **115** to provide an actuator locking action only for all latch plate windows except end window **60**D. The spring bias of any blade **115**, due to the spring of fin **128** of the plastic material of an actuator, is substantially weaker than the bias due to wire spring **62**. Consequently when a latch plate is biased to the left, as seen in FIG. 5, downward motion of an actuator will not cause movement of latch plate **50** toward any unlocking position (in this case to the right as seen in FIG. 5) for stations A to C inclusive. End window **60**D of a latch plate should not have any blade **115** for an actuator operating in that station. The dimensions of latch plate window **60**D between opposing sides **67** and **68** are small enough so that camming boss **110** will always move a latch plate away from its biased position due to spring **62** for unlocking irrespective whether the bias spring is placed at one end as illustrated in FIG. 1 or at the other end as illustrated in FIG. 5.

A switch module is locked into position at a station by having finger part **91** of the actuator extend through an appropriate flange window, insuring that lugs **78** of the module base plate are properly positioned in the window sides and manipulating the module assembly so that parts **38** and **39** along the bottom edge of the base plate for a station extend through slotted flange **108** of a module. When a module is properly positioned, tongue **38** for the particular station involved is laterally twisted, this automatically insuring that the entire module, including camming boss **110**, is in proper position. A switch module may be replaced by reversing this process.

A switch module is a self-contained unit with its own actuator normally biased to an up position by the coil spring within the module and movable to a down or off-normal position against the spring bias. The mechanism upon which the module is supported may, when desired, provide for cooperation between companion modules carried by the same mechanism for locking an actuator to an off-normal down position, releasing previously locked actuators, depending upon the direction of bias of the latch plate. Preferably the locking shoulders for sides **67** and **68** of the normal latch plate windows **60**A to **60**C inclusive are offset from each other in the direction of actuator travel with the locking shoulder for side **67** being preferably lower than the locking shoulder for side **68** of latch plate windows **60**A to **60**C inclusive. Such an offset permits a somewhat narrower latch plate window (this being measured in the direction along the length of latch plate **50**). By controlling the relative slope of the cam surfaces for sides **67** and **68** of latch plate window and controlling the relative dimensions and shapes of the windows and camming boss **110**, it is possible to determine the timing between modules and determine the lock-out and release action.

In addition to the functions so far described, the mechanism, illustrated in FIGS. 1 and 2 has means (which may be omitted if desired) for a lock-out action between adjacent actuators to prevent more than one actuator in a group from being pushed down at any one time. Referring to FIGS. 1 and 2, between two adjacent stations, an inverted T shaped rocking member **135** having head **136** and pivot portion **137** is provided. Pivot portion **137** has embossing **138** extending laterally therefrom and dimensioned to fit into circular aperture **35** of base plate body **11**. Pivot portion **137** of the inverted T has laterally extending shoulders **139** on each side thereof which continues into tapering sides **140**. Inverted T **135** has embossing **142** extending laterally therefrom substantially smaller in diameter than aperture **34** in base plate body **11**. This difference in size between embossing **142** and aperture **34** permits inverted T **135** to rock as illustrated in FIG. 2. The rocking is about embossing **138** as a pivot. Embossing **142** can move in aperture **34** during rocking. When installed, each inverted T is disposed against the reverse face **11**B of base plate body **11** with the embossings of each inverted T extending into apertures **34** and **35** of the base plate body. The switch modules anchored to a base plate normally have sufficient clearance between reverse face **11**B of the base plate body and the adjacent face of the module housing to accommodate the thickness of a T.

Block **103** of actuator **90** is so shaped and dimensioned relative to shoulders **139** of an inverted T as to permit only one of two adjacent actuators to be moved to a full down position at any one time, assuming that a lockout inverted T is positioned between such adjacent actuators. In the mechanism illustrated in FIG. 2, stations **15**A and **15**B are related to each other for lockout action and the same relationship exists between stations **15**C and **15**D. By adding a lockout inverted T between stations **15**B and **15**C, the four actuators illustrated in FIG. 2 will be interconnected for lockout action. In any group of adjacent actuator stations, lockout between adjacent stations will be provided only if an inverted T is provided between such adjacent stations so that a number of stations as, for example five or six, may be divided, insofar as lockout function is concerned, into more than one group.

The clearance due to aperture **34** in base plate body portion **11** with respect to embossing **142** in the inverted T is great enough so that when one of two actuator rods on opposed sides of an inverted T is moved downwardly, the travel of T head **136** along the length of base plate body **11** is sufficiently great so that successive inverted T's will be rocked and cause locking of successive positioning rods for successive stations having lockout inverted T's. In other words, if station A, for example, has its actuator depressed and if all stations are provided with lockout inverted T's, then depressing the actuator for station A will prevent simultaneous actuation of any one or more of actuator rods for stations B, C and succeeding stations. If station C for example has its actuator depressed, then inverted T's for stations, A and B as well as stations D and so on will be displaced by both sides of the C actuator. Thus lockout will occur for stations on both sides of station C in this example.

In addition, in a large number of stations, any actuator may be provided with rocking blade **115** for suitable variation of functions. In all instances, an actuator for a latch plate window as shown in **60**D may be relied upon for releasing any previously locked actuators.

By controlling the direction of latch plate bias, providing an actuator with blade **115** or omitting the same, and/or providing or omitting lockout between desired adjacent stations different operating characteristics may be provided. It should be noted that the ease with which one or more switch modules may be removed or replaced makes it possible to provide or omit lockout at any time. Preferably, however, such changes in function are accomplished at the factory during initial assembly. However, in case a switch system employing the present invention is wired into a complicated system, it is possible to effect changes in the direction of latch plate bias and changes in lockout as well as adding blades **115** with minimum disturbance to wired switch modules. Where an actuator has blade **115** installed and later this is not desired, it will generally be easier to replace and rewire one switch module not having such a blade.

What is claimed:

1. A mechanism for controlling a plurality of physically separate switches or the like, said mechanism comprising a flat frame plate having a flange portion at 90° thereto, said flange portion extending along the length of said frame plate, the outer face of said flange portion extend-

ing from an obverse face of said frame plate, the inner face of said flange portion extending along the inside of the 90° bend and merging into the reverse face of said flat frame plate, said frame plate having the bottom portion thereof generally parallel to the bend between the flange portion and flat plate, said plate and flange having a length depending upon the number of switch stations, said flange having a window for each station, said flat plate also having a window for each station, a generally flat latch plate whose length is about the same as the frame plate length but whose width is substantially less than the width of the flat frame plate, said latch plate having a window for each station, means for supporting said latch plate adjacent the obverse face of said flat frame plate for limited longitudinal movement with respect to said frame plate, means for biasing said latch plate to a normal end position, a latch plate window having at least a portion thereof registering at all times with the frame plate window for each station, a switch assembly for use at a station, an assembly being functionally complete and adapted to be incorporated into or removed as a unit and including its own base plate and actuator rod, a switch assembly including individual means for supporting its actuator rod for longitudinal movement over a limited range, means for supporting one end of the assembly base plate in position adjacent the flange window of the station, said switch assembly being in proximity to the reverse face of the flat frame plate with an actuator rod portion extending beyond the switch assembly through the flange window to be accessible for pushing, support means for a switch assembly also including cooperating parts at the bottom portion of the flat frame plate and the switch assembly base plate, a cam engaging portion carried by said actuator rod and extending laterally therefrom through the windows of the frame plate and latch plate, said cam engaging portion cooperating with a generally downwardly extending latch plate window edge for mechanical cooperation depending upon the cam and window edge shapes, a switch assembly including means for biasing an actuator rod to a normal upper end position from which said actuator rod is movable downwardly toward the plate bottom and also including movable and stationary switch contacts, said actuator rod being mechanically coupled to movable contacts for switch operation.

2. The construction according to claim **1** wherein said switch assembly includes a housing having an apertured locking flange, said housing supporting said switch means and actuator rod, a bias spring disposed between a portion of said housing and a portion of said actuator rod for biasing said actuator rod to an up position, said housing and switch means constituting a self-contained unitary assembly, the bottom edge of the frame plate having an irregular shape to provide at least one tongue per switch assembly extending through the aperture in a switch housing locking flame, said tongue being bendable to lock a switch assembly housing in position on said frame plate, a switch assembly being disposable into or out of position on said frame plate substantially independently of other switch assemblies.

3. The construction according to claim **1** wherein said frame plate has pivot support means between two adjacent stations near the flange, an inverted T supported on said pivot support means against the obverse face of the frame plate to hang downwardly, said inverted T being flat and having the head of the T adjacent the bottom edge portion of the base plate with the shoulders of the T extending laterally to adjacent switch assemblies for such adjacent stations, said inverted T having its body and shoulders dimensioned to cooperate with a portion of each actuator rod for said adjacent stations for lockout to permit full downward travel of only one actuator rod, an inverted T being rocked about its pivot upon downward rod travel, said inverted T, when rocked, having its shouldered portion move along the length of the base plate sufficiently so that rocking of one inverted T will cause movement of successive inverted T's.

4. The construction according to claim **2** wherein said frame plate has pivot support means between two adjacent stations near the flange, an inverted T supported on said pivot support means against the obverse face of the frame plate to hang downwardly, said inverted T being flat and having the head of the T adjacent the bottom edge portion of the base plate with the shoulders of the T extending laterally to adjacent switch asemblies for such adjacent stations, said inverted T having its body and shoulders dimensioned to cooperate with a portion of each actuator rod for said adjacent stations for lockout to permit full downward travel of only one actuator rod, an inverted T being rocked about its pivot upon downward rod travel, said inverted T, when rocked, having its shouldered portion move along the length of the base plate sufficiently so that rocking of one inverted T will cause movement of successive inverted T's.

5. The construction according to any one of claims **1** to **4** inclusive wherein the means for supporting said latch plate includes a slot at each end of one of said plates extending inwardly from the edge along the length thereof, a tongue at each end of the other plate extending through each of said slots, each tongue having a portion bent laterally to lock said plates against lateral separation, said tongues and slots being so dimensioned as to provide for the limited range of latch plate travel.

6. The construction according to any one of claims **1** to **4** inclusive wherein a latch plate has one window side edge shaped to provide a locking shoulder for cooperation with the cam engaging portion carried by an actuating rod, said window edge and cam engaging portion being shaped to cause relative movement between the two along the length of the frame plate when an actuator rod is pushed downwardly, said locking shoulder locking said actuator rod against said stop shoulder substantially in a down position.

7. The construction according to any one of claims **1** to **4** inclusive wherein said cam engaging portion is integral with the actuator rod and rigid with respect thereto and wherein the latch plate window edge is cam shaped so that upon downward actuator rod travel, said latch plate is moved away from its biased position, said cam shaped edge being shaped to provide a locking shoulder to retain an actuator rod in down position while permitting the latch plate to return to its biased position.

8. The construction according to any one of claims **1** to **4** inclusive wherein said actuator rod carries a latch window edge engaging portion rockably secured thereto, said rockable portion being weakly biased to engage the side of a latch plate window and being deflectable from its biased position on downward actuator rod movement while permitting the latch plate to remain in its biased position, said window edge having a stop shoulder for locking the actuator rod in down position.

9. The construction according to any one of claims **1** to **4** inclusive wherein said actuator rod carries a latch window edge engaging blade rockably secured in a slot thereto, said blade being weakly biased to engage the side of a latch plate window and being deflectable from its biased position on downward actuator rod movement while permitting the latch plate to remain in its biased position, said window edge having a stop shoulder for locking the actuator rod in down position.

10. The construction according to any one of claims **1** to **4** inclusive wherein a latch plate window has opposed downwardly extending edges, each edge being cam shaped and having a stop shoulder, said windows being wide enough, longitudinally of the latch plate, so that only one window edge is functional, depending upon the direction of latch plate bias, an actuator rod having one cam engaging portion as a rigid portion thereof for cooperation with one window edge to cause latch plate movement upon rod travel, said rod having a rockably mounted

portion for cooperation with the other window edge, said rockably mounted portion being biased toward said other window edge so weakly that rod travel downwardly permits the latch plate to remain in its biased position, said rockable part yielding.

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U.S. Cl. X.R.

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