Oct. 28, 1958 J. H. WILLIAMS 2,857,781

PUSH BUTTON MECHANISM

Filed Jan. 22, 1957 3 Sheets-Sheet 1

Fig. 1.

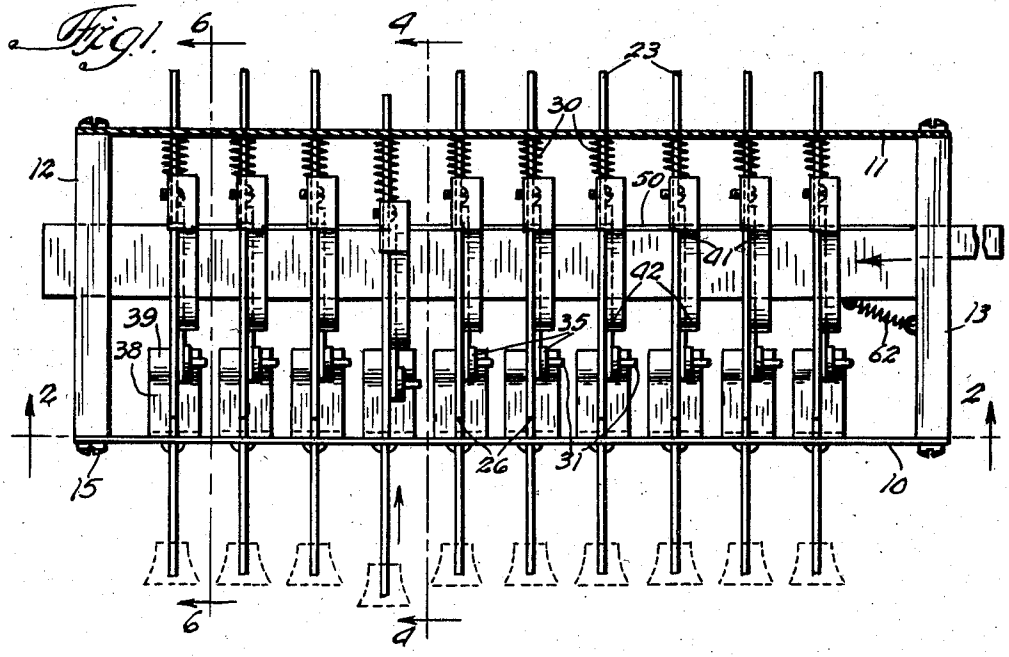


Fig. 2.

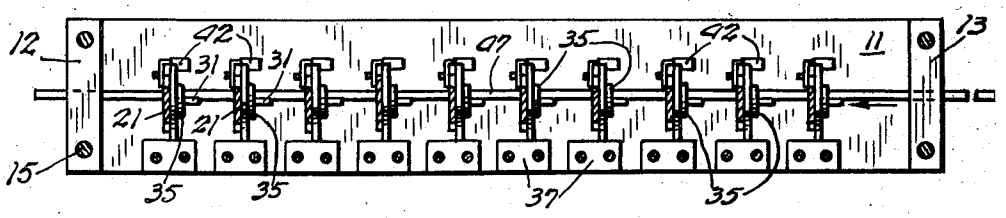


Fig. 3.

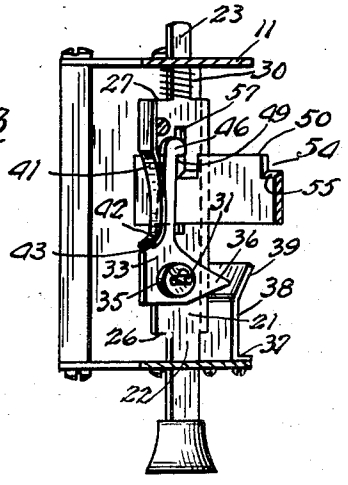


Fig. 9.

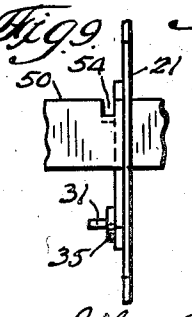
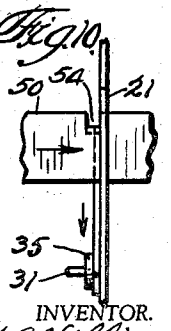


Fig. 10.



INVENTOR.

John H. Williams

BY.

Robert L. Kahn.

Atty.

Oct. 28, 1958 J. H. WILLIAMS 2,857,781

PUSH BUTTON MECHANISM

Filed Jan. 22, 1957 3 Sheets-Sheet 2

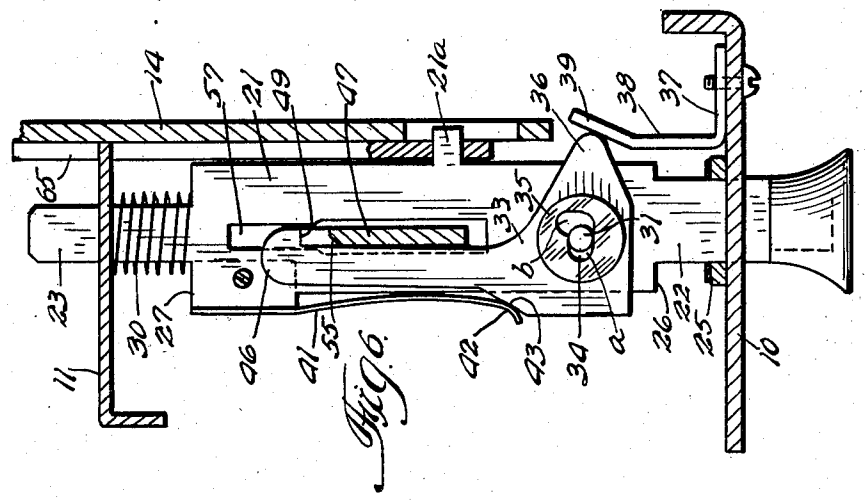


Fig. 6.

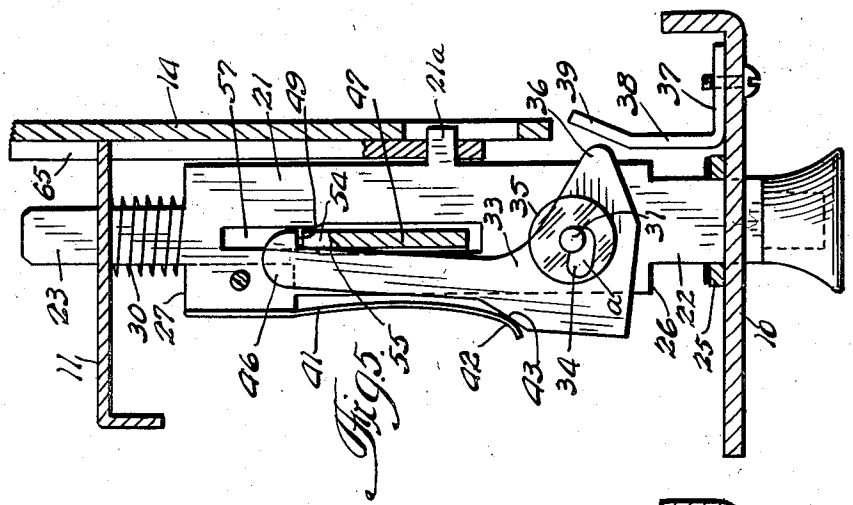


Fig. 5.

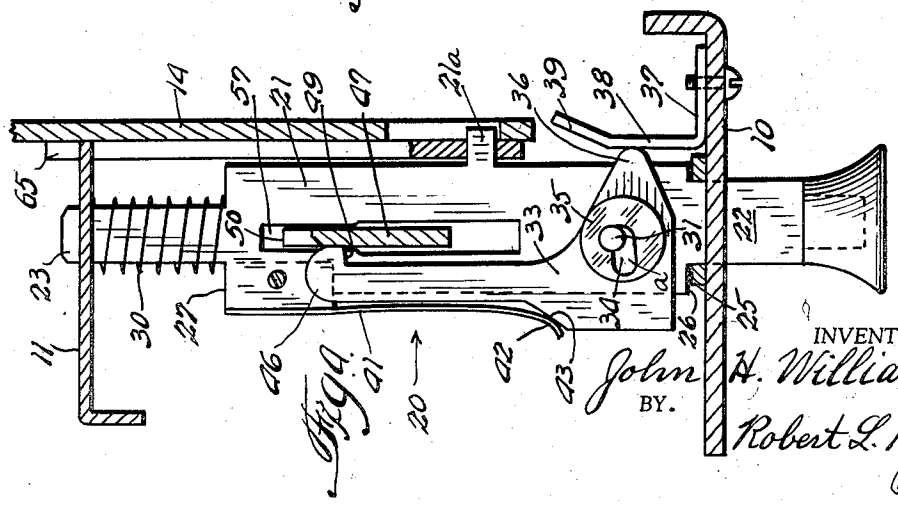


Fig. 4.

INVENTOR.
John H. Williams.
BY.
Robert L. Kahn
Atty.

Oct. 28, 1958 J. H. WILLIAMS 2,857,781

PUSH BUTTON MECHANISM

Filed Jan. 22, 1957 3 Sheets-Sheet 3

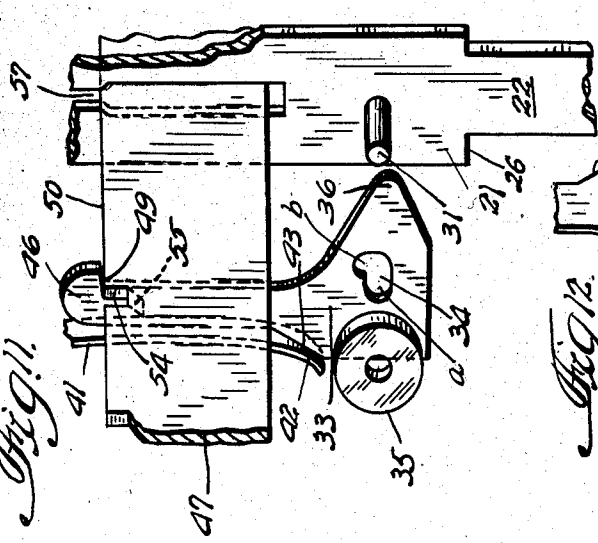


Fig. 11.

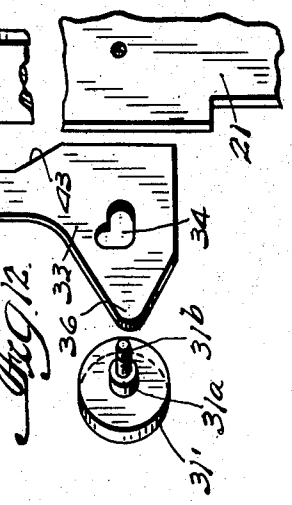


Fig. 12.

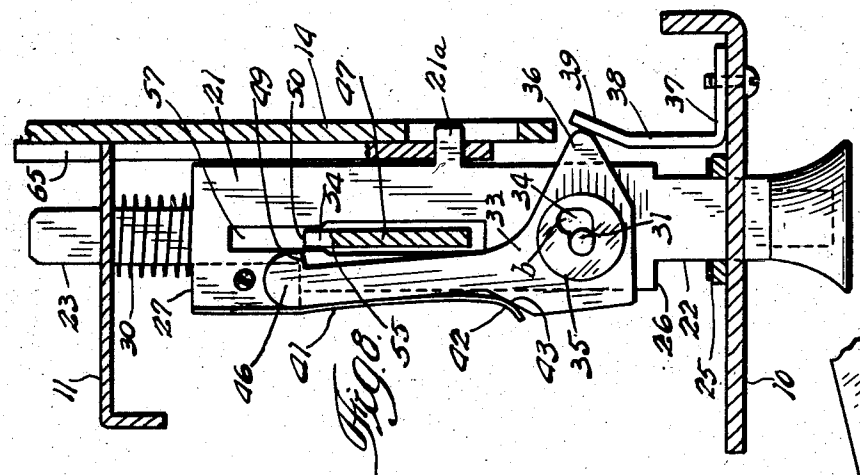


Fig. 8.

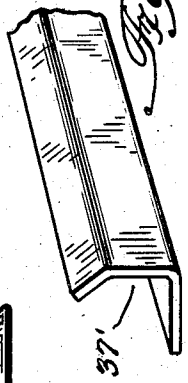


Fig. 13.

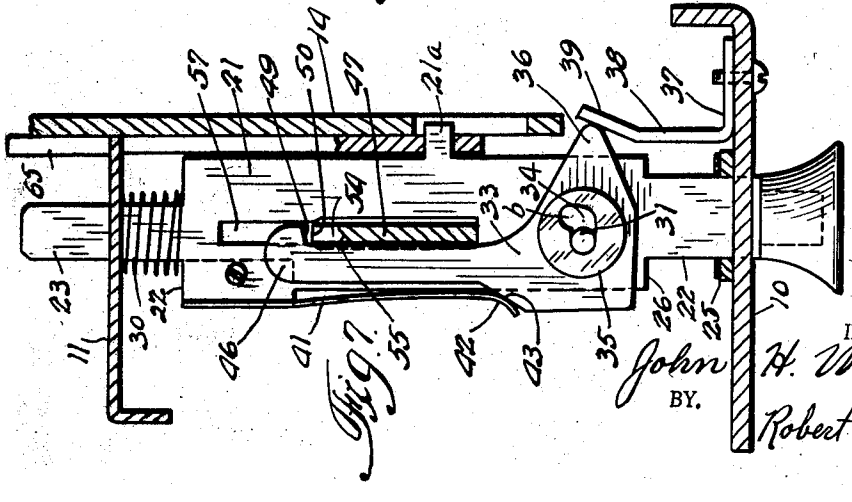


Fig. 7.

INVENTOR.
John H. Williams
BY.
Robert L. Kahn
Attty.

United States Patent Office 2,857,781 Patented Oct. 28, 1958

2,857,781

PUSH BUTTON MECHANISM

John H. Williams, Barrington, Ill., assignor to Oak Mfg. Co., Cook County, Ill., a corporation of Illinois

Application January 22, 1957, Serial No. 635,280

13 Claims. (Cl. 74—483)

This invention relates to a push button mechanism and more particularly to a mechanism having one or more push buttons for operating such devices as electric switches or the like. Push button mechanisms for use in connection with various types of apparatus are well known. As a rule, such push button mechanism may be provided with interlock means whereby a push button may be moved from a normal "out" position to a locked "in" position, interlock means being provided for releasing previously locked push buttons.

In prior interlocked push button mechanism, once a push button has been moved from an "out" to an "in" position, it has been necessary to use the interlock means for releasing the "in" button. Such a release usually operates on all "in" buttons.

This invention provides a mechanism wherein a plurality of push buttons are provided having stable "in" and "out" positions, said push buttons being independent of each other and a common means for unlocking all "in" buttons when such action is desired.

The mechanism forming the subject matter embodying the present invention is simple and effective and may be ganged with a large number of other similar mechanisms to provide a relatively simple structure.

In order that the invention may be understood it will be described in connection with the drawings wherein exemplary embodiments are disclosed. It is understood however that variations may be made without departing from the scope of the invention as defined by the appended claims.

In the drawings, Figure 1 is a plan view of a multi-button mechanism embodying the present invention.

Figure 2 is a section along the line 2—2 of Figure 1.

Figure 3 is a perspective view of one of the push button units in a locked "in" position.

Figure 4 is a section along line 4—4 of Figure 1 showing the unit in an "out" position.

Figure 5 is a view similar to Figure 4 but showing a unit in a full "in" position preliminary to locking.

Figure 6 is a section along line 6—6 of Figure 1 illustrating a push button unit after it has been locked to an "in" position.

Figure 7 is a view similar to Figure 6 but showing a unit in a full "in" position preliminary to being unlocked.

Figure 8 is a view similar to Figure 7 but showing the unit in a more advanced stage of being unlocked.

Figure 9 is a detail illustrating the relationship between the latch bar and one push button unit in a locked latch bar position.

Figure 10 is a detail similar to Figure 9 but showing the latch bar in position to unlock the unit.

Figure 11 is an exploded view of elements of a push button unit.

Figure 12 is an exploded detail of a modified unit showing a different latch mount on a push rod.

Figure 13 shows a common cam for the push button units of Figures 1 and 2.

One or more push button units may be mounted in

a frame consisting of front plate 10 and rear plate 11 maintained in spaced parallel relation by side plates 12 and 13 respectively. A bottom plate 14 for carrying switches or other means operated by the push rods may be provided. The side plates may be attached by any suitable means as bolts 15. Front plate 10 and rear plate 11 are provided with alined slots for accommodating the push button units. Inasmuch as the push button units are alike, a description of one unit will apply equally well to the remaining units.

Each push button unit, which may be indicated generally by 20, includes push rod proper 21 of flat bar stock having reduced front portion 22 and reduced rear portion 23. Push rod 21 has finger 21*a* for operating a switch or other load. Front portion 22 passes through a suitable slot in front plate 12 and may have washer 25 of suitable flexible material, as rubber, disposed around portion 22 for silencing the action of the push rod. Push rod 21 has shoulders 26 which may engage washer 25 to limit the outward movement of the push rod.

Reduced rear portion 23 of a push rod passes through a suitable slot in rear plate 11, this reduced portion extending from shoulders 27 of push rod 21. Between shoulders 27 and the opposed inside surface of rear plate 11 there is disposed coil spring 30 around reduced portion 23. Coil spring 30 will bias the push rod outwardly.

Push rod 21 is movable between end positions, the front position being determined by shoulders 26 on the push rod. The push rod carries a latch construction having a suitable lost motion mounting so that the latch may rock around some pivot axis and also may have some bodily movement along the line of rod movement and also transversely to the line of rod movement. In the specific construction disclosed herein, push rod 21 carries pivot pin 31 extending laterally therefrom.

Pin 31 is positioned on a forward portion of the push rod (the push button end is assumed to be the front). Floating on pin 31 is latch 33 provided with aperture 34 into which pin 31 extends. Aperture 34 is L-shaped and has lateral branch *a* and longitudinal branch *b*. The aperture branches are just wide enough to accommodate pin 31. Thus branch *a* of the aperture permits bodily movement of the latch transversely of the push rod over a distance between two end positions determined by the length of branch *a*. Branch *b* permits longitudinal movement of the latch with respect to the push rod.

It is thus clear that the pin and aperture provide a lost motion mounting for the latch upon the push rod permitting the latch to rock at all times about some pivot axis and also permitting the latch to move bodily transversely of the rod movement from one position to another position and to move longitudinally with respect to the rod.

It is, of course, possible to reverse the pin and aperture so that the pin is carried by the latch and the aperture, or a recess, with its two branches lies in the push rod. Other lost motion mountings are possible.

As illustrated here however pin 31 carries latch 33 and in order to lock the latch to its corresponding push rod, retaining washer 35 is provided. Washer 35 may be locked in position by a cotter pin or by staking the pin or in any other suitable fashion. Figure 12 shows a modification of the latch retention. This modification consists of bolt 31′ having a large head and stepped portions 31*a* and 31*b*. Portion 31*a* corresponds in function to pin 31 and will operate in aperture 34. Portion 31*b* is threaded and may engage threading in the push rod. If desired, portion 31*b* may be smooth and be formed as a rivet to enter an aperture in the push rod.

Latch 33 has cam portion 36 laterally offset from pin 31 or from the general region containing the axis around

which the latch can rock. Cam portion **36** has a general toe shape.

Cooperating with cam portion **36** of the latch is cam plate **37** rigidly secured to front plate **10** by bolts or any other suitable means. Cam plate **37** has portion **38** extending generally along the line of movement of the push rod. Cam plate **37** also has portion **39** which bends away from the push rod.

Supported in any suitable manner from the push rod near the rear portion of the rod is leaf spring **41**. Leaf spring **41** has curved forward end **42** which cooperates with outwardly bulging cam surface **43** on latch **33**. Cam surface **43** and cam portion **36** of the latch are generally on opposite sides of pin **31**. Thus as illustrated, cam surface **43** of the latch is disposed rearwardly of pin **31**. This provides a force tending to rock latch **33** in one direction and also tending to move the latch outwardly with respect to the push rod and also tending to move latch **33** bodily to the right, as seen in Figure 4, against the cam plate. In fact, the rocking force is the resultant of the two forces tending to move the latch toward the blind ends of the L-shaped path of travel provided by the lost motion support of the latch on the push rod.

Latch **33** has detent head **46** which is adapted to cooperate with latch bar **47** extending transversely through window **57** of the push rod. Latch bar **47** has edge **50** which may be engaged by detent head **46**. Leaf spring **41** biases the latch so that the detent head is biased toward a latch engaging position. When the push rod is "out," as seen in Figure 4 for example, the detent head of the latch is stopped by the side of the latch bar. When the push rod is in far enough, the detent head can move to a locking position around the latching edge of the latch bar and engage edge **50** of the latch bar.

A brief description of the locking and unlocking operation of a unit will now be given. Referring for example to Figure 4, the push rod is in an extreme "out" position. In this position, pin **31** normally is at the blind end (rear) of the *b* branch of aperture **34**. Leaf spring **41** biases the detent head of the latch against the adjacent side face of the latch bar. Toe-shaped cam portion **36** of the latch rests against part **38** of the cam plate.

When the push rod is moved against its bias to an extreme "in" position as illustrated in Figure 5, pin **31** of the latch will urge latch **33** rearwardly, pin **31** still being at the blind or rear end of branch *b* of aperture **34**. When the push rod has reached an extreme "in" position, as seen in Figure 5, cam portion **36** of the latch will have cleared cam plate portions **38** and **39**. At the same time, the latch detent head can engage the latch bar.

Upon release of the pressure upon the push rod, spring **30** urges the push rod outwardly a short distance. This causes pin **31** to move forwardly of branch *b* of aperture **34**. The latch and cam plate are so proportioned that leaf spring **41** can move the latch so that pin **31** is in branch *a* of the latch aperture. Branch *a* is long enough so that latch toe **36** can take up the space separating it from the cam plate portion **39**. Springs **30** and **41** cooperate to keep the parts in a stable locked "in" position, as illustrated in Figure 6.

If the push rod as seen in Figure 6 is pressed again, the unit will assume successively the positions illustrated in Figures 7 and 8. Figure 7 illustrates the extreme "in" position during the unlocking stroke. Pin **31** moves the latch rearwardly. Leaf spring **41** rides forwardly of latch cam surface **43** and increases its pressure on the latch. At the same time, latch toe **36** is nearer the rear end of cam plate portion **39**. Hence pin **31** will travel, relative to the latch, left along branch *a* of aperture **34**. The detent head will be somewhat beyond latch bar edge **50**. As the push rod begins to move outwardly from the position of Figure 7, latch toe **36** catches on the cam plate. Spring **30** is strong enough to push the rod outwardly

and cause the latch to be rocked against the bias of leaf spring **41** to an unlocked position as seen in Figure 8. The cam plate can now direct latch toe **36** leftward as seen in Figure 8 with outward travel of the push rod. The detent head is braced against the base of spring **41** and keeps the latch toe against the cam plate. As latch toe **36** moves to cam plate portion **38**, the latch is forced bodily leftward, pin **31** travelling along branch *a* toward branch *b*. When pin **31** reaches the intersection of branches *a* and *b* the force of portion **42** of the leaf spring acting on cam surface **43** of the latch creates a longitudinal force on latch **33** to move the latch forwardly. Pin **31** therefore moves to the rear blind end of branch *b* as seen in Figure 4.

In the discussion of the movement of pin **31**, it is understood that relative movement of the pin and latch is considered. Sometimes it is the latch which actually moves.

To permit a push rod unit to be unlocked by means of the latch bar, edge **50** of the latch bar has slot **54** at a region normally offset from detent head **46**. Upon movement of latch bar **47** to the right, as seen in Figure 11 for example, slot **54** will be brought into registration with detent head **47**. The bar material is tapered at bottom **55** of slot **54** so that the edge slopes toward detent head **46**. This tapering portion **55** of slot **54** will function as a cam surface to aid in rocking latch **33** away from the latch bar when the push rod responds to spring **30** and moves to an "out" position. This taper may be omitted but is preferred to insure proper action at all times.

Latch bar **47** extends the entire length of the frame and passes through suitable slots or openings in end plates **12** and **13**. Latch bar **47** is biased by spring **62** to a normal position, as illustrated in Figure 11 for example, where slot **54** is offset from detent head **46** of latch **33**. By moving latch bar **46** to the left, as seen in Figure 1, slots **54** will be alined with the respective detent heads and release the various push rods units for return to an unlocked position.

It is possible to have slots **54** offset from their corresponding detent heads in one position of the latch bar for say the left five units of the entire array of units in Figure 1, and to have the slots and detent heads of the right hand five units in alignment and reverse this relationship for the other latch bar position. Thus in the left hand position of the latch bar (Figure 1), the left hand five units, may, as far as latch bar **47** is concerned, be locked to an "in" position while the right hand five units can not be locked to an "in" position. On movement of the latch bar to the right, the functional relationship of the left hand and right hand groups will be reversed.

Similarly the latch bar may have the slots so arranged that it may be moved to successive positions longitudinally of the latch bar to unlock selected groups of units.

The entire array of push rod units may be used to operate electric switches such as for example disclosed in United States Patent No. 2,196,433 issued April 9, 1940. Fingers **21***a* may engage switch operating members **65**.

The individual cam plate **37** may be replaced by cam plate **37'**, Figure 13 running the full length of the array of units.

It is possible to omit portion **39** of the cam plate since the toe shape of portion **36** of the latch will cooperate with the free end of such modified cam plate **37'** and provide the rocking action when the push rod begins to move outwardly from an extreme "in" position. It is clear that the latch is spring biased by the leaf spring toward the two blind ends of the L-shaped travel path. The cam plate tends to overcome the bias of the latch to the blind end of the transverse branch of the L. The resultant force on the cam creates the rocking of the latch when the push rod is moved from an extreme "in" position in connection with an unlocking operation.

The latch during rocking will generally move about some axis located in the L-shaped path defining the movement of the latch.

In connection with the detent head and latch bar, it is possible to have the detent head operate in a suitable window of the latch bar. In such case, the detent head will engage an edge of the window rather than an edge of the latch bar.

What is claimed is:

1. A push-button operated mechanism comprising a push rod, means for supporting said push rod to be longitudinally movable between extreme "out" and "in" positions, means for biasing said push rod to an "out" position, a latch, lost motion means for supporting said latch on said rod, said lost motion means permitting rocking of said latch about a pivot axis and also permitting bodily movement of said latch in a generally L-shaped path, one part of said L being substantially parallel to the path of rod movement, the other part of said L being substantially transverse to the path of rod movement, spring means for biasing said latch toward the blind ends of both parts of said L, means operating on said latch when the rod is disposed in the outer portion of its travel range for overcoming the spring bias tending to move the latch toward the blind end of the transverse L portion, said latch including a detent head disposed inwardly of the lost motion mount, a latch bar for cooperation with said detent head, said latch and latch bar providing a locking engagement at an "in" rod position when said latch is free of said last named means and is subject only to said spring means, said mechanism being locked to an "in" position upon one rod movement in and being unlocked upon a succeeding in rod movement.

2. The mechanism according to claim 1 wherein the spring means for biasing the latch and the means operating on said latch for overcoming the spring bias act on opposite parts of the latch.

3. The mechanism according to claim 2 wherein said means operating on said latch for overcoming the spring bias includes a rigid plate having a cam surface generally parallel to the line of rod movement.

4. The mechanism according to claim 3 wherein said spring means for biasing the latch comprises a leaf spring, said latch having a suitable surface for cooperation with said leaf spring so that said latch is biased longitudinally of the rod in an out direction.

5. A push-button operated mechanism comprising a push rod, means for supporting said push rod for longitudinal movement between extreme "out" and "in" positions, means for biasing said rod to an out position, a latch, lost motion means for supporting said latch on said rod, said lost motion means including a pin and L-shaped recess for permitting latch rocking and latch bodily movement parallel or transverse to the path of rod movement, spring means for biasing said latch toward the blind ends of both parts of said L path, means operating on said latch only when the rod is disposed in the outer portion of its travel range for overcoming the spring bias tending to move the latch transversely toward the blind end of the L, said latch including a detent head disposed inwardly of the lost motion mount, a latch bar for cooperation with said detent head, said latch and latch bar providing a locking engagement at an "in" position when said latch is free of said last named means and is subject only to said spring means, said mechanism being locked to an "in" position upon one rod movement "in" and being unlocked upon a succeeding "in" rod movement.

6. The mechanism according to claim 5 wherein said spring means for biasing the latch and the means operating on said latch are disposed on opposite sides of the lost motion means.

7. The mechanism according to claim 6 wherein said means operating on said latch comprises a stationary cam plate having an active cam surface extending generally parallel to the line of rod movement, said parallel surface being long enough so that said latch cooperates therewith over a substantial portion of the rod travel range beginning from an extreme out position and terminating short of the extreme "in" end of the rod travel range.

8. A push-button operated mechanism comprising a push rod, means for supporting said push rod for longitudinal movement between extreme "out" and "in" positions, means for biasing said push rod to an "out" position, a latch, lost motion means for supporting said latch on said rod, said lost motion means permitting rocking of said latch about a pivot axis and also permitting bodily movement of said latch in a generally L-shaped path, one part of said L being substantially parallel to the path of rod movement, the other part of said L being substantially transverse to the path of rod movement, said latch having an elongated portion extending inwardly from the lost motion mount, said latch having a detent head on said elongated portion, a latch bar for cooperation with said detent head, said latch bar extending perpendicularly to the plane of movement of said latch, spring means engaging a portion of said latch inwardly of said lost motion mount for biasing said latch toward the two blind ends of the L, said spring means also creating a rocking force on said latch tending to move the same toward said latch bar, said latch also having a camming portion laterally offset from the lost motion mount in a direction generally parallel to the line of latch travel transversely of the rod path and away from the blind end of the L, a stationary cam plate cooperating with said camming portion, said stationary cam plate having a cam surface extending substantially parallel to the line of rod travel, said cam plate cooperating with the camming portion of the latch only during the outermost part of the travel range of said rod, said cam plate and latch cooperating to force the latch to move transversely along the L path away from the blind end to the intersection of the two L portions, said latch moving longitudinally of the rod toward the blind end of the L portion when assuming an "out" position, said latch and latch bar providing a locking engagement when said latch camming portion is free of the straight part of said cam plate and is subject only to said spring means, said mechanism being locked to an "in" position upon one rod movement "in" and being unlocked upon a succeeding "in" rod movement.

9. The mechanism according to claim 8 wherein said spring means for said latch comprises a leaf spring, said latch having a curved surface cooperating with said leaf spring for creating the rocking force on said latch.

10. A push-button operating mechanism comprising a push rod, means for supporting said push rod to be longitudinally movable between extreme "out" and "in" positions, means for biasing said push rod to an "out" position, an elongated latch extending lengthwise of said rod, said latch having forward and rear portions, lost motion means for mounting the forward portion of said latch on said rod, said lost motion means permitting the latch to rock and also permitting bodily movement of the forward portion of said latch along a generally L-shaped path, the L-shaped path having portions substantially parallel and substantially transverse to the path of rod movement, spring means for biasing said latch toward the blind ends of both portions of said L-shaped path, said latch having a camming portion at the side thereof, said camming portion being laterally offset from the lost motion mount, a fixed cam plate having a substantially straight cam surface extending generally parallel to the line of rod movement, said cam plate cooperating with the latch camming portion for overcoming the latch bias along the transverse part of the L, said cam plate being long enough to be effective for a portion of the inward travel of the rod from an extreme outer position, said camming portion of the latch being free of the cam plate at an extreme "in" position of the push rod, said

latch having a detent head at the rear portion thereof, a latch bar for cooperation with said detent head, said detent head and latch bar being adapted to have a locking engagement when the push rod reaches an "in" position, said latch responding to the rocking force to reach engagement, said mechanism being adapted to be rocked upon one inward movement of the push rod from an "out" position, said locking position being an "in" position and said push rod having an extreme "in" position somewhat beyond the locking "in" position and rearwardly thereof, said mechanism being adapted to be unlocked when said push rod is moved from a locking to its extreme "in" position and then released, said latch being rocked to an unlocking position by the first engagement of said cam plate upon the latch camming portion, said cam plate upon further outward movement of the push rod forcing said latch to move against its bias away from the blind end of the transverse portion of the L toward the intersection of the two L portions whereupon the spring bias on the latch causes the latch to move toward the blind end of the longitudinal portion of the L.

11. The mechanism according to claim 10 wherein said spring means for biasing said latch comprises a leaf

spring, said latch having a cam surface rearwardly of the lost motion mount, said leaf spring and cam surface on the latch cooperating to provide the rocking bias and the bias toward the blind ends of the L-shaped path.

12. The construction according to claim 11 wherein said latch bar and leaf spring are on opposite sides of the latch and wherein the fixed cam plate is also on the side of the latch opposite to the spring engaging portion of the latch.

13. The mechanism according to claim 10 wherein said latch bar has an active detent engaging edge portion for maintaining the mechanism in a stable locked position, said latch bar having an auxiliary edge portion shaped to permit the push rod to move outwardly in response to its spring bias and to rock said latch to an unlocking position against the latch bias and means for selectively positioning said latch bar so that either type of unlocking may be provided, the last named unlocking action permitting the push rod to return to an "out" position without any manual manipulation thereof.

No references cited.