

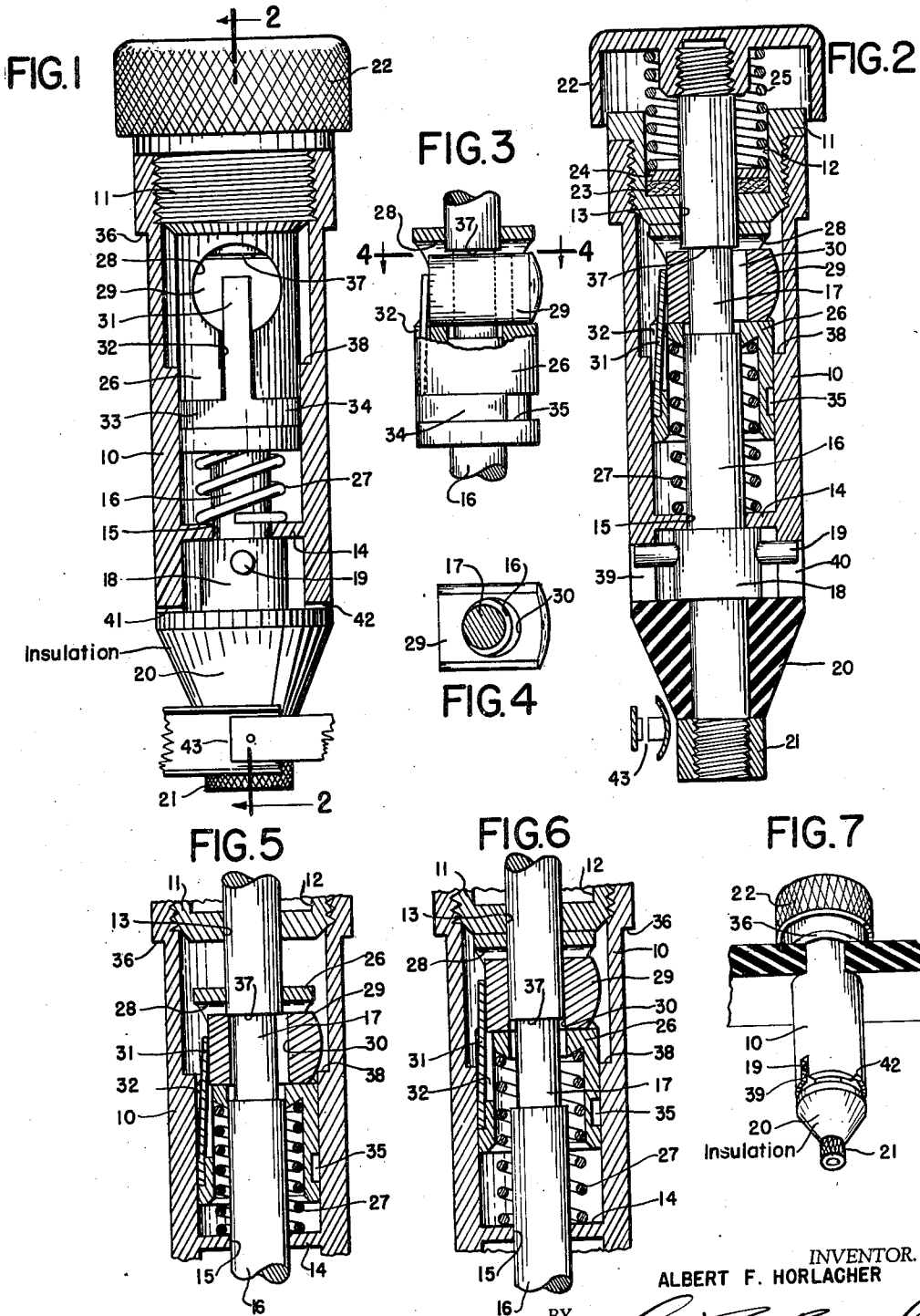
Nov. 20, 1945.

A. F. HORLACHER

2,389,259

PUSH BUTTON

Filed Nov. 27, 1942



INVENTOR.  
ALBERT F. HORLACHER

BY *Chas. H. Candy*  
ATTORNEY

## UNITED STATES PATENT OFFICE

2,389,259

## PUSH BUTTON

Albert F. Horlacher, Palatine, Ill., assignor to  
Automatic Electric Laboratories, Inc., a corporation of Delaware

Application November 27, 1942, Serial No. 467,089

8 Claims. (Cl. 74—503)

The present invention relates in general to push buttons, and more particularly to push buttons of the type used to control electrical circuits by opening and closing switch contacts.

In the electrical art it often is necessary or desirable to produce a certain change in an electrical circuit by use of a self-restoring switch, and very frequently it is useful for the switch to take the form of a push button such as may be operated by the finger or thumb of one's hand. Switches of this character have, for example, been provided in microphone casings and in telephone handsets, wherein they are usually so located that the speaker may depress the push button with the thumb of the hand by which he holds the instrument.

In these applications, as well as in many others which need not be pointed out in detail, it has been discovered that the push button is subject to certain objections. On one hand, the restoring force which must be overcome to maintain the button depressed often is sufficient to fatigue the hand of the operator in those instances when he is compelled to depress the button for a prolonged period; on the other hand, if the strength of this restoring force is reduced the chance of false operation through accidental contact with the button increases dangerously. Manifestly, the latter result is quite as much to be avoided as the former.

It is the general object of the present invention, therefore, to solve the problem indicated, and to this end I have provided a push button which in its normal condition resists operation with comparatively great force but which when fully operated requires very little pressure to maintain it operated. In this way accidental operation is substantially eliminated, while operator fatigue is greatly minimized.

A feature of the invention is the provision of a self-contained push button mechanism of small size and very compact construction which requires much less force to maintain it operated than to originally operate it.

Another feature of the invention is the provision of a self-contained push button mechanism of the above character, which may be associated with any electrical contact or other device desired to be controlled by the push button, but which is not dependent upon such association for its variable resistance to operation.

Another feature is the provision of a push button mechanism of the above character which normally is self-restoring but which may be locked in its operated condition at will.

Another feature is the provision of a push button having a plunger which in its normal position has connected to it a source of pressure opposing its movement away from normal, together with an arrangement for disconnecting said source from the plunger upon completion of a predetermined movement of the latter away from normal and reconnecting said source to the plunger responsive to the complete restoration of said plunger to normal.

Another feature is the provision of a novel latching mechanism for connecting and disconnecting the opposing force to the plunger.

Further features and objects of the invention will be apparent from the following description of one embodiment thereof, reference being made to the accompanying drawing, in which

Fig. 1 is a view of the push button with half of its casing cut away to show, in elevation, the mechanism contained therein,

Fig. 2 is a cross section of the push button taken along its longitudinal axis and in the direction indicated by the arrows 2, 2 of Fig. 1,

Fig. 3 is a partial cross section also taken along the longitudinal axis of the push button and in the direction indicated by the arrows 2, 2 of Fig. 1,

Fig. 4 is a partial section taken along the line 4—4 of Fig. 3,

Figs. 5 and 6 are longitudinal sections of the central portion of the push button, Fig. 5 showing the condition of the mechanism when the button is partly depressed and Fig. 6 showing its condition when the button is fully depressed, and

Fig. 7 is a perspective view of the push button.

Referring now more in detail to the drawing, it will be seen that the push button mechanism is incased within a generally tubular barrel 10. One end of the barrel is threaded on the inside to receive a short screw stud 11; this screw stud contains a cylindrical well 12 at the bottom of which is a centrally disposed opening 13 of somewhat smaller diameter than the well itself. Near the opposite end of the barrel is a transverse wall 14 having a similar central opening 15. These two openings serve to maintain an elongated shaft 16 in coaxial relationship with the barrel 10, being just large enough to permit the shaft to rotate freely and to slide in an endwise direction.

It will be noted that the upper portion of shaft 16 includes a restricted region 17, while the lower portion includes a collar 18. The collar may either be an integral part of the shaft or it may, if desired, be formed separately and thereafter affixed rigidly to the shaft in any known manner.

The shaft, in the region of the collar, contains a small hole transverse to the axis of the shaft, and into this is driven a tightly fitting pin 19, the two ends of which are permitted to extend outwardly a short distance from the collar. It will be obvious that this pin may be employed as the means of securing the collar to the shaft in the event that the two are formed separately. A tapered bushing 20, made generally in the shape of a truncated cone, is secured to the shaft 16 between the collar 18 and a knurled nut 21 which is screwed to the lower end of said shaft; this bushing preferably is formed of hard rubber or other suitable insulating material. The upper end of shaft 16 is threaded, and screwed thereto is a cap 22. The shaft, together with the members affixed rigidly to it (cap, bushing, etc.) form a unitary structure which hereinafter will be referred to as the plunger of the push button.

At the bottom of the cylindrical well 12 is a petrolatum-impregnated, felt washer 23 which hugs shaft 16 very closely, sealing the opening 13 to guard against the passage of moisture there-through into the chamber below the screw stud. Above the felt washer is a metallic washer 24. Resting upon the latter is a helical spring 25 which bears against the underside of cap 22, urging the plunger in an upward direction. The upward movement of the plunger is limited by the collar 18 abutting against the wall 14, and it will be noted that the tapered bushing 20 at the same time abuts against the bottom edge of the barrel.

Within the barrel and encircling shaft 16 is a sleeve 26. This sleeve is free to slide up or down the barrel in the limited zone between the wall 14 and the bottom of screw stud 11, and it can also slide freely on the shaft 16 except as it may be prevented from doing so at times by the latching arrangement about to be described. A helical spring 27 resting upon the transverse wall 14 urges the sleeve upwardly whereby its upper end normally abuts against the bottom of the screw stud 11, as shown in Figs. 1 and 2.

Near the top of the sleeve is a generally cylindrical keyway 28 supporting a flat topped key 29, in such a manner that the latter is free to move in a direction transverse to the axis of the shaft. One end of the key is flat while the other is dome-shaped. The key contains a hole 30 of the same diameter as holes 13 and 15, and it will be clear that whenever this hole is concentric with the shaft as shown in Fig. 6, the sleeve may slide up or down the shaft without hindrance. Normally, however, the hole is not concentric with the shaft, due to the key being forced into the restricted portion 17 of said shaft by a small flat spring 31 pressing on the flat end of the key. This spring lies in a groove 32 in the sleeve, and is fastened to said sleeve by means of an integral clip comprised of two arcuate arms 33 and 34, which fit into a peripheral recess 35 in the lower part of the sleeve.

#### Assembly

In assembling the push button it is convenient to hold the empty barrel 10 in a vertical position, as shown in the drawing. The shaft 16 first is inserted into the lower end of the barrel and pushed upward through the opening in wall 14 until the collar 18 abuts against said wall. Then the helical spring 27 is placed over the upper end of the shaft and dropped into the barrel. Next the spring 31 is clipped to the sleeve 26, and the key 29 is inserted, flat end first, into

the keyway 28; pressing the key against the force of spring 31, until the hole 30 is aligned with the central hole in the sleeve, the sleeve then is thrust over the upper end of the shaft 16 and pushed down into the open end of the barrel. Next, the screw stud 11 is dropped over the end of shaft 16 and screwed into the threads in the top of the barrel. (In doing this, the bottom of the screw stud comes into contact with the top of sleeve 26, pushing the latter down against the force of spring 27 until the key 29 is opposite the restricted part 17 of shaft 16, whereupon the spring 31 displaces the key to the right as shown in Fig. 2.) Then the felt pad 23 and the washer 24 are inserted into the cylindrical well 12, followed by the helical spring 25. Finally the cap 22 is screwed on the top end of shaft 16, and the bushing 20 is attached to the bottom.

It will be seen that the push button, as now assembled, is a completely self-contained unit. It is of small size (having, preferably, an overall length of approximately 1½ inches) and may be mounted on a support in any desired way; conveniently, for example, the barrel 10 may be thrust into a tightly fitting hole provided in the support, until the shoulder 36 is firmly seated against the face of said support as shown schematically in Fig. 7.

#### Operation

The push button is operated by applying pressure to the top of cap 22, say with the finger or thumb on one's hand. Under such pressure the plunger moves downwardly compressing the spring 25. Also, at the beginning of the plunger's movement, the shoulder 37 on shaft 16 engages the flat top of key 29, pushing the key and hence the sleeve 26 downwardly against the force of spring 27. Accordingly, springs 25 and 27 both oppose the downward movement of the plunger.

Before the bottom of the sleeve reaches wall 14 of the barrel, the dome-shaped end of key 29 engages an offset 38 on the inner surface of the barrel, as shown in Fig. 5. Upon the continued downward movement of the sleeve this offset forces the key to the left against the pressure of spring 31 until the hole 30 is concentric with the shaft. Thereupon spring 27 quickly restores the sleeve to its original position (see Fig. 6), while the plunger remains depressed so long as the pressure of the operator's finger continues to be applied to cap 22. It will be noted that while the force which was originally required to depress the plunger had to be great enough to overcome the pressure of both helical springs, only force enough to overcome the pressure of spring 25 alone is required to hold the plunger depressed after the sleeve has been freed from the shaft at the end of the latter's downward movement.

The stiffness of the two helical springs may easily be varied to suit different applications. In a push button constructed for experimental purposes, for example, they were so chosen that a force of approximately 4 pounds was required to fully depress the plunger, whereas only one-half pound thereafter was required to hold it depressed.

During the movement of the push button plunger from its normal position to its depressed position as described above, the shaft 16 is prevented from rotating by pin 19, the two ends of which ride in the slots 39 and 40 provided near the bottom of the barrel. When the shaft is fully depressed this pin leaves the slots and stands

with each end just outside the entrance of one of said slots. If the pressure of the operator's finger now is removed from cap 22, the pin will at once re-enter the slots as spring 25 restores the shaft to normal; if, on the other hand, the cap 22 is rotated while depressed, so that the pin 19 is out of line with the slots, spring 25 cannot restore the shaft to normal even though the operator removes his finger from the cap 22. Thus the push button can be made to function either as a locking or as a non-locking device, at will. Preferably when it is desired to lock the push button in its operated condition the operator will rotate cap 22 through 90° before removing his finger from the cap. This brings the ends of pin 19 opposite the shallow recesses 41 and 42 which form a seat for the pin and prevent the shaft from being accidentally rotated while the operator's finger is off of the cap; to restore the push button to normal the operator must first turn the cap 90° in either direction in order to again bring the ends of the pin opposite the slots 39 and 40 and then release the button, whereupon spring 25 will return the plunger to normal.

As soon as the plunger reaches its normal position spring 31 will at once displace key 29 into the restricted portion 17 of the shaft. Sleeve 26 therefore is again keyed to the shaft so that on the next operation of the push button the force of spring 27 (in addition to that of spring 25) will have to be overcome, just as in the case already described. Thus it will be clear that the push button automatically resets itself after every operation, in preparation for the next operation.

Any desired combination of electrical contact springs such as 43 may be placed in operative relationship to the push button so that they will be operated by the downward movement of the bushing 20 and restored by its upward movement. Manifestly, other devices could similarly be associated with the push button, and controlled by it in like manner.

Having described the invention, what is considered new and is desired to be protected by Letters Patent is set forth in the following claims.

What is claimed is:

1. In combination, an elongated shaft, a generally tubular sleeve encircling said shaft, a generally tubular casing encircling said sleeve, said sleeve and said casing both being shorter than said shaft and being so disposed with respect to the length of said shaft that each end of the shaft extends beyond the corresponding end of said sleeve and beyond the corresponding end of said casing, means for moving said shaft with respect to said casing, means normally linking said sleeve to said shaft whereby said movement of said shaft imparts to said sleeve a certain movement with respect to said casing, said last means controlled conjointly by said sleeve and said casing for unlinking said sleeve from said shaft responsive to a predetermined movement of said sleeve relative to said casing.

2. In combination, an elongated shaft, a generally tubular sleeve encircling said shaft, a generally tubular casing closely encircling said sleeve so that the interior of said casing engages the exterior of said sleeve, whereby said casing slidably supports said sleeve within itself, means for moving said shaft axially with respect to said casing, a latch mechanism linking said sleeve to said shaft whereby said movement of said shaft causes said sleeve also to move in an axial direction with respect to said casing, said mechanism including an operating member carried by said sleeve, means

on said casing for engaging and operating said member responsive to a predetermined movement of said sleeve with respect to said casing, said member effective upon such operation thereof to unlink said sleeve from said shaft.

3. In combination, an elongated shaft, a generally tubular sleeve encircling said shaft, a generally tubular casing encircling said sleeve, means for moving said shaft axially with respect to said casing, a latch mechanism linking said sleeve to said shaft whereby said movement of said shaft causes said sleeve also to move in an axial direction with respect to said casing, said mechanism including an operating member carried by said sleeve, means on said casing for engaging said member after a predetermined axial movement of said sleeve with respect to said casing and, upon the continued axial movement of said sleeve with respect to said casing, causing said member to move in a direction transverse to the direction of said movement of said sleeve, said member effective upon such transverse movement to unlink said sleeve from said shaft.

4. In combination, an elongated shaft, a generally tubular sleeve encircling said shaft, a generally tubular casing encircling said sleeve, a keyway in said sleeve having a key adapted to move therein in a direction transverse to the axis of said sleeve, a spring carried by said sleeve for urging said key in such a direction in said keyway as to engage said shaft and hence couple said sleeve to said shaft, means for moving said shaft in an axial direction with respect to said casing, said sleeve thereupon effective to move with said shaft due to said coupling, and means on the interior of said casing effective after a predetermined movement of said sleeve to engage said key and move it against the force of said spring, thereby to uncouple said sleeve from said shaft.

5. In combination, an elongated shaft, a generally tubular sleeve encircling said shaft, a generally tubular casing closely encircling said sleeve so that the interior of said casing engages the exterior of said sleeve, whereby said casing slidably supports said sleeve within itself, means for moving said shaft with respect to said casing, a latch mechanism linking said sleeve to said shaft, whereby said movement of said shaft causes said sleeve also to move with respect to said casing, a spring within said casing applying force to said sleeve in such a direction as to oppose said movement of said sleeve and said shaft, and means on said casing for operating said latch mechanism responsive to a predetermined movement of said shaft with respect to said casing, thereby to unlink said sleeve from said shaft and hence relieve said shaft of the opposition caused by said spring.

6. In combination, a stationary support, an elongated shaft slidably mounted upon said support, a generally tubular sleeve encircling said shaft, a keyway in said sleeve, a key slidably supported in said keyway so that the two ends of said key are on opposite sides of said shaft, a spring mounted on said sleeve applying to one end of said key a force tending to move said key endwise in a direction transverse to the axis of said shaft, a recess in said shaft thereupon engaged by a portion of said key intermediate the two ends of said key, whereby said sleeve and said shaft are latched together, means for moving said shaft and said sleeve as a unit in an axial direction while they are thus latched together, and means on said support effective responsive to a

predetermined amount of such axial movement to engage the other end of said key and move it transverse to the axis of said shaft against the pressure of said spring, thereby to disengage said key from said recess and hence unlatch said shaft and said sleeve from one another.

7. In combination, a member having an opening therethrough, an elongated shaft extending through said opening, a recess in said shaft at a point intermediate the two ends of said shaft, a spring always urging said member in a direction transverse to the axis of said shaft whereby said member at times is displaced into said recess, means for moving said shaft axially, said member effective if positioned in said recess during such axial movement to move in the same direction as said shaft, and means for moving said member transverse to the axis of said shaft against the pressure of said spring responsive to a predetermined movement of said member in the same direction as said shaft, thereby to displace said member from said recess.

8. In combination, a first member having an opening therethrough, a second member having a similar opening therethrough, an elongated shaft extending through both of said openings, means normally maintaining said two members in such relationship to each other that their respective openings are not in alignment, means for moving said shaft in an endwise direction, means whereby said shaft is effective, during such endwise movement, to move at least one of said members if said openings are not in alignment and is ineffective, during such endwise movement, to move said one member if said openings are in alignment, and means effective responsive to a predetermined movement of said one member under control of said shaft for bringing said members into such relationship to each other that their respective openings are in alignment.

ALBERT F. HORLACHER.