March 9, 1965 W. A. DE SMIDT 3,172,985

PUSH BUTTON ASSEMBLY

Filed Oct. 25, 1961

Fig. 1

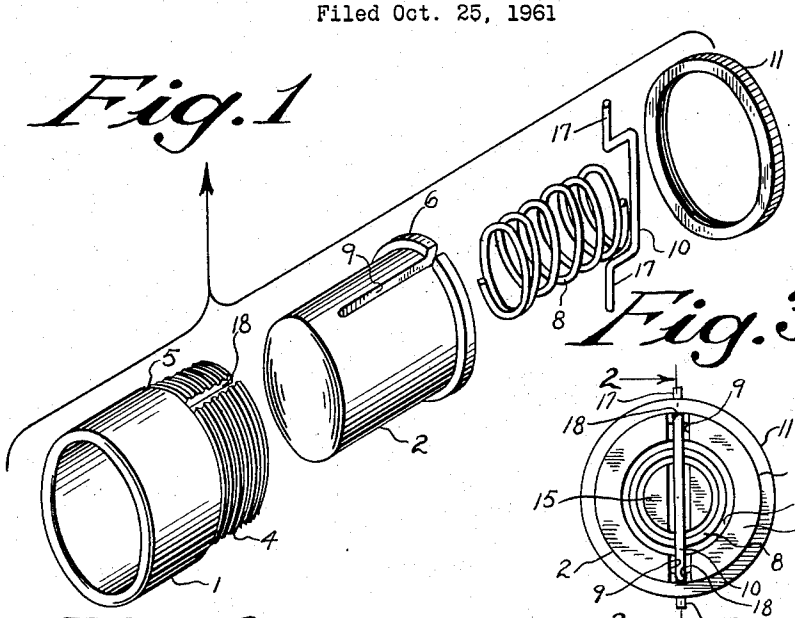


Fig. 3

Fig. 2

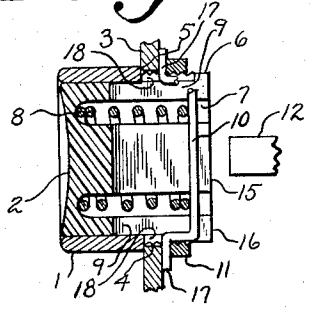


Fig. 5

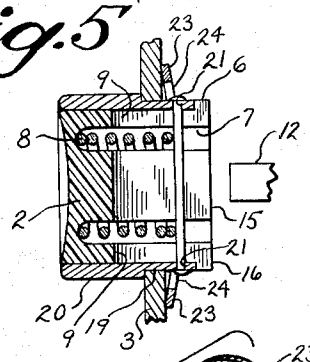
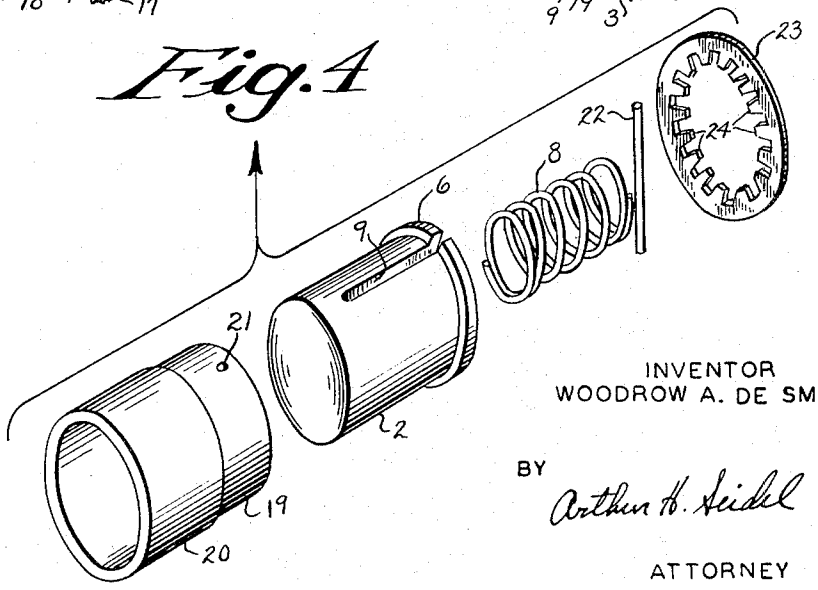


Fig. 4



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PUSH BUTTON ASSEMBLY

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This invention relates to a push button assembly for operating electrical contacts and the like, and it more specifically resides in an assembly of a tubular housing with a button slidable therein which has a spring containing cavity extending a substantial portion of its length and a longitudinal slot communicating between the outer side of the button and the cavity, there being a bias spring seated in said cavity to urge the button forward and a spring retainer protruding through said slot to engage the after end of the spring to form a stationary member against which the spring operates, such spring retainer extending outward from the slot being held in a fixed position, and there further being provided a means for fastening said housing in a switch cabinet cover or the like.

Commonly, electric motors for machine tools and the like are placed across an alternating current power source by electro-magnetically operated starter switches. Such starter switches are operated either by a manual act of the machine tool operator, or by an automatic control circuit including some sort of pilot control. The pilot control may consist of electrical contacts opened and closed by a thermostat, float, pressure sensitive device, timer, limit switch or other control relay, or in the case of manual operation a push button unit including contacts in a control circuit may be employed. In the instance of a push button control, with which this invention is concerned, the button and its associated contacts may be mounted either directly within the starter switch enclosure, or in a remote station, depending upon which would be most convenient for the operator.

Clearly the location of a push button control will frequently depend upon the type and model of the machine with which the starter switch is to be used. However, the location of the push button control may also be determined by the particular environment in which the machine tool is operating, by reason of limitations growing out of space, safety or particular production line considerations. In any event, the location of the push button control is quite unpredictable to the manufacturer of motor controls.

Therefore, it has been the practice to produce two forms of starter switch enclosures for starter switches to be controlled by push buttons. One enclosure form is adapted for and equipped with push buttons, and the other enclosure is adapted to be used with a remotely located push button station and cannot be equipped with push buttons. Since customer requirements are unpredictable, inventory problems have been complicated by the stocking in number of each form of enclosure. Where warehouse facilities are at a premium, or it is necessary to stock starter switches in several locations the expense is considerable.

It is an object of this invention to make possible the production and sale of starter switch enclosures without push buttons which can be easily adapted in the field for use with a push button by provision of a button that is easily and quickly installed in the cover of the enclosure.

The control contact assemblies that are mounted in a starter switch enclosure are usually fastened to the switch itself or some other part of the enclosure, so as to be quite independent of the enclosure cover. Push buttons

for such control contacts are generally mounted in either of two ways. First, the push button may be mounted on the control contact assembly. In such construction it is necessary to have holes in the enclosure cover which will allow the push button to protrude from the cover when the cover is closed, but which will not engage the push button, so the cover may be opened without moving the push button from its mounting on the contact assembly. Alternatively, the push button may be mounted upon the enclosure cover separate from the electrical contact assembly. When the push button is so mounted upon the enclosure cover, the after end of the button must be immediately adjacent to the contact assembly when the cover is closed, so that when the button is depressed it will operate the associated contacts to either complete or open the control circuit.

This invention relates to the latter form of construction, where the push button is mounted upon the enclosure cover, and finds use whether the enclosure be that of the starter switch or of a remote control station. Thus it is an object of this invention to provide a push button assembly that can be mounted in an enclosure cover in the field for operating contacts that are mounted in the enclosure at the time of incorporating the button assembly in the cover.

It is also an object of this invention to provide a unitary self-contained push button assembly which greatly assists installation.

It is another object of this invention to provide a push button assembly which can be installed with few, if any, tools.

It is another object of this invention to provide a push button assembly which can be installed by relatively unskilled persons.

It is another object of this invention to provide a push button assembly containing its own bias spring, push button and bushing, with means to secure it in position in a hole in an enclosure cover.

The foregoing and other objects and advantages of the invention will appear from the following description and the accompanying drawings, which form a part hereof, there being shown therein by way of illustration and not of limitation specific forms in which the invention may be embodied..

In the drawings:

FIG. 1 is an exploded view in perspective of a preferred embodiment for the push button of the invention,

FIG. 2 is a view in section of the push button of FIG. 1 taken on the plane 2—2 shown in FIG. 3,

FIG. 3 is a view in elevation of the after end of the push button assembly,

FIG. 4 is an exploded view in perspective of a second preferred embodiment for a push button assembly incorporating the invention, and

FIG. 5 is a view in section of an assembly of the embodiment of FIG. 4 taken on a vertical plane passing through the center line of the component parts of FIG. 4.

Referring now to the drawings, FIG. 1 shows a push button assembly having a thin-walled, tubular housing 1 which serves as a bushing in which cylindrical button 2 slides when the assembly is installed in a hole in an enclosure cover, portions of such a cover being indicated by the reference numeral 3 in FIGS. 2 and 5. The outer diameter of the rear portion 4 of the housing 1 is reduced, creating a rearward facing shoulder 5. The rear portion 4, as illustrated in FIG. 1, has its outer surface threaded and is approximately two-fifths of the length of the housing, although that dimension is not critical. When the assembly is installed, a hole is cut in the enclosure cover 3 to fit snugly around the reduced outer diameter of the rear portion 4 of the housing 1, which housing is inserted

in the hole until the rearward facing shoulder 5 abuts the outer surface of the enclosure cover 3 around the hole.

Cylindrical button 2 has a circumferential shoulder 6 formed on the outer surface of its after end, one function of which is to engage the after end of housing 1 for limiting the forward motion of the button. An annular spring receiving cavity 7 extends into the button 2 from its after end for a substantial portion of the button length. This cavity 7 defines a central stud 15 and a concentric outer shell 16 for the rear portion of the button 2. Thus, the shoulder 6 is a part of the after end of the shell 16, and the ends of stud 15 and shell 16 are coplanar to present a contact actuating surface. A helical bias spring 8 is placed in the cavity 7 with the forward end of the spring 8 bearing against the forward end of the cavity.

A diametrically disposed slot 9 is formed in the button 2 which extends forward from the after end of the button for a substantial portion of the button length. Such slot 9 bisects the outer shell 16 and inner stud 15 formed by the annular cavity 7, and provides an access channel for a wire-like spring retainer 10. The spring retainer 10 extends through the entire length of and emerges from each end of the slot 9, so as to pass across both sides of the last turn of the spring 8. In this fashion it engages the after end of spring 8 to provide a fixed spring seat that serves as a reaction member against which the expansive force of the spring 8 is exerted. The spring force is also exerted forwardly against the front end of the spring containing cavity 7 to thereby urge the button 2 into its forward position. Since the slot 9 extends through a substantial portion of the length of the button 2, bias spring 8 may be compressed by holding stationary the ends of the wire-like spring retainer 10, in a manner as will be described, and forcing the button rearward. When the rearward force is released, the bias spring 8 will expand, moving button 2 forward.

In FIGS. 1, 2 and 3 the spring retainer 10 has offset ends 17 which bend forwardly and engage the rear face of the mounting panel 3. The housing 1 accommodates the offset ends 17 by provision of a pair of diametrically opposed slots 18 cut in the after end of the housing 1. The ends 17 are then inserted in the slots 18 and are held against displacement by a ring shaped mounting member 11 which is threaded on its inner surface to engage the threads of the rear portion 4 of the housing 1. The member 11 is brought up tight against the retainer ends 17 to not only hold the retainer 10 in place, but to hold the housing 1 against the panel 3 for keeping the entire assembly mounted in place.

Preferably the circumferential ridge 6 on the after end of the button 2 is given a larger diameter than the inner diameter of mounting member 11 and when this is done the four elements consisting of the button 2, the bias spring 8, the spring retainer 10 and the mounting member 11 may be pre-assembled into a unitary self-contained combination during manufacture and before installation of the push button assembly upon the panel 3. This pre-assembly is made by depositing the spring 8 in the cavity 7, placing the mounting member 11 over the button 2 and moving it adjacent the circumferential ridge 6, and then working the spring retainer 10 through the slot 9 while holding the spring 8 partially compressed. In the resulting unitary pre-assembly, the bias spring 8 forces the spring retainer 10 rearward against the mounting member 11 to hold the mounting member 11 against the circumferential ridge 6. Accordingly, the spring retainer 10 is prevented from sliding out of the rearward opening slot 9 by the mounting member 11, and the mounting member 11 is held in place between the spring retainer ends 17 and the ridge 6.

With the provision of the pre-assembly just described only two parts are required, namely the pre-assembly and the housing 1. In order to install these parts one need only insert the reduced rear portion of the housing 1 inward through a hole cut in the enclosure cover 3, then insert the pre-assembly of button 2, spring retainer 10, mounting member 11 and spring 8 into the housing 1 from the rear, so that the ends 17 of the spring retainer 10 are aligned in the slots 18 of the housing 1 and the threads of the mounting member 11 engage those on the housing 1. Then, the mounting member 11 is turned onto the housing 1 until the enclosure cover 3 is gripped tightly between the rearward facing shoulder 5 on the housing 1 and the protruding ends 17 of the spring retainer 10.

The second embodiment, as illustrated in FIGS. 4 and 5, differs from the embodiment just described in the type of mounting member used and the construction used to anchor the spring retainer against rearward movement. It will be noted that the outer surface of the rear portion 19 of housing 20 in the second embodiment is not threaded, but is smooth. Also, where the rear portion 4 of housing 1 in the first embodiment has longitudinally extending slots to receive the protruding ends of the spring retainer 10, rear portion 19 of housing 20 in the second embodiment has two diametrically opposed holes 21 to receive a spring retainer 22 which is a straight piece without offset ends. Finally, the mounting member 23 used in the second embodiment is an annular clip formed from flat spring steel that has inwardly facing teeth 24 about its inner circumference.

The elements are pre-assembled for the second embodiment with the spring retainer 22 held in position by inserting its protruding ends through the holes 21 in housing 20, so that a unitary assembly is had comprising the housing 20, the button 2 (elements identical to those in the embodiment of FIGS. 1–3 have been given like designating reference numerals) placed within the housing 20, the spring 8 seated within the button 2, and the retainer 22 holding the spring 8 in place and being in turn fixed with the housing 20. Hence, the pre-assembly in FIGS. 4 and 5 includes the housing 20, but does not include the mounting member 23. To install the device, the pre-assembly is inserted into a suitable hole in the enclosure cover 3 from the front, until rearward facing shoulder on housing 20 abuts the outer surface of enclosure cover 3. Then the clip 23 is moved over the rear portion 19 of housing 20 extending inward from the hole in the enclosure cover 3, and is brought into the position of FIG. 5, in which it abuts the inside of enclosure cover 3 and clinched to the surface of the rear portion 19 of housing 20 by engagement of the teeth 24.

The button 2 is the same for either embodiment illustrated and since the spring containing cavity 7 and slot 9 are of relatively small cross section, the after end of either button 2 presents a substantially flat planar surface for engaging an end of a contact actuating plunger 12. The plunger 12 is illustrative of any type of device to be operated by rearward depression of the button 2, and it is the purpose of installing the push button assembly to provide a manual means of actuating a plunger 12 when the enclosure member 3 is disposed in place. Thus, the plunger 12 may be a part of a contact assembly mounted in a cabinet, or on a switch in a cabinet, and the push button assembly is placed in the cover of the cabinet. Since the push button assembly may be readily installed the cabinet and cover can be readily converted, in the field, to one in which a control contact assembly is operated at the cabinet, rather than at some remote station.

I claim:

1. In a push button assembly the combination comprising

a button having

a spring containing cavity extending through a substantial portion of its length

a longitudinally extending transverse slot com-

municating between the cavity and the side of the button
a bias spring
seated in said cavity
bearing against the forward end of said cavity
a stationary spring retainer
engaging the after end of said spring
extending outwardly through said slot
a tubular housing
slidably receiving said button
having a stop member engageable with said button limiting the forward movement of said button
and receiving said spring retainer in stationary relationship therewith
and means for securely mounting the housing in a cabinet cover.

2. In a push button assembly the combination comprising
a button having
a substantially cylindrical shape
a spring containing cavity extending through a substantial portion of its length
longitudinally extending transverse slots communicating between the cavity and the side of the button
and an outwardly flanged shoulder formed on its after end
a bias spring
seated in said spring containing cavity
and bearing against the forward end of said spring containing cavity
a stationary spring retainer
engaging the after end of said spring
and extending outward through said slots
a tubular housing
slidably receiving said button
its after end engageable with the outwardly flanged shoulder on said button limiting the forward movement of said button
and receiving said spring retainer in a stationary relationship therewith
and means for securely mounting said housing in a cabinet cover with the forward end facing outwardly from and the after end within said cabinet.

3. In a push button assembly the combination comprising
a button having
a substantially cylindrical shape
an annular spring containing cavity extending through a substantial portion of its length and opening to the after end of said button
a longitudinally extending diametrically disposed slot bisecting the side walls and center stud formed by the annular spring containing cavity
and an outwardly flanged circumferential shoulder formed on its after end
a helical bias spring
seated in said annular spring containing cavity
and bearing agains the forward end of said spring containing cavity
a spring retainer
engaging the after end of said spring
and extending outward through said slot
a tubular housing
slidably receiving said button
its after end engageable with the outwardly flanged circumferential shoulder of said button limiting said button's forward movement
and receiving said spring retainer in stationary relationship therewith
and means suitable for securely mounting the after end of said housing through a hole in relatively thin, stiff sheet material.

4. In a push button assembly the combination comprising
a button having
a substantially cylindrical shape
an annular spring containing cavity extending through a substantial portion of its length and opening to the after end of said button
a longitudinally extending diametrically disposed slot bisecting the side walls and center stud formed by the annular spring containing cavity
and an outwardly flanged circumferential shoulder formed on its after end
a helical bias spring
seated in said annular spring containing cavity
and bearing against the forward end of said spring containing cavity
a spring retainer
consisting of a wire-like member
extending through the longitudinal slot and protruding outward on either side of said button
and engaging the after end of said spring
a tubular housing
with a smooth bore slidably receiving said button
its after end engageable with the outwardly flanged circumferential shoulder of said button limiting the forward movement of said button
and receiving the protruding ends of said spring retainer in a stationary relationship therewith
and means suitable for securely mounting the after end of said housing through a hole in relatively thin, stiff sheet material.

5. In a push button assembly the combination comprising
a tubular housing
with a smooth bore
having a reduced outer diameter at its after end forming a rearwardly facing circumferential shoulder to abut the outer surface of a cabinet cover
and having two diamertically opposed holes piercing the walls of its reduced rear portion
a button
slidable within said housing
having an outwardly flanged ridge at its after end for engagement with the after end of said housing to limit forward travel of the button
a spring containing cavity extending through a substantial portion of its length and a longitudinally extending transverse slot opening along its side and merging with said cavity
a bias spring
seated in the cavity of said button
with its forward end bearing against the button to urge the button in a forward direction
a spring retainer
consisting of a wire-like member seated in the slot in said button engaging the after end of said bias spring and extending through the holes piercing the walls of the reduced rear portion of said housing to form a member secured to said housing against which the spring operates
and a mounting member consisting of an annular clip adapted to engage the reduced rear portion of said housing and abut the inner surface of said cabinet cover.

6. In a push button assembly the combination comprising
a tubular housing having
a smooth bore
a reduced outer diameter along its after portion forming a rearwardly facing circumferential shoulder to abut the outer surface of a cabinet cover
the outer surface of said reduced after portion being threaded to receive a mounting member

and having transverse slots through the walls of the reduced after portion opening to the after end and extending longitudinally through the length of said reduced after portion

a button

slidable within said housing

having an outwardly flanged ridge at its after end for engagement with the after end of said housing to limit forward travel of the button

a spring receiving cavity extending through a substantial portion of its length

and a longitudinally extending transverse slot opening along its side and merging with said cavity

a bias spring

seated in the cavity of said button

with its forward end bearing against the button to urge the button in a forward direction

a spring retainer

consisting of a wire-like member

seated in the slot of said button

engaging the after end of said bias spring

and extending through the slots in the walls of the reduced after portion of said housing

to form a member cooperatively engaged with said housing for being held in a fixed position with respect thereto

a mounting member

consisting of a ring the inner surface of which is threaded to engage the reduced after portion of said housing

to abut the inner surface of said cabinet cover.

7. In a push button assembly the combination as claimed in claim 6, wherein

the transverse slots through the walls of the reduced after portion of the tubular housing are diamertically opposed and open to the rear of said housing

the longitudinally extending transverse slot in the button also opens to the rear of said button

the outwardly flanged ridge on the after end of said button has a diameter larger than the inner diameter of the mounting member

limiting axial motion of said mounting member rearward with respect to said button

and the ends of the spring retainer bear against the front facing surface of said mounting member.

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