March 2, 1971 E. FRYDMAN 3,566,705

PUSH BUTTON KEYS

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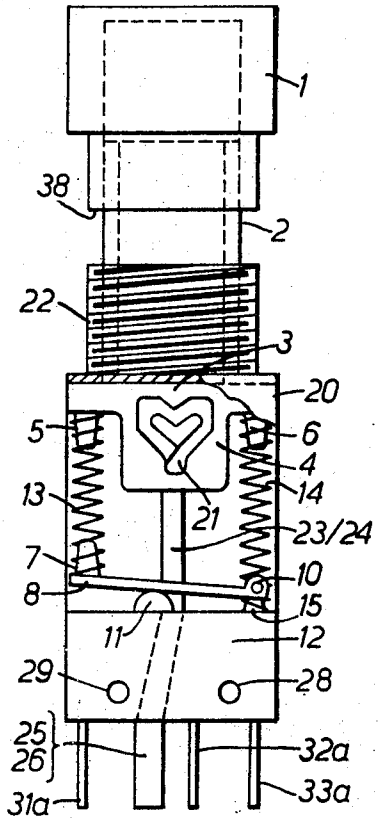


FIG. 1.

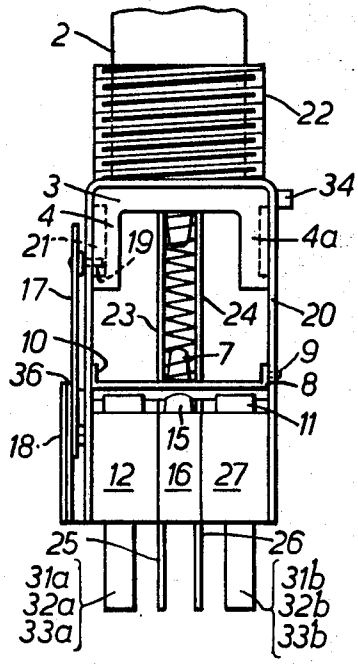


FIG. 2.

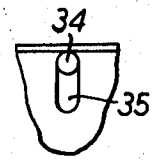


FIG. 2a.

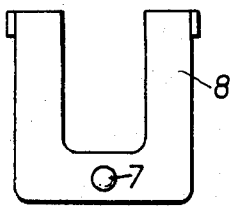


FIG. 3.

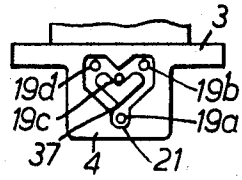


FIG. 4.

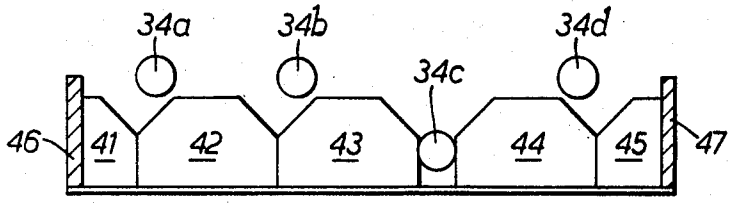


FIG. 5.

INVENTOR
Emanuel Frydman
BY
Watson, Cole, Grindle & Watson
ATTORNEYS

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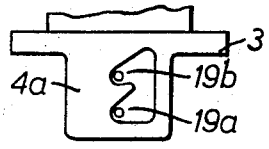


FIG. 6.

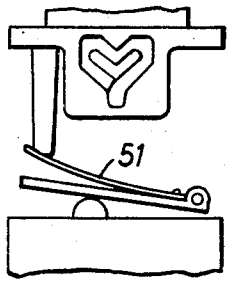


FIG. 7.

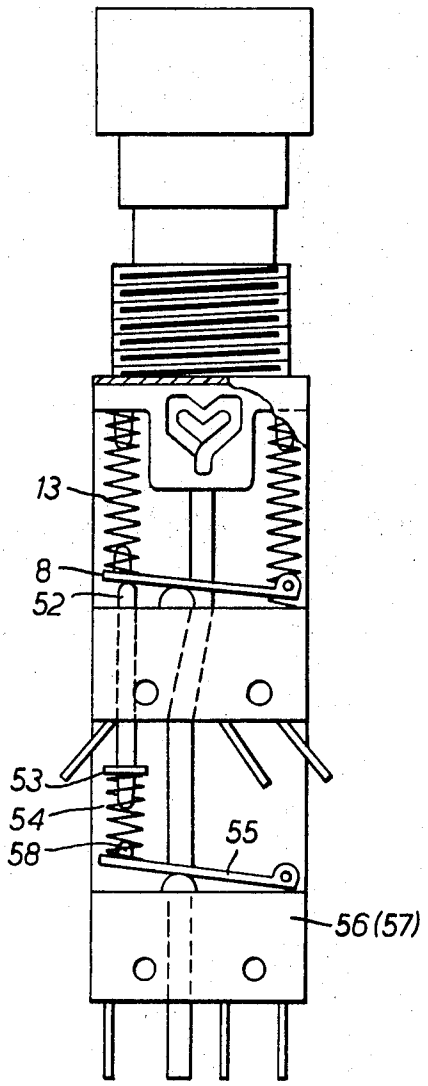


FIG. 8

INVENTOR
Emanuel Frydman
BY
Watson, Cole, Grindle & Watson
ATTORNEYS

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3,566,705

PUSH BUTTON KEYS

Emanuel Frydman, West Norwood, London, England, assignor to Telephone Manufacturing Company Limited

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Claims priority, application Great Britain, Feb. 14, 1968, 7,262/68
Int Cl. F16h 21/44, 21/54, 25/18
U.S. Cl. 74—107 2 Claims

ABSTRACT OF THE DISCLOSURE

The improved construction of push button switch unit incorporating micro-switch units.

This invention relates to push button switch units and more particularly to such units which incorporate micro-switches arranged to be operated by a push button key.

Push button keys are available in several versions to meet the varying requirements. These broadly comprise a simple push key which only remains operated so long as manual pressure is applied, a push-to-operate-push-to-release key (push-push), a push to operate key which is released by operating a further key (mutual interlock) and a push key forming one of a group of keys in which only one key can be operated at a time (mutually exclusive). Each or any of these types are required in illuminated (lamp in the housing which causes the key knob to be illuminated) and non-illuminated versions.

Generally speaking, each key type is manufactured to perform only a few of these required functions and one object of the present invention is to provide a multi-purpose key for operating microswitches incorporated in a switch unit.

According to the invention there is provided a push button switch unit comprising a housing, a push button mounted so as to project at one end thereof into said housing and movable to increase the extent of projection of said one end into said housing against a spring restoring force, a switch actuating plate pivotally mounted at one end within said housing, spring means disposed within said housing to act between said one end of said push button and said actuating plate, and at least one microswitch arranged to be actuated by pivoting movement of said actuating plate in response to movement of said push button into said housing.

The various features and advantages of the present invention will be apparent from the following description of embodiments thereof taken in conjunction with the accompanying drawings,

FIG. 1 is a side elevation of a push-push key with part of the support frame and the track pin removed.

FIG. 2 is a first angle projection of FIG. 1 and FIG. 2(*a*) shows a detail of FIG. 2,

FIG. 3 is a plan version of the lever plate,

FIG. 4 shows the track used for a push-push action,

FIG. 5 shows a method of providing mutually exclusive operation,

FIG. 6 shows the track used for mutual interlock action,

FIG. 7 shows an alternative form of operating spring, and

FIG. 8 shows a means for operating additional microswitches.

Referring now to FIG. 1, the push key comprises a moulded cap or button **1** fitted onto a hollow shank **2** forming part of a moulding which also comprises stop plate **3**, track member **4**, and spring retaining pins **5** and **6**.

A further retaining pin **7** is fixed to a U-shaped lever plate **8** (see FIG. 3) which is pivoted at points **9** and **10** (FIG. 2).

The lever plate **8** bears lightly on the operating button **11** of a microswitch **12**.

An operating spring **13** is retained between spring retaining pins **5** and **7** and a restoring spring **14** is located at one end on spring retaining pin **6** and, at the other end, is located on spring retaining pin **15** mounted on an intermediate block **16** (FIG. 2).

Referring now to FIG. 2, a track pin assembly **17** is pivoted on a centre **18** and the pin **19** rests in the U-shaped track **21**. The operation of the pin and track to provide a push-push operation is fully described in British Patent No. 958,663.

The hollow shank **2** passes through an externally threaded push **22** fixed to the U-shaped support frame **20** and the stop plate **3** is pressed against the top inner face of support frame **20** by the action of restoring spring **14**. This represents the normal position of the key.

Two flat leads **23**, **24** support and provide electrical connections to a lamp holder (not shown) in the hollow shank **2**. These two flat leads are held in place by slots in the intermediate block **16** and are extended to provide electrical terminal connections **25**, **26**.

The intermediate block **16** also acts as a spacer between two microswitches **12** and **27** and these three members are located and secured by means of rivets passing through both sides of the support frame **20** and the holes **28**, **29** in the microswitches **12** and **27** and also in the intermediate block **16**. The three electrical terminals of each of the microswitches are shown at **31***a*, **31***b*, **32***a*, **32***b*, **33***a*, and **33***b*.

For convenience and clarity, the operating and restoring springs **13** and **14** respectively are omitted from FIG. 2.

Still referring to FIG. 2, the stop plate **3** has a cylindrical extension **34** which moves vertically in slot **35** as shown in FIG. 2(*a*).

The operation of the unit as a push-push key will now be described, mainly with reference to FIG. 4, which shows the track member **4** forming an extension of stop plate **3** and having a V-shaped track **21**. Four positions of the pin **19** are shown as **19***a*, **19***b*, **19***c*, and **19***d*. It is to be assumed that the pin **19** is urged towards the left in FIG. 4 by bias spring **36** (FIG. 2). With the push key in the normal (unoperated) condition, pin **19** occupies position **19***a* in track **21**. As the button **1** is pressed downwards, the pin **19** rides up the right hand portion of track **21**. This is ensured by the provision of the nonreturn step **37** which prevents pin **19** from entering the left hand portion of track **21**. When the button **1** is fully depressed, the microswitches are operated and pin **19** occupies position **19***b*. On release of the button, pin **19** settles back in position **19***c*, in which position the microswitches remain operated, as will be explained later. On the next operation of button **1**, pin **19** occupies position **19***d* and, on release of the button, the pin rides down the left hand side of the track, drops down the non-return step **37** and reverts to position **19***a*.

From the above described operation, it can be seen that the button assembly partially restores on the first release motion. The microswitches **12** and **27**, therefore, have to operate when the button is fully depressed (pin **19** in position **19***b*) and remain operated when the button partially restores (pin **19** in position **19***c*).

In the push button key according to the invention, use is made of the fact that a microswitch will remain operated with considerably less force exerted on the operating button **11** than that required to operate it. On initial operation, with the button fully depressed, stop plate **3** exerts sufficient force via operating spring **13** on the lever plate **8** to cause the microswitch to operate. On initial release of the button, the stop plate **4** partially restores to the position represented by pin position **19***c*. Although the force exerted by operating spring **13** is reduced it is still sufficient to maintain the microswitch in the operated condition. This situation is readily achieved since, in general, the force required to maintain the microswitch operated is of the order of one third of the force required to operate it.

On the next operation and release of the button **1**, the pin **19** restores to position **19***a* and the key is now at the normal position. The retraction of stop plate **3** has withdrawn operating spring **13** and the microswitch contact is released. Spring **14** supplies the restoring force to the stop plate **3** and, hence, the associated assembly of shank **2** and cap **1**.

In order to prevent strain on pin **19** during the released condition, the track **21** is so arranged that, with the support frame **20** acting as a back-stop for stop plate **3**, the pin **19** does not touch the lower extension of track **21**, as shown at position **19***a* in FIG. 4.

Also, when the button is fully operated, the underside edge **38** of moulded cap **1** abuts the upper edge of bush **22**. In this condition, pin **19** is just clear of the upper edge of track **21** as shown in positions **19***b* and **19***d* of FIG. 4 and cannot, therefore, be damaged by "punch" operation of the key.

During the various operating actions, the cylindrical extension **34**, attached to stop plate **3**, is moving up and down the slot **35**. This pin has two functions. Firstly, it helps prevent any slight rotation of stop plate **3** and, hence, cap **1**. This enables a strip of adjacently-mounted keys to line up reasonably accurately with each other.

The second function is to provide mutually exclusive action between a gang of keys. The extension piece **34** acts as an interference piece between a series of balls, discs, plates, or the like, which have a total freedom of sideways movement greater than the diameter of extension **34** and less than twice its diameter. An example of such an action is shown in FIG. 5, where thin plates **41** to **45** are constrained to move freely in a sideways direction only. The extensions **34** of four adjacent push keys are represented by **34***a*, **34***b*, **34***c*, and **34***d*. The push button represented by extension **34***c* is operated and plates **42**, **43**, **44**, have been pushed sideways to make sufficient clearance. It can be seen that the position of the plates now prevents the operation of any other keys. Plates **41** and **45** never need to move, of course, and remain adjacent the end stops **46** and **47** respectively.

It can also be appreciated that, if two keys are operated simultaneously, the plates would readjust such that both keys could only be operated a small amount—insuffiicient, in fact, to operate the microswitch.

Referring again to FIG. 2, a further track member **4***a* is provided on the opposite side of the stop plate **3**. This track member is shown in FIG. 6. The pin operation is the same as that already described, i.e. biased to the left of the figure. In the normal condition, pin **19** is at position **19***a*. When the key is operated, the pin slides up the ramp and then springs into position **19***b*. The key is now in a locked position and cannot be released by further operation of the same key. In this case, a series of keys have their pin assemblies **17** (FIG. 2) connected together. The

operation of another key causes all pins **19** to move to the right, whereupon the locked key is released by the other key (when the pin of the latter rides up the ramp) and moves pin **19** of the locked key from its position **19***b* until it clears the step of the ramp. The locked key is then fully released by the restoring spring **14**. This provides the well known mutual interlock facility.

The tension gradient of spring **13** can be chosen to operate the microswitches when pin **19** enters the latching position **19***c*. This arrangement ensures that, if the push key is not operated fully, the microswitches will not operate and key will not lock.

It can thus be seen that either a push-push or a mutual interlock action can be provided according to which track (FIG. 4 or FIG. 6) is assembled adjacent to the pin assembly side of the key.

When the key is required as a simple push key (no locking action) the pin assembly **17** is not fitted.

In this manner, the one key can be assembled in order to provide push-push, mutually exclusive mutual interlock, or simple push actions as required.

Referring now to FIG. 7, the operating spring **13** has been replaced by a leaf or blade spring **51**. The rest of the drawing is exactly the same as for FIG. 1. This provides a simple means of adjustment of the operating spring by the well-known method of "stroking."

If the push key is required to operate more than the two microswitches shown hitherto without increasing the area occupied on the fascia or panel on which the keys are mounted, the additional microswitch may be conveniently mounted as shown in FIG. 8.

In this figure, the upper portion of the key is exactly as shown in FIGS. 1 and 2. An operating rod **52**, having a flange **53**, rests lightly against the underside of lever plate **8**. An identical lever plate **55** operates the additional microswitch(es) **56** (**57**) in the same fashion as described for microswitches **12** and **27**. A further operating spring **54** is located between the flange **54** and the spring retaining pip **58**. The spring **54** now acts in the identical manner to operate the additional microswitch(es) as described in respect to spring **13**. Also, in similar fashion, spring **54** may be replaced by a blade spring as shown in FIG. 7.

It can also be seen that the lamp leads have been extended beyond the additional microswitches in order to be accessible for termination from the bottom of the key in the same manner as shown in FIGS. 1 and 2.

A further advantage of the present invention can now be appreciated, namely that the microswitch is not operated directly from the push button, but is buffered by the spring **13**. This helps reduce possible damage to the microswitch by repeated "punching" of the key. Further, the presence of this spring enables a comparatively large movement of the button (required to operate the tracking sequence) to be translated into the small movement required to operate the microswitch.

I claim:

1. In a push button switch unit comprising a housing, a push button mounted so as to project at one end thereof into said housing and movable to increase the extent of projection of said one end into said housing against a spring restoring force, the provision of a switch actuating plate pivotally mounted at one end within said housing, spring means disposed within said housing to act between said one end of said push button and said actuating plate, said spring means being a compression spring disposed to engage said plate at one end and, at its opposite end, to engage said push buton, and at least one microswitch arranged to be actuated by pivoting movement of said actuating plate in response to movement of said push button into said housing.

2. In a push button switch unit comprising a housing, a push button mounted so as to project at one end thereof into said housing and movable to increase the extent of projection of said one end into said housing against a spring restoring force, the provision of a switch

actuating plate pivotally mounted at one end within said housing, spring means disposed within said housing to act between said one end of said push button and said actuating plate, said spring means being a blade spring anchored at one end to said actuating plate and projecting away from such plate towards an inwardly projecting extension of said push button, and at least one microswitch arranged to be actuated by pivoting movement of said actuating plate in response to movement of said push button into said housing.

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FRED C. MATTERN, JR., Primary Examiner

W. S. RATLIFF, JR., Assistant Examiner