Dec. 13, 1955 C. C. BARBER 2,727,103

CLICK ELIMINATING MEANS FOR THREE-POSITION TYPE KEYS

Filed April 24, 1953

FIG. 1

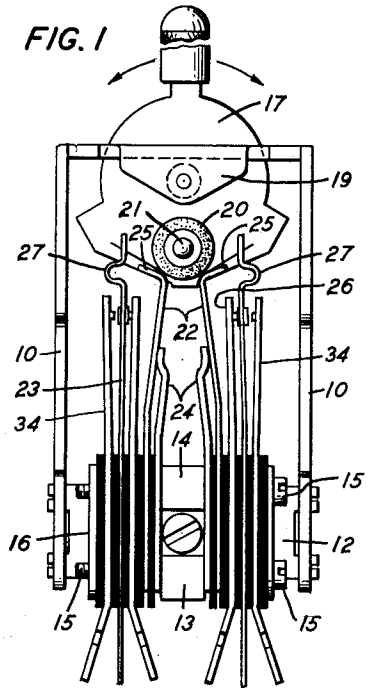


FIG. 2

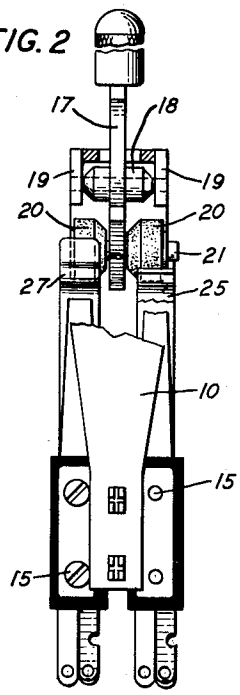


FIG. 3

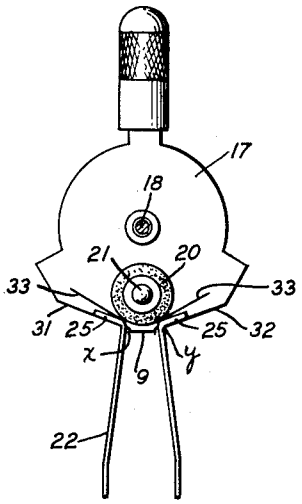


FIG. 4

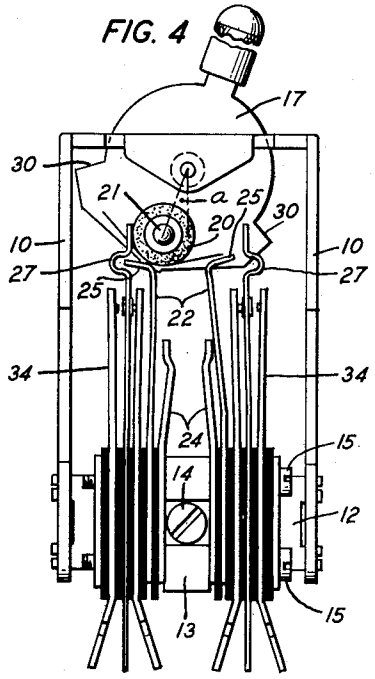
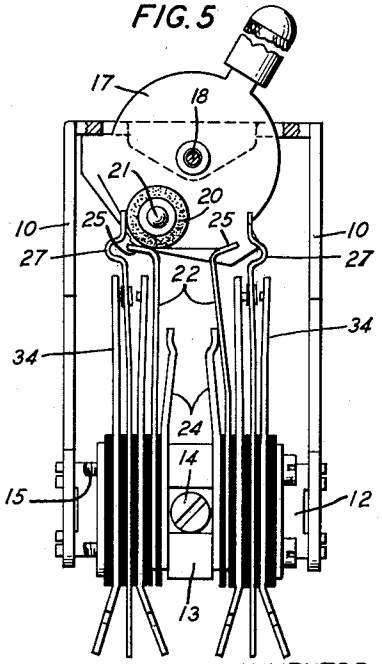


FIG. 5



INVENTOR
C. C. BARBER
BY
A. F. Kane
ATTORNEY

United States Patent Office 2,727,103 Patented Dec. 13, 1955

2,727,103

CLICK ELIMINATING MEANS FOR THREE-POSITION TYPE KEYS

Charles C. Barber, Freeport, N. Y., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

Application April 24, 1953, Serial No. 350,954

8 Claims. (Cl. 200—1)

This invention relates to switching keys and particularly to three-position lever type keys wherein a manually operable lever is actuated in either of two opposed directions from a normal position to effect the operation of either of two sets of contact springs.

Such keys, in general, are manually operated to either of their operate positions against the restraining action of a plunger spring or similar device which functions, in some instances to lock the lever in its operating position and in all instances to restore the lever to its normal position when released from an operate position. In its function of restoring the lever to normal position the plunger spring, unless other safeguards are provided, causes the lever to override its normal position and to falsely operate the springs of the adjacent set of springs. The two sets of contact springs and their corresponding plunger springs are so disposed that the plunger spring of one set functions to absorb the inertia of the lever as it restores from the position in which the springs of the other set are actuated, thus minimizing rebound and otherwise cushioning the shock of the returning lever. Heretofore, such plunger springs were contact-bearing springs and performed actual circuit control functions and were so disposed relative to a spring-actuating roller carried by the lever that even though rebound of the lever was considerably reduced, the impact of the roller on the spring frequently resulted in momentary false operation of the contact springs.

It is the object of this invention to eliminate false and untimely operation of the contact springs of switching keys and to otherwise simplify and improve the design of three-position manually operated keys from the viewpoint of manufacture and maintenance.

This object is attained in accordance with a particular feature of the invention by a switch design which permits the operating lever of a manually operable three-position key to be moved in either direction from a normal central position throughout a relatively large portion of its possible angular displacement before the actuating roller carried thereby encounters and operates the booster or control spring of a set of contact springs. This permits the operating lever to override its normal position appreciably when returning from an operate position without causing false or untimely operation of contact springs.

Another feature of the invention contemplates contactless plunger springs thereby further minimizing the possibility of false or untimely contact operation caused by transient or abnormal movements of the spring.

Still another feature of the invention resides in the utilization of a master or booster spring which controls the contact operations of the key and which is provided with a bulge or recessed area which is adapted to receive a roller-engaged lip of the plunger spring as the latter is moved in the direction of the contact springs, thereby permitting the plunger spring to move a considerable distance in the direction of the contact springs without actually encountering them.

A still further feature contemplates a switch construction which permits the lever roller to move the plunger spring in the direction of the booster spring throughout the initial portion of its angular displacement and to thereafter engage the booster spring and further displace it from the plunger spring to effect contact spring operation.

Still another feature of the invention resides in a switch lever design which permits the lever to be used as a target or reference in adjusting and check testing the shape and position of the plunger springs.

These and other features of the invention will be readily understood from the following detailed description when read with reference to the accompanying drawings in which:

Fig. 1 is a side view, in elevation, of a switching key incorporating the features of the invention;

Fig. 2 is an end view of the key shown in Fig. 1;

Fig. 3 is a side view of the operating lever of the switch showing the gauging contours and scribed lines thereon, each of which with the corresponding lower edge of the lever defines an area on the face of the lever within which the lip of the plunger spring must appear, when viewed by an assembler or inspector, to insure proper functioning of the switch;

Fig. 4 is a side view of the switch shown in Fig. 1 and illustrates the relative positions of the plunger and booster springs and the operating roller when the switch lever is moved in one direction through a major portion of its possible angular displacement; and

Fig. 5 shows the switch with the operating lever in a fully operated position.

The switch of this invention comprises an inverted U-shape frame having a pair of oppositely disposed, downwardly extended arms **10** which are joined near their extremities by a bridging member **12** which is staked or otherwise suitably secured to the frame as shown. The bridging member **12** supports a block **13** on either side thereof by means of a screw **14**. The blocks **13** are centrally disposed on the bridge member **12** and each serves to mount two sets of springs, one on each side of the block. Each two sets of springs are secured to their corresponding block by means of suitable screws **15** which pass through the components of both spring sets and the mounting block, and screw into a clamping plate **16**. This construction insures the spring sets being rigidly located on the bridging member **12** and in correct position with respect to a centrally disposed operating lever **17**.

The lever **17** is pivotally mounted on a pin **18** which is supported in suitable apertures in the oppositely disposed depending ears **19** of the frame. At its lower extremity and on each side thereof the lever **17** carries an insulating roller **20**, each of which is supported on a pin **21** which projects at right angles from the lever at a point below the pivot axis thereof.

Each set of springs comprises a plunger spring **22**, a booster or master control spring **23**, a rigid back stop or abutting member **24** and a number of circuit controlling springs all insulated one from the other and from the frame. In the drawings, the circuit controlling springs, by way of example, are shown consisting of a make spring **34** and a break spring **26**, it being understood that other contact spring combinations may also be incorporated in the switch structure. It is understood however, that regardless of the spring combinations employed, the make and/or break operations of the springs are controlled by the booster spring **23** which, in turn, is controlled by the lever-borne roller **20**.

Each plunger spring **22** is provided with an integral offset portion or lip **25** which projects from the upper end of the plunger spring in the general direction of the master spring **23** of the corresponding set of springs. The plunger

spring is so tensioned initially that the lips of two adjacent plunger springs abut the roller **20** on either side thereof at points on its periphery located to the right and left of the vertical axis of the roller, viewing Fig. 1. Thus the plunger springs, by virtue of the engagement of the lips thereof with the roller **20** cause the roller, and therefore the lever **17** to assume a normal upright or vertical position and to oppose any movement of the lever in either direction from normal.

Each booster or master control spring **23**, near its upper or operating end, is crimped or otherwise formed at **27** to provide a recessed or concave area or depression. This concavity is so located with respect to the lip of the plunger spring **22** of the same set that as the switch lever is actuated and the plunger spring moved by the roller **20** away from the stop **24**, the lip **25** enters the recessed area as shown in Fig. 4. It will be observed that during the initial movement of the lever from normal position the plunger spring is moved in the direction of the booster spring and because of the recessed area at **27** into which the lip **25** moves, the plunger spring is capable of considerable movement in the direction of the booster spring before engagement therewith is possible. It will be observed further, with particular reference to Fig. 4, that after the plunger spring **22** has been moved a considerable distance in the direction of the booster spring **23** and before engagement of these two springs might occur, the roller **20** engages the upper end of the booster spring and moves it in a direction away from the lip of the plunger spring which, during the last increment of the lever displacement, remains stationary while the roller **20** rolls on or slides over the face of the lip. This fully operated position of the switch is shown in Fig. 5 and in this position the lever **17** is locked by the action of the lip **25** on the roller **20**. When the lever is moved manually out of its locked position the plunger spring **22** acts upon the roller **20** in such a manner as to cause the lever to restore to normal position with a snap action. The plunger spring **22** of the adjacent set of springs then acts to cushion or absorb the shock of the restoring lever and tends to restrain the lever from overriding its normal position.

Since, as hereinbefore described, the lever is capable of movement from a normal position through an angular distance *a* Fig. 4, before the roller **20** engages the booster spring **23**, it follows that the lever, under the restoring action of a plunger spring, may overshoot its normal position to the same degree before the springs of the adjacent set would be disturbed. Furthermore, the roller encounters the plunger spring of the adjacent set of springs as it reaches normal position and any movement of the lever beyond this position is opposed by such spring. It is apparent therefore, that the likelihood of false operation of contact springs in the three-position switch of this invention is substantially non-existent. Still further, since the plunger spring as now designed does not carry contacts nor in any other way constitute an element of an electric circuit controlled by the switch, the possibility of false or accidental contact operation is further precluded.

The extent to which the lever can be operated in either direction from normal position is determined by the shoulders **30** of the lever which engage the undersurface of the cross bar of the U-shape frame as illustrated in Fig. 5.

As clearly illustrated in Figs. 1 and 3, the lower section of lever **17** is contoured in a manner to provide two slanting edges **31** and **32** and a joining short horizontal section **9**. This lever contour provides means for enabling an assembler or inspector to check the position of the plunger springs **22** with respect to permissable upper and lower limits and, with the two scribed lines **33** on the face of the lever define the margin or variation permitted in the angle the lip portion **25** of the spring makes with the horizontal when viewed by the assembler or inspector.

In utilizing the lever face as a target or background for the purpose of check testing the position of the plunger spring, the assembler notes whether or not there is any observable clearance or space between the end X of the edge section **9** and the inner face of the spring while the lip **25** is in engagement with the roller **20**. If no clearance is observed, the spring is too low and should be raised until there is an observable clearance at X. Under this condition the assembler knows the spring is not too low.

To determine whether or not the spring is too high, the assembler views the bend in the spring at Y and if any portion of the lever is observable at that point, then the spring is too high and must be lowered until the undersurface of the bend at Y coincides with or is in alignment with the edge **32** at the point immediately in back of the bend. Each of the described observations is made with the spring lip **25** touching the roller **20**.

The lip angle is checked by observing the location of the lip with respect to the lever area included between an edge **31** or **32** and the associated scribed line **33**. If the lip falls within this area, when observed by the assembler, the lip angle is concluded to meet prescribed requirements.

From the immediately preceding description it is apparent that the lever design provides a visual reference or target against which the plunger springs may be observed in order to check their positions on the switch and also the angle of the lips **25** thereof. It is also now apparent that the switch design of this invention provides a key unit having a large "non-click" travel margin that can be readily constructed and adjusted to gauged dimensions, gaps and travels by relatively inexperienced labor and which does not require a dynamic "click" test on the part of the adjuster or inspector.

What is claimed is:

1. In a switching key having a frame supporting a set of contact springs including a master spring and a pivotally mounted lever having a roller at one end for operating said contact springs, a plunger spring included in said set and having an offset portion at one end thereof projecting in the direction of said contact springs and normally engaged by said roller for movement thereby in the said direction, said master spring projecting above the offset portion of said plunger spring into the path traversed by said roller when said lever is actuated, and means including a recessed portion of said master spring located in substantial alignment with and adapted to receive the offset portion of said plunger spring when moved by said roller in the direction of said master spring whereby said roller first engages said plunger spring and moves it in the direction of said master spring and thereafter engages the projecting portion of said master spring to operate it.

2. In a switching key, a frame, an oscillatable lever mounted on said frame, a roller secured to said lever, two sets of contact springs mounted on said frame, one operable by said roller when said lever is moved in one direction from normal position and the other operable by said roller when said lever is moved in another direction from normal position, means for restricting overthrow of said roller in the direction of one set of contact springs when said lever is returned to normal position from a position in which the other set of contact springs is operated comprising a plunger spring associated with the said one set of contact springs and having an offset lip engaged by said roller upon return of said lever with a force tending to drive said plunger spring in the direction of the said one set of contact springs, and means permitting limited movement of said plunger spring in the direction of the said one set of contact springs without disturbing the contact springs thereof comprising a recess formed in one of the contact springs of the said one set adapted to receive the lip of said plunger spring.

3. In a key switch, a set of contact springs including a

master spring controlling the make and break of the switching contacts of said springs, said master spring having a recessed area near the operating end thereof, means for operating said master spring comprising a pivotally mounted lever and a roller secured thereto, said roller adapted to engage the operating end of said master spring to actuate said spring when said lever is displaced angularly through a predetermined arc, and means opposing the movement of said lever when operated comprising a plunger spring having an offset lip normally in tensioned engagement with said roller and extending in the direction of the recessed area of said master spring whereby said plunger spring is moved in the direction of said master spring and the lip thereof enters the recess in said master spring when said lever is operated.

4. The structure and combination defined in claim 3 wherein said master and plunger springs are so disposed relative to said roller that the master spring is operated by said roller only after said lever is moved through a major portion of its total angular displacement and during which movement the plunger spring is moved by the roller in the direction of the master spring.

5. The structure and combination defined in claim 3 wherein said plunger spring is devoid of switching contacts and is at all times during the angular displacement of said lever disassociated from said master spring.

6. The structure and combination defined in claim 3 wherein the lip of said plunger spring is so designed and said plunger and master springs are so disposed relative to said roller that during an initial angular displacement of the lever the lip end of the plunger spring is moved by the roller in the direction of the master spring a predetermined distance and thereafter the master spring is engaged and moved by the roller in a direction away from the lip end of the plunger spring to operate the contact springs.

7. In a switching key having a frame supporting sets of contact springs and a pivotally mounted oscillatable lever provided with an operating handle and an oppositely disposed roller, means cooperating with said roller for controlling the operation of said lever comprising a plunger spring abutting said roller on either side thereof, each of said plunger springs resiliently engaging said roller throughout a different angular movement of said lever from normal position, and a contact controlling master spring disposed with respect to each of said plunger springs so that it is engaged by said roller to effect contact between various of said contact springs only after said lever has been moved through a major portion of its angular displacement in a particular direction from normal and during which movement the corresponding plunger spring is flexed by said roller in the direction of said contact controlling spring.

8. In a switching key, sets of contact springs, a lever having a roller thereon for operating said springs when said lever is actuated, a pair of plunger springs for centering said roller with respect to said sets of contact springs, each said plunger spring having an offset lip extending therefrom at a predetermined angle and in engagement with said roller on a different side thereof, and means providing a visual method of adjusting and checking the location of said plunger springs with respect to said roller including a scribed line on said lever, which, with an edge of said lever defines an area within which the lip of a plunger spring must appear when viewed against the face of said lever as background.

References Cited in the file of this patent

UNITED STATES PATENTS

2,261,809	Nesius	Nov. 4, 1941
2,427,187	Bosh	Sept. 9, 1947