Clickless listening and ringing key

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2 Sheets—Sheet 2
The present invention relates to a three position switching key and more particularly to a telephone listening and ringing key.

Key structures of the type disclosed in the present invention are characterized by a manually operable lever which may be rotated from a neutral non-operated position clockwise or counter-clockwise through a prescribed angle about a fixed axis of rotation to effect the closure or opening of spring contact sets. The switch lever may be retained in an operated position, i.e., an operated position by a locking spring which may be included in the spring contact sets.

In general, the locking spring is a cantilever type being fixed at one end and having a bent portion turned outward in the path prescribed by a roller mounted on the lever in a manner well known to those skilled in the art. Equally well known to those skilled in the art is the inherent whipping action of the locking spring when the switch lever is released from an operated position. The locking spring suddenly and forcibly accelerates the switch lever from the first operated position past the neutral non-operating position causing a momentary overthrow of the switch lever into the opposite operating position before settling back to the neutral position.

These position switching keys having locking springs just discussed have been found to work satisfactorily for the purpose for which they were intended. However, when three position switching keys are equipped with spring contact sets in both operated positions, for example, telephone listening and ringing keys, the cantilever locking spring may cause an objectionable condition. This objectionable condition is experienced when the lever is released from the locked position. The switch lever may rotate about the axis to the other operating position momentarily to effect the closure or opening of the spring contact sets.

In telephone circuits in which listening and ringing keys of this type are used, the objectionable characteristic is characterized by a "click," which may be audible in a subscriber's telephone set connected to the current carrying lines in which the key is actuated.

Telephone listening and ringing keys which eliminate the "click" may be called clickless listening and ringing keys.

Accordingly, it is the general object of the present invention to provide a new and improved switching key.

It is another object of the invention to provide a novel means for automatically locking the switch lever in three stable positions, namely, a neutral non-operated position and two operated positions.

It is still another object of the invention to provide a novel means for preventing the overthrow of the switch lever past the neutral non-operated position when released from an operated position.

It is yet another object of the present invention to provide a single mechanical means for automatically locking the lever in the three positions of the switching key and to eliminate the overthrow of the switch lever.

Another object of the invention is to provide a switching key that may be easily converted from a locking type to a non-locking key.

It is the particular object of this invention to provide an improved clickless listening and ringing key.
The key embodying the features of this invention comprises a one-piece frame 1 substantially U-shaped having parallel first and second side plates 2 and 3, respectively, a height portion 4 connecting the parallel side plates 2 and 3 across the top of the key and inwardly turned end plates 5 and 6 extending perpendicularly from each side plate 5 and 6 nesting together to form a box-like structure 7 across the lower portion of the frame 1. The box-like structure 7 serves to mount two sets of spring contacts on each of the diametrically opposite end plates 5.

The spring contact sets are secured to the box-like structure 7 by means of suitable screws 8 which pass through the various components of the contact spring sets and screws into each end plate 5 and 6. This type of construction insures that the contact springs are rigidly and correctly located on a frame with respect to a centrally disposed operating switch lever 10 and at the same time lies in the side plates 5 and 6.

The switch lever 10 is mounted to rotate within the frame 1 by a shaft structure comprising a frame pin 11 which is fixed in a prepared opening in the side plates 2 and 3 of a bushing 12 to which the lever 10 is fixed. The frame pin 11 and bushing 12 are closely fitted in such a manner that bushing 12 is free to rotate on pin 11 without any appreciable shake. FIGURES 4 and 5 illustrate the action between the pin 11 and bushing 12 when the lever 10 is rotated clockwise or counterclockwise from a neutral position. FIGURE 6 shows one means by which the bushing 12 may be fastened to the lever 10. The means for fastening the bushing 12 to the lever 10 may be a knurled 13 roller on the outside diameter of the bushing and pressed into a prepared hole 14 in the lever 10. It is apparent, therefore, that the lever 10 rotates as a stable body about the pin 11 and that the force applied normal to the lever in its direction of travel will be balanced by the stabilized effect of the bushing 12.

The switch lever 10 includes a handle 15 at its upper portion, insulated lever rollers 17 and lever indent rollers 18 and 19. The pins 19 may be fastened to the lever in a manner similar to the bushing 12 as shown in FIGURE 6. The roller pins 19 are mounted at right angles to the lever 10 and positioned at a given angular and radial distance from the frame pin 11. The given angular distance of the pin is fixed relative to the spring contacts mounted on the frame pin 11. The indent roller 18 will be explained more in detail in conjunction with the features of the invention; but, for the present, the current application of the insulated rollers is to deflect outward certain spring contacts of the contact spring sets to open or close associated electrical circuits. The handle 15 which is made from insulating materials may be fastened to the lever by a threaded extension 16 of the lever 10.

The switch contact sets may comprise an operating spring 20 and a number of circuit controlling springs 21, 22, and 23, separated by insulating strips 24. The circuit controlling springs 21, 22, and 23 are fabricated in a manner well known to those skilled in the art and form no part of this invention. The operating springs 20 are tensioned against the rollers 17 and 18 to return the switch lever 10 to the neutral position. Thus, since the operating springs 20 serve only in the present case by their resiliency to return the lever 10 to the neutral non-operating position, these operating springs can be made with a smaller spring constant than locking type springs and in this way decrease the amount of force required to operate the switching key. The operating spring 20 may be a simple rectangular shaped leaf-spring of nickel silver or other suitable material. Excessive wear on the operating spring 20 is reduced by the rolling action of the rollers 17 and 18 on the operating spring 20.

In accordance with the invention, the above described switching key structure includes resilient detent means for the combined purpose of eliminating the over-throw of the switching lever 10 and for retaining the switching lever automatically locked in an operated position and in the neutral non-operated position. The resilient detent means comprises a resilient member 24, ball-dentets 25, an indent 26 positioned in the distal end of the roller 18 and screw 27 threaded through member 24 to frame 1. The ball-detents 25 may be hardened steel balls positioned to enter the indent 26 on rollers 18, when rollers 17 are in a first operated position and to occupy the space between rollers 17 and 18 when the lever 10 is in a neutral non-operated position. For this purpose, holes 28 are provided in the side plates 2 and 3 positioned at a point in the path prescribed by the indent 26. In this arrangement the ball-detents 25 are in constant rolling contact with rollers 17 and 18 normal to the direction of travel of the lever 10. Rolling contact between the ball-detent 25 and the rollers 17 and 18 reduces excessive wear.

The resilient member 24 may be a flat rectangular leaf-spring fixed at one end to the side plate 2 and 3 by screws 27. A hole 30 is provided at the free end of the resilient member 24 for the ball-detent 25. A chamfer 31 may be coined on the rim of hole 30 in order to reduce the friction between ball-detent 25 and resilient member 24. While it is absolutely necessary that the ball-detent 25 roll on the rollers 17 and 18, it does offer advantages by reducing friction between the cooperating parts. The combination of the ball-detent 25 and resilient member 24 may be modified into different embodiments of the invention as will be discussed later.

To illustrate the operation of the telephone listening and ringing keys, assume that moving the handle 15 counter-clockwise is the listening position as shown in FIGURE 3; and that moving the handle clockwise from the neutral position, is the ringing position. As it is well known the ringing position is momentarily actuated to call a subscriber by energizing the ringer in a telephone sub-set. It is not necessary to lock the switch lever 10 in the ringing positions since telephone systems may employ automatic ringing circuits. The switch lever may be locked in the listening position so that the operator can work hands free of the switching keys while still listening to a subscriber. Referring in particular to FIGURE 3, the lever 10 is moved clockwise about the frame pin 11 causing the lever rollers 17 and 18 to move the switch lever 10 on the rollers 18, while the indent 26 scribes a circular path about the frame pin 11. The ball-detents 25 enter the indent 26 when the rollers 17 depress operating spring 20 so as to close a circuit between spring 22 and 21. It should be noted that as the ball-detent 25 rolls on the roller 18, the roller 18 also rotates so that various surfaces of the indent 26 are presented to the ball-detent 25 in order to distribute wear on the periphery of the indent 26. To restore the switch to the neutral position, the lever 10 is moved clockwise about pin 11 causing the indent 26 to leave the ball-detent 25. The ball-detent 25 on the distal end of the roller 18 while the lever 10 is rotated until it snaps into the space between the rollers 18 and 17 automatically locking the lever 10 in a neutral non-operated position, thus preventing any overtravel of the switch lever 10 and also to give a sense of being in the neutral position.

In the ringing cycle of the switching key the lever 10 is rotated clockwise about pin 11 causing the indent ball 25 to move normal to the switch lever 10 and roll on roller 17. The switch lever 10 may be rotated until lever stop 32 abuts the frame 1. When the handle 15 is released the operating spring 20 automatically returns the lever 10 to the neutral position where the ball-detents 25 snap into the space between rollers 17 and 18 and again prevent the overtravel of the lever 10 past the neutral position. While there has been disclosed what is at present consid-
ered to be the preferred embodiment of the invention, modifications thereto will readily occur to those skilled in the art; for example, it may be obvious to those skilled in the art that the switching key may be a three way locking key having indent rollers 18 on the roller pins 19 replacing dent rollers 17, as shown in FIG. 8. A non-locking type of key may be provided by employing only rollers 17 on pins 19, as shown in FIG. 9. Regardless of what combination is shown in FIGS. 5, 7, 8 and 9 is used, the listening and ringing key still operates as a clickless key because a detent will snap automatically into the space between the rollers when the switch lever 10 is returned to the neutral position.

The resilient member 24 and ball-detent 25 may be combined into a single member. The resilient member 24 may have a spherical projection in place of the ball-detent 25 to occupy the space between the rollers.

In another embodiment of the switching key, one of the resilient detent means 24 and ball-detent 25 may be removed from one side of the switch frame 1. Rollers 17 and 18 and detent member 24 and ball-detent 25 on one side of the switching key will function in a similar manner heretofore mentioned. This is possible because of the shaft structure previously described comprising the frame pin 11 and bushing 12.

It may also be obvious to those skilled in the art that the rollers 17 and 18 may be replaced by projections on the switch lever 10, and when it is desired that the switch be locked in one position or the other, indent 26 should be provided accordingly on the distal end of the projections. Other modifications thereto will readily occur to those skilled in the art. It is not, therefore, desired that the invention be limited to the specific arrangement shown and described, and it is intended in the appended claims to cover all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A switch comprising a frame, a member rotatable about a given axis on said frame, said member including first and second roller pins juxtaposed thereon at a given radial distance from said given axis, the longitudinal axis of said first and second pins being substantially parallel to said given axis, first and second rollers each having a distal end and a proximal end substantially perpendicular to the longitudinal axis thereof, end of said first and second rollers having an axial bore on said proximal end thereof for rotatably mounting said first and second rollers on said first and second roller pins, respectively, resiliently secured detent means including a detent positioned in the space between said first and second rollers when said member has a given neutral position, at least one of said first and second rollers having an indented surface on said distal end thereof, said detent being positioned to come into positive engagement with said indented surface on said distal end of said one end roller in response to said member rotating through a first given angle in a first direction from its neutral position, first and second spring contacts, said first spring contacts being positioned on said frame to be actuated by said second roller in response to said member being rotated through a second given angle and said second spring contacts being positioned to be actuated by said first roller in response to said member being rotated through a second given angle.

2. The switch defined in claim 1 wherein each of said first and second rollers have an indented surface on said distal end thereof, said detent being positioned to come into positive engagement with said indented surface on said distal end of said first roller in response to said member rotating through a first given angle in one direction from its neutral position and to come into positive engagement with said indented surface on said distal end of said second roller in response to said member rotating through a second given angle in the other direction from its neutral position.

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