July 10, 1951 W. S. BABCOCK, JR 2,560,324

SWITCHING KEY WITH ROLLER ACTUATING MEANS

Filed Oct. 9, 1948

2 Sheets-Sheet 1

Fig. 1

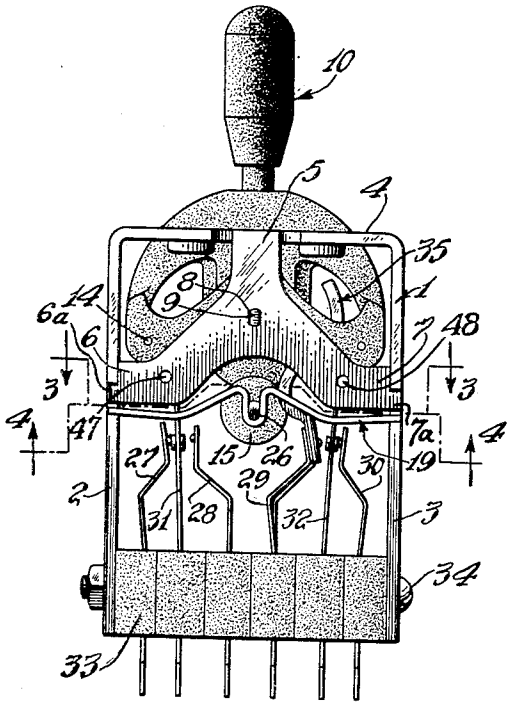


Fig. 3

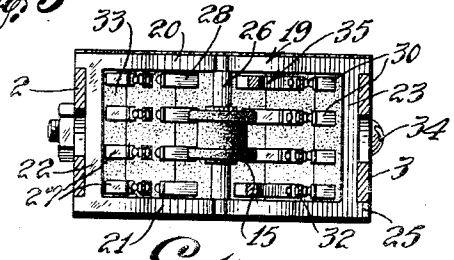


Fig. 4

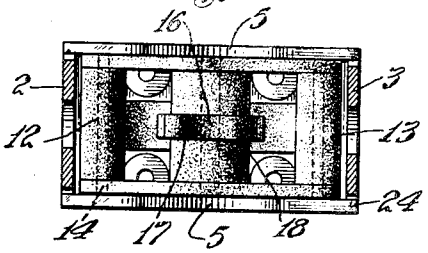


Fig. 5

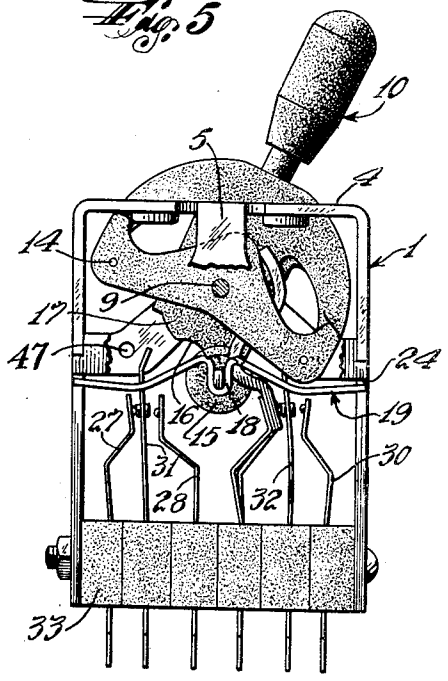
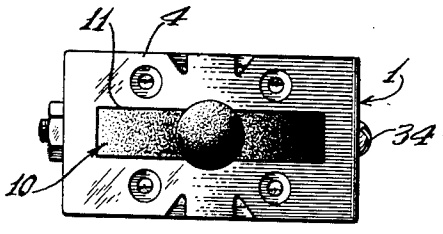


Fig. 2



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Fig. 6

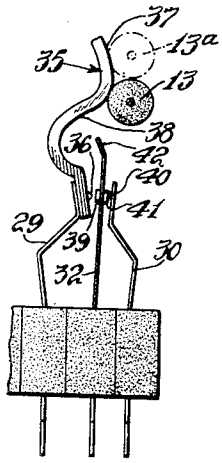


Fig. 7

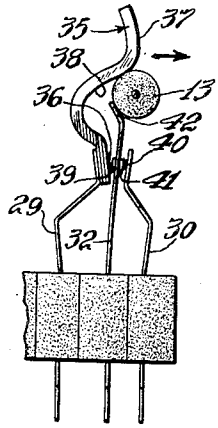


Fig. 8

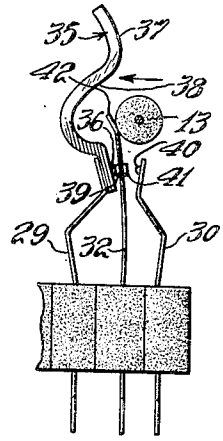


Fig. 9

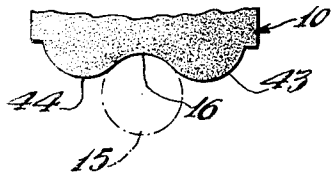
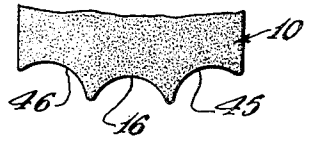


Fig. 10



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SWITCHING KEY WITH ROLLER ACTUATING MEANS

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12 Claims. (Cl. 179—176)

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This invention relates to electric switching and more particularly to a telephone switching key commonly used in conjunction with telephone switchboards.

One of the objects of this invention is to provide an improved switching key which is sturdy in construction and capable of being made up in several different variations from a minimum number of different parts.

Another object is to provide a switching key having improved lever positioning action and one which prevents or greatly minimizes any tendency of the lever to "over throw" when allowed to return to normal position.

One of the features of the invention is the simple and yet sturdy construction of the frame for supporting the lever of the key, the lever positioning roller and spring arrangement, and the contact units.

Another feature is the cam surface arrangement on the lever and the spring biased roller whereby the position of the lever is controlled either for a releasably locking position or for a self-restoring operation.

Still another feature of the invention is the identical shaping and arrangement of contact units whereby contact unit assemblies may be made up from a minimum number of different contact units.

The above-mentioned and other features and objects of this invention and the manner of attaining them will become more apparent and the invention itself will be best understood, by reference to the following description of an embodiment of the invention taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a view in side elevation of the switching key;

Fig. 2 is a plan view of the switching key;

Figs. 3 and 4 are sectional views taken along lines 3—3 and 4—4 of Fig. 1 to show the arrangement of contact units and the underside of the lever, respectively;

Fig. 5 is a view in side elevation similar to Fig. 1 with part of the frame removed and the lever moved to one of the contact actuating positions;

Figs. 6, 7 and 8 are fragmentary views of the contact actuating roller and an associated spring contact group, Fig. 6 showing the roller in normal position, Fig. 7 showing the roller moved slightly from normal position and Fig. 8 showing the roller moved to one extreme contact actuating position;

Fig. 9 shows one form of the cam surface of

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the lever adapted to cause the lever to return to normal position when released in contact actuating positions; and

Fig. 10 shows another form of cam surface for the lever adapted to releasably lock the lever in contact actuating positions.

Referring to Figs. 1 to 5 of the drawings, the switching key of my invention is shown to comprise a frame 1 of generally U-shape having legs 2 and 3 connected by a bight portion 4. The frame further includes two side parts each comprising three legs 5, 6 and 7, the leg 5 being integral with the bight portion 4 and disposed at right angles thereto with the legs 6 and 7 extending at right angles with respect to legs 2 and 3. While the two side parts are shown as comprising three legs, it will be clear that these parts may be of other shape if desired. For example, the parts may comprise a rectangular portion only which may or may not be the width of the bight portion 4.

The legs 5 of the side parts are provided with aligned openings 8, to receive a spindle or trunnion extensions 9 carried by the lever 10, whereby the lever is pivoted for rocking movement. As shown in Fig. 2 the bight portion 4 is provided with a slot 11 through which the lever 10 extends. In Figs. 1, 4 and 5, the lever 10 is shown to have two contact actuating rollers 12 and 13 rotatably supported a distance to the left and right of the lever spindle 9. Each of these rollers is pivotally supported on the body of the lever 10 by means of a spindle 14.

In order to control the position of the lever 10, a lever positioning roller 15 is provided for resilient engagement with cam surfaces 16, 17 and 18 provided on the lower extremity of the lever. The roller 15 is supported by a rectangular frame-like spring 19 carried by the legs 2 and 3 of the frame. As shown in Fig. 3, the spring 19 includes two side strips 20 and 21 connected together by end strips 22 and 23. The frame is provided with four cutouts or shoulders, as indicated at 24, to receive corner extensions such as indicated at 25. The strips 20 and 21 are provided with aligned detents or pockets or other locating means to receive the ends of spindle 26 upon which roller 15 is rotatably supported.

The spring 19 thus urges the roller 15 with resilient pressure against the cam surfaces 16, 17 and 18. As shown more particularly in Fig. 5, the center cam portion 16 is of concave shape so as to releasably lock onto the roller 15 thereby maintaining the lever 10 in normal or vertical position. The cam portion 18 in this form is also

shown to be concave so as to likewise releasably lock onto the roller 15 and thereby retain the lever in the position to which it is moved for this roller cam engagement. The cam portion 17, however, is shown to be of convex or inclined shape so that when the lever is moved to the position bringing surface 17 into contact with roller 15, the action of the spring and the roller on this surface exerts a pivotal movement on the lever so that should the lever be released in this position it is automatically returned to normal position. In this connection it should be noted that the concave cam surface 16 is such that when the lever is returned to neutral position either automatically or manually, the locking action of the surface 16 is such as to prevent or greatly minimize any tendency of the lever to "over throw" beyond normal.

The spring contacts of the switching key are made identical wherever possible so as to reduce the number of different parts. As shown, there is only one form of "outside" contact leaf and one form only of center contact leaf. For example, the outside contact leaves 27, 28, 29 and 30 are identical except that the contact leaves 28 and 30 are reversed in position so as to face contact leaves 27 and 29. Likewise, the center contact leaves 31 and 32 are identical except that they are reversed in position.

In the embodiment shown, four contact trios are provided on each side of the lever pivot, each trio comprising two outside contact leaves and one center contact leaf. The identical contact leaves that are arranged in alignment, such as the four contact leaves 27, Fig. 3, are molded together in a block of insulating material 33 to form an individual unit. Likewise, the other identical contact leaves that are arranged in alignment are also molded together as indicated by the unit bases for contact leaves 31, 28, 29, 32 and 30. It will be understood, of course, that each unit may have a greater or lesser number of contact leaves than here illustrated.

The bases of these units are all identical and preferably include corresponding aligned bosses and recesses so that they may be interchanged and reversed in position without varying the spacing relationship of the contacts carried by the leaves. These units are supported on a bolt 34 which passes through the bases thereof and the legs 2 and 3 of the frame. To insure a proper clamping action on the assembled units the ends of the legs 2 and 3 are slightly bowed crosswise thereof.

Prior to application of bolt 34, the legs 2 and 3 have a greater spread at the lower ends thereof than at the bight portion of the frame. This permits easy assemblage of the contact units and when the legs 2 and 3 are drawn by bolt 34 into clamping relation onto the contact units, the legs 2 and 3 are also brought into abutting engagement with the ends of legs 6 and 7. The extensions 6a and 7a of the legs 6 and 7 are received in cutouts on legs 2 and 3 to insure a minimum spacing between the legs 2 and 3 for the lever 10.

In the embodiment shown, particular reference being had to Figs. 1 and 5, the left hand contact group is shown to be of the break-before-make type while the contact group on the right hand side is of the make-before-break type. The latter type is made possible by using the same contact leaves together with the addition of extensions 35 which are secured thereto as indicated for leaf 29. The extension 35 is of such a width at its contact end that when welded or

otherwise attached to the leaf 29 it advances the contact 36 for a given spring tension toward the center of the contact group by the width of the extension 35. The extension 35 has two arcuately shaped portions 37 and 38, the portion 37 to be engaged by the roller 13 and the portion 38 shaped to recede from the roller as the roller is moved adjacent thereto.

As indicated, more particularly in Figs. 6, 7 and 8, the roller 13 is shown in engagement with the portion 37 for neutral position of the lever key. Should the lever be pivoted to the left to actuate the contact group on the left hand side, the roller 13 follows the arcuate shape of the portion 37 without movement of the leaf 29 to which the extension 35 is secured.

The curvature of portion 37 comprises the arc of a circle the center of which coincides with the axis of the lever spindle 9, so that a movement of the lever causing roller 13 to move up on portion 37 does not change the position of contact 36. This upper position of the roller 13 is indicated at 13a, Fig. 6. Fig. 7 shows the lever moved slightly to the right of normal position bringing the roller 13 slightly below the portion 37 whereby the extension 35 has been allowed to move a sufficient amount to the right bringing contact 36 into engagement with contact 39 of the center contact spring 32 while the contact 40 of the outer spring leaf 30 is still in contact with the contact 41 of leaf 32. Thus both outside contacts are closed with the center contact. With a continued movement of the lever to the right, the roller 13 leaves the extension 35 and engages the upper end 42 of the center contact leaf urging it to the left against the spring action of outside contact leaf 29. This action insures a tight conductive engagement between contacts 36 and 39 prior to the opening of contacts 40 and 41. As the lever is moved to the extreme right position the center contact is moved away from the outside contact 40 thereby breaking circuit therewith. It will be understood to those skilled in the art that additional make-before-break contact trios may be provided by adding extensions 35 to certain of the outside leaves of a trio depending upon available clearance provided by the structure of the lever.

The operation of the break-before-make contact group such as indicated in the left hand contact grouping (Figs. 1 and 5) is well known and need not be described in detail other than to call attention to the fact that as the roller 12 is brought into engagement with the upper end of leaf 31 the contact of leaf 31 is first caused to disengage from the contact of leaf 27 and then to engage with the contact of leaf 28.

In Fig. 9 an alternative arrangement of cam surfaces is shown for the lever. The cam surface includes a central concave portion 16, the same as in the form shown in Figs. 1, 4 and 5, and two side cam portions 43 and 44 identical to the convex cam portion 17. It will be understood that by using a lever with cam surfaces of this shape the lever is self-restoring each time it is released in one or the other contact actuating positions.

Fig. 10 shows still another cam surface arrangement. In this form the central concave cam portion 16 is also employed while the two side cam portions 45 and 46 are identical and present a similar concave shape for releasably locking the lever in right and left positions.

From the foregoing description of the cam surface arraangements, it will be clear that for

all practical purposes only three types of lever need be provided, that is to say, one having the cam surface arrangement shown in Figs. 1 and 5 and the other two having cam surfaces as shown in Figs. 9 and 10. It will be understood, however, that the form shown in Figs. 1 and 5 may be reversed by merely placing the lever in the reverse position within the frame.

Should it be desired to limit the lever for movement in only one direction from the normal or vertical position, a movement limiting pin may be placed in aligned pairs of openings 47 or 48 depending on which movement direction is to be rendered inactive.

While I have described above the principles of my invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of my invention.

I claim:

1. A switching key comprising a frame of substantially U-shape having a bight portion and two leg members projecting therefrom, said frame including two side parts formed integral with the sides of the bight portion of said frame, said parts being disposed at right angles to said bight portion and having aligned openings therein, a lever pivotally mounted on said frame, said lever having a cammed surface thereon, a roller, and means attached to said frame for supporting said roller independently of said lever and for resilient engagement with respect to said cammed surface to control the pivotal position of said lever.

2. A switching key comprising a frame of substantially U-shape having a bight portion and two leg members extending therefrom, a lever pivotally mounted on said frame, said lever having a cammed surface thereon, a roller for engagement with said cammed surface, means for supporting said roller on said frame and independently of said lever for resilient engagement with respect to said cammed surface, said frame including two three-legged side parts with a first leg of each part being formed integrally with the bight portion of said frame and the other two legs of said parts being disposed at substantially right angles to the said first leg for engagement with said two legs of the U-shaped frame and a spindle mounted between said parts being operatively positioned to pivotally support said lever.

3. In the switching key according to claim 1, wherein the means for supporting said roller includes two spaced spring strips having means to support said roller in a given relation with respect to said cammed surface.

4. A switching key comprising a frame of substantially U-shape having a bight portion and two leg members projecting therefrom, said frame including two side parts formed integral with the sides of the bight portion of said frame, said parts being disposed at right angles to said bight portion and having aligned openings therein, a lever pivotally mounted on said frame, said lever having a cammed surface thereon, a roller, and means for supporting said roller for resilient engagement with respect to said cammed surface to control the pivotal position of said lever, the pivotal mounting of said lever including a spindle forming trunions at its opposite ends supported within said openings, and the means for supporting said roller comprises a spring of rectangular frame-like form, two sides of said form having means to support said roller,

and means on the legs of said U-shape frame for supporting said spring form whereby said roller is held in a given resilient relation with respect to said cammed surface.

5. A switching key comprising a frame of substantially U-shape having a bight portion and two leg members projecting therefrom, said frame including two side parts formed integral with the sides of the bight portion of said frame, said parts being disposed at right angles to said bight portion and having aligned openings therein, a lever pivotally mounted on said frame, said lever having a cammed surface thereon, a roller, and means for supporting said roller for resilient engagement with respect to said cammed surface to control the pivotal position of said lever, wherein the cammed surface of said lever includes a concave portion operatively positioned to engage said roller and to maintain said lever in a first position and a second cammed portion to one side of said concave portion operatively positioned to control said lever when said lever is pivoted out of said first position.

6. A switching key comprising a frame of substantially U-shape having a bight portion and two leg members projecting therefrom, said frame including two side parts formed integral with the sides of the bight portion of said frame, said parts being disposed at right angles to said bight portion and having aligned openings therein, a lever pivotally mounted on said frame, said lever having a cammed surface thereon, a roller, and means for supporting said roller for resilient engagement with respect to said cammed surface to control the pivotal position of said lever, the cammed surface of said lever including a concave portion operatively positioned to engage said roller and to maintain said lever in a first position and a second cam portion to one side of said concave portion operatively positioned to control said lever when said lever is pivoted out of said first position, said second cam portion being of concave shape and operatively positioned to engage said roller upon being brought by movement of the lever into engagement with said roller.

7. The switching key according to claim 5, wherein said cam is of convex shape and is operatively positioned on said lever to abut said roller when said lever is pivoted from said first position, said roller, through the action of said resilient support, being operative to urge said lever back to said first position.

8. A switching key comprising a frame of substantially U-shape having a bight portion and two leg members projecting therefrom, said frame including two side parts formed integral with the sides of the bight portion of said frame, said parts being disposed at right angles to said bight portion and having aligned openings therein, a lever pivotally mounted on said frame, said lever having a cammed surface thereon, a roller, and means for supporting said roller for resilient engagement with respect to said cammed surface to control the pivotal position of said lever, the said cammed surface including a center concave portion operatively positioned to engage said roller and to maintain said lever in a first position of operation, and cam portions on either side of said center portion also of concave shape operatively positioned to engage said roller when the lever is moved to either side of said first position.

9. A switching key comprising a frame of substantially U-shape having a bight portion

and two leg members projecting therefrom, said frame including two side parts formed integral with the sides of the bight portion of said frame, said parts being disposed at right angles to said bight portion and having aligned openings therein, a lever pivotally mounted on said frame, said lever having a cammed surface thereon, a roller, and means for supporting said roller for resilient engagement with respect to said cammed surface to control the pivotal position of said lever, the said cammed surface including a center concave cam portion operatively positioned to engage said roller and to releasably maintain said lever in a first position, and other cam portions to the right and left sides thereof of convex shape operatively positioned to abut said roller and to urge the lever back due to the action of the resilient support for said roller when said lever is left in a position other than said first position.

10. The switching key according to claim 2, and further comprising a plurality of spring contact units and means to support said spring contact units between the legs of said U with the extremities of certain of said spring contacts operatively positioned for engagement by said lever.

11. In a switching key, a frame, a lever pivotally carried by said frame, a plurality of tricontact units arranged in side-by-side relationship in said frame each unit comprising a center contact and a pair of outer contacts, one of the outer contacts of at least one unit being provided with a substantially rigid extension having preformed oppositely curved convex and concave portions, said projection extending substantially transverse to the path of movement of said lever and having its convex portion normally in engagement with said lever to maintain said one of said outer contacts out of contact engagement with the adjacent center contact and upon initial movement in said direction said lever registering with said concave portion

to permit said outer contact to engage said center contact and upon further movement to engage said center contact to move said center contact, said projection and said outer contact away from the other outer contact of the trio group to provide a make-before-brake contacting sequence.

12. In a switching key, a lever, a center and two outer contact springs, one of said outer contact springs having a substantially rigid extension having preformed oppositely curved concave and convex portions to cooperate with said lever respectively at different angular positions thereof, said extension being mounted substantially transverse to the path of movement of said lever and with the convex portion normally engaging the said lever to maintain said outer contact spring from engagement with said center contact, said lever during the initial movement thereof in one direction from normal registering with said concave portion to allow said center contact to engage both said outer contacts and subsequent movement of said lever in said direction causing said lever to engage said center contact to disengage it from said other outer contact while maintaining it in engagement with said one outer contact.

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