March 3, 1959 H. J. SMITH 2,875,639

SWITCHING DEVICE MECHANISM

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FIG. 2

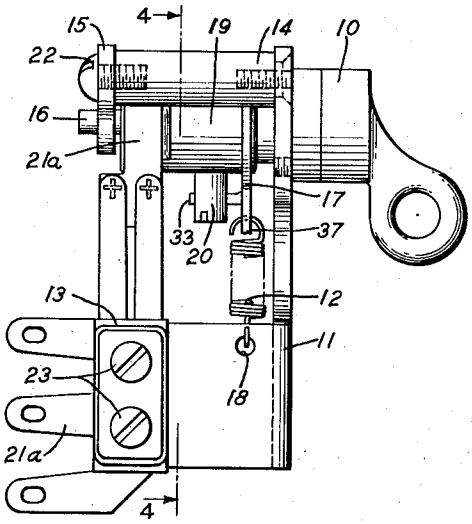

FIG. 1

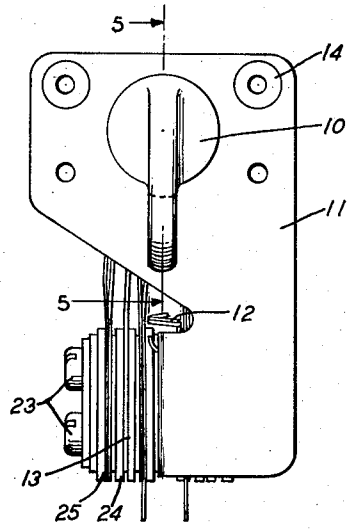

FIG. 3

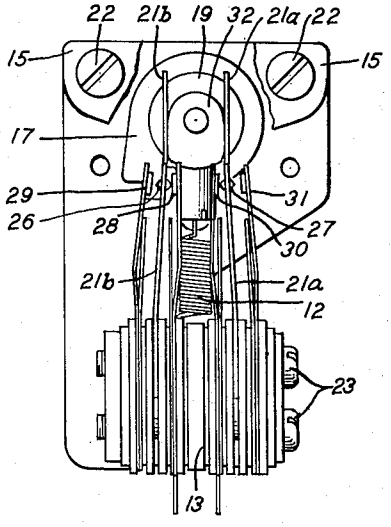

FIG. 4

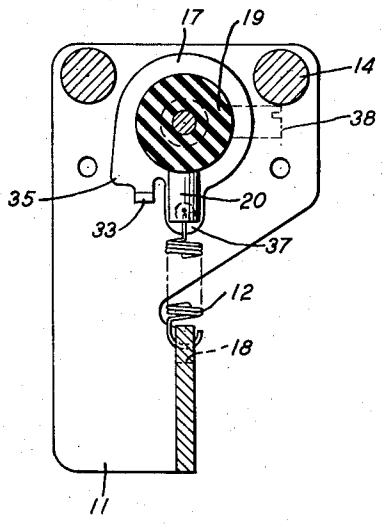

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FIG. 5

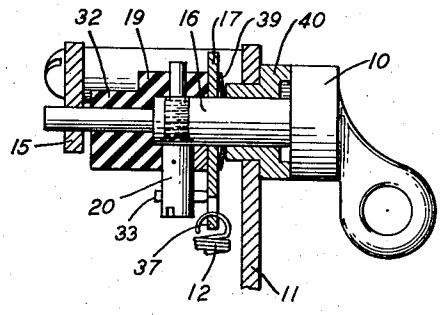


FIG. 6

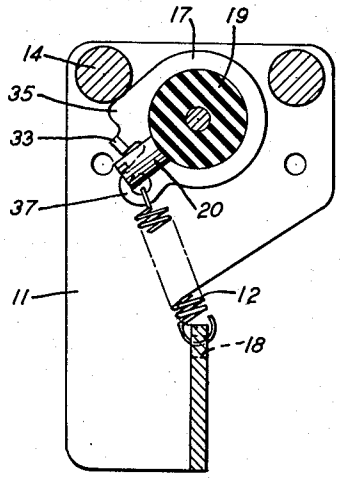


FIG. 7

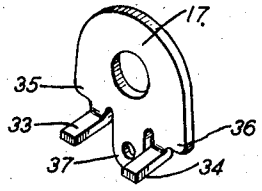


FIG. 9

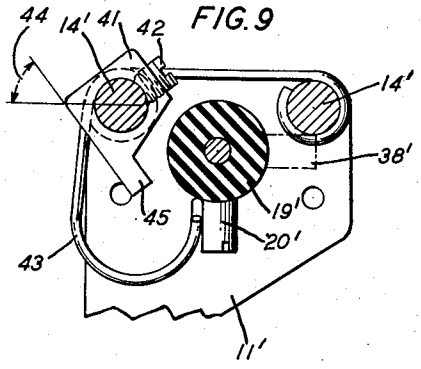
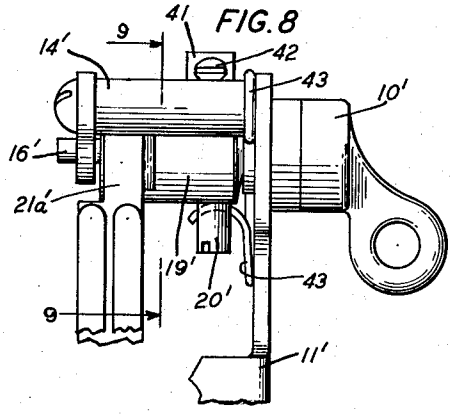


FIG. 8



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SWITCHING DEVICE MECHANISM

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Application January 15, 1954, Serial No. 404,211

6 Claims. (Cl. 74—504)

This invention relates to switching devices, and more particularly to keys.

An object of this invention is to provide a key which can be non-locking or locking, as desired, when it is operated to either side of its normal or unoperated position.

A further object of this invention is to provide a key that is more economical and simpler to manufacture, which requires fewer parts and whose trouble-free life expectancy is greater than those presently in existence.

Still another object of this invention is to provide elementary means for establishing various combinations of locking and non-locking operations to meet varying circuit requirements.

A feature of this invention is the employment of a plate which acts as a stop to prevent over-travel when the key lever is operated.

Another feature of the invention involves the utilization of a helical spring cooperating with the plate to return an operated key lever to its normal position when it is released.

More particularly, the non-locking and stop features involve the employment of a plate, mounted on the shaft of the key lever and freely rotatable with respect thereto, held in the unoperated position by the restraining force of a helical spring, moved by a projecting pin integrally connected to the key lever shaft and a cam which controls the spring contact assemblies, and used to provide positive stops when the key lever is operated in a direction which is to be non-locking and to return the key lever to its unoperated position under the action of the stressed spring after the key lever has been released from an operated non-locking position.

The improvements in keys noted above may be more fully understood from the following detailed description when read with reference to the acompanying drawings in which:

Fig. 1 is a front view of a preferred embodiment of the present invention;

Fig. 2 is a side view of the improved key shown in Fig. 1;

Fig. 3 is a rear view of the key shown in Fig. 1, partially cut away to show certain details of the construction more clearly;

Fig. 4 is a section taken on line 4—4 of Fig. 2;

Fig. 5 is a section taken on line 5—5 in Fig. 1;

Fig. 6 is a section taken on line 4—4 in Fig. 2 when the key is in a non-locking operated position;

Fig. 7 is a perspective view of one arrangement of the plate used on an improved key, which particular plate is non-locking in both directions from the normal or unoperated position;

Fig. 8 is a side view of a key which illustrates the prior art type of key lever mechanism which may be replaced by the present invention as an improvement thereon; and

Fig. 9 is a section taken on line 9—9 in Fig. 8.

In the description to follow, whenever a relative position or direction of movement is indicated, e. g. to the left, to the right, upward or downward, it has reference

to a key in a position such as shown in Fig. 1 and viewed in its proper perspective. For instance, if the key lever is said to be displaced to the left, it means that the key lever **10** is moved towards the left side of the drawing. A reference to the rearmost portion of the key identifies that portion of the key toward the left side of Fig. 2, or behind the key depicted in Fig. 1.

Figs. 1, 2, 3 and 4 show the key in its normal or unoperated position. Referring to these figures, it will be observed that the key comprises a frame assembly, a key lever and shaft assembly, a non-locking stop assembly, and a spring pileup assembly.

The frame assembly comprises a key shaft support bracket **15**, spacers **14**, and a bracket **11** which is properly formed for mounting the key lever and shaft assembly, the spring pileup assembly **13**, and a portion of the non-locking stop assembly. The spacers or separators **14** maintain a desired separation between the bracket **11** and the key shaft support bracket **15**; these parts are held in their proper positions by screws **22**.

The key lever and shaft assembly (Fig. 5) is supported and restrained from lateral movement by the bracket **11** and the key shaft support bracket **15**, but it is freely rotatable therein. The key lever and shaft assembly comprises a key lever **10**, a shaft **16**, a cam **19**, a bushing **40**, a washer **39** and a pin **20**. One end of the shaft **16** is fixedly connected to the key lever **10** and the combination is rotatable with respect to the bushing **40** which is fixedly retained on the bracket **11**. The other end of the shaft **16** is supported by the key shaft support bracket **15**. Integrally connected with the shaft **16** is a cam **19** whose rearmost (towards support bracket **15**) portion **32** is formed in the shape of a spherically capped rectangle (see Fig. 3). Fixedly screwed through the cam **19** and the shaft **16** is a projecting pin **20**. The plate **17** is freely rotatably mounted on the shaft **16** between the cam **19** and a spring washer **39**, the washer abutting the bushing **40**.

The non-locking stop assembly comprises the plate **17** and the helical spring **12**. The plate **17** (Fig. 7) is of a semicircular shape having thereon one or two shoulders **35** and/or **36** and one or two projecting arms **33** and/or **34** on its lower portion and a tab **37** lying between and below the arms **33** and **34**. As was pointed out above, plate **17** is mounted on the shaft **16**, freely rotatable therewith; the helical spring is attached between the tab **37** and the predrilled hole **18** in the bracket assembly **11**.

The spring pileup assembly **13**, comprising alternate layers of insulator blanks such as **24** and flat contact springs such as **25** (see Fig. 1), has two control springs **21***a* and **21***b* (see Fig. 3) on which are mounted contacts **27** and **26**. These control springs **21***a* and **21***b* act as lead-out terminals for the pileup assembly. The spring pileup assembly is mounted on the frame assembly by screws **23**. When so mounted, the uppermost ends of control springs **21***a* and **21***b* bear with positive pressure against the rearmost portion **32** of cam **19** (see Fig. 3) due to the pretensioning of springs **21***a* and **21***b* before assembly.

In explaining the mode of operation of the improved key, it is best to disregard the non-locking stop assembly for the moment. Under this condition, when the key lever **10** is rotated to the left of its normal or unoperated position (see Fig. 3), the rearmost portion **32** of cam **19** displaces the control spring **21***a* to the left which transfers the circuit by way of control contact **27** from break contact **30** to make contact **31** without affecting control spring **21***b*, control contact **26**, and contacts **28** and **29**; they are not affected due to the configuration of, and pivoting point for, the cross-section of the rearmost portion **32** of cam **19**. Reversely, when the key lever **10** is operated to the right of its normally unoperated position, control spring **21***a*, control contact **27** and contacts

30 and 31 are unaffected, while control spring 21*b* is displaced to the right thereby transferring the circuit by way of control contact 26 from the break contact 28 to the make contact 29.

Fig. 4 more clearly discloses the novel features of the improved key with a non-locking stop assembly included. A key which is non-locking in one direction and locking in the other direction is illustrated. If the key lever 10 is displaced to the left of its normal position, the pin 20 will not "pick up" the plate 17 because projecting arm 34 on the plate 17 (Fig. 7) has been removed. Thus, when the key lever 10 has been rotated approximately ninety degrees the pin 20 abuts the spacer 14 and the key remains in an operated position identified by the reference numeral 38 (Fig. 4) due to the pressure of control springs 21*a* and 21*b* on the rearmost portion 32 of cam 19. The key lever must be manually returned to its normal position. On the other hand, when the key lever is displaced to the right from its normal unoperated position (Fig. 6), the pin 20 positively and continuously engages the projecting arm 33 on the plate 17 thereby carrying the plate with it as the key lever and shaft are rotated. When the key lever and shaft have been rotated a predetermined number of degrees the shoulder 35 on the plate 17 stops further rotation by abutting the frame assembly spacer 14. Because the plate 17 has been angularly displaced from its normal position the helical spring 12 is placed in tension. On release of the key lever the energy stored in the stressed spring 12 returns the plate 17 to its normal position and the projecting arm 33 of the plate 17 positively and continuously engages the key lever and shaft assembly and carries it to its normal unoperated position through the agency of pin 20.

If it is desired to produce a key which is non-locking when the key lever is moved either to the right or to the left of the normal or unoperated position, the plate 17, depicted in Fig. 7, would be employed. In this case the pin 20 of the key lever and shaft assembly would rotate the plate 17 by engaging projecting arm 33 or 34 and then shoulder 35 or 36 would act as a stop against one of the spacers 14 of the frame assembly. On release of the key lever the energy stored in the spring 12 would return the plate 17 to its normal position, and concomitantly, the key lever and shaft assembly.

In order to fabricate a key which locks when the key lever is displaced to either side from the normal or unoperated position, the plate 17 may be replaced by a washer (not shown) or the projecting arms 33 and 34 and their corresponding shoulders 35 and 36 may be removed from the plate 17.

In the case where it is desired to have the key non-locking in one direction only, say to the left, the projecting arm 33 and shoulder 35 on the right side of the plate (see Fig. 7) would be omitted thereby allowing the key lever to operate as described above.

In some cases it is desirable that only one operated position be provided. This can be accomplished very simply by mounting a projecting pin (not shown) on the bracket 11 in such a position that it acts as a premature stop for pin 20.

Figs. 8 and 9 disclose a typical prior art key which may be referred to in order to illustrate the improvements embodied in the present invention. The principal difference between the old key and the improved device herein described in detail lies in the non-locking stop assembly. As will be noted in Fig. 9, a separate stop 41 is fixedly mounted on separator 14' by set screw 42 and at horizontal angle 44 so that pin 20' of the key lever and shaft assembly will abut the stop 41 at a projection 45 when the key lever is operated to that side of its normal position. A formed wire spring 43, so shaped that it fits around spacers 14' and rests against pin 20' close to cam 19', is used to provide the non-locking feature. As the key lever and shaft assembly is rotated to the right, pin 20' compresses spring 43 until pin 20' is stopped by projection 45 on stop 41. When the key lever is released spring 43 returns the key lever and shaft assembly through the agency of pin 20' to its normal or unoperated position. When the key lever is rotated to the left (to the locking position), however, the absence of a formed wire spring cooperating with pin 20' in this movement permits the key lever to function in a manner similar to the improved key lever's operation to a locking position.

It is to be understood that the above-described arrangements are illustrative of the application of the principles of the invention. Numerous other arrangements may be devised by those skilled in the art without departing from the spirit and scope of the invention.

What is claimed is:

1. A switching device comprising, in combination, a frame, a shaft rotatably mounted in said frame and maintaining a normal unrotated position with respect thereto, said shaft having an integral radially projecting member thereon, means for rotating said shaft from its normal position, a plate freely rotatably mounted on said shaft, and biasing means urging said plate to maintain a normal unrotated position, said plate including means positively and continuously engageable by said member when said roating means is actuated to cause said plate to be rotated and to operate against the effect of said biasing means, said plate rotatable in opposite directions from the normal unrotated position of the plate, said means of said plate positively and continuously reacting against said member to return said shaft to said normal position in response to said biasing means upon the deactuation of said rotating means.

2. A switching device comprising, in combination, a frame, a shaft rotatably mounted in said frame and maintaining a normal unrotated position with respect thereto, said shaft having an integral radially projecting member thereon, means for rotating said shaft from its normal position, resilient means, a plate freely rotatably mounted on said shaft and interconnected to said frame by said resilient means thereby to urge said plate to maintain a normal unrotated position, and said plate including means positively and continuously engageable by said member when said rotating means is actuated to cause said plate to be rotated and to place said resilient means under tensile stress, said plate rotatable in opposite directions from the normal unrotated position of the plate, said means of said plate positively and continuously reacting against said member to return said shaft to said normal position in response to said stressed resilient means upon the deactuation of said rotating means.

3. A switching device comprising, in combination, a frame, a shaft rotatably mounted in said frame and maintaining a normal unrotated position with respect thereto, said shaft having an integral radially projecting member thereon, means for rotating said shaft from its normal position, a plate freely rotatably mounted on said shaft, resilient means interconnecting said frame with said plate to urge said plate to maintain a normal unoperated position, said plate including first means positively and continuously engageable by said member when said shaft is rotated by the actuation of said rotating means to rotate said plate against the resilient force of said resilient means, said plate rotatable in opposite directions from the normal unrotated position of the plate, and said plate including a preselectedly formed second means engageable by said frame to limit shaft rotation to a preselected amount, whereby said first means enables said plate which positively and continuously acts on said member in response to said resilient means to return said shaft to said normal position upon the deactuation of said rotating means.

4. In combination, a frame, a shaft rotatably mounted in said frame and maintaining a normal unrotated position with respect thereto, means for applying a force

to said shaft to rotate same from its normal position, an integral radially projecting member on said shaft, a plate having at least one projecting arm cooperating with said member and at least one stop shoulder cooperating with said frame, said plate being freely rotatably mounted on said shaft, and resilient means interconnecting said plate with said frame to urge said plate to maintain a normal unrotated position with respect to said frame, said member and said arm mechanically disposed with respect to each other such that when said shaft is rotated in a predetermined direction said member positively and continuously engages said arm to rotate said plate against the resilient force of said resilient means and to maintain said plate in said rotated position until said force is removed from said shaft, said plate rotatable in opposite directions from the normal unrotated position of the plate, said shoulder and said frame mechanically disposed with respect to each other such that said rotation of said plate is stopped when said shoulder abuts said frame, said arm positively and continuously acting against said member upon the removal of said force to return said shaft to its normal position under the action of said resilient force of said resilient means.

5. A switching device comprising, in combination, a frame, a shaft rotatably mounted in said frame and maintaining a normal unrotated position with respect thereto, means for applying a force to said shaft to rotate said shaft in either direction from its normal position, an integral radially projecting member on said shaft, a plate having a first and a second projecting arm both cooperating with said member and a first and a second stop shoulder both cooperating with said frame, said plate being freely rotatably mounted on said shaft, and resilient means interconnecting said plate with said frame to urge said plate to maintain a normal unrotated position with respect to said frame, said arms mechanically disposed with respect to said member such that when said shaft is rotated in one direction said member positively and continuously engages said first projecting arm and when said shaft is rotated in an opposite direction said member positively and continuously engages said second projecting arm to rotate said plate alternatively in one of said directions against the resilient force of said resilient means and to maintain said plate in a rotated position until said force is removed from said shaft, said shoulders mechanically disposed with respect to said frame such that rotation of said plate in said one direction is stopped when said first shoulder abuts said frame and rotation of said plate in said other direction is stopped when said second shoulder abuts said frame, one of said arms positively and continuously acting against said member upon the removal of said force to return said shaft to its normal position under the action of said resilient force of said resilient means.

6. A switching device comprising, in combination, a frame, a shaft rotatably mounted in said frame and having a normal unrotated position with respect thereto, means for applying a force to said shaft to rotate said shaft in either direction from its normal position, an integral radially projecting member on said shaft and cooperating with said frame, a plate having only one projecting arm cooperating with said member and only one stop shoulder cooperating with said frame, and said plate being freely rotatably mounted on said shaft, resilient means interconnecting said plate with said frame to urge said plate to maintain a normal unrotated position with respect to said frame, said member and said arm mechanically disposed with respect to each other such that when said shaft is rotated in only one direction said member positively and continuously engages said arm to rotate said plate against the resilient force of said resilient means and to maintain said plate in a rotated position until said force is removed from said shaft, said shoulder and said frame mechanically disposed with respect to each other such that the rotation of staid plate in only said one direction is stopped when said shoulder abuts said frame, said arm positively and continuously acting against said member upon the removal of said force to return said shaft to said unrotated position under the action of said resilient force of said resilient means, and said member functioning independently of said plate when said shaft is rotated in the opposite direction to abut said frame to stop said opposite rotation.

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