Sept. 12, 1950 N. H. KOERTGE ET AL 2,522,278

CAM TYPE LIMIT SWITCH ASSEMBLAGE

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Fig. 1.

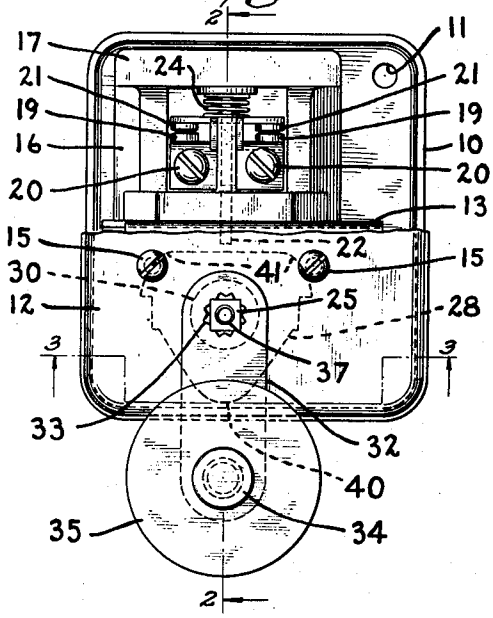
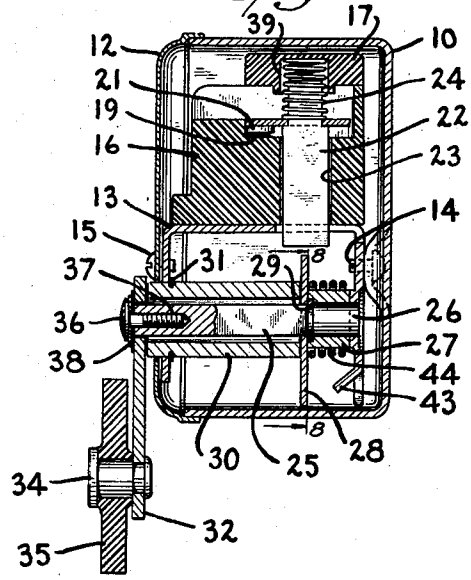


Fig. 2.



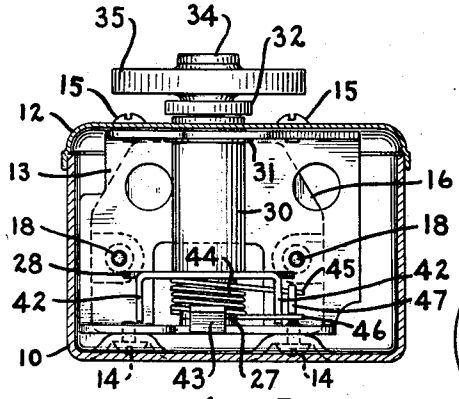


Fig. 3.

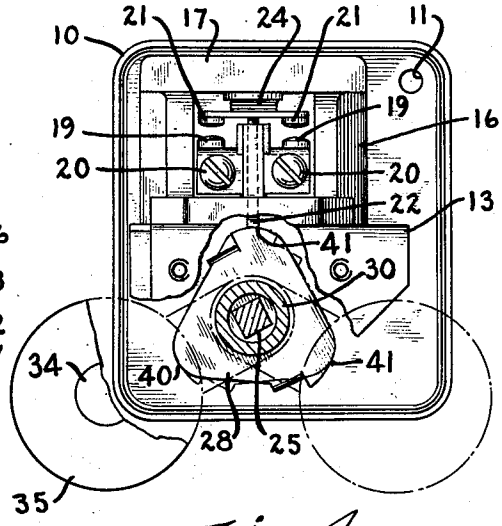


Fig. 4.

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Fig. 5.

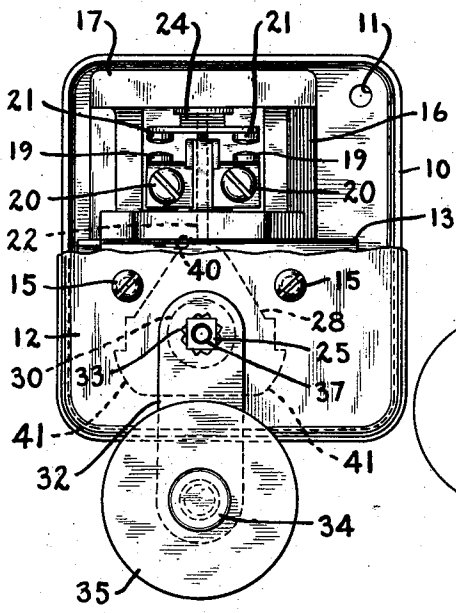
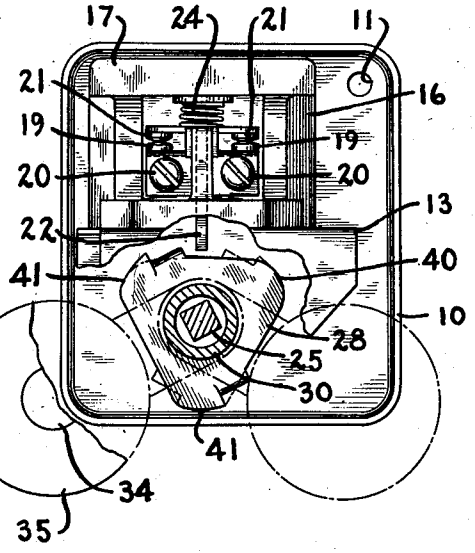


Fig. 6.



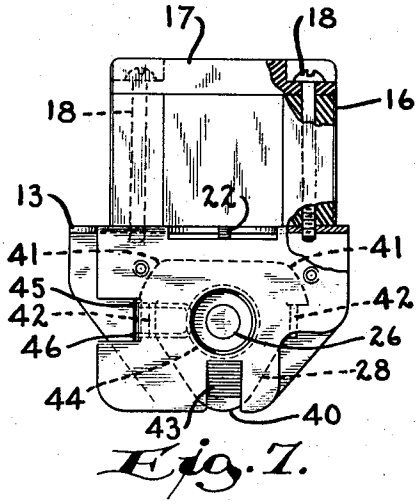


Fig. 7.

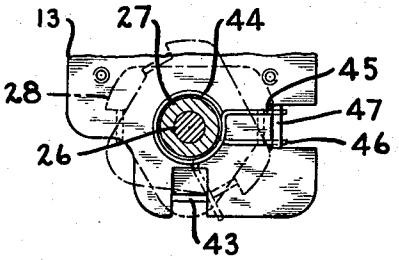


Fig. 8.

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CAM TYPE LIMIT SWITCH ASSEMBLAGE

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Application November 12, 1947, Serial No. 785,254

4 Claims. (Cl. 200—47)

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Our present invention relates generally to improvements in electric switch assemblages, and relates more particularly to various improvements in the construction and operation of limit switches of the type wherein the switch contacts are mechanically actuated with the aid of cam mechanism or the like, as illustrated in Patent No. 2,289,643, dated July 14, 1942, to W. C. Furnas and J. H. Hansen.

A primary object of the present invention is to provide an improved cam type limit switch which is extremely simple, durable, and compact in construction, and which is moreover highly efficient in use and flexible in its adaptations.

A more specific object of this invention is to provide an improved limit switch unit which is positive, dependable and rapid in action and which is moreover composed of relatively few simple parts.

Another specific object of the invention is to provide an improved neat and compact limit switch assemblage which can be quickly and conveniently adjusted to effectively meet various conditions of operation by merely changing the relative positions of simple parts, or by replacing one of the parts by a correspondingly simple element.

Another specific object of our invention is to provide an improved mechanically actuated limit switch wherein the switch contacts, operable to produce a variety of actions, are actuated by improved cam mechanism provided with integral limit stops.

A further specific object of our present invention is to provide an improved limit switch unit wherein the switch contact supporting block or housing is mounted in an improved and simple manner on an inverted U-shaped bracket or frame which also serves to rotatably support the cam actuating shaft and its associated parts.

An additional specific object of the present invention is to provide an improved cam type limit switch unit which is composed of a minimum number of simple parts assembled and retained in assembled condition in a novel and improved manner, and which may be readily utilized either with or without the enclosing casing or housing.

Still another specific object of our present invention is to provide an improved cam type limit switch wherein the various parts may be sturdily constructed of sheet metal or the like and readily assembled at extremely low cost.

These and other specific objects and advantages of the invention will be apparent from the following detailed description.

A clear conception of the several features constituting our present improvement, and of the mode of constructing and of utilizing improved cam type limit switches embodying the invention, may be had by referring to the drawings accompanying and forming a part of this specification, wherein like reference characters designate the same or similar parts in the several views.

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Figure 1 is an outside front view of one of our improved limit switches, showing the contact actuating cam assembled in "Normally On" position, and with a portion of the closure cover having been broken away to reveal internal structure and the retaining screw for the cam actuating lever also having been omitted.

Figure 2 is a transverse vertical section through the switch assemblage, taken along the line 2—2 of Figure 1;

Figure 3 is a transverse horizontal section through the switch unit, taken along the irregular line 3—3 of Figure 1;

Figure 4 is a front view of the normally concealed switch mechanism with the cam and its actuating lever moved to contact opening position, the enclosing cover having been removed and portions having been broken away to reveal internal and normally hidden structure;

Figure 5 is a view similar to that of Figure 1, but showing the contact actuating cam assembled in "Normally Off" position;

Figure 6 is a front view of the assemblage of Figure 5 showing the normally concealed switch mechanism with the cam and its actuating lever moved to contact closing position, the enclosing cover having been removed and portions having been broken away to reveal internal and normally concealed structure;

Figure 7 is a rear view of the switch contact assemblage of Figure 1, the casing or housing having been removed and portions having been broken away to reveal normally concealed structure; and

Figure 8 is a transverse section through the switch actuating mechanism, taken along the line 8—8 of Figure 2, the actuating cam being shown in dot-and-dash lines.

While the various features of the present invention have been shown and described herein as being especially applicable to a cam type limit switch of a particular design and with special reference to Patent No. 2,289,643, dated July 14, 1942, to W. C. Furnas and G. H. Hansen, it is not our desire or intention to unnecessarily restrict or limit the scope or utility of the improved feature by reason of such limited embodiment.

Referring to the drawings, the improved switch assemblage shown therein comprises, in general a main outer cup-shaped casing 10 having openings 11 in the rear wall thereof for effecting attachment of the switch unit to a suitable support, the casing or housing 10 also being provided with a detachable cover or closure plate 12; an inverted U-shaped supporting frame or mounting bracket 13 having one side or leg thereof removably secured to the rear wall of the casing by means of screws 14, with the casing cover 12 being detachably attachable to the other side or leg of the U by means of screws 15; a switch contact supporting block or housing 16 having a top plate 17 and being retained in assembled condition and rigidly secured to the top of the inverted U-shaped frame 13 by means of screws 18 or the like; a pair of laterally separated fixed contacts 19 rigidly secured within the housing 16 and having terminal attaching screws 20; a pair of similarly spaced movable contacts 21 flexibly suspended from a flat guide bar 22 slidably penetrating the housing 16 through an aperture 23, the contacts 21 coacting with a compression spring 24 which reacts against the plate 17; a square or otherwise polygonally shaped spindle 25 having a cylindrical inner end portion 26 bearing in a bore formed in the rear or inner wall or leg of the U-shaped frame 13 and snugly embraced by a spacer bushing 27; a cam 28, having a similarly shaped polygonal opening snugly received by the spindle 25 adjacent the cylindrical end 26 and spacer 27 in the plane of movement of the contact carrier bar 22; the cam 28 being retained in position on the spindle by a split retaining ring 29 or the like; a sleeve or spacer bushing 30 embracing the polygonal portion of the spindle 25 and coacting at its inner end with the flat side of the cam 28, the spacer 30 being formed with an annular groove near the outer end thereof for receiving a split retaining ring 31 which coacts with the inner surface of the front or outer wall or leg of the U-shaped frame 13 to retain the various parts in assembled condition; an actuating lever 32 having a star-shaped opening 33 at one end coacting with the spindle 25 adjacent to the outer end of the sleeve or spacer 30 and having its opposite end provided with a headed pin 34 on which an actuating roller 35 is journalled; a screw 36 coacting with a threaded socket 37 in the outer end of the spindle 25 and with a lock washer 38 to retain the lever 32 in place on the spindle 25; and torsion spring mechanism associated with the spacer 27 and cooperable with the cam 28 and with the rear wall of the U-shaped frame 13, as will be hereinafter more fully described, to effect automatic actuation of the movable contacts 21 in various positions of adjustment.

Most of the parts, including the main casing or housing 10, cover 12, supporting frame 13, switch contacts 19, 21, cam 28, and lever 32, may all be readily formed of sheet metal and with the aid of punches and dies and these parts may be coated in a well known manner to prevent corrosion. The contact supporting block or housing 16, top plate 17, and guide bar 22 are preferably formed of durable insulating material, and the movable contacts 21 may be flexibly suspended from a reduced upper portion of the carrier bar 22, as shown in Figure 2, so that proper engagement of these movable contacts with the fixed contacts 19 is insured when the switch is closed. The flat guide bar 22 should be freely slidable longitudinally in the contact supporting block 16,

and this bar, together with the movable contact 21, is constantly urged toward the cam 28 by the spring 24 which is preferably confined within a recess 39 in the top plate 17, as clearly shown in Figure 2, in order to retain it in place. Obviously the main casing 10 may also be provided with openings, not shown, in one side thereof through which the conducting wires may be introduced into the enclosure for attachment to the terminal screws 20 in the usual manner, or the main casing 10 may be omitted entirely and the frame 13 may be mounted directly to the desired support. It is particularly important to note that the top plate 17 is retained in position on the contact block or housing 16 by the two screws 18 which also serve to rigidly secure the contact supporting block 16 to the U-shaped frame 13, and this frame 13 additionally houses the cam 28 and its associated mechanism and serves as a bearing for the rotating parts.

As hereinabove set forth, the cam 28 is provided with a polygonal opening which snugly engages the polygonal spindle 25 and is retained on the polygonal portion of the spindle 25 by the split ring 29, and the cam 28 may be removed endwise from the spindle upon removal of the split ring 29 and applied thereto in different angular positions with respect to the spindle axis. The cam 28 is approximately heart-shaped, as shown, and has a pointed lobe 40 and two similar side lobes 41; and this cam is also provided with two integral tabs bent inwardly or rearwardly to form ears 42, each ear being formed between one of the side lobes 41 and the central lobe 40. When the cam 28 is applied to the shaft or spindle 25 as shown in Figs. 1 and 2, with the lobe 40 directed downwardly, the movable contacts 21 will be normally maintained in closed position by the action of the spring 24 and will be moved to open position against the action of this spring by coaction with one or the other of the lobes 41 upon oscillation of the cam 28 in either direction from central position as clearly shown in Fig. 4. To provide a positive safety stop for limiting the extent of swing of the cam 28, the rear wall or leg of the U-shaped frame 13 is formed with an integral forwardly-bent tab forming a stop lug 43 engageable with the ears or abutments 42 upon oscillation of the cam 28. When the cam 28 is reversely applied to the spindle 25 as shown in Fig. 5, with the central lobe 40, directed inwardly, the movable contacts 21 will normally be held in open position by the lobe 40 of the cam 28, and will be moved to closed position by the action of the spring 24 when the cam 28 is oscillated in either direction from central position, and the stop lug 43 will likewise coact with the ears 42 of the cam to positively limit the movement of the cam 28.

As hereinabove set forth, the rear wall or leg of the U-shaped frame 13 is formed with a bore adapted to receive and serve as a bearing for the cylindrical end portion 26 of the spindle 25, and this cylindrical portion 26 of the spindle also carries the spacer 27 and the split retaining ring 29. The sleeve or spacer 30 which embraces the hexagonal portion of the spindle 25 serves primarily to retain the cam 28 against the retaining ring 29 and in proper position with respect to the bar 22, and this spacer snugly engages the corners of the hexagonal shaft portion. It should be noted that the sleeve or spacer 30 is retained in position within the U-shaped frame 13 and against the flat side of the cam 28 by the split ring 31 which coacts with the front leg or wall

of the frame 13, and since the other flat side of the cam 28 coacts with the ring 29 carried by the spindle 25, the entire contact actuating mechanism is properly maintained in position within the frame 13. The star-shaped opening 33 in the lever 32 is so formed that the lever may be applied to the polygonal portion of the spindle 25 in various positions of angular adjustment about the spindle axis, and the spacer 30 also serves as an abutment for the lever 32 when it is applied to the spindle 25. It is thus apparent that the actuating roller 35 and lever 32 may be associated with the polygonal spindle 25 in different angular positions relative to the cam 28, and the cam may likewise be associated with the same spindle in various angular positions, thereby providing a highly flexible assemblage. When the lever 32 and the screw 36 and lock washer 38 have been applied to the spindle 25, the actuating assemblage is complete; and it is important to note that the screw 36 not only holds the lever 32 in place on the spindle 25 but also draws the spindle 25 and the ring 29 forwardly against the cam 28 and spacer 30, thereby tightening the mechanism.

Referring particularly to Figs. 2, 3, 7 and 8, the improved torsion spring mechanism for automatically returning the cam 28 and lever 32 to predetermined position after oscillation of the lever 32 in either direction has been effected, comprises in general, a torsion spring 44 embracing the spacer 27 and having opposite outwardly projecting ends 45, 46 disposed on opposite sides of one of the ears 42 of the cam 28 and also coacting with opposite sides of a forwardly projecting lug 47 formed integral with the rear leg or wall of the U-shaped frame 13 outwardly beyond the plane of movement of the ears 42. The ears 42 of the cam 28 and the lug 47 may be provided with notches for retaining the spring ends 45, 46 in proper position; and when the spindle 25 and cam 28 are oscillated in either direction after the device has been assembled, either spring end 45, 46 will be moved with the ear 42 away from the fixed lug or pin 47, as shown by dot-and-dash lines in Fig. 8, while the other end will be held against movement by the lug 47, thereby causing the spring 44 to be wound about the axis and placed under higher tension. When the oscillating force on the roller 35 and lever 32 has been released, the spring 44 will act quickly to return both of its ends 45, 46 into engagement with the lug or pin 47, and the cam 28, spindle 25, and lever 32 will thus be automatically returned to initial or predetermined inactive position.

During normal use of the improved cam type limit switch, it is first necessary to properly position the cam 28 with respect to its carrying shaft or spindle 25, and to likewise properly position the lever 32 with respect to the spindle 25, so as to produce the desired operation of the switch at the desired moment. If the cam 28 and lever 32 are secured to the spindle 25 in the relative positions shown in Figs. 1, 2, 3, 4, 7 and 8, the movable contacts 21 will normally be closed and in engagement with the fixed contacts 19 and movement of the lever 32 and roller 35 to either the full or the dot-and-dash positions in Fig. 4, will cause one of the lobes 41 of the cam 28 to engage the actuating bar 22 and to thereby open the switch. Upon release of the actuating pressure on the roller 35, the cam 28 will automatically be returned to central position by action of torsion spring 44 in an obvious manner, and the spring 24 will accordingly become effective to close the contacts. On the other hand, if the cam 28 and lever 32 are secured to the spindle 25 in the relative positions shown in Figs. 5 and 6, the movable contacts 21 will normally be out of engagement with the fixed contacts 19 with the lobe 40 of the cam 28 in engagement with the actuating bar 22. If the roller 35 and lever 32 are subsequently shifted to either of the positions shown in full or in dot-and-dash lines in Fig. 6, the spring 24 will become active to move the contacts 21 to closed position in engagement with the fixed contacts 19. Upon release of the actuating pressure against the roller 35, the torsion spring 44 will become quickly effective to restore the cam 28 and lever 32 to the position shown in Fig. 5. It should, of course, be understood that the position of the actuating lever 32 with respect to the spindle 25 may be readily varied to suit different conditions of operation by merely releasing the screw 36 and adjusting the lever 32 upon the spindle 25.

From the foregoing detailed description, it will be apparent that the present invention contemplates provision of an improved cam type limit switch which is simple, compact, durable in construction and highly efficient and flexible in use. The improved assemblage is composed of a minimum number of parts and may be readily dismantled and reassembled with the cam 28 so positioned that the switch is either "normally on" or "normally off" as desired, and adjustments may be effected without use of special tools. Provision of the U-shaped frame 13 permits all working parts to be compactly and sturdily mounted and retained on this frame so that the improved switch assemblage may be used either with or without the outer casing 10 and cover 12, and the contacts are effectively housed and protected within the contact support 16 and top plate 17. The U-shaped frame 13 forms a bearing for the one-piece spindle 25 which is securely held against displacement by coaction of the retaining rings 29, 31, cam 28 and spacer 30; and the provision of integral ears 42 on the cam 28 and integral lugs 43, 47 on the rear leg of the frame 13 results in simple and effective means for limiting movement of the cam and for making the torsion spring effective to return the cam to neutral or predetermined position. The improved switch assemblage has proven highly satisfactory in actual use and may be manufactured and sold at moderate cost. While only one embodiment of the invention has been herein shown and described, it is apparent that the several features may be utilized in modified structures wherein it is desired to provide more than one cam of the same or different shapes to operate more than one set of contacts without departing from the present invention.

It should therefore be understood that it is not desired or intended to limit this invention to the exact details of construction or to the precise mode of use, herein shown and described, for various modifications may occur to persons skilled in the art to which this invention pertains.

We claim:

1. A switch assemblage comprising, an inverted unitary U-shaped frame, a polygonal spindle carried by said frame, said spindle having a cylindrical inner portion journalled for rotation in one integral side wall of said frame, a contact housing mounted directly upon the upper wall of said frame, a motion transmitting element slidably confined within said housing and movable through a guide slot in said upper frame wall toward and away from the axis of said spin-

dle, means for constantly urging said element toward said spindle, a cam mounted upon the polygonal portion of said spindle for rotation therewith in the path of movement of said element, said cam being adapted for coaction with said element to move the latter away from the spindle axis, a lever mounted on the polygonal portion of said spindle externally of said frame, a sleeve surrounding the polygonal portion of said spindle and coacting with said cam and with said lever to definitely space said elements apart, and means carried by said sleeve and coacting with the other side wall of said frame to prevent displacement of said sleeve, said spindle and said cam from said frame.

2. A switch assemblage comprising, a unitary sheet metal frame having depending front and rear integral walls and an upper transverse wall provided with a slot, a spindle passing through an opening in the front depending wall and being journalled for rotation directly in the rear depending wall, said spindle having a cylindrical journal portion and a polygonal portion extending away from said cylindrical portion and outwardly beyond said frame, a cam mounted upon one end of said polygonal portion adjacent said cylindrical journal portion and in proximity to said slot, a switch having a movable contact-carrying member passing through and guided in said slot and operatively cooperating with said cam, a lever mounted directly upon the protruding opposite end of the polygonal portion of said spindle, and a sleeve surrounding said polygonal spindle portion and having one end in engagement with said cam while its other end passes through and is confined against displacement by the front depending wall of said frame.

3. A switch assemblage comprising, a unitary sheet metal frame having depending front and rear integral walls and an upper transverse wall provided with a slot, a spindle passing through an opening in the front depending wall and being journalled for rotation directly in the rear depending wall, said spindle having a cylindrical journal portion and a polygonal portion extending away from said cylindrical portion and outwardly beyond said frame, a cam mounted upon one end of said polygonal portion adjacent said cylindrical journal portion and in proximity to said slot, a switch having a movable contact-carrying member passing through and guided in said slot and operatively cooperating with said cam, a lever mounted directly upon the protruding opposite end of the polygonal portion of said spindle, a sleeve surrounding said polygonal spindle portion and having one end in engagement with said cam while its other end passes through and is confined against displacement by the front depending wall of said frame, a cup-shaped outer casing secured directly to the rear wall of said frame, and an enclosing cover secured directly to the front wall of said frame, said spindle and said sleeve projecting through an aperture in said cover and said lever being secured to said spindle outwardly of the cover.

4. A switch assemblage comprising, a unitary sheet metal frame having depending front and rear integral walls and an upper transverse wall provided with a slot, a spindle passing through an opening in the front depending wall and being journalled for rotation directly in the rear depending wall, said spindle having a cylindrical journal portion and a polygonal portion extending away from said cylindrical portion and outwardly beyond said frame, a sheet metal cam mounted upon one end of said polygonal portion adjacent said cylindrical journal portion and in proximity to said slot, said cam being provided with a pair of spaced laterally projecting integral ears, a lug formed on the rear wall of said frame in the plane of movement of said cam ears and cooperable therewith to positively limit rotational movement of said cam in either direction, a switch having a movable contact-carrying member passing through and guided in said slot and operatively cooperating with said cam, a lever mounted directly upon the protruding opposite end of the polygonal portion of said spindle, and a sleeve surrounding said polygonal spindle portion and having one end in engagement with said cam while its other end passes through and is confined against displacement by the front depending wall of said frame.

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The following references are of record in the file of this patent:

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Number	Name	Date
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2,398,007	Hunter	Apr. 9, 1946