

July 14, 1942.

W. C. FURNAS ET AL

2,289,643

CAM TYPE LIMIT SWITCH

Filed June 9, 1941

2 Sheets-Sheet 1

Fig. 1.

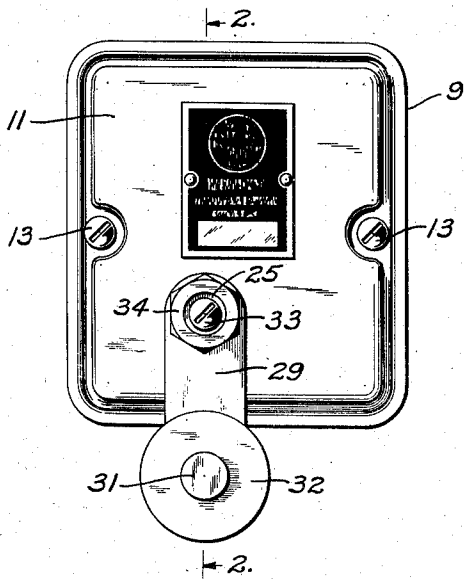


Fig. 2.

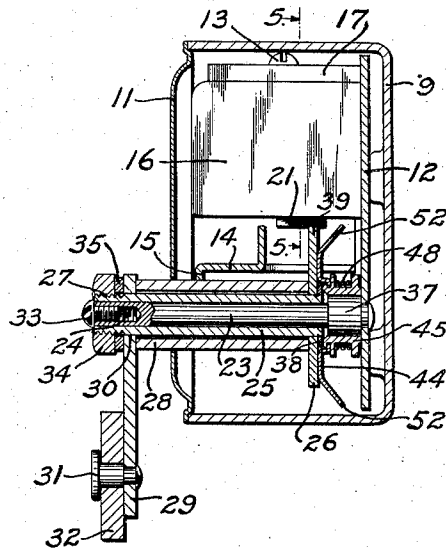
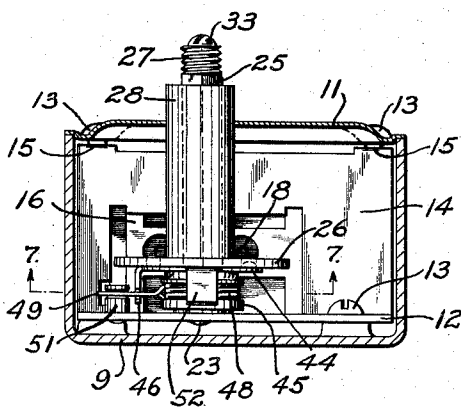


Fig. 3.



INVENTORS
W. C. Furnas
BY G. H. Hansen
Lieber & Lieber ATTORNEYS

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Fig. 4.

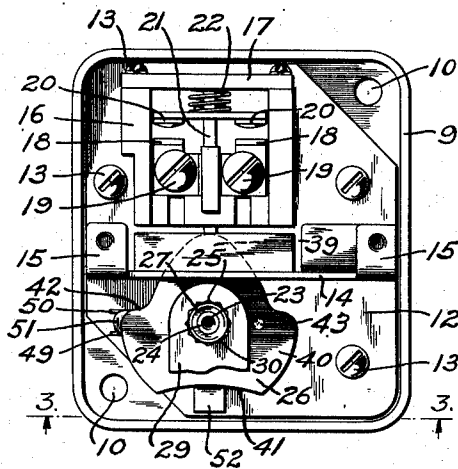


Fig. 5.

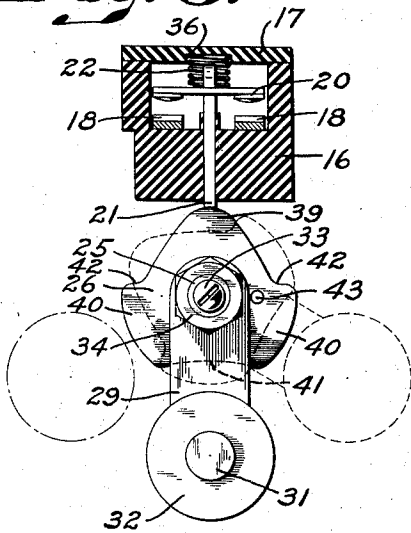


Fig. 6.

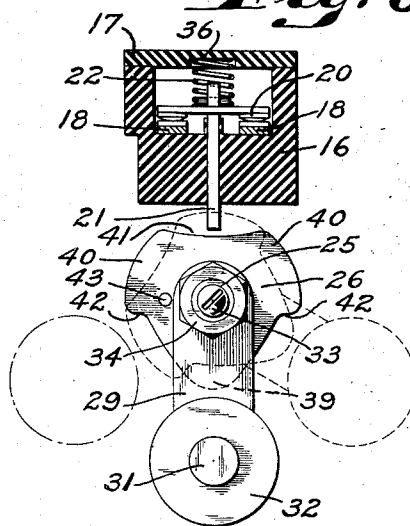
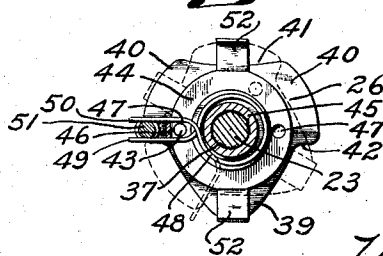


Fig. 7.



INVENTORS
W. C. Furnas
BY J. H. Hansen
Lieber & Lieber ATTORNEYS

UNITED STATES PATENT OFFICE

2,289,643

CAM TYPE LIMIT SWITCH

William C. Furnas and Gilbert H. Hansen,
Batavia, Ill.; said Hansen assignor to said
Furnas

Application June 9, 1941, Serial No. 397,228

6 Claims. (Cl. 74-99)

Our invention relates primarily to improvements in electric switch assemblies, and relates more particularly to various improvements in the construction and operation of limit switches of the type wherein the switch contacts are actuated mechanically with the aid of cam mechanism or the like.

An object of the present invention is to provide a new and useful cam type limit switch which is simple and compact in construction, and which is also highly effective in use and flexible in its adaptations.

Another more specific object of our present invention is to provide an improved cam type switch assembly of the general class wherein a roller carried by the switch operating lever is engageable with a cam or the like carried by a moving device such as an elevator, the movement of which is being controlled by the switch, to either make or break the electrical circuit.

A further specific object of the invention is to provide an improved limit switch unit, which is durable in construction, and which is also positive, dependable and rapid in action.

Still another specific object of our invention is to provide an improved compact switch assembly 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 similarly simple element.

An additional specific object of this invention is to provide a mechanically actuated limit switch wherein the contacts are actuated by improved cam mechanism of simple construction, and are operable to produce a variety of actions.

Another specific object of the present invention is to provide an extremely compact and sturdy limit switch unit, all parts of which may be readily constructed and assembled at minimum cost, and which is highly efficient in operation.

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

A clear conception of one embodiment of the invention, and of the mode of constructing and of utilizing the improved cam type limit switch, 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 various views.

Fig. 1 is an outside front elevation of one of the improved limit switches with the closure cover in normal position;

Fig. 2 is a section through the switch unit of Fig. 1, taken along the line 2-2;

Fig. 3 is a transverse section through the casing of the switch, taken along the line 3-3 of Fig. 4, and showing the actuating lever removed and the other mechanism in elevation;

Fig. 4 is a front elevation or plan view of the normally concealed switch mechanism, the enclosing cover having been removed;

Fig. 5 is a section through the switch contact assembly taken along the line 5-5 of Fig. 2, and showing the contact actuating the cam in one position of adjustment;

Fig. 6 is a section similar to that of Fig. 5, but showing the contact actuating cam in another position of adjustment; and

Fig. 7 is a transverse section through the switch actuating mechanism, taken along the line 7-7 of Fig. 3.

While the features of the present invention have been shown herein as being embodied in a cam type roller and lever actuated limit switch of a particular design, it is not our desire to thereby unnecessarily limit or restrict the scope and utility of the improvement.

Referring to the drawings, the improved cam type limit switch shown therein, comprises in general a main outer cup-shaped casing 9 having openings 10 in the rear wall thereof for effecting attachment of the switch unit to a support, and being provided with a detachable closure plate or cover 11; a supporting plate 12 removably secured to the rear wall of the casing 9 by screws 13, and having a bracket 14 rigidly attached thereto and provided with front flanges 15 to which the cover 11 is detachably attachable by other screws 13; a switch contact support and housing 16 rigidly secured to the plate 12 above the bracket 14 and having a removable top plate 17; a pair of laterally separated fixed contacts 18 rigidly secured within the housing 16 and having terminal attaching screws 19; a pair of similarly spaced movable contacts 20 flexibly suspended from a flat guide bar 21 slidably penetrating the housing 16, and coacting with a compression spring 22 which reacts against the plate 17; a fixed stub shaft 23 rigidly secured to the supporting plate 12 beneath the bracket 14 and having a threaded socket 24 at its outer end beyond the cover 11; a hollow hexagonal shaft 25 journaled for rotation on the fixed stub shaft 23 and having a cam 26 firmly attached to its inner end in the plane of movement of the contact carrier bar 21, while its outer end is provided with screw threads 27; a sleeve 28 embracing the

medial hexagonal portion of the shaft 25 and co-acting at its inner end with the flat cam 26; an actuating lever 29 having a star shaped opening 30 at one end coacting with the shaft 25 adjacent to the outer end of the sleeve 28, and having its opposite end provided with a headed pin 31 on which an actuating roller 32 is journaled; a screw 33 coacting with the socket 24 to retain the hollow shaft 25 upon the journal shaft 23; a nut 34 coacting with a lock washer 35 and with the screw threads 27, to retain the lever 29 and sleeve 28 in place; and torsion spring mechanism associated with the inner end of the stub shaft 23 and being cooperable with the cam 26 in various positions of adjustment to effect automatic actuation of the movable contacts 20.

The main casing 9, cover 11, supporting plate 12, bracket 14, switch contacts 18, 20, cam 26, and lever 29, may all be formed of sheet metal with the aid of punches and dies, and are preferably coated to prevent rusting. The contact supporting and protecting housing 16, top plate 17, and guide bar 21 are preferably formed of durable insulating material, and the movable contacts 20 may be flexibly suspended from the carrier bar 21 in order to insure proper engagement with the fixed contacts 18 when the switch is closed as in Fig. 6. The upper end of the spring 22 may be confined within a recess 36 in the top plate 17 as shown in Figs. 5 and 6, in order to retain the spring in place, and the flat bar 21 should be freely slidable in the housing 16 and is constantly urged toward the cam 26 by the spring 22. One side of the main casing 9 may also be provided with openings, not shown, for introducing the conducting wires into the switch enclosure so that they may be attached to the terminal screws 19.

The fixed stub shaft 23 may be provided with an enlarged base portion 37 as shown in Figs. 2 and 7, and the flat cam 26 is provided with a hexagonal central hole snugly engaging the outer hexagonal surface of the shaft 25 which is journaled on the outer smaller portion of the shaft 23. The end of the hollow shaft 25 adjacent to the enlarged portion 37 of the bearing shaft 23, is provided with a fixed plate 38 forming a stop for the cam 26, and this cam may be removed endwise from the opposite end of the shaft 25 and applied thereto in different angular positions with respect to the shaft axis. The cam 26 is of approximately heart shape as shown, and has a pointed lobe 39 and two side lobes 40 separated by a depression 41. Each of the side lobes 40 is separated from the central lobe 39 by an abutment 42, and when the cam 26 is applied to the shaft 25 as in Fig. 5, the movable contacts 20 will be held in open position by the cam when the latter is centrally disposed, and will be moved into closed position by the spring 22 when the cam is oscillated in either direction from central position. When such oscillation occurs, the abutments 42 will function to stop or limit the extent of swing of the cam 26, by engagement of the abutments with the end of the bar 21, but these abutments 42 will not ordinarily become effective and act merely as safety devices. When the cam 26 is reversely applied to the shaft 25 as shown in Fig. 6, the movable contacts 20 will be held in closed position by the spring 22 when the cam is centrally located, and will be moved into open position by the cam lobes 40 when the cam 26 is oscillated in either direction from central position. The improved cam 26 is also provided with an eccentric pin 43 pro-

jecting rearwardly therefrom, the function of which will be later explained.

The sleeve 28 which embraces the hexagonal portion of the shaft 25 serves primarily to keep the cam 26 against the stop plate 38 and in proper position with respect to the bar 21, and this sleeve 28 snugly engages the corners of the hexagonal shaft portion. The sleeve 28 however also serves as an abutment for properly positioning the lever 29 upon the hexagonal shaft 25, and the star opening 30 is so formed that the lever 29 may be applied to the shaft 25 in various positions of angular adjustment about the shaft axis. The actuating roller 32 and lever 29 may thus be associated with the hexagonal shaft 25 in different angular positions relative to the cam 26, and the cam may also be associated with this same shaft in various angular positions, thereby making the assemblage very flexible and adapted for operation under diverse conditions. As previously indicated, the screw 33 serves to retain the hollow shaft 25 upon the fixed bearing shaft 23; and the nut 34 and lock washer 35 serve to retain the lever 29 attached to the shaft 25 and also maintain the sleeve 28 and cam 26 in place, and the position of the lever 29 may be varied without removing the cover 11.

The improved torsion spring mechanism for automatically returning the cam 26 and lever 29 to predetermined position, after oscillation of the lever 29 in either direction has been effected, is best shown in Figs. 2, 3 and 7, and comprises a plate 44 rigidly secured to a spool or hub 45 journaled on the enlarged portion 37 of the fixed shaft 23, and having an integral laterally projecting lug 46 and two diametrically opposite holes 47 interchangeably cooperable with the cam pin 43; a torsion spring 48 embracing the hub 45 and having opposite outwardly projecting ends 49, 50 disposed on opposite sides of the lug 46; and a pin 51 rigidly secured to the supporting plate 12 and disposed between the torsion spring ends 49, 50. The plate 44 may be formed of sheet metal, and is also provided with inclined peripheral projections 52 adapted to limit the extent of oscillation thereof about the shaft 23; and the lug 46 and pin 51 may be provided with notches for retaining the spring ends 49, 50 in proper position. This torsion spring assemblage is so constructed and arranged, that the cam projection 43 may be caused to cooperate with either of the holes 47 in the disk or plate 44, and when the shaft 25 and cam 26 are subsequently oscillated in either direction, either spring end 49, 50 will be moved away from the fixed pin 51 while the other spring end will be held against movement, thereby causing the spring 49 to be wound about its axis and placed under higher tension. When the oscillating force is released, the spring 48 will act quickly to return both of its ends 49, 50 into engagement with the pin 51, and the cam 26, shaft 25, and lever 29 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 26 with respect to its carrying shaft 25, and to likewise properly position the lever 29 with respect to this shaft 25, so as to produce the desired operation of the switch at the desired moment. If the cam 26 and lever 29 are secured to the shaft 25 in the relative positions shown in Fig. 5, the movable contacts 20 will normally be out of engagement with the fixed contacts 18. If the roller 32 and lever 29 are subsequently shifted to either of the positions shown in dot-

ted or in dot-and-dash lines in Fig. 5, the spring 36 will become active to move the contacts 20 to closed position in engagement with the fixed contacts 18. Upon release of the actuating pressure against the roller 32, the torsion spring 48 will become quickly effective to restore the cam 26 and lever 29 to the position shown in Fig. 5. On the other hand, if the cam 26 is reversed as in Fig. 6, the movable contacts 20 will normally be closed and in engagement with the fixed contacts 18; and movement of the lever 29 and roller 32 to either the dotted or dot-and-dash positions, will cause the lobes 40 of the cam 26 to engage the actuating bar 21 and to thereby open the switch. Release of the actuating pressure on the roller 32, will again cause the cam 26 to assume central position and will thereby permit the spring 36 to become effective to close the contacts. This operation will again be automatically accomplished by the torsion spring 48, in an obvious manner. It will be understood that the position of the actuating lever 29 with respect to the shaft 25 may be readily varied to suit different conditions of operation, by merely releasing the nut 34 and adjusting the lever 29 upon the shaft 25.

From the foregoing detailed description of the construction and operation of the improved switch, it will be apparent that the present invention provides an improved cam type limit switch which besides being simple and durable in construction, is extremely flexible in its adaptations and efficient in operation. The various adjustments can be quickly and readily accomplished without the use of special tools, and the improved cam 26 makes it possible to have the switch either open or closed when the mechanism is in central or neutral position.

All of the elements of the assemblage are readily accessible for inspection and adjustment, and all parts may be readily constructed and assembled. The casing 9 and cover 11 provide an effective housing for the working parts, while permitting adjustment of the lever 29 without removing the cover. The contact support 16 cooperates with the top plate 17 to effectively house and protect the contacts, and the bracket 14 is so constructed that the conductor wires may be readily applied to the terminals 19 without danger of having the wires interfere with the normal operation of the cam mechanism. The improved switch assemblage has proven highly satisfactory in actual use, and may be manufactured and sold at moderate cost since most of the elements are adapted to be formed of sheet metal with the aid of punches and dies.

While the invention has been shown and described herein as being embodied in a cam type limit switch having a single cam 26 of definite shape, and wherein the contacts are either closed or open when the cam is in central or mid-position, it should be clearly apparent that more than one cam may be mounted on the same shaft 25 and caused to operate more than one set of contacts; and that the cam may also be positioned to produce other operations of the contacts than those herein described. Such modifications are obviously within the contemplation of the present invention, and the particular shape of cam shown herein is purely illustrative.

It should be understood that it is not desired

to limit this invention to the exact details of construction or to the precise mode of use, herein shown and described, for various modifications within the scope of the claims may occur to persons skilled in the art.

We claim:

1. In combination, a casing, a stub shaft having one end fixedly mounted within said casing, a motion transmitting element slidably confined within said casing and being movable toward and away from the axis of said shaft, means for constantly urging said element toward said shaft, a hollow externally polygonal shaft journaled for oscillation upon said fixed shaft and having one end disposed within said casing in the path of movement of said element, a cam mounted upon said hollow shaft and coacting with said element to move the latter away from said axis, means carried by said stub shaft and coacting with said cam to constantly urge said hollow shaft into a predetermined position relative to said axis, and a lever mounted upon said hollow shaft remote from said cam, said lever and said cam each having a polygonal opening snugly engageable with the polygonal exterior of said hollow shaft in different angular positions relative to said axis so as to permit independent adjustment of said cam and lever about said axis.

2. Mechanism as per claim 1, characterized thereby, that a sleeve snugly embraces the polygonal outer portion of said hollow shaft and coacts with said cam and lever to definitely space said elements apart.

3. Mechanism as per claim 1, characterized thereby, that said casing is provided with an enclosing cover which is pierced by the outer ends of said stub and hollow shafts, and that said lever is detachably secured to said hollow shaft outside of said casing and cover.

4. Mechanism as per claim 1, characterized thereby, that the means for constantly urging the motion transmitting element toward the stub shaft is a spring, and that the means coacting with the cam for constantly urging the hollow shaft into a predetermined position is a torsion spring carried by a hub snugly embracing the fixed end of said stub shaft.

5. Mechanism as per claim 1, characterized thereby, that said hollow shaft is retained endwise upon said stub shaft by a set screw coacting with the adjacent outer ends of these shafts, and that said lever is held in place upon said hollow shaft by a nut which is removable without removing said set screw.

6. Mechanism as per claim 1, characterized thereby, that said hollow shaft is retained endwise upon said stub shaft by a set screw coacting with the adjacent outer ends of these shafts, and that said lever is held in place upon said hollow shaft by a nut which is removable without removing said set screw, and characterized thereby, that both said lever and said spacing sleeve are held in place upon said hollow shaft by the nut which is removable without removing said set screw, and that said lever and sleeve are also thus removable from the hollow shaft.

WILLIAM C. FURNAS
GILBERT H. HANSEN