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2,474,945

ADJUSTABLE LIMIT SWITCH

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3 Sheets-Sheet 1

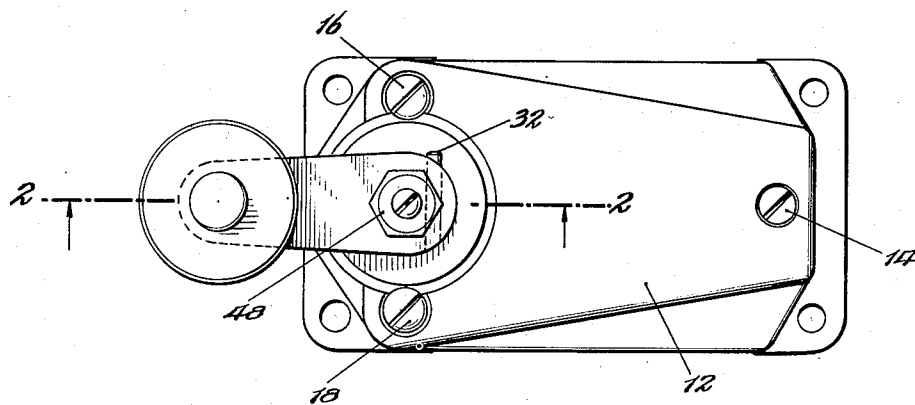


Fig. 1.

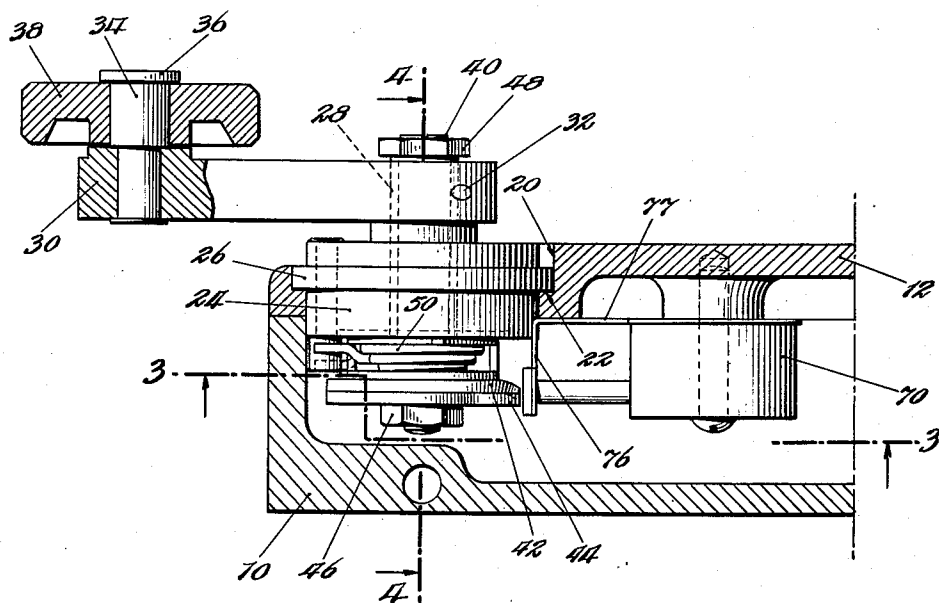


Fig. 2.

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3 Sheets-Sheet 2

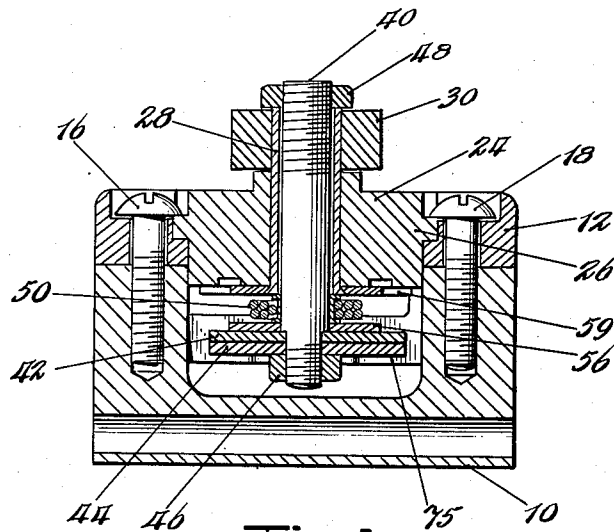
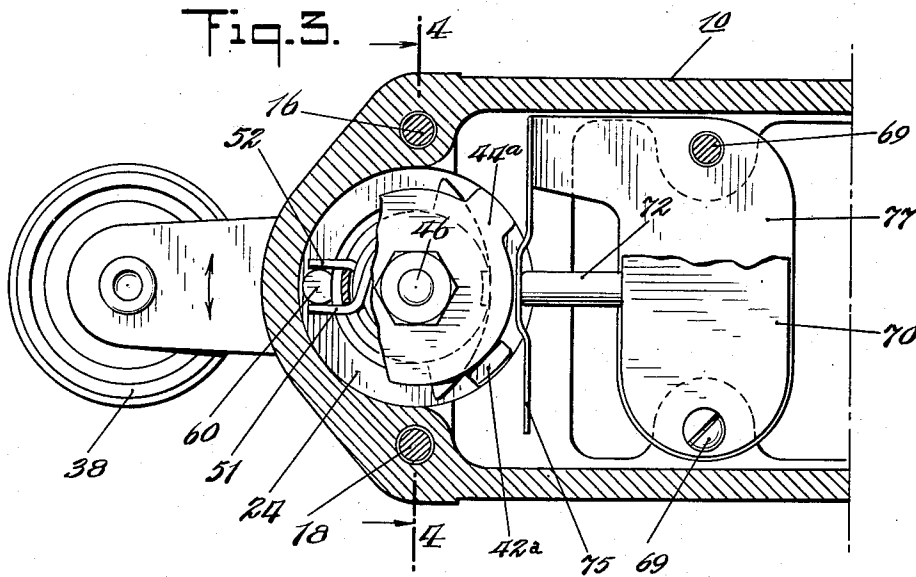


Fig. 4.

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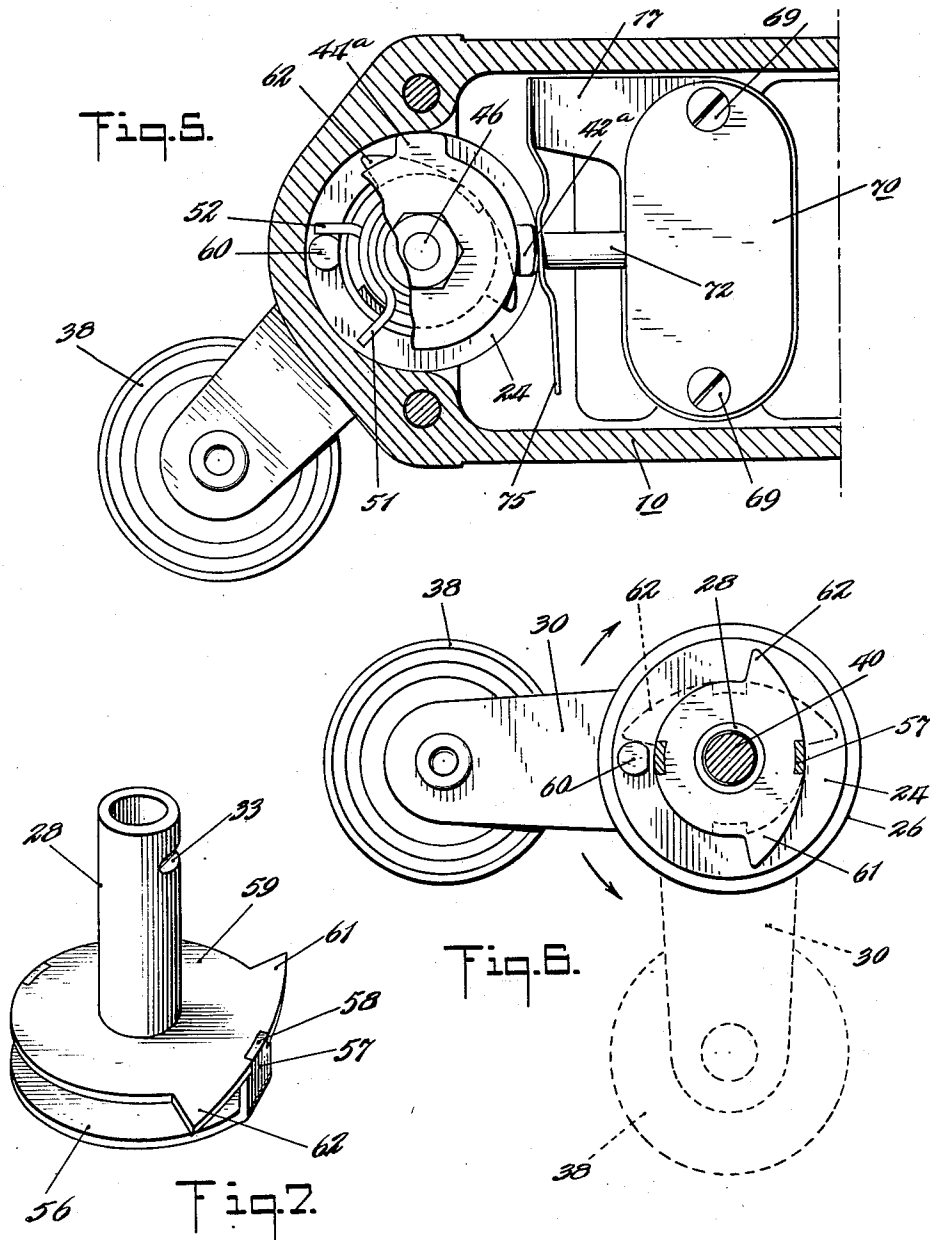
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ADJUSTABLE LIMIT SWITCH

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,474,945

ADJUSTABLE LIMIT SWITCH

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16 Claims. (Cl. 74-470)

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This invention relates to electric switches. More particularly it relates to the type of electric switch known as a limit switch wherein an arm is engaged by a moving part of a machine or mechanism after predetermined movement of that part to cause operation of contacts within the limit switch. In order that this type of mechanism can be adapted for general use, it is necessary that adjustment be possible for different amounts of movement and for different positions of the part of the machine or mechanism which is to operate the limit switch.

It is an object of the invention to provide an electric limit type switch having an operating mechanism which is unitary so that it may be adjusted as a unit within its mounting without changing the location or position of the support or of the switch contacts of the device.

Another object is to provide in a switch of the foregoing type means for adjusting the actuating elements of the switch individually without the necessity for adjustment of other parts of the mechanism or of its support.

Another object is to provide a switch mechanism of the foregoing type in which the operating parts return automatically to their original position after disengagement therefrom of the part of the machine or mechanism which has caused the operation of the device.

Another object is to provide a switch mechanism of the foregoing type which can be moved in either clockwise or counterclockwise direction from a neutral position.

Other objects and advantages will become apparent as the invention is described in the accompanying drawings.

In the drawings—

Fig. 1 is a plan view of the invention;

Fig. 2 is a longitudinal section view taken along line 2-2 of Fig. 1;

Fig. 3 is a longitudinal section view taken along line 3-3 of Fig. 2;

Fig. 4 is a transverse section view taken along line 4-4 of Fig. 2;

Fig. 5 is a view similar to Fig. 3 with the parts in a different position;

Fig. 6 is a detailed bottom plan view of the operating unit removed from its housing, and

Fig. 7 is a detailed view showing in perspective the spring cage member and mounting sleeve.

Referring to the drawings the invention is mounted in a hollow box or housing 10 having vertical side and end walls and an open top upon which a cover 12 is secured by means of three spaced securing screws or bolts 14, 16 and 18. At

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one end of the cover there is provided a circular opening 20 reduced inwardly to a smaller diameter to provide a shoulder 22. Rotatively slidable within the opening 20 there is cylindrical bearing member 24 having a circular peripheral flange 26 in its mid portion adapted to rest upon the shoulder 22. The flange and barrel of the member 24 are of slightly lesser diameter than the walls of the opening 20 with which they cooperate so as to permit rotation of the bearing member 24, under conditions as will hereinafter more fully appear. To fix the bearing in relation to the cover 12, the heads of the bolts 16 and 18 are positioned to overlie the flange 26 so that when the bolts 16 and 18 are screwed down tight, the underside of their heads will press upon and frictionally hold the flange and bearing member 24 in the position to which the bearing member has been adjusted.

The bearing member 24 has a central bore or passageway within which is slidably received a sleeve member 28 which extends beyond the upper surface of the bearing 24 and has mounted on its extending end a crank member 30. The crank is fixedly secured to the sleeve by a tangential pin 32 passing through a bore therein intersecting the sleeve 28 in a tangential groove 33 which is provided to accommodate the pin. In the end of the free end of crank 30 there is mounted a stud shaft 34 having one end enlarged to form a shoulder resting upon the upper surface (referring to Fig. 2) of the crank. The lower end of this reduced portion is peened over to secure the shaft upon the crank; and in the opposite or upper end of the shaft 34 there is provided a flange 36 to hold a roller 38 upon the shaft 34. The roller is rotatable upon the larger portion of the shaft to minimize friction as the roller is struck by or engages with a moving part of the machine or mechanism with which it may be desired to use the invention.

Passing axially through the sleeve 28 is a shaft or spindle 40. On the lower or inner end of the shaft 40 (shown in Figs. 2 and 4) two operating cam members 42 and 44 are mounted. Preferably these cams are stamped from sheet metal into disc form with radially extending segmental cam surfaces 42a and 44a. The cam 42 may be non-rotatably mounted upon the spindle 40 by providing a non-circular aperture in the cam to fit upon a non-circular portion of the shaft. Thus the cam 42 and the spindle 40 will always bear a fixed relation to each other. Preferably the cam 44 is made rotatively adjustable upon the end of the spindle 40 by providing a circular aperture in the

cam 44 to receive the spindle. To secure the cam 44 in properly adjusted position relative to the cam 42 and spindle 40, the lower or inner end (referring to Figs. 2 and 4) of the spindle 40 has a screw threaded nut 46 screwed thereon whereby to secure the cam 44 in immovable frictional engagement between the nut 46 and the cam 42.

In order to cause conjoint or unitary movement of the crank 30 and the spindle 40 with the parts mounted thereon, a securing nut 48 is screwed upon the threaded upper (referring to Figs. 2 and 4) end of the spindle 40 to bind the crank hub upon the end of the sleeve 28 thereby locking the spindle 40 and the sleeve 28 together.

In order to return the crank and associated moving parts to neutral or mid-position, a spiral spring 50 is wound around the spindle between the cam 42 and bearing member 24. The spring is contained within a spring cage which is stamped from sheet metal parts comprising a disc shaped bottom plate 56 having legs 57 bent up parallel to the spindle axis and having reduced ends 58 engaging in diametrically opposite peripheral notches in a disc-shaped top plate 59. The reduced ends of legs 57 are peened over to hold the plate 59 on the shoulders of the legs adjacent their reduced ends 58, to maintain the plates in fixed spaced parallel relationship. The ends 51 and 52 of the spring 50 embrace one of the legs 57 and also a stop pin 60 projecting downwardly from the inner or under surface of the bearing member 24. On the plate 59 are formed peripherally extending wings or extensions 61, 62 engageable with the pin 60 to limit the rotary movement of the spring cage, spindle and crank arm.

On the inside of the cover 12 near the bearing member 24 is mounted by bolts 69, a conventional switch 70, preferably, a micro-switch in which a small amount of movement of an operating member or push button 72 extending from the switch body is sufficient to operate the switch contacts (not visible) inside the body. Since the switch 70, per se, is not my invention and since different forms of conventional switches may be used satisfactorily, a detailed illustration and description thereof need not be given. The spring biased push button or other operating member 72 extends in position to be operated by the cams 42a, 44a. To assist the action of the cams upon the switch button 72 a flexible sheet metal arm 75 extends between the cams and the switch button. The arm 75 is edgewise to the cover 12 and parallel thereto and is integral with and supported by a leg 76 extending inwardly into the casing from a flat plate portion 77 which may be between the switch body and the inner surface of the cover and be there held by the switch body.

From the foregoing description it will be understood that the invention may be mounted in a suitable or convenient location with the crank arm 30, and particularly with its roller 38, in position to be engaged by a part of a machine or mechanism, the limit of whose movement it is desired to control by operation of the switch 70. When the crank 30 is moved in clockwise or counterclockwise direction from the position shown in Figs. 1 and 3, that rotation will cause simultaneous rotation of the sleeve 28 and spring cage. The rotation of the spring cage will cause one end 51 of the spring 50 to be moved by one of the spring cage legs 57 while the other end 52 of the spring is held against movement by

the pin 60. The limit of movement in a counterclockwise direction permitted the crank is determined by the wing 62 as illustrated in Fig. 6. Upon release of the crank, the spring will thus return it to the neutral or mid-position illustrated in Figs. 1 and 3. Rotation in a clockwise direction (from the position in Figs. 1 and 3) is similar to that just described. When it becomes necessary to change or adjust the neutral or mid-position of the crank arm either during or after installation of the invention in a fixed location, such adjustment may be readily made by loosening the screw bolts 16 and 18 whereupon it will become possible to rotate the whole operating mechanism as a unit because all of the parts thereof are mounted upon the bearing member 24. Upon completion of the adjustment, it is only necessary to tighten the screw bolts 16 and 18 to maintain the parts in the newly adjusted position. It is thus clear that only a simple adjustment need be made to cause the crank arm to be engaged sooner or later or to accommodate its position to variation in the part of the machine which is to engage the crank.

Adjustments of the relative positions of cam elements 42 and 44, as may be necessary upon change in the position of adjustment of the whole operating mechanism, can readily be accomplished by merely loosening the nut 46 and rotating the cam 44 to the new position.

The cams 42 and 44 in their largest radial dimension are made no larger than the opening into which the barrel of the bearing member 24 fits, in order that it may be possible upon removal of the screw bolts 16 and 18 to remove the whole operating mechanism as a unit, thus greatly facilitating assembly and disassembly of the parts for repair or adjustment.

Many modifications within the scope of the invention will occur to those skilled in the art. Therefore I do not limit it to the precise form herein disclosed and described.

I claim:

1. Electric switch operating mechanism comprising the combination with a support of a mounting adjustable rotatively within a recess in said support, a spindle rotatable within said mounting, an operating arm on said spindle located on one side of said support, spring means anchored to said mounting urging said spindle toward an original at-rest position, means located on the other side of said support and mounted on said spindle and adapted to operate switch contacts as said spindle is rotated, means to mount said mounting and parts carried thereby within said recess and permitting removal of the mounting through said recess by movement in the direction of the spindle axis without detaching from the mounting any of the parts it carries.

2. Electric switch operating mechanism comprising the combination with a support of a mounting adjustably mountable within a recess in said support, a spindle rotatable within said mounting, an operating arm on said spindle located on one side of said support, spring means anchored to said mounting urging said spindle toward an original at-rest position, means located on the other side of said support and mounted on said spindle and adapted to operate switch contacts as said spindle is rotated, means to mount said mounting and parts carried thereby within said recess and permitting removal of the mounting through said recess by

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movement in the direction of the spindle axis without detaching from the mounting any of the parts it carries, a stop on said mounting, means rotating with said spindle to engage said stop after predetermined movement.

3. In combination, a mounting plate, operating mechanism for electric switch contacts comprising a bearing member adjustably mountable within a recess in said plate, a spindle rotatable within said bearing member, an operating arm on said spindle located on one side of said plate, spring means anchored to said bearing member urging said spindle toward an original at-rest position, means located on the other side of said plate and mounted on said spindle and adapted to operate switch contacts as said spindle is rotated, and means serving to secure said mounting plate on a support and also serving to secure said bearing member in adjusted position within said recess.

4. A structure as claimed in claim 3 including means permitting said operating mechanism to be removed through said recess as a unit.

5. In combination, a mounting plate, operating mechanism for electric switch contacts on one side of said plate comprising a bearing member adjustably mountable within a recess in said plate, a spindle rotatable within said bearing member, an operating arm mounted on said spindle on the other side of said plate, spring means anchored to said bearing member urging said spindle toward an original at-rest position, means on said spindle adapted to operate switch contacts as said spindle is rotated, said operating mechanism including means enabling its removal through said recess as an intact unit by movement in the direction of the spindle axis, and means serving to secure said mounting plate on a support and also serving to secure said bearing member in adjusted position within said recess.

6. In combination, a mounting plate, operating mechanism for electric switch contacts comprising a bearing member adjustably mountable within a recess in said plate, a shoulder adjacent said recess upon which said bearing member is supported, a spindle rotatable within said bearing member, an operating arm on said spindle, spring means anchored to said bearing member urging said spindle toward an original at-rest position, means on said spindle adapted to operate switch contacts as said spindle is rotated, and means serving to secure said mounting plate on a support and also serving to secure said bearing member in adjusted position within said recess.

7. A structure as claimed in claim 6 including means permitting said operating mechanism to be removed through said recess as a unit.

8. In combination, a mounting plate, operating mechanism for electric switch contacts comprising a bearing member adjustably mountable within a recess in said plate and adjustable rotatively therein, a spindle rotatable within said bearing member, an operating arm on said spindle, spring means anchored to said bearing member urging said spindle toward an original at-rest position, means on said spindle adapted to operate switch contacts as said spindle is rotated, and a screw bolt serving to secure said mounting plate on a support, the under side of the head of said bolt engaging said bearing member to secure the latter in adjusted position.

9. In combination, a mounting plate, operat-

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ing mechanism for electric switch contacts comprising a bearing member adjustably mountable within a recess in said plate and rotatively adjustable therein, a spindle rotatable within said bearing member, an operating arm on said spindle, spring means anchored to said bearing member urging said spindle toward neutral position from which said spindle may be moved clockwise or counter-clockwise, means on said spindle adapted to operate switch contacts as said spindle is rotated, and means serving to secure said mounting plate on a support and also serving to secure said bearing member in adjusted position within said recess.

10. In combination, a mounting, operating mechanism rotatively adjustable within a recess in said mounting, said operating mechanism comprising a bearing member, a sleeve rotatively mounted within said bearing member, a spring cage mounted on said sleeve, a spring having an end held by means on said bearing during rotation in either counter-clockwise or clockwise directions, an end of said spring also engaging said spring cage during rotation and tending to return the same to neutral position, a spindle within said sleeve, means causing said sleeve and spindle to turn as a unit, cam disc means adapted to operate switch contacts, means to fix said cam disc means in adjusted position on said spindle, an operating arm mounted on said sleeve, and means to secure said bearing member in adjusted position on said mounting.

11. In combination, a mounting plate, operating mechanism for electric switch contacts comprising a bearing member rotatively adjustable within a recess in said mounting plate, a spindle rotatable within said bearing member, an operating arm on said spindle located on one side of said plate, spring means anchored to said bearing member urging said spindle toward an original at rest position, means located on the other side of said plate and adjustably secured on said spindle adapted to operate switch contacts as said spindle is rotated, said operating mechanism being constructed and arranged for removal through said recess as a unit.

12. In combination, a mounting, operating mechanism rotatively adjustable within a recess in said mounting, said operating mechanism comprising a bearing member, a sleeve rotatively mounted within said bearing member, a spring actuating member moving with said sleeve, a spring having an end held by means on said bearing during rotation in either clockwise or counter-clockwise directions, an end of said spring also engaging said spring actuating member during rotation and tending to return the same to neutral position, cam disc means adapted to operate switch contacts, means to fix said cam disc means in different adjusted positions relative to said sleeve, an operating arm mounted on said sleeve, and means to secure said bearing member in adjusted position on said mounting.

13. In combination, a mounting, operating mechanism rotatively adjustable within a recess in said mounting, said operating mechanism comprising a bearing member, rotary means extending through the bearing member, an operating arm affixed on said rotary means, cam means adjustably mounted on said rotary means adapted to actuate switch contacts, a spring, a spring actuating member turning with said rotary means, means on said bearing member to anchor an end of said spring while the other end is moved by said actuating member, said spring tending to

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return the actuating member to neutral position, means to secure said bearing member and operating mechanism in adjusted position in said recess.

14. In combination, a mounting, operating mechanism rotatively adjustable within a recess in said mounting, said operating mechanism comprising a bearing member, rotary means extending through the bearing member, an operating arm affixed on said rotary means, cam means adjustably mounted on said rotary means adapted to actuate switch contacts, a spring, a spring actuating member turning with said rotary means, means on said bearing member to anchor an end of said spring while the other end is moved by said actuating member, said spring tending to return the actuating member to neutral position, means acting to secure said bearing member in adjusted position on said mounting and to secure said mounting on a support.

15. A structure as claimed in claim 14 in which the operating mechanism is constructed and arranged for removal through said recess as an intact unit.

16. In combination a mounting, operating mechanism rotatively adjustable within a recess

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in said mounting, said operating mechanism comprising a bearing member, rotary means extending through the bearing member, an operating arm affixed on said rotary means, cam means adjustably mounted on said rotary means adapted to actuate switch contacts, a spring, a spring actuating member turning with said rotary means, means on said bearing member to anchor an end of said spring while the other end is moved by said actuating member, said spring tending to return the actuating member to neutral position, and a shoulder adjacent said recess on which said bearing member is rotatably slidable and a screw bolt the under side of whose head secures said bearing on said mounting, said bolt also securing said mounting on a support.

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