Aug. 25, 1942. J. F. O'BRIEN 2,293,752

ELECTRICAL SWITCH

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Fig.1.

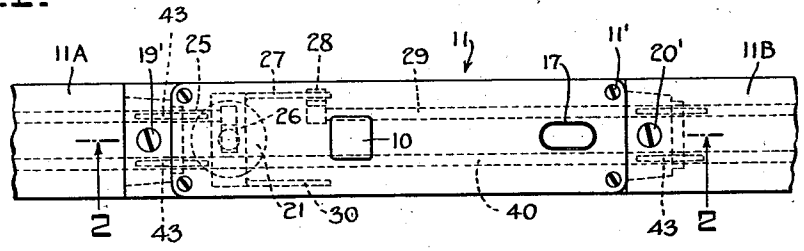


Fig.2.

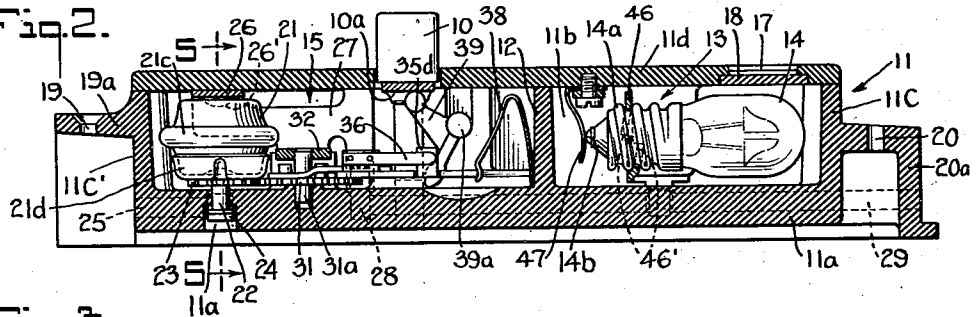


Fig.3.

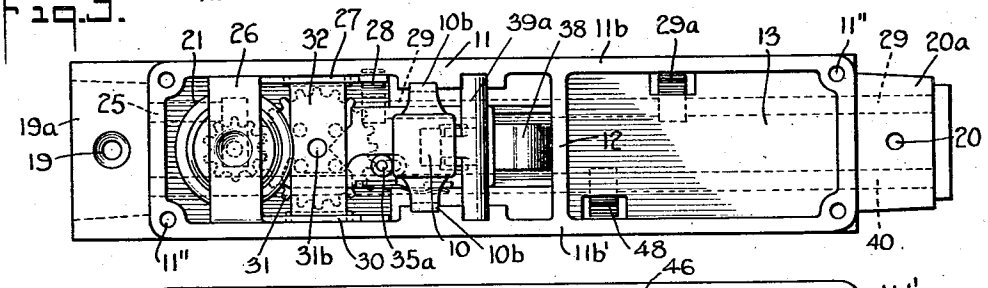


Fig.4.

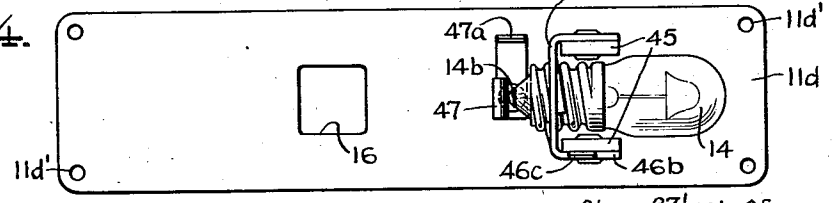


Fig.5.

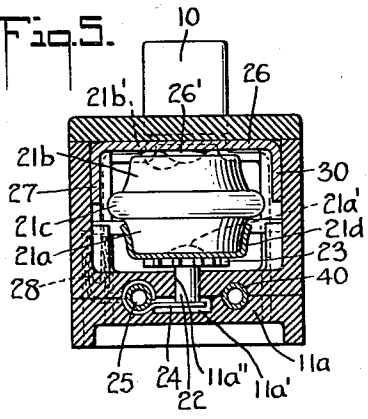
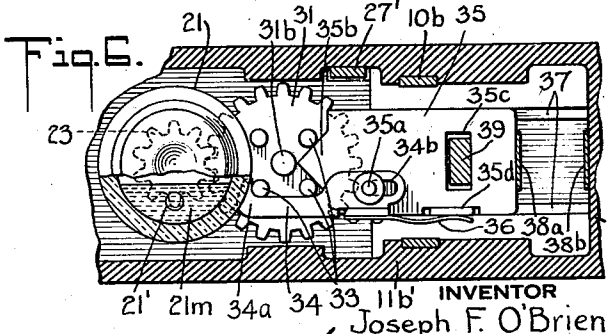


Fig.6.



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Fig. 7.

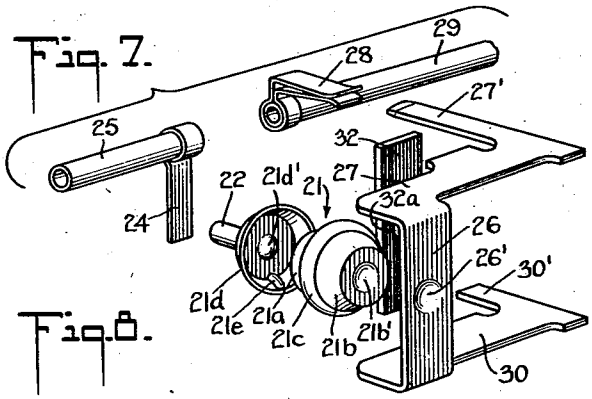


Fig. 8.

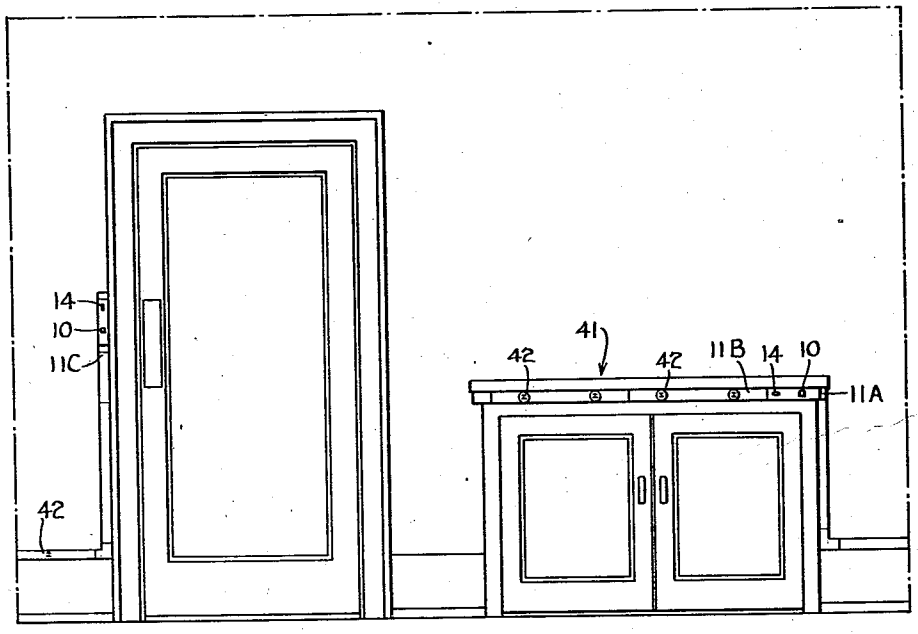
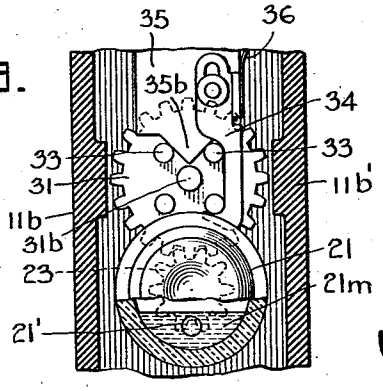


Fig. 9.



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2,293,752

ELECTRICAL SWITCH

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Application October 26, 1939, Serial No. 301,345

5 Claims. (Cl. 200—167)

The present invention relates to improved electric switches employing liquid contact circuit closers.

A feature of the invention is the provision of a suitable closer embodying suitable liquid for controlling an electrical current and suitable means for displacing the closer in continuous direction for positively effecting successive stages of closing and opening the electrical current.

An advantage resulting from this feature is that the electric switch may be operated by means of a single manipulating element such as a push button, to effect successive closing and opening of the electrical circuit.

A further feature, adapted particularly for embodiments of the invention wherein the casing of the closer is substantially cylindrical in cross-section and is displaced rotatively, resides in rotating the closer at successive stages of circuit-closing and circuit opening by means of a drag link or equivalent carried by a slide provided with suitable means for insuring positive rotational displacement of predetermined extent, and precluding overthrow or underfeed of the operated parts.

The stated features of the invention enable an operating chain in lieu of a push button, to be employed as the manipulating element, while insuring certainty of operation.

The structural assembly of preferred embodiments of the invention, further comprises operating parts which may be variantly arranged in relative position to afford installation of the electric switch in positions of use at right angles to one another, notwithstanding that a liquid medium, such as mercury, serves as the effective circuit closing and opening agent.

In the instances of use where any embodiment of the invention is operated by means of a single manipulating device, either as a remote circuit controlling switch or for controlling illumination or the like, it is advantageous to associate with and adjacent the switch a miniature lamp such as a low wattage neon lamp, or equivalent, to indicate visually the respective stages of circuit-closing and circuit-opening. Indicia rendered effective during the stage of lighting of such indicating lamp, or equivalent, may also be employed.

Embodiments of the invention may be employed as so-termed wall switches for general control of electrical current, switches for controlling apparatus such as industrial, household and like machines and other appliances, and also as elements of and serving as the current control switch of seriatim connected sectional conduit systems certain units of which are provided with outlets, such as is disclosed in the co-pending application Serial No. 286,734, filed July 27, 1939, entitled Electrical unit.

The invention comprises an improved assembly of operating parts associated with a casing or equivalent containing the mercury or other liquid circuit-controlling medium, as appears more fully hereinafter.

Further features and objects of the invention will be more fully understood from the following detail description and the accompanying drawings, in which:

Fig. 1 is a top plan view of a preferred type of embodiment of the invention.

Fig. 2 is a longitudinal central sectional elevational view taken on line 2—2 of Fig. 1, on a somewhat enlarged scale.

Fig. 3 is a top plan view of Fig. 1, the cover being removed; the scale of Fig. 3 corresponds to that of Fig. 2.

Fig. 4 is a bottom plan view of the cover, shown in Fig. 2 and omitted in Fig. 3.

Fig. 5 is a transverse sectional elevational view on line 5—5 of Fig. 2.

Fig. 6 is a detail sectional elevational view on line 6—6 of Fig. 2, on a somewhat enlarged scale.

Fig. 7 is an exploded view illustrating in perspective view the closer in opened position, the mercury or liquid being omitted, members for rotatively mounting the closer, and parts of the electrical conductors and their respective contact elements.

Fig. 8 is a diagrammatic elevational view of the interior of a room of a building structure, indicating two modes of application of the invention. At the right, the electric switch is installed at the front ledge of a work table. At the left, the electric switch is shown positioned adjacent the frame of a door opening.

Fig. 9 is a central longitudinal sectional view corresponding to Fig. 6, but illustrating certain operating parts in variant mutual arrangement to afford installation of the electric switch at relative right angled positions, corresponding respectively to the right hand and left hand illustrated uses indicated in Fig. 8.

Referring to Figs. 1 through 6, the type of embodiment of the invention illustrated therein is applicable to the fields of use in which the operating plunger 10 is displaced by substantially horizontal movement. An illustration of such use is indicated in Fig. 8, wherein the electrical

switch is shown installed at a side of a work bench, sewing table, kitchen table or the like.

Such type of embodiment, indicated in Figures 1 through 6, comprises a casing which may be, and desirably is, wholly of electrical insulating material, such as molded plastic. As shown, the casing comprises a body portion 11, including a base part 11*a*, opposite lateral walls 11*b*, 11*b'*, and opposite end walls 11*c*, 11*c'*. The cover of the body 11 is indicated 11*d*.

Desirably, and as shown, the hollow interior of the casing 11 is divided by a septum 12 to provide a compartment 13 in which an indicating lamp 14 may be disposed and a compartment 15 in which is disposed a switch operating mechanism, described more fully hereinafter. Advantageously, the septum 12 is molded integrally with the base part 11*a* and the opposing lateral walls 11*b*, 11*b'*.

An opening 16 is formed in the cover lid for receiving the plunger 10, and desirably also for guiding the path of movement of the plunger 10. To facilitate visual perception of the illumination afforded by the indicating lamp 14 when lighted, the cover 11*d* may be provided also with an opening 17, preferably shielded by a plate 18 of translucent material. Such arrangement is of advantage to effectually close the casing when the cover is in position, and to enable the use of opaque material for the cover.

Suitable provision is made for securing the casing 11 to a suitable support; such provision of means is shown in the drawings by openings 19, 20, shown disposed at or adjacent the ends of the casing 11, for receiving screws or like fastening elements. Specifically, the opening 19 is shown located in the top wall of a hollow extension 19*a* of the casing 11, shown open at an end and at its bottom. Specifically, the opening 20 is shown located in the top wall of a hollow extension 20*a* of the casing 11, shown open at its bottom.

As appears from Fig. 1 screws 19', 20', passing through the openings 19, 20, secure the circuit closer to a suitable support (not shown). Specifically, Fig. 1 indicates the casing 11 secured in position not only with respect to a suitable support, but illustrates the same mechanically and electrically interconnected seriatim with contiguous units 11A, 11B of a sectional conduit system, referred to more fully hereinafter.

The liquid contact circuit closer 21, see Figs. 2, 3, 5, 6 and 7, containing the mercury, 21*m*, may be of conventional construction; as shown it comprises pressed metal half parts of opposite hand 21*a*, 21*b*, see Fig. 3, sealingly joined on opposite sides to a central insulating diaphragm, such as vitreous or other electrical non-conducting material. As appears more fully hereinafter, the circuit closer 21 is operated to rotate about a horizontal axis passing through the central axis of its stated two metal parts, the diaphragm being provided with a transversely extending recess 21' at a predetermined position of its rotation, whereby electrical connection is afforded through such recess by the mercury from metal part to metal part of the circuit closer when the same is at a predetermined stage of its rotation.

Suitable means are provided for positive control of the rotation of the circuit closer 21, such as per the association of a cup-like member 21*d*, secured to an end of the stub shaft 22, the inner face of the cup member having a feather 21*e* formed by pressing the metal flange of the cup member 21*d*, which cooperates with a correspondingly grooved indentation or the like, formed in the metal circular periphery of the circuit closer part 21*a*.

The shaft 22 is suitably secured to the cup member 21*d*, as by a rivet 21*d'*, the round head of which is received within the rounded indentation 21*a'*, see Fig. 5, as also Fig. 7, of the metal part 21*a*. A pinion 23 is frictionally or otherwise secured to the shaft 22, and the outer end of the shaft 22 is spring pressed and in electrical connection with the contact finger 24, soldered or otherwise secured to the electrical conductor part 25. The circular indentation 21*b'* receives the circular indentation 26' to serve as a rotary bearing. The indentation 26' is formed in the otherwise flat cross-over 26 of a metal yoke, one leg 27 of which, see Fig. 7 and Fig. 3, and compare with Fig. 2, has a right-angle extension 27', the terminus of which is adapted to be received within the electrical terminal clip 28, soldered or otherwise secured to the electrical conductor part 29.

The other leg of the stated metal yoke is designated 30, and its right angled extension 30' is of less length than the stated therewith parallel leg 27'.

The inner faces of the opposing lateral walls 11*b* and 11*b'* of the casing 11 are recessed, or molded to be recessed to retain the legs 27, 30, of the yoke, the spring contact 24 passing through a recess 11*a* in the outer face of the base 11*a* of the casing 11, such recess affording access to the electrical conductor 25. The free end of the stud shaft 22 carrying the pinion 23, see Figs. 5 and 2, projects through an opening 11*a''* in the base 11*a*, to engage the spring contact 24. The pinion 23 is thus disposed in a plane parallel to but spaced from the inner face of the base 11*a* of the casing.

Meshing with the pinion 23 is a gear 31 having, say a 2 to 1 ratio with respect to the pinion 23; the gear 31 is mounted on a stud shaft one end 31*a* of which is received in a recess in the inner face of the base 11*a*; the opposite end 31*b* of such shaft passes through an opening 32*a* in the mounting and retaining plate 32, of fibre board or other electrically insulating material.

Suitable means are provided for positively operating the driving gear 31, to insure a predetermined travel of the circuit closer 21 and precluding overtravel and undertravel. Applicable to the specific construction of the illustrated circuit closer 21, an angular rotation of 180 degrees from circuit closing to circuit opening stage and conversely, corresponding to such gear ratio of 2 to 1 of the driving gear 21 relative to the driven gear 23, the gear 31 may be provided with pins 33, set at 90 angular degrees, with which a drag link 34 is associated, the pawl portion 34*a* of which at the beginning of a stroke positively engages a pin 33. Positive motion to the drag link 34 is suitably imparted, as by means of the reciprocated plate 35, suitably operated by the push button 10 or equivalent.

To afford relative motion of the drag link 34, due to the arcuate movement of the engaged pin 33 while maintaining positive mechanical connection of the pawl 34*a* with such engaged pin 33, the drag link 34 is connected with the reciprocated plate 35 by a suitable lost motion connection, shown as a slot 34*b* formed in the link 34 and a headed retainer pin 35*a* secured to the plate 35, combined with a spring 36, the fixed end of which is secured to the link 34 and its

free end resiliently engaging the upturned lip 35d, formed at the edge of the plate 35. For simplicity of assembly, the plate 35 is reciprocatively mounted in the slide grooves 37, 37, formed or molded in the base part 11a of the casing 11.

To positively preclude overthrow or underfeed of the driving gear 31, at each stage of reciprocation of plate 35, the latter is provided with a centrally pointed or equivalent extension 35b, tapered in correspondence to the angular spacing between successive pins 33, cooperating with an urging spring 38, the fixed end portion 38a of which is secured against the inner face of the end wall 11c of the casing 11, as in a recess therein, and its free end portion 38b engages the end of the plate 35.

As a simple assembly in association with the push button 10 for reciprocation of the plate 35, there is provided a bell-crank member 39, the upper leg of which is rotatively received in the recess 10a formed in the base of the push button 10, see Fig. 2, its lower leg slidingly received in the slot 35c formed in the reciprocated plate 35. The bell-crank member 39, as shown, is pivotally mounted by means of its stud extension 39a, received in the indicated bearing recesses formed in the inner faces of the casing walls 11b, 11b'.

In the specific arrangement as above described, the stated parts serve, upon operation, say by the single manipulatable member 10, shown as a push button, to effect positive and controlled predetermined rotational displacement of 180 angular degrees of the liquid contact circuit closer 21 in continuous movement from circuit closing stage to circuit opening stage, and so on, with respect to the electrical conductor parts 25, 29; the electrical conductor of opposite polarity or phase is designated 40.

Such conductor parts 25, 29 and the opposite conductor 40 may be mounted, as shown, in suitable grooves formed in the underside of the insulating base part 11a and retained in position by screws or the like by a sub-base 11e, see Fig. 5, which is formed with registering grooves. While the electric conductors 40, 25—29 are shown hollow it is apparent for the purposes above described, the conductors may be solid, i. e., bars, plates, strips, wire, etc.

The assembly of the specific parts above referred to will be largely apparent. It will suffice to add that upon positioning the opposing electrical conductors as described, one end of the stud shaft 22 is dropped in bearing position within the opening 11a'', see Fig. 5, its free end engaging the spring contact 24, secured to the conductor part 25; the end 31a of the shaft of gear 31 is placed in its bearing recess, see Fig. 2, and gear 31 placed in mesh with the smaller gear 23, secured to the already positioned stud shaft 22. Then the circuit closer 21 is placed with part 21a received within the cup member 21d carried by the shaft 22. Thereafter the plate 35 and its urging spring 38 are located. Then the retaining fibre plate 32 is positioned within the casing, its bearing opening 32a passing about the shaft end 31b of the gear 31, after which the yoke is inserted, then the bell-crank 39 slid in position and the push button placed upon the upper leg of the bell-crank. The cover 11d is then secured to the casing 11. The yoke is desirably of spring metal, such as phosphor-bronze to afford a degree of flexing when the cover is secured in position.

Preferably as shown, the push button is self-guided in its reciprocation, as by its oppositely projecting extensions 10b, 10b, riding in suitable guiding recesses formed in the inner faces of the lateral walls 11b, 11b', of the casing 11.

The arrangement above described and illustrated in Figs. 1 through 7, provides for rotational movement of the circuit closer about a horizontal axis, the mercury 21m subject to gravitational action remaining in the lower zone of the interior of the circuit closer 21, and effecting circuit closing when the recess 21' attains lowermost position. Such arrangement positions the push button 10, see right hand portion of Fig. 8, to extend horizontally relative to the casing 11, convenient for use, as when mounted, as at or near the ledge of a work table 41, or the like. In such mode of use, the direction of length of the casing 11 extends horizontally.

The invention affords modes of use at right angles to that above particularly described, namely the installation of the casing 11 in the direction of its length extending vertically, viz, as indicated at the left hand portion of Fig. 8. To effect operability of the circuit closer for such change of position, compare Fig. 9 with Fig. 6, the circuit closer 21 is set for circuit closing position by a rotation to the extent of 90 angular degrees; positive control is insured by the operating parts assembled similarly as above described with respect to Figs. 1 through 6.

Advantageously, and as indicated in Figs. 1 and 8, the electric switch is a unit of seriatim connected units, certain of which units are provided with outlets indicated at 42, adapted for affording electrical connection by insertion of electrical plugs. Such type of seriatim connected units is described in the copending application above identified, characteristics of such units residing in the conjoint mechanical and electrical interconnection of the respective units by suitable metal pins 43 or other liaison electrical connecting means respectively connecting the terminals of the electrical conductors of like polarity or phase of the successive units. For such or other purposes, tubular conductors or conductors having tubular or socketed ends are advantageous.

As appears from the above, the improved electrical switch is applicable for general uses for controlling electrical circuits. In the circumstance that the electric switch serves to control electrical apparatus remote from the location of the electric switch an indicating lamp may serve as a tell-tale; the terminals of the tell-tale lamp may be connected in multiple with respect to the electrical conductors extending from the electric switch to the electrical apparatus. In other circumstances, such indicating lamp may serve as a beacon, as for example in uses where the electric switch controls the illumination of a room in which the electric switch is located and for other modes of use, where its presence is indicated by such beacon lamp. In the latter modes of use, the electrical terminals of the beacon lamp are connected in series with the electrical conductors extending from the electrical source to the electric switch, as will be understood by those skilled in the art.

The present day neon lamp of low wattage is a desirable type of indicating lamp; a characteristic, however, of such neon lamp when energized by direct current, is that its filament is divided into two sections, one section only of which at any given time is the illuminating section. In view of such low luminosity of the lighted fila-

ment of such neon lamp, it is advantageous to mount such lamp to afford ready turning of the lamp while maintaining electrical connection, to thereby position the lighted section of its filament more closely to the side of the casing toward the observer. An advantageous mounting of such indicating neon lamp in association with the electric switch herein set forth, is had, see Figs. 2 and 4, by supporting such lamp 14, by spaced lugs 45, 45 shown extending from the inner face and desirably integral with the cover 11d of the casing. To such lugs 45 is secured a U-shaped metal cross member 46, or equivalent, the peripheral edge of its central opening being spirally offset, as indicated at 46', 46', etc., see Fig. 2, serving as incomplete screw threads adapted to receive the screw threaded base 14a of the indicating lamp 14. One end 46b of such metal cross member is provided with a knife edge portion 46c, see Fig. 4, which is adapted to be received within the electrical clip terminal 29a, connected as by solder or otherwise to the electrical conductor 29, see Fig. 3. To complete the circuit as in parallel relationship, as indicated in Figs. 2, 3 and 4, the central terminal 14b of the lamp is frictionally and resiliently engaged by a spring terminal 47, the base of which may be secured by a screw, as indicated, to the inner face of the cover 11d; such base is provided with an angular extension 47a serving as an electrical terminal adapted to be received within the clip terminal 48, soldered or otherwise electrically connected with the conductor 40. The resiliency of the electric terminal 47 affords turning of the indicating lamp 14 through an arc, say of 180 angular degrees while maintaining effective electrical contact therewith, thus affording rotational setting of the lighted portion of the filament of a neon or like lamp.

It will be observed that the mounting of the indicating lamp upon the reverse face of the cover of the casing enables the lamp to be removed automatically upon removal of the cover from the casing, thus affording ready adjustment, inspection, repair and replacement; such positioning also locates the body of the lamp closely adjacent to the observation opening 17 of the casing.

Whereas, I have described my invention by reference to specific forms thereof, it will be understood that many changes and modifications may be made without departing from the spirit of the invention.

I claim:

1. In an electrical control switch, a casing, a circuit closer including a movable element, means for mounting said circuit closer in said casing for moving said movable element in continuous direction, gearing means for operating said circuit closer, said gearing means including a gear adjustably connected with said circuit closer to afford variant operative positioning of the casing, said casing being provided with an opening, a single manipulatable rigid element mounted in said opening for positively actuating said gearing means, said gearing means having shafts for rotatably supporting the same, said casing being provided with recesses for receiving said shafts, means for predetermining the extent of rotation of said circuit closer operable conjointly with said actuating means, and a lamp mounted on the inner side of the cover of the casing for indicating circuit opening and circuit closing stages of said circuit closer.

2. The combination of a casing, a circuit closer including a movable element, said casing being provided at opposite inner faces with open ended slots for removably receiving and supporting said circuit closer, gearing means for moving said movable element of said circuit closer, said gearing including shafts for supporting the same, said casing having recesses for rotatably supporting said shafts, reciprocable means for actuating said gearing, said reciprocable means including a manually displaceable element having oppositely directed extensions, said casing having at its opposite inner faces open ended recesses for receiving and guiding said extensions and a cover for closing said casing for securing in position and within the casing said circuit closer and said gearing shafts and said extensions, said cover being provided with a perforation through which extends said manually displaceable element.

3. The combination of a casing, a circuit closer including a movable element, said casing being provided at opposite inner faces with open ended slots for removably receiving and supporting said circuit closer, gearing means for operating said circuit closer, said gearing means including shafts for supporting the same, said casing having recesses for rotatably supporting said shafts, reciprocable means for actuating said gearing, said reciprocable means including a manually displaceable element having oppositely directed extensions, said casing having at its opposite inner faces open ended recesses for receiving and guiding said extensions, and means for positively predetermining the extent of movement of said movable element of said circuit closer, said positively predetermining means including a reciprocable element cooperating with said gearing.

4. The combination of a casing, a circuit closer including a movable element, said casing being provided at opposite inner faces with open ended slots for removably receiving and supporting said circuit closer, gearing for operating said circuit closer, said gearing including shafts for supporting the same, said casing having recesses for rotatably supporting said shafts, reciprocable means for actuating said gearing, said reciprocable means including a manually displaceable element having oppositely directed extensions, said gearing including an adjustable intermediate gear for controlling the relative positions of circuit closing and circuit opening of said circuit closer.

5. The combination of a casing, a circuit closer including a movable element, said casing being provided at opposite inner faces with open ended slots for removably receiving and supporting said circuit closer, gearing means for operating said circuit closer, said casing having recesses for rotatably supporting said shafts, reciprocable means for actuating said gearing, said reciprocable means including a manually displaceable element having oppositely directed extensions, said casing having at its opposite inner faces open ended recesses for receiving and guiding said extensions, means for positively predetermining the extent of movement of said movable element of said circuit closer, said positively predetermining means including a reciprocable element cooperating with said gearing, said gearing including an adjustable intermediate gear for controlling the relative positions of circuit closing and circuit opening of said circuit closer, said adjustable intermediate gearing including a plurality of pins cooperating with said positive predetermining means.

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