Aug. 30, 1949. A. C. PRESCOTT 2,480,161

ELECTRIC SWITCH

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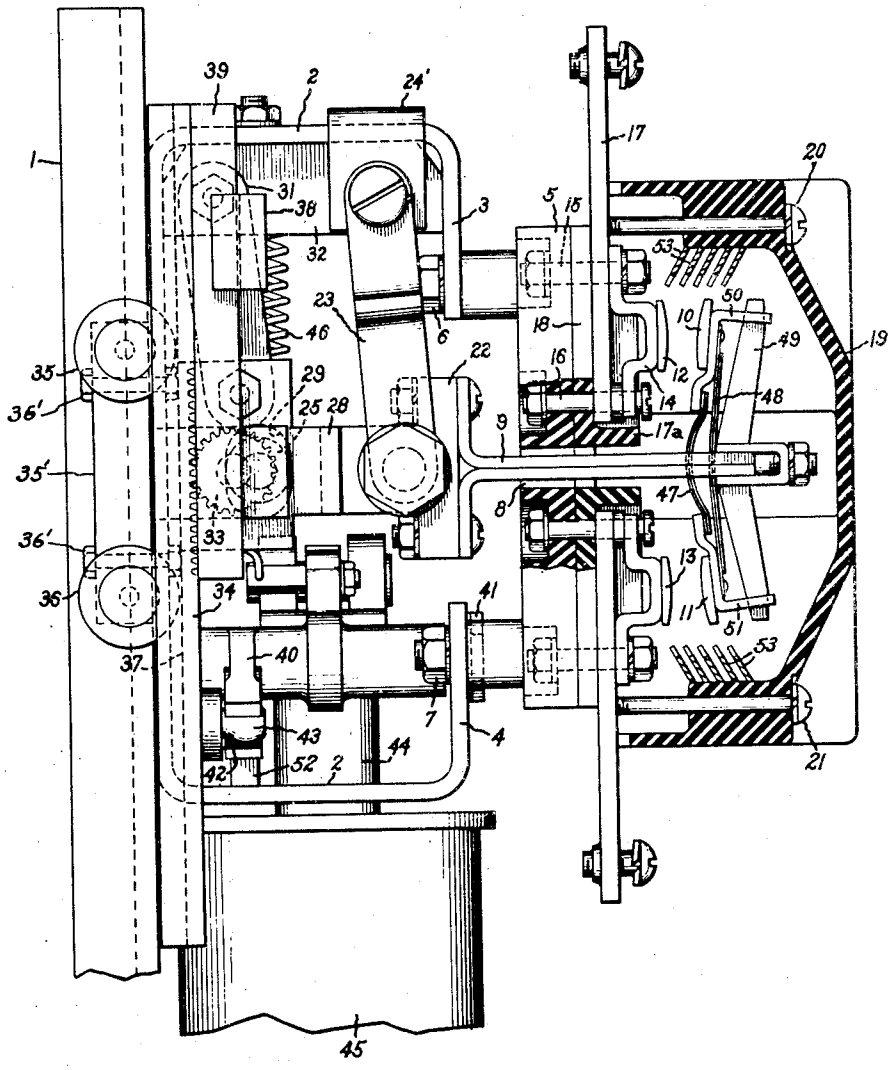
Fig. 1.



Inventor:
Arthur C. Prescott,
by Claude M. Statt
His Attorney.

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Fig. 2.

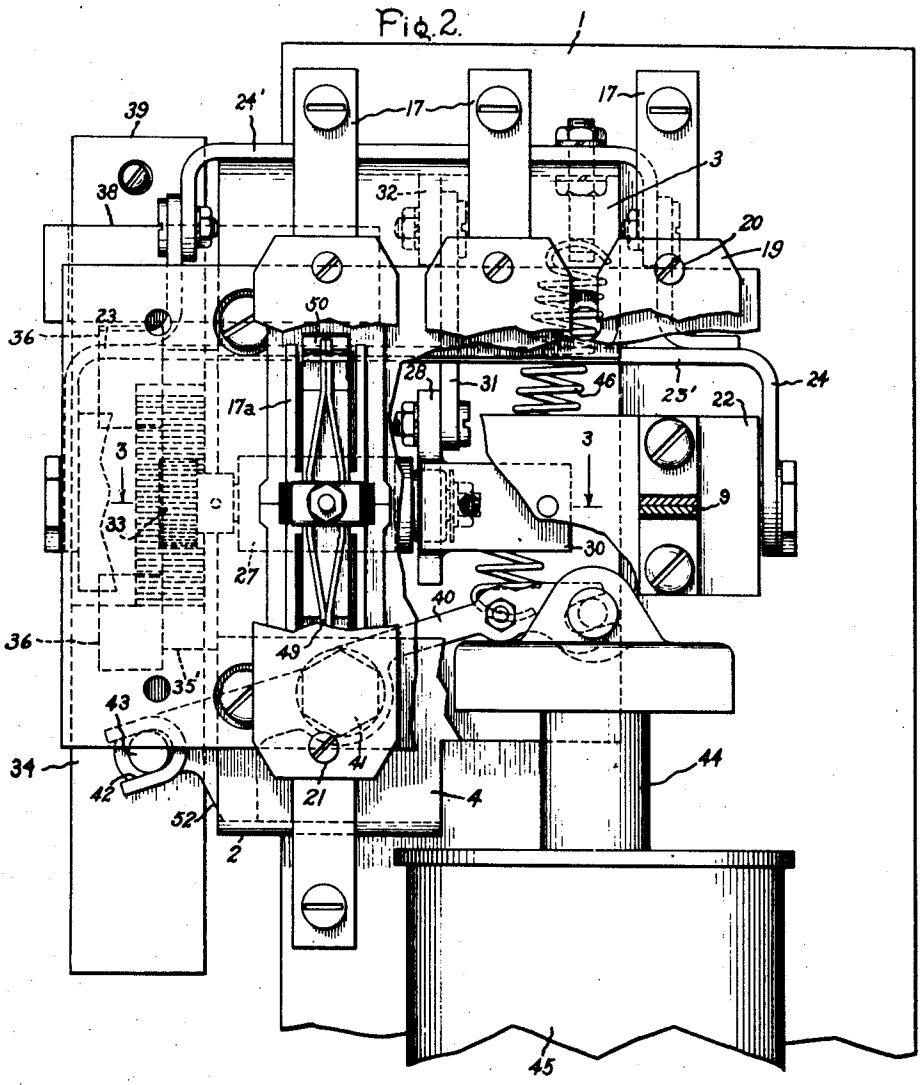
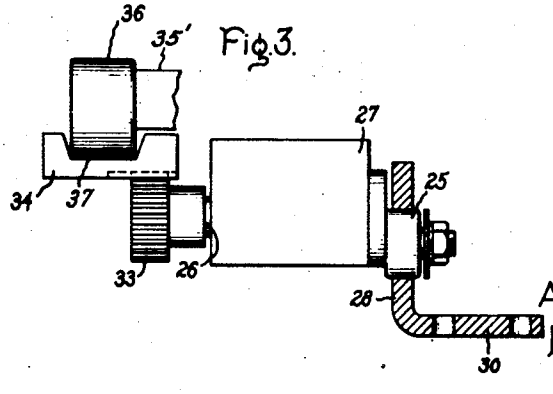


Fig. 3.



Inventor:
Arthur C. Prescott,
by Claude A. Phillips
His Attorney.

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ELECTRIC SWITCH

Arthur C. Prescott, Schenectady, N. Y., assignor to General Electric Company, a corporation of New York

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4 Claims. (Cl. 200—87)

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My invention relates to electric switches, more particularly to shockproof electromagnetically operated switches of the type known as contactors, and has for its object a simple, reliable and shockproof electric switch.

In carrying out my invention in one form, I provide operating mechanism for the movable switch contacts comprising a contact supporting member mounted for substantially straight line movement, together with an eccentric connected to move the contact supporting member, and a rack for operating the eccentric connected through a lever to the operating magnet.

For a more complete understanding of my invention, reference should be had to the accompanying drawing, Fig. 1 of which is a side elevation view, partly in section, of an electric switch embodying my invention; Fig. 2 is a front elevation view with parts broken away of the device shown in Fig. 1; while Fig. 3 is a sectional view of part of the operating mechanism taken along the line 3—3 of Fig. 2 looking in the direction of the arrows.

Referring to the drawing, in one form of my invention I provide a supporting member 1 shown as a channel iron on which is mounted on its central or base portion a U-shaped metal bracket 2 having the outer ends 3 and 4 of its sides bent toward each other into parallel relation with the support 1. On the ends 3 and 4 is mounted a stationary contact supporting plate 5 by means of suitable bolts only two of which, 6 and 7, are shown, this plate being made of electrically insulating material and provided with a plurality of central apertures 8 through each of which extends a switch operating bar or rod 9 bearing on its outer end the movable contacts 10 and 11. The movable contacts are arranged to cooperate with stationary contacts 12 and 13, each of which is mounted on an electrically conducting strap member 14 electrically secured, in turn, by bolts 15 and 16 to a terminal connector strap 17. An additional insulating spacing member 18 is provided between each terminal connector 17 and the plate 5, this insulating member 18 having barrier walls 17a forming a recess for its particular terminal strap and contact support 14 and these parts being secured together and to the plate 5 by the bolts 15 and 16. A cover 19 made of molded electrically insulating material encloses the movable contacts and is secured in place tightly on the member 18 by bolts 20 and 21 at its ends threaded into the terminal strap 17.

It will be seen that, in the particular device

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disclosed, three poles or circuits are provided, each duplicating the one just described and each provided with a separate cover. Such a switch would be used, for example, in a three-phase circuit.

Each of the three operating bars or rods 9 is secured to a transversely extending bar 22 made of electrically insulating material positioned on the left hand side of the supporting plate 5, as seen in Fig. 1. At its opposite ends, this bar is pivotally secured by links 23 and 24 (Fig. 2) to the opposite ends of a bar 24' in turn secured to the U-shaped support 2 and extending in parallel relation with the support 1. The two links 23 and 24 are rigidly secured together by a cross bar 23' so that the two links move together.

For the purpose of moving the support 22 on the links 23 and 24, an eccentric 25 is provided (Fig. 3) rigidly secured to one end of the shaft 26 journalled in a supporting block 27, which in turn is secured to the bracket 2 as by welding. A connection is provided between the eccentric 25 and the bar 22 by a movable bracket member 28 having an aperture 29 (Fig. 1) in which the eccentric 25 fits loosely, this aperture being elongated in a direction parallel with the support 1 to provide for lateral movement of the eccentric as it is turned by the shaft 26. A transversely extending portion 30 on the bracket 28 is secured to the left-hand side of the cross bar 22, as seen in Fig. 1. Also, the bracket 28 is pivotally connected by means of a link 31 (Fig. 2) to a projection 32 secured to the U-shaped bracket 2. This link 31 is parallel with the links 23 and 24, but as shown it is somewhat shorter, the links supporting the bar 22 and the movable contacts for movement in a substantially straight line.

For turning the shaft 26 and the eccentric 25, a spur gear 33 is provided on the opposite end of the shaft which meshes with a rack 34 mounted for slidable movement on the support 1. For the purpose of providing a substantially friction-free support for the rack 34, two rollers 35 and 36 are provided which are secured to a support 35', the support 35' being secured to the bracket 2 by bolts 36' as shown in Fig. 1. The rollers 35 and 36 extend into a longitudinal groove 37 on the rearward side of the rack 34 whereby the rack is supported on the rollers. The opposite side of the rack has one end in engagement with a flat guide 38 secured to the bracket 2 and its other engaging a lever 40 and whereby the rack is held against the rollers 35 and 36 a counterweight member 39 is secured to the rack and extends under the guide 38.

In turn, the rack is moved up and down by means of a lever 40 mounted on a pivot post 41 secured to the bracket 2 between the base portion and the end portion 4, the lever extending in parallel relation with the base of the bracket 2. One end of the lever is provided with a slot 42 into which extends a pin 43 secured to the rack and provided with a partly spherical bearing surface loosely engaging the sides of the slot 42. The opposite end of the lever is connected through a similar pin and slot connection to the armature 44 of a magnet 45. A helical spring 46 has its lower end attached to the lever 40 and its upper end secured to the support 2 so as to apply a counterclockwise force to the lever 40, as seen in Fig. 2, and thereby bias the switch in its open circuit position shown.

Upon energization of the magnet 45, the armature 44 is pulled downward whereby the rack 34 is moved upward, as seen in the drawing, and the eccentric turned to move the cross bar 22 toward the left hand, as seen in Fig. 1, whereby the movable contacts are moved into engagement with the stationary contacts for closure of the switch. Preferably, the eccentric is in one dead center position when the switch is open, as shown in Fig. 1, and it is moved to its opposite dead center position for closure of the switch. Thus the movable switch member is secured by the eccentric in each position against movement as the result of a shock.

Each pair of movable contacts 10 and 11 are electrically connected to each other by means of a flexible electric conductor 47 so that the two together form a bridging contact. By means of a leaf spring 48 connected to the two contacts, the contacts are biased toward their closed circuit position, the spring 48 bending upon engagement of the contacts to provide a desired amount of sliding and wiping action between the contacts. As shown, the middle of the spring 48 engages a bar 49 whose opposite ends extend through elongated slots in contact supporting members 50 and 51. Preferably the spring 48 is stressed somewhat by the bar 49 when the contacts are disengaged thereby to provide an initial pressure at the instant of engagement of the contacts.

An additional shockproof feature is balancing of the weights of rack 34 and the armature 44 together with the lever 40 about the axis of the pivot part 41. In other words, the rack 34 serves both as a driving member and as a counterbalancing member for the armature 44, the weight 39 on the rack being provided for balancing purposes. In other words, the movable parts not driven by the eccentric are counterbalanced.

A stop projection 52 is provided on the lever 40, which stop 52 engages the lower resilient side arm of the bracket 2, as shown in Figs. 1 and 2, when the switch is open. This side arm is constructed to have a very substantial resiliency under shock conditions so that it absorbs a substantial amount of the shock force and prevents the transmission of sufficient shock force to the moving parts to cause false operation and closure of the switch by the shock. I refer to high impact shocks up to 2000 foot pounds.

Arc extinguisher plates 53 made of a magnetic material such as steel are provided at opposite ends of each cover 19 opposite the pairs of contacts. These plates have their outside edges and ends embedded in the end and side walls of the cover.

While I have shown a particular embodiment of my invention, it will be understood, of course, that I do not wish to be limited thereto since many modifications may be made, and I therefore contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An electromagnetically operated switch comprising a slidably mounted rack, an operating coil, an armature for said coil, a lever connecting said armature to said rack for slidably moving said rack between two positions, the weights of said armature, lever and rack being balanced about the pivot of said lever, a pinion meshing with said rack, an eccentric operated by said pinion from one dead center position to another, a switch member moved by said eccentric between two circuit controlling positions each corresponding to one of said dead center positions, supporting means for said switch member for giving said switch member a substantially straight-line movement, a movable switch contact mounted on said switch member, and a cooperating stationary contact mounted on said support.

2. An electromagnetically operated switch comprising a slidably movable rack, an operating coil, a movable armature for said coil, a lever movable about its pivot connecting said armature to said rack for slidable movement of said rack between two positions, the weights of said movable parts being balanced about the pivot of said lever, a pinion meshing with said rack, an eccentric operated by said pinion from one dead center position to the other, a switch member connected for movement by said eccentric between two circuit-controlling positions each corresponding to one of said dead center positions, supporting means for said switch member for giving said switch member a straight-line movement a movable switch contact mounted on said switch member, a cooperating stationary switch contact mounted on said support, and a resilient stop engaged by one of said movable parts in its open circuit position for preventing shock movement of said parts to their closed circuit positions.

3. An electromagnetically operated switch comprising a rack, an operating coil, an armature for said coil, a lever connecting said armature to said rack for slidably moving said rack between two positions, the weights of said armature, lever and rack being balanced about the pivot of said lever, a pinion meshing with said rack, an eccentric operated by said pinion from one dead center position to the other, a switch member connected for movement by said eccentric, in a direction substantially perpendicular to the direction of movement of said rack and between two circuit controlling positions each corresponding to one of said dead center positions, supporting means for said switch member for giving said switch member a straight-line movement, a movable switch contact mounted on said switch member, a cooperating stationary switch contact mounted on said support, and a resilient stop engaged by said lever in its open circuit position for preventing shock movement of said lever to its closed circuit position.

4. A switch comprising a first support, a metal bracket secured to said first support, an electrically insulating second support secured to said bracket in parallel spaced relation with said first support, said second support being provided with a central aperture, a pair of stationary contacts

mounted on opposite sides of said aperture on the outer side of said second support, a movable switch operating member extending through said aperture, a pair of spaced apart parallel links connecting said operating member to said bracket for substantially straight-line movement through said aperture, a bridging contact member mounted on the outer end of said operating member cooperating with said pair of stationary contacts, a rack mounted for slidable movement on said first support in a direction substantially perpendicular to the direction of movement of said switch operating member, a pinion meshing with said rack, an eccentric operated by said pinion, an operating connection between said eccentric and the inner end of said operating member for moving said operating member and said bridging contact member into and out of engagement with said stationary contacts when said eccentric is turned from one dead center position to the other with respect to said operating member, and operating means on said first support including a balanced lever connected to said rack for rotating said pinion and said eccentric from a first of said dead center positions to

the other, and spring means connected to said rack for biasing said rack to a position in which said eccentric is in its said first dead center position.

ARTHUR C. PRESCOTT.

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