Nov. 16, 1937. W. R. HUTTINGER 2,099,607

SWITCH

Filed Aug. 31, 1935 3 Sheets-Sheet 1

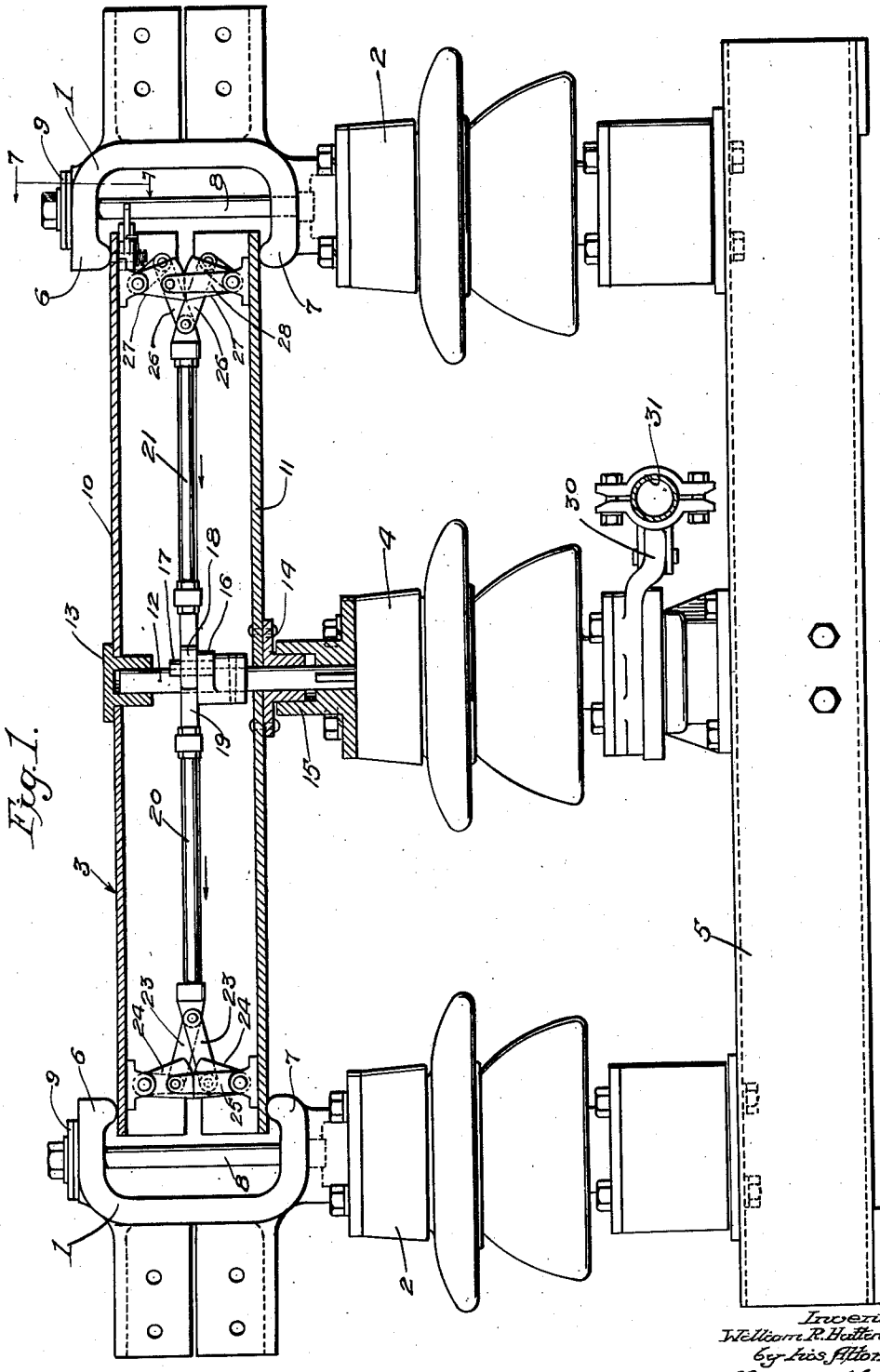


Fig. 1.

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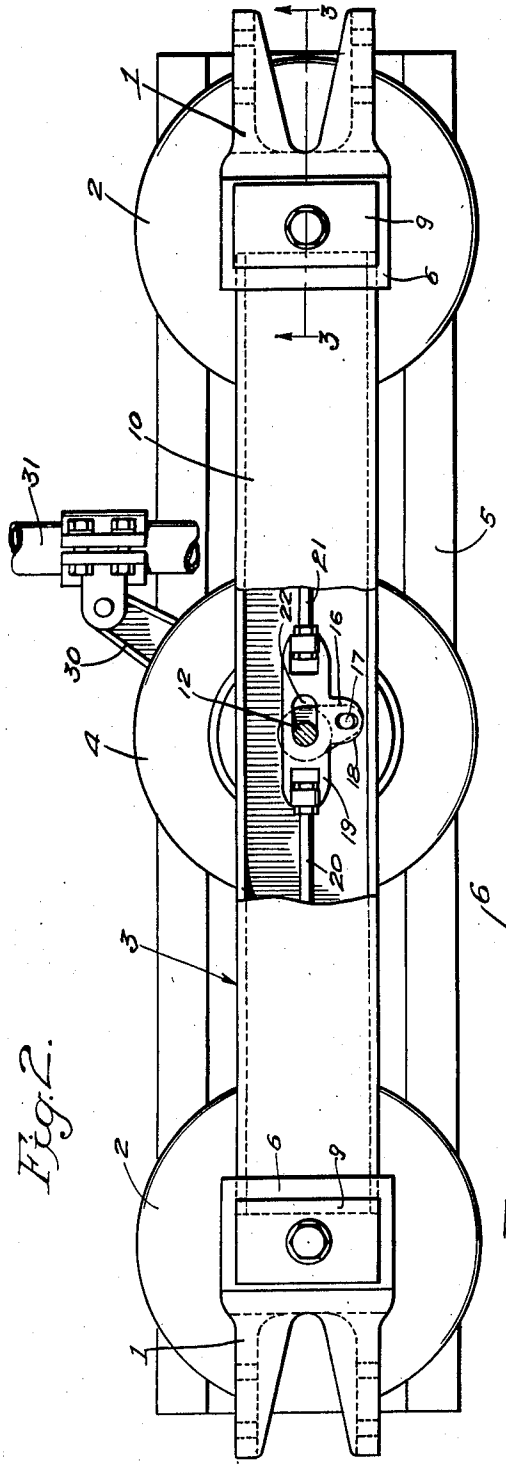


Fig. 2.

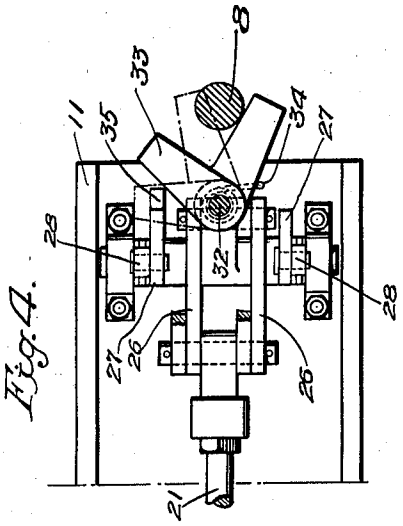


Fig. 4.

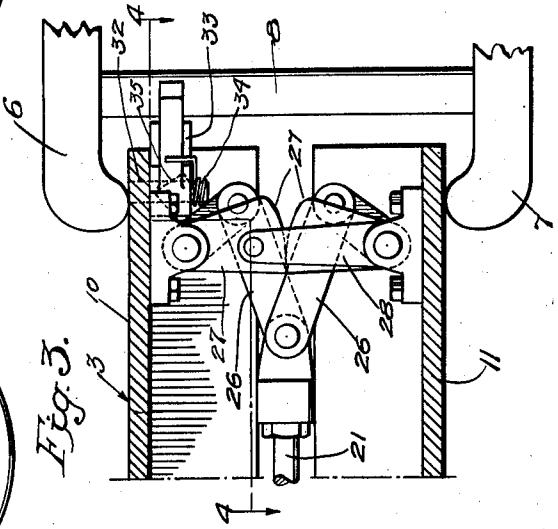


Fig. 3.

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SWITCH

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Fig. 5.

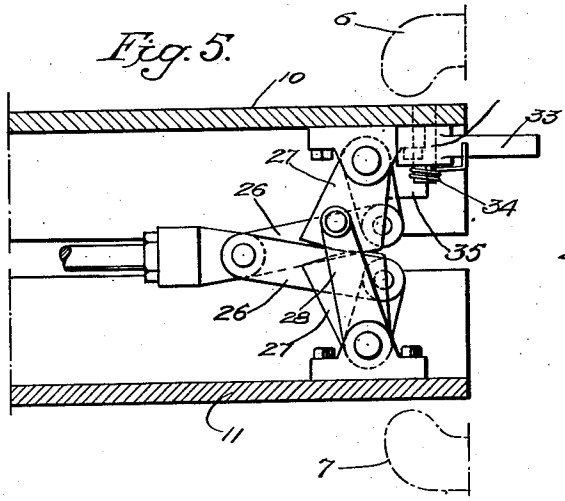


Fig. 6.

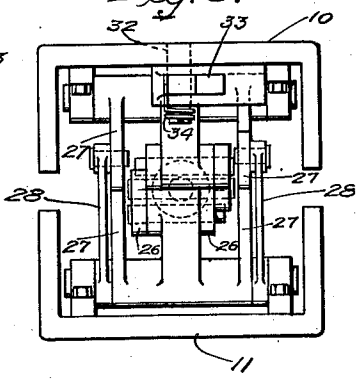


Fig. 7.

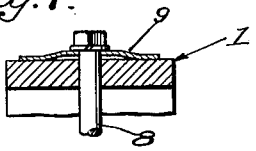
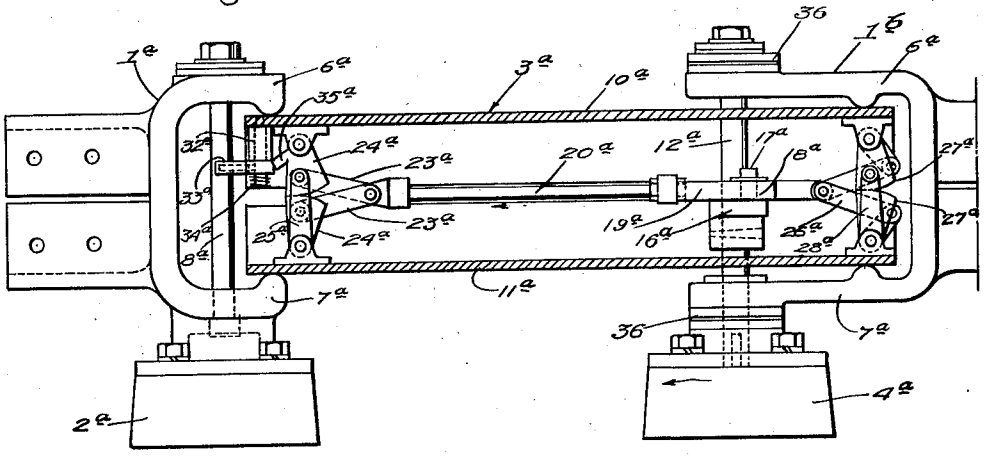


Fig. 8.



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2,099,607

SWITCH

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Application August 31, 1935, Serial No. 38,827

9 Claims. (Cl. 200—48)

This invention relates to electric switches and, more particularly, to high current capacity switches. The principal object of the invention is to provide an improved switch of this nature having certain novel features by which important advantages are obtained.

Another object of the invention is to provide a switch of this character which is so constructed that positive operation is assured regardless of any external influence such as might be caused by an accumulation of ice or snow on the switch parts where the switch is exposed to the weather.

A further object of the invention is to provide a switch of this character having a movable contact member which comprises a plurality of bodily movable elements adapted to be moved relatively to one another in a positive manner in either direction of movement.

A still further object of the invention is to provide a switch of the stated character in which the movable contact member is pivotally mounted and is fully operated through its pivotal support.

Still another object of the invention is to provide a switch of the stated character having means for preventing relative movement of the elements of the movable contact member until such elements are in proper relation to the stationary contact member or members.

These and other objects, as well as the novel features of the improved switch provided by the invention may be more fully understood from the description to follow when read in connection with the accompanying drawings.

In the drawings:

Fig. 1 is a side elevational view of the switch with certain parts shown in section for clarity of illustration;

Fig. 2 is a plan view of the switch with a portion of the movable contact member broken away for the purpose of illustration;

Fig. 3 is an enlarged partial section taken along line 3—3 of Fig. 2;

Fig. 4 is a sectional plan view taken along line 4—4 of Fig. 3;

Fig. 5 is a partial section similar to Fig. 3 but showing the switch parts in different position during operation of the switch;

Fig. 6 is an end view of the movable contact member and its associated elements as viewed from the right of Fig. 5;

Fig. 7 is a detail section taken along line 7—7 of Fig. 1; and

Fig. 8 is a side elevation of an alternative form of the switch.

Referring particularly to Figs. 1 and 2 of the drawings, the preferred form of the switch comprises stationary contact members 1 mounted upon stationary insulator supports 2 and a movable contact member 3 carried by a centrally disposed rotatable insulator support 4. The supporting members for the switch parts may be mounted in any suitable fashion, for example upon a stationary beam 5.

Each of the stationary contact members 1 comprises opposed jaws 6 and 7 through which a supporting and adjusting pin or rod 8 extends, the rod being secured to the stationary support. The jaws of the stationary contact members have some degree of resiliency and their resilience is enhanced by leaf-spring members 9, one of which is shown clearly in Fig. 7. The function of the stationary contact members is, of course, to receive the ends of the movable contact member 3, as will be clearly obvious.

The movable contact member 3 comprises bodily movable blades 10 and 11. The blades may take any desired cross-sectional form. Since the invention is directed to a high current capacity switch, the blades are of substantially cross-sectional area and, as shown in the drawings, each of the blades preferably has a channel-like cross section. It will be apparent, therefore, that the blades are rigid and are incapable of any appreciable flexing throughout their entire length. By the present invention, the rigid blades are made bodily movable and they are actuated as described hereinafter. If desired the switch blades may take the form of angles or they may take the form of flat bars or they may consist of groups of bars. These possible forms and any others which may prove suitable are contemplated by the invention.

As shown clearly in Fig. 1, the bodily movable blades 10 and 11 are slidably mounted upon the stud 12 which is carried by the rotatable insulator 4. The upper movable blade 10 is provided with a bearing cap 13 which slidably engages the end of stud 12. The lower movable blade 11 has secured thereto a flanged bushing 14 which is slidably associated with stud 12 and is seated in the upper cup-shaped part 15 of the rotatable support. Bushing 14 may be secured to the underside of blade 11 by rivets or in any other suitable fashion.

Stud 12 carries a crank arm 16 which is pivotally connected by a pin 17 to the extending por-

tion 18 of connecting link 19, as shown clearly in Fig. 2. The connecting link 19 connects together the inner ends of operating rods 20 and 21. An elongated aperture or slot 22 is provided in the connecting link 19 and stud 12 extends through the said aperture or slot. The outer end of rod 20 is connected to toggle links 23, which are arranged to actuate cam members 24 pivotally mounted on the blades of the movable contact member. Links or arms 25 are pivotally connected at their lower ends to the pivotal support of the lower cams and at their upper ends to the upper cams, as shown. The purpose of these links is to forcibly contract the blades during opening of the switch. When the toggle links 23 are in the positions shown in Fig. 1, as governed by rod 20, the effective portions or lobes of cams 24 cooperate to spread or expand the movable blades 10 and 11 at the end of the movable contact member under consideration. To effect this closing of that end of the switch, it is necessary that rod 20 be pulled away from the stationary contact member, as will be clearly apparent. On the other hand, to effect opening of the switch at that end, it is necessary that the rod 20 be pushed toward the stationary contact member in order that the toggle links 23 will pivotally move cams 24 to bring the low surfaces or ineffective portions of the cams into cooperative engagement. When this is done, the movable blades 10 and 11 are forcibly moved toward each other and away from the jaws of the stationary contact member by virtue of link 25. Normally the upper blade will drop by gravity until it rests on the end of stud 12 and the lower blade will be lifted. In the event that either or both of the blades adhere to the stationary contacts, however, on account of accumulated ice or corrosion, they will be forcibly moved.

The opposite end of the movable contact member comprises toggle links 26 connected to the outer end of rod 21 and arranged to actuate cams 27 which are pivotally mounted on the contact blades 10 and 11. Links 28, similar to links 25, are arranged to effect positive operation of the blades.

When the toggle links 26 are in the positions shown in Figs. 1 and 3, the effective portions or lobes of cams 27 are in cooperative engagement so that the contact blades 10 and 11 are moved outwardly or expanded at the end under consideration and they engage the jaws of the stationary contact member. To effect this closing of the switch at the end in question, it is necessary that rod 21 be pushed toward the stationary contact member. On the other hand, to effect opening of the switch at the end in question, it is necessary that rod 21 be pulled away from the stationary contact member in order to rotate the cams 27 to bring their low surfaces, or ineffective portions, into cooperative engagement. It will be noted that the operation of rod 21 and its associated toggle links and cams is the reverse of the operation of rod 20 and its toggle links and cams. In other words, both rods 20 and 21 are moved in the same direction to effect closing of both ends of the switch and these rods are both moved in the opposite direction to effect opening of both ends of the switch.

It will be seen that the blades of the movable contact member are moved bodily and in a positive manner by the actuating mechanism provided. By virtue of their slidable mounting on stud 12, the contact elements are enabled to move bodily relative to one another. The joint or simultaneous operation of both ends of the movable contact member, as well as rotation of the movable contact member as a unit in a plane perpendicular to the axis of the rotatable support 14, is effected by means of the crank arm 16, which revolves with the rotatable support 4. The support has attached thereto a crank arm 30 which may be actuated by a rod 31 or the like.

Considering the operation of the switch as a whole and assuming that the switch is in closed position as illustrated in Fig. 1, in order to open the switch, the crank arm 30 will be rotated in a clockwise direction, as viewed in Fig. 2. This will cause rotation of stud 12 and crank arm 16 in a clockwise direction and crank arm 16 will cause the connecting link 19 to move from right to left, thus moving both the operating rods 20 and 21 in the same direction. The slot 22 in the connecting link 19 permits such movement of connecting link 19 relative to stud 12. The movement of rods 20 and 21 in this fashion causes actuation of the toggle links and cams in the manner above described to actuate the blades 10 and 11 of the movable contact member. The blades are pulled forcibly away from the jaws of the stationary contacts so as to forcibly break any seal due to ice or corrosion. The upper blade 10 now rests on the end of the stud 12, while the lower blade 11 has been lifted bodily upward.

Continued rotation of the insulator support 4 causes the movable contact member 3 to move as a unit in a plane perpendicular to the axis of support 4 or, as viewed in Fig. 1, in a plane perpendicular to the plane of the drawing sheet. The insulator support continues to rotate until the movable contact assembly is at right angles to its closed position shown in Fig. 1. The switch is now completely operated to open position.

To close the switch, the insulator support 4 is rotated by crank arm 30 in the reverse direction to move the movable contact assembly in the plane above mentioned to the position shown in Fig. 1. When the ends of the movable contact member 3 are in cooperative relation with the jaws of the stationary contact members, continued rotation of the insulator support 4 causes actuation of the toggles and cams through crank arm 16 and the operating rods 20 and 21, as above described. This causes forcible expansion or outward movement of the movable blades 10 and 11 to bring the ends of the blades into firm engagement with the jaws of the stationary contact members.

It will be seen that it is essential to the successful operation of the switch that the toggles do not cause expansion of the ends of the movable contact member until such ends are in proper position between the jaws of the stationary contact members, since premature expansion of the said ends might prevent entrance thereof between the stationary contact jaws. Accordingly, there is provided means for preventing this improper action. Referring particularly to Figs. 3 to 5, a stud 32 is carried by the upper blade 10 and a bell-crank 33 is loosely mounted on the stud. A coiled or helical spring 34 surrounds stud 32 and is arranged so as to exert constant pressure on bell-crank 33 in a counter-clockwise direction, as viewed in Fig. 4. When the switch is closed, the right-hand arm of the bell-crank rests against the bolt 8 of the stationary contact member, as illustrated in Fig. 4, thus holding the bell-crank in the full-line position. When

the switch is opened, the lug **35**, provided integrally on one of the cam members **27**, swings to a horizontal position and, as soon as the movable contact member **3** has been moved far enough for the bell-crank arm to clear bolt **8**, the spring **34** rotates the bell-crank **33** to the broken-line position of Fig. 4 so as to bring the left-hand arm of the bell-crank into locking engagement with the lug **35**. This prevents operation of the toggle links and cams until the ends of the movable contact member **3** have entered the stationary contact members sufficiently for the bell-crank **33** to be moved to ineffective position by engagement of the bolt **8** with the right-hand arm of the bell-crank.

Although a double-ended switch construction is preferred, it will be understood that the invention is not limited thereto but is applicable to a single-ended construction, such as shown in Fig. 8. In that figure, a stationary contact member *1a* is provided, the same being mounted on a stationary insulator support *2a*. The movable contact member *3a* is pivotally mounted near one end upon the rotatable insulator support *4a*. The other stationary contact member *1b* utilizes the stud *12a* as a supporting and adjusting member. Stud *12a* is enabled to rotate while the contact member remains stationary by virtue of ball bearings **36** or the like. The actuating mechanism is identical with that used to actuate the movable contact member and the ends thereof in the double-ended construction above described. The specific parts in Fig. 8 are designated by numerals corresponding to those used to designate the corresponding parts in the preferred embodiment. It is believed to be unnecessary to further describe the construction and operation of the modified form of the device, as these will be clearly understood from the previous description. It should be noted, however, that in this instance the bell-crank *33a* and associated elements are provided at the left-hand end of the movable contact member.

A switch constructed in accordance with the invention has very important advantages. It will be seen that the path of the electrical current through the switch is substantially straight and has no pronounced bends or curves. This is advantageous in that a lower temperature obtains in the switch parts during operation, and there is less strain on the switch when subjected to short-circuit currents. In the conventional switch structure and in any structure involving pronounced curves or bends in the path of current flow, the current traversing the bends crowds into one area of the bend or curve due to the electromagnetic action at that point. This causes abnormal temperature and strain on the switch at that point, particularly when excessive currents, such as caused by short-circuits, flow through the switch.

Another important advantage of the switch provided by this invention is that the operation of the parts to effect closing and opening is positive and overcomes any resistance, such as is commonly caused by accumulation of ice or corrosion. As switches of the type here concerned are commonly exposed to the weather, this is a very important feature. Furthermore the use of cams distributes the strain of operation over a period of time and does not impose a sudden strain on the parts, as would be the case if toggles alone were used. It is to be understood, however, that the invention is not limited to the use of cams but contemplates any mechanism for effecting positive action in both directions.

Another important feature of the device is the locking feature above described which prevents improper operation of the switch and which insures that the ends of the movable contact member will, at all times, enter between the jaws of the stationary contact members. This eliminates a serious objection which is inherent in prior switch constructions.

Other features and advantages will be apparent to those skilled in the art. It will be understood, of course, that although specific illustrations have been disclosed herein, they are merely illustrative and do not limit the invention. The invention contemplates broadly a structure in which there is obtained positive operation of parts of a switch member in both directions of operation. The movable parts need not comprise bodily movable blades, as preferred, but may take other forms. For example, a unitary blade with an expansible end may be used. Such modifications and changes as will occur to persons skilled in the art and such as fall within the scope of the appended claims are within the scope of the invention.

I claim:

1. In an electric switch, a pair of spaced stationary contact members, a rotatable support interposed between said stationary contact members, a contact member carried by said support and movable as a unit thereby to bring the ends of the said contact member into and out of cooperative relation with said stationary contact members, said movable contact member comprising a pair of adjacently-disposed coextensive rigid blades adapted for transverse bodily movement toward and away from one another, said blades being incapable of any appreciable flexing throughout their entire length, actuating members arranged axially of said movable contact member between said blades, cooperating cam members pivotally attached to said blades at each end of said movable contact member, toggle members connecting the outer ends of said actuating members to said cam members, and means operable by said support for moving said actuating members axially of said movable contact member when the ends of the movable contact member are in cooperative relation with said stationary contact members, whereby to forcibly move said blades bodily in transverse relation to one another to effect engagement thereof with said stationary contact members.

2. In an electric switch, a stationary contact member, a movable contact member having an expansible end for cooperative engagement with said stationary contact member, an actuating member arranged axially of said movable contact member, a pair of opposed cooperative rotary cam members attached to said expansible end, said cam members having arcuate cam surfaces in engagement with one another, toggle members connecting an end of said actuating member to said cam members for rotating said cam members, and means for moving said actuating member axially of said movable contact member when said expansible end is in cooperative relation with said stationary contact member, whereby to rotate said cam members and forcibly expand said end to effect engagement thereof with said stationary contact member.

3. In an electric switch, a stationary contact member, a movable contact member having an expansible end for cooperative engagement with

said stationary contact member, an actuating member arranged axially of said movable contact member, a pair of opposed cooperative rotary cam members attached to said expansible end, said cam members having arcuate cam surfaces in engagement with one another, toggle members connecting an end of said actuating member to said cam members for rotating said cam members, a link interconnecting said cam members for contracting said end when the cam members are rotated in a manner to open the switch, and means for moving said actuating member axially of said movable contact member when said expansible end is in cooperative relation with said stationary contact member, whereby to rotate said cam members and forcibly expand or contract said end to effect engagement or disengagement thereof with said stationary contact member.

4. In an electric switch, a pair of spaced stationary contact members, a rotatable support interposed between said stationary contact members, a contact member having expansible ends carried by said support and movable thereby to bring its said ends into and out of cooperative relation with said stationary contact members, actuating members arranged axially of said movable contact member, cooperating cam members pivotally attached to each of said expansible ends, toggle members connecting the outer ends of said actuating members to said cam members, and means operable by said support for moving said actuating members axially of said movable contact member when said expansible ends are in cooperative relation with said stationary contact members, whereby to forcibly expand said ends to effect engagement thereof with said stationary contact members.

5. In an electric switch, a pair of spaced stationary contact members, a rotatable support interposed between said stationary contact members, a contact member having expansible ends carried by said support and movable thereby to bring its said ends into and out of cooperative relation with said statonary contact members, actuating members arranged axially of said movable contact member, cooperating cam members pivotally attached to each of said expansible ends, toggle members connecting the outer ends of said actuating members to said cam members, and means operable by said support for moving said actuating members in the same direction axially of said movable contact member when said expansible ends are in cooperative relation with said stationary contact members, whereby to forcibly expand said ends to effect engagement thereof with said stationary contact members.

6. In an electric switch, a stationary contact member, a movable contact member having an expansible end for cooperative engagement with said stationary contact member, an actuating member arranged axially of said movable contact member, cooperating cam members pivotally attached to said expansible end, toggle members connecting an end of said actuating member to said cam members, means for moving said actuating member axially of said movable contact member when said expansible end is in cooperative relation with said stationary contact member, whereby to forcibly expand said end to effect engagement thereof with said stationary contact member, a spring-biased latching member carried by said end so as to be engageable by a part of said stationary contact member to move the latching member to ineffective position, and a lug on one of said cam members engageable by said latching member in its effective position.

7. In an electric switch, a pair of spaced stationary contact members, a rotatable insulator carrying an axially-extending stud or shank, a movable contact member comprising a pair of adjacently-disposed rigid blades slidably mounted intermediate their ends on said stud for transverse bodily movement toward and away from one another, means operable by rotation of said insulator to rotate said movable contact member bodily about the axis of said insulator to move the ends of said blades into or out of cooperative relation with said stationary contact members, and means for moving said blades bodily in transverse relation to one another along said stud to effect engagement of the blades with said stationary contact members during the switch closing operation and to effect disengagement of said elements during the switch opening operation.

8. In an electric switch, a pair of spaced stationary contact members, a rotatable insulator carrying an axially-extending stud or shank, a movable contact member comprising a pair of adjacently-disposed rigid blades slidably mounted intermediate their ends on said stud for transverse bodily movement toward and away from one another, and means operatively connected to said stud for rotating said movable contact member when said insulator is rotated and for moving said blades bodily in transverse relation to one another on said stud into or out of engagement said said stationary contact members.

9. In an electric switch, a pair of spaced stationary contact members, a rotatable insulator carrying an axially-extending stud or shank, a movable contact member comprising a pair of adjacently-disposed rigid blades slidably mounted intermediate their ends on said stud for transverse bodily movement toward and away from one another, crank means on said stud between said blades, actuating members attached to said crank means and extending axially of said movable contact member between said blades toward the ends of said contact member, and means connected between the outer ends of said actuating members and the ends of said blades for moving said blades bodily in transverse relation to one another along said stud into or out of engagement with said stationary contact members.

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