July 30, 1929. C. BOLLINGER 1,722,452

ELECTRICAL SWITCH

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Fig. 1.

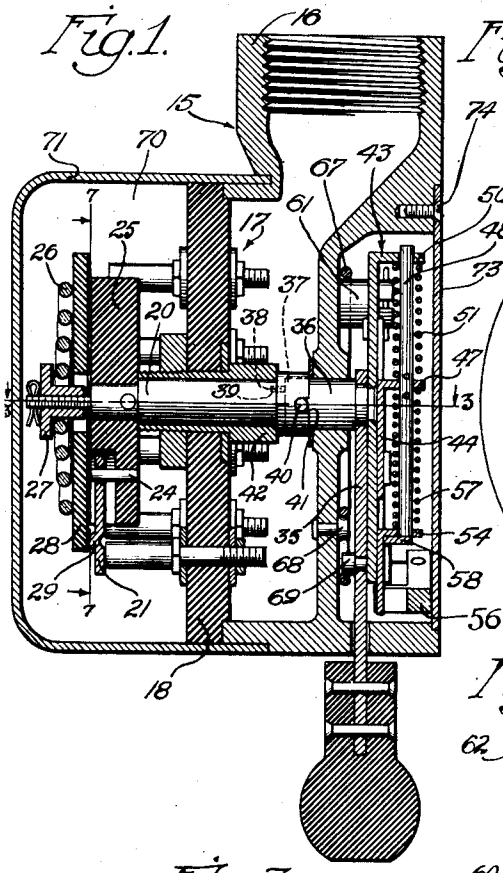


Fig. 2.

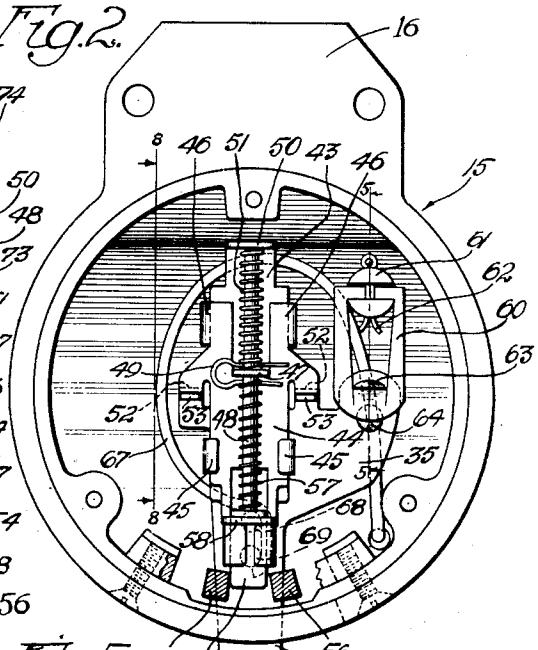


Fig. 5.

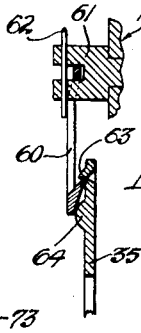


Fig. 3.

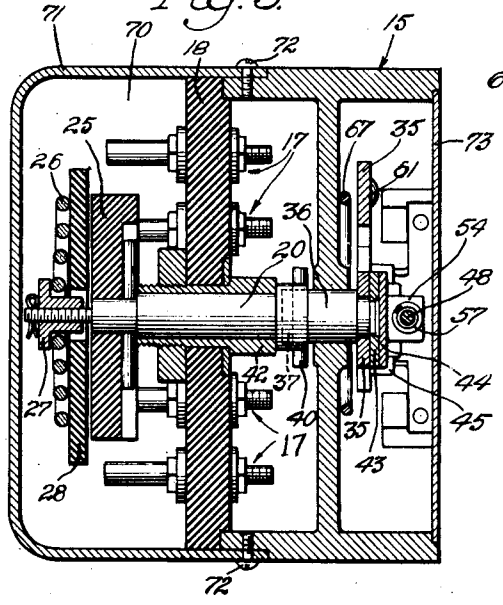
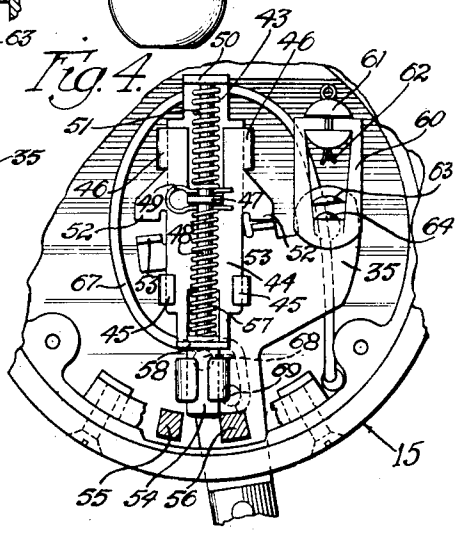


Fig. 4.



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Fig. 6.

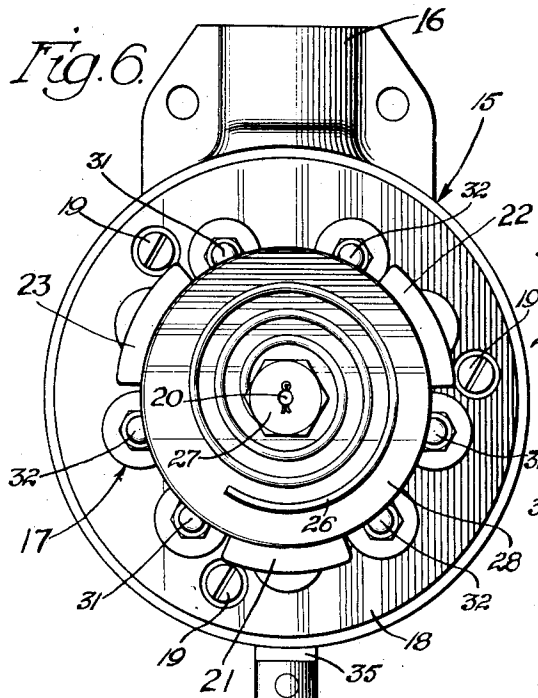


Fig. 7.

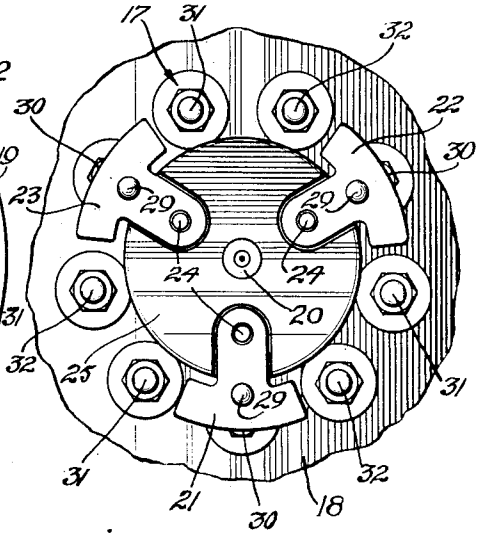


Fig. 9.

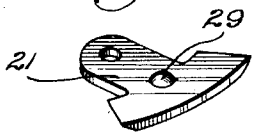


Fig. 8.

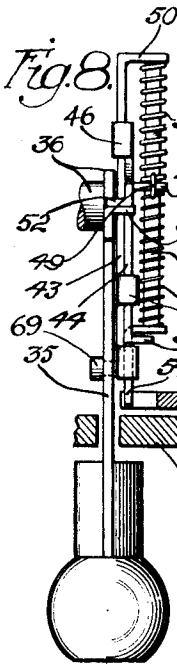


Fig. 10.

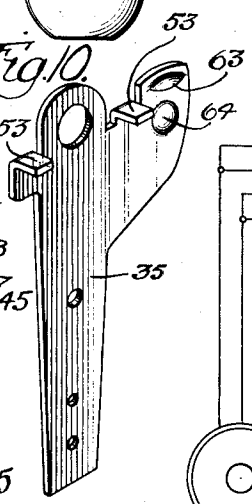
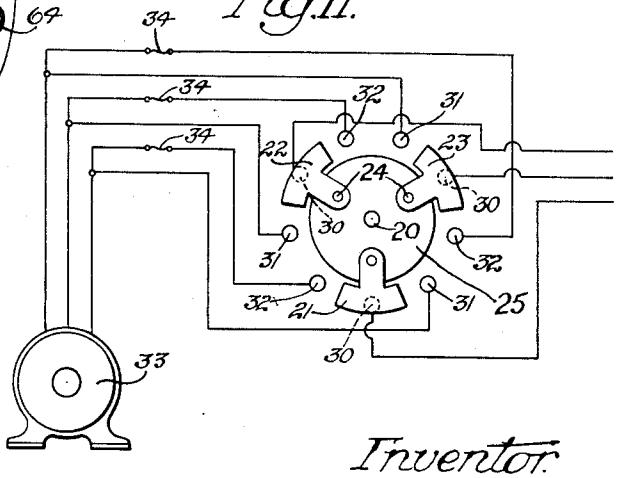


Fig. 11.



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Patented July 30, 1929. 1,722,452

UNITED STATES PATENT OFFICE.

CHARLES BOLLINGER, OF CHICAGO, ILLINOIS, ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

ELECTRICAL SWITCH.

Application filed April 4, 1924. Serial No. 704,099.

This invention relates to electrical switches, and more particularly to the operating mechanisms of switches.

The primary object of the invention is to provide improved operating mechanism for bringing the movable contact or contacts of a switch into and out of engagement with the fixed or stationary contact or contacts thereof.

Other objects of the invention are to provide a switch wherein the movable contact must be brought into a certain one of its positions before it can be brought into the other; to provide operating mechanism which insures that the movable contact of a switch will be moved from its intermediate position to a certain one of its extreme positions before it is moved to the other extreme position; to provide a switch wherein the movable contact is locked against displacement in one direction when it is in an intermediate position; to provide a switch wherein the movable contact is stopped in an intermediate position if it does not travel at a predetermined rate of speed when moving from one of its extreme positions to another; to provide improved quick make and break mechanism for a switch, and to provide means for equalizing the force with which several contacts of a switch press upon other contacts of the switch.

To facilitate the disclosure of this invention, a switch embodying a preferred form of the invention is shown in connection with the starting and running circuits of an alternating current motor. In the switch, a plurality of movable contacts are loosely mounted upon an insulating member which is rigidly secured to a shaft carrying a spring adapted to equalize the force with which the movable contacts bear or press upon a plurality of fixed or stationary contacts. Quick make and break mechanism operatively connects the shaft to an actuating lever which may be moved from an intermediate position to an extreme position and then returned through the intermediate position to a second extreme position. The lever when so displaced, brings the movable contacts, as a unit, into like positions, one of the extreme positions being the position wherein these contacts close the starting circuit of the motor and the other extreme position being the position wherein they close the running circuit. The intermediate position in this case is a neutral position wherein the contacts do not close a circuit or circuits. To insure against improper manipulation of the switch, a latch locks the lever against direct displacement from the intermediate position to the running position, but if the lever is first moved to the starting position, it may be moved quickly to the running position as a cam surface on the lever will then render the latch ineffective.

In this embodiment of the invention if the lever is released while in the starting position, it is returned to the intermediate position by a spring which is compressed whenever the lever is moved from the intermediate position to the starting position. The spring has not sufficient strength to drive the lever through the intermediate position.

The quick make and break mechanism comprises an arm rigidly secured to the shaft and adapted to slidably journal a plate, which together with the arm, slidably journals a latch bar adapted to engage a plurality of stops which correspond to the above described positions of the actuating lever. A spring tends to hold the plate in alignment with the actuating lever and a second spring tends to hold the latch bar in an extended position with respect to the arm. The actuating lever, when displaced, causes the plate to withdraw the latch from its extended position wherein it engages a stop, and when the latch is disengaged from the stop, the arm springs into alignment with the actuating lever, the arm being held stationary during the initial movement of the lever as it moves from one position to another. This construction allows the quick make and break mechanism to function when the movable contacts are brought from the intermediate position to the starting position, as well as when they are brought from the starting position to the running position or from the running position to the intermediate position.

Further objects of the invention will become apparent as the detailed description progresses, reference being had to the accompanying drawings wherein,

Fig. 1 is a central longitudinal section taken through a switch embodying the invention;

Fig. 2 is an elevation of the switch looking from the right in Fig. 1;

Fig. 3 is a section taken on the line 3—3 of Fig. 1;

Fig. 4 is a fragmentary view showing a changed position of the mechanism shown in Fig. 2;

Fig. 5 is a section taken on the line 5—5 of Fig. 2;

Fig. 6 is an elevation of the switch looking from the left in Fig. 1;

Fig. 7 is a section taken on the line 7—7 of Fig. 1;

Fig. 8 is a section taken on the line 8—8 of Fig. 2;

Fig. 9 is a detail perspective of one of the movable contacts which form parts of the improved switch;

Fig. 10 is a detail perspective of an actuating lever which forms a part of the improved switch, and

Fig. 11 is a diagram of the starting and running circuits of an alternating current motor, the switch being shown in connection therewith.

Referring to the drawings wherein like reference characters designate like parts throughout the several views, the reference character 15 designates in its entirety a housing upon and in which the mechanism of the improved switch is preferably mounted. The housing comprises an apertured boss 16 through which suitable conductors may be led to a plurality of fixed or stationary contacts indicated in general by the reference character 17. The stationary contacts are mounted on an insulating base plate 18 which is rigidly secured by means of a plurality of screws 19 to the housing 15. As best shown in Fig. 7 the stationary contacts 17 are equi-distantly spaced from each other and from the axis of a shaft section 20 which is adapted to bring a plurality of movable contacts 21, 22, and 23 into and out of engagement with various combinations of the stationary contacts 17. The movable contacts 21, 22, and 23 are loosely mounted upon pins 24 carried by an insulating disk 25 which is rigidly secured to the shaft section 20. It will be noted that the several pins 24 are disposed parallel to the axis of the shaft section 20 and that the movable contacts 21, 22, and 23 may be moved away from or toward the stationary contacts 17. However, yielding means are provided for holding the movable contacts in engagement with the stationary contacts, the yielding means comprising a spiral spring 26 which is interposed between a nut 27 threaded upon the shaft section 20 and an insulating disk 28 loosely mounted upon the shaft section 20; the shaft section may be termed a support for the insulating disk 28. The spiral spring 26 forces the insulating disk 28 against the movable contacts, the disk being adapted to engage arcuate surfaces 29 formed upon the contacts. Each of the movable contacts is adapted to be brought into a position wherein it rests upon two adjacent stationary contacts and it is apparent that the spring pressed insulating disk 28 operating upon the arcuate surfaces 29 of the contacts will cause the movable contacts to press against each of the two stationary contacts with equal force. As the spiral spring 26 is common to the several movable contacts 21, 22, and 23 and is centrally disposed with respect to them, it follows that the spring will equalize the force with which these contacts press against the stationary contacts.

Referring now to Figs. 7 and 11, each of the movable contacts 21, 22, and 23 is shown associated with three of the stationary contacts 17. Thus in Figs. 7 and 11 each of the movable contacts is shown in engagement with a stationary contact 30 disposed midway between a pair of stationary contacts 31 and 32. Fig. 11 illustrates the manner in which the switch may be employed to control the starting and running circuits of a three-phase alternating current motor 33. Each contact 30 is shown connected to one of the three mains. The contacts 31 are local to the starting circuit of the motor and the contacts 32 are local to the running circuit of the motor, the running circuit of the motor being provided with a plurality of fuses 34. The movable contacts may be moved into positions wherein each will bridge a pair of adjacent contacts 30 and 31 or into positions where each will bridge a pair of adjacent contacts 30 and 32. It is apparent that when the contacts 30 and 31 are bridged, the starting circuit of the motor will be closed and that when contacts 30 and 32 are bridged, the running circuit of the motor will be closed.

The means for bringing the movable contacts into positions wherein they will close the starting and running circuits of the motor comprises an actuating lever 35 pivoted upon a shaft section 36 rotatably journaled in the housing 15. The shaft section 36 seats in a socket 37 formed in one end of the shaft section 20 and has its axis disposed coincident with the axis of the shaft section 20. A pin 38 projecting from the shaft section 36 and eccentrically disposed with respect to the axis thereof is adapted to enter a recess 39 formed in the shaft section 20. The pin 38 insures that the shaft sections will be assembled in predetermined positions relative to each other. A pin 40 projecting through the shaft section 36 and engaging slots 41 in the shaft section 20 provides means whereby the shaft section 36 may an-

gularly displace the shaft section 20, the shaft section 20 being rotatably journaled in a bushing 42 mounted in the insulating base plate 18.

The actuating lever 35 is operatively connected to the shaft section 36 by quick make and break mechanism comprising an arm 43 rigidly secured to the shaft section 36 (Figs. 1 to 4 inclusive). The arm 43 slidably journals a plate 44, the arm and the plate being provided with guides 45 and 46 respectively. The plate 44 has an outstanding lug 47 carrying a pin 48, the axis of which is disposed normal to the axis of the shaft section 36. The pin 48 is secured to the lug 47 by means of a cotter pin 49 and the upper end of the pin (Fig. 1) is slidably journaled in an outstanding lug 50 formed upon the arm 43. A helical compression spring 51 wound around the pin 48 and disposed between the outstanding lugs 47 and 50 is adapted to hold the plate 44 in a position wherein a pair of rearwardly extending lugs 52 formed integral with the plate 44 will bear upon a pair of forwardly extending lugs 53 formed integral with the actuating lever 35. When the plate 44 is in this position it is said to be in alignment with the actuating lever. The arm 43 and the plate 44 together slidably journal a latch member 54 which rides upon the lower end of the pin 48 and is adapted to engage a plurality of stops 55 and 56. A helical compression spring 57 tends to hold the latch member in engagement with either of the stops, the spring being wound around the pin 48 and being disposed between the outstanding lug 47 and the latch member 54. The latch member 54 may be withdrawn from the stops by means of the plate 44 which has an integral bar 58 engaging the latch member. As shown in Fig. 4, if the actuating member 35 is angularly disposed in a counter-clockwise direction, the right-hand lug 53 of the actuating lever will displace the plate 44 against the action of the spring 51 and the bar 58 of the plate 44 will in turn displace the latch member 54. If the actuating member is displaced in a counter-clockwise direction from the position wherein it is shown in Fig. 4, the latch member 54 will be disengaged entirely from the left-hand side of the stop 56 and the compression spring 51 will act to bring the plate 44 into alignment with the actuating lever. The latch member 54 will then be driven in a position wherein it engages the right-hand side of the stop 56. If the actuating lever is now angularly displaced in a clockwise direction (Fig. 4) the plate 44 will again lag behind the actuating lever until the latch member 54 has been withdrawn from engagement with the right-hand side of the stop 56. This displacement may be continued until the latch member engages either the left-hand side of the stop 56 or the left-hand side of the stop 55, from which latter position it may be brought again to the position wherein it engages the left-hand side of the stop 56. As the movable contacts 21, 22, and 23 are constrained to move with the arm 43 and as angular displacement of the arm relative to the common axis of the shaft sections 20 and 36 is controlled by the plate 44, it is readily understood that the angular movements of the plate are transmitted to the movable contacts. Therefore the movable contacts will not move in unison with the actuating lever 35 but will be moved from one position to another position at a speed determined mainly by the helical compression spring 51.

Returning now to Fig. 11, it will be noted that if the actuating lever has been displaced in a counter-clockwise direction, the several movable contacts will bridge each pair of adjacent stationary contacts 30 and 31 to close the starting circuit of the motor 33. The movable contacts may then be moved in a clockwise direction (Fig. 11) to positions wherein they will bridge the several pairs of adjacent stationary contacts 30 and 32 to close the running circuit of the motor. It is of course important that the movable contacts be moved into positions wherein they close the starting circuit before they are moved into positions wherein they close the running circuit, as otherwise the several fuses 34 might be destroyed. The invention contemplates means for controlling the actuating mechanism of the switch so that the movable contacts must be brought as a unit into a certain one of their extreme positions before they can be brought into the other of their extreme positions. Or to state it more specifically, means are provided for controlling the actuating mechanism of the switch so that the movable contacts must be brought into positions wherein they will close the starting circuit of the motor before they can be brought into positions wherein they will close the running circuit thereof.

The means for controlling the actuating mechanism so that the starting circuit of the motor must be closed first, comprises a latch 60 depending from a slotted post 61 which projects from the housing 15. A cotter pin 62 closes the outer end of the slot in the post 61 and prevents the latch 60 from being displaced therefrom (Figs. 2, 4, and 5). The latch 60 may be said to be pivotally mounted in the post and as best shown in Fig. 5, it is adapted to engage a lug 63, formed on the actuating lever 35, when the actuating lever is in its intermediate position. The latch 60 permits the lever 35 to be displaced in a counter-clockwise direction (Figs. 2 and 4) but will not permit the actuating lever to be displaced directly from its intermediate position to the position wherein it causes the

movable contacts to close the running circuit. However, if the actuating lever is first displaced in a counter-clockwise direction (Figs. 2 and 4) it may be returned quickly through the intermediate position to the position wherein the running circuit is closed, as means are provided for rendering the latch 60 ineffective. The means for rendering the latch ineffective comprises a cam surface 64 formed upon the actuating lever 35. The cam surface 64 will throw the free end of the latch 60 out of the path of the lug 63 when the actuating lever 35 is moved quickly in a clockwise direction (Figs. 2 and 4) from one of its extreme positions to the other. It is apparent that the actuating lever may be returned to its intermediate position at any time.

Means are preferably provided for insuring that the actuating lever will not be left in the starting position. This means includes a spring 67 which has one of its ends secured to the housing 15, the other end of the spring being adapted to bear upon a pin 68 when the actuating lever is in its intermediate position. The pin 68 is fixed in the housing 15 and simply serves as a stop for the free end of the spring. A shouldered pin 69 projecting from the actuating lever 35 also engages the free end of the spring and, when the actuating lever is angularly displaced in a counter-clockwise direction (Figs. 2 and 4) compresses the spring. The spring 67 is of sufficient strength so that if the operator releases the actuating lever while it is in the starting position, the spring will drive the lever to the intermediate position.

In the operation of the switch, the operator first moves the actuating lever to the right (Fig. 2), thus causing the right-hand lug 53 of the actuating lever to displace the plate 44 against the action of the spring 51. The latch in turn withdraws the latch member 54 from engagement with the left-hand side of the stop 56, which action permits the spring 51 to drive the plate 44 into alignment with the actuating lever and to bring the movable contacts into positions wherein they close the starting circuit of the motor. As soon as the motor has picked up its load the operator throws the actuating lever 35 to its other extreme position wherein it closes the running circuit. When the running circuit is to be opened the actuating lever is moved to its intermediate position.

An advantage attending the improved switch is the ability of the quick make and break mechanism to operate when the actuating lever is brought from any one of its several positions to another of its positions. For instance, the quick make and break mechanism is effective when the actuating lever is brought from its intermediate position to the starting position, and it is also effective when the lever is brought from the starting position to the running position, or when the lever is brought from the running position to the intermediate position. In addition, the latch member 54 of this mechanism serves to lock the actuating member in the running position, a function which it would also perform when the lever is in the starting position if the spring 67 were omitted from the switch.

As best shown in Fig. 1, the movable and stationary contacts of the switch are disposed in a chamber 70 formed by the housing 15 and a cover 71, the cover being detachably secured to the housing by screws 72. In practice, the chamber 70 is preferably filled with oil or any other compound or mixture which would prevent or reduce arcing between the contacts. The actuating mechanism of the switch is protected by a cover plate 73 secured to the housing by screws 74.

What is claimed is:

1. In a switch, a plurality of contacts, a plurality of contact members, an arcuate surface projecting from each contact member, an insulating plate contacting with all of the arcuate surfaces, and resilient means engaging the plate to cause a uniform pressure between the contacts and contact members.

2. In a switch, a plurality of contacts, a plurality of contact members, an insulating disk for carrying the contact members provided with a slot for each contact member, a pin in each of said slots upon which the contact member is mounted permitting axial movement of the contact member, and means for resiliently urging the contact members in an axial direction to cause a firm engagement with the contacts.

3. In a switch, a plurality of contacts, a plurality of contact members, a supporting element for said contact member, a shaft operatively connected to said supporting element, means fastened to the opposite end of said shaft having oppositely disposed projecting portions, a lever loosely mounted on said shaft and provided with members cooperating with the projecting portions of said means for causing the rotation thereof to effect the movement of said supporting element, means secured to said lever, and a latch engaging said last recited means for preventing the movement of said lever in one direction.

4. In a switch, a plurality of contacts, a plurality of contact members, a supporting element therefor, a shaft operatively connected to said supporting element, means fastened to the opposite end of said shaft having oppositely disposed projecting portions, a lever loosely mounted on said shaft and provided with members cooperating with the projecting portions of said means

for causing the rotation thereof to effect the movement of said supporting element, means secured to said lever, a latch engaging said last recited means for preventing the movement of said lever in one direction, and a cam surface formed on said lever and effective when said lever is moved from one extreme position to the other for rendering said latch ineffective.

In witness whereof, I hereunto subscribe my name this 27th day of March, A. D. 1924.

CHARLES BOLLINGER.