

April 28, 1936.

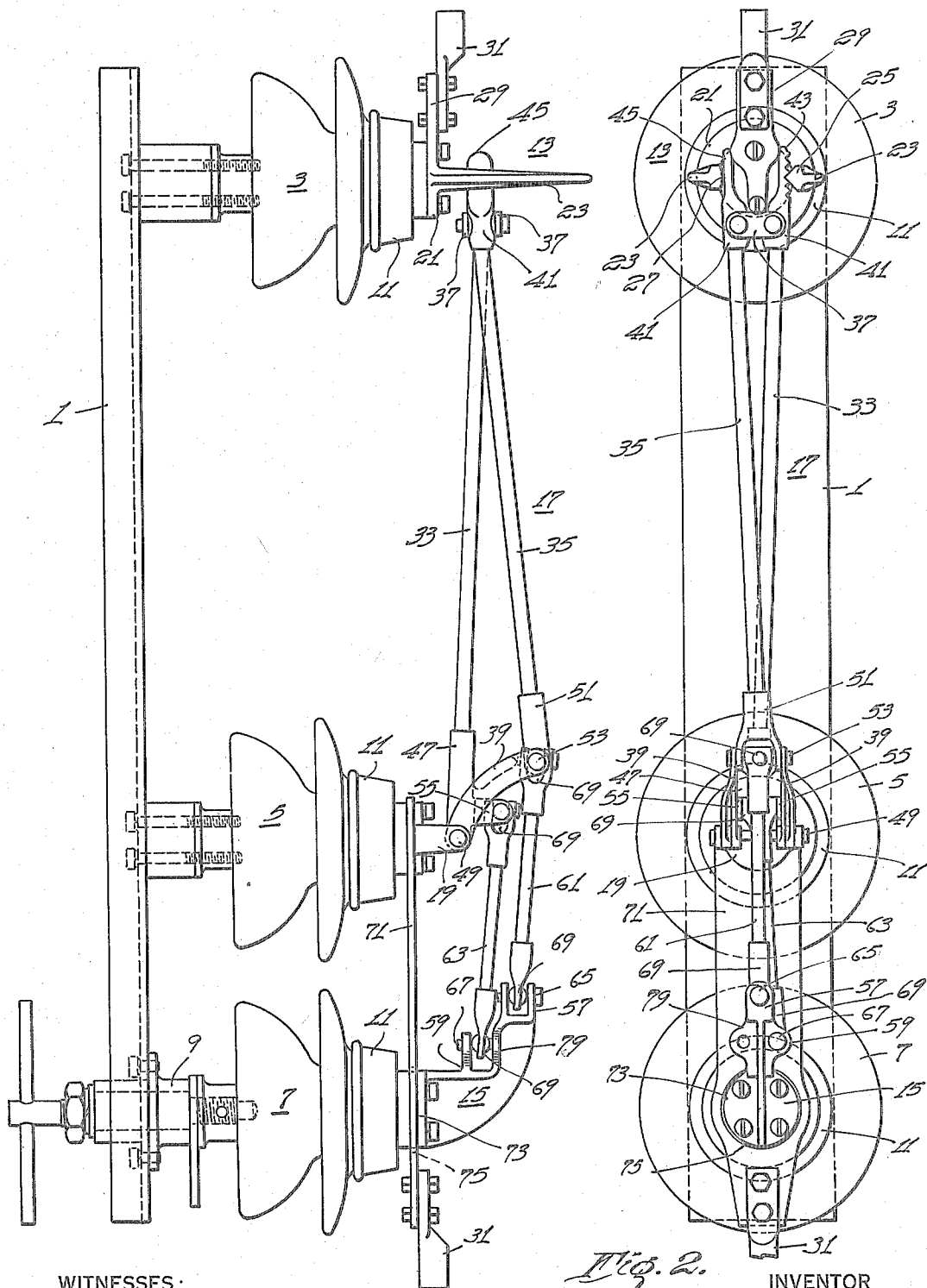
H. J. CRABBS

2,039,059

CIRCUIT BREAKER

Filed Oct. 11, 1934

3 Sheets-Sheet 1



WITNESSES:

C. C. Speding *Fig. 1.*
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Fig. 2.

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April 28, 1936.

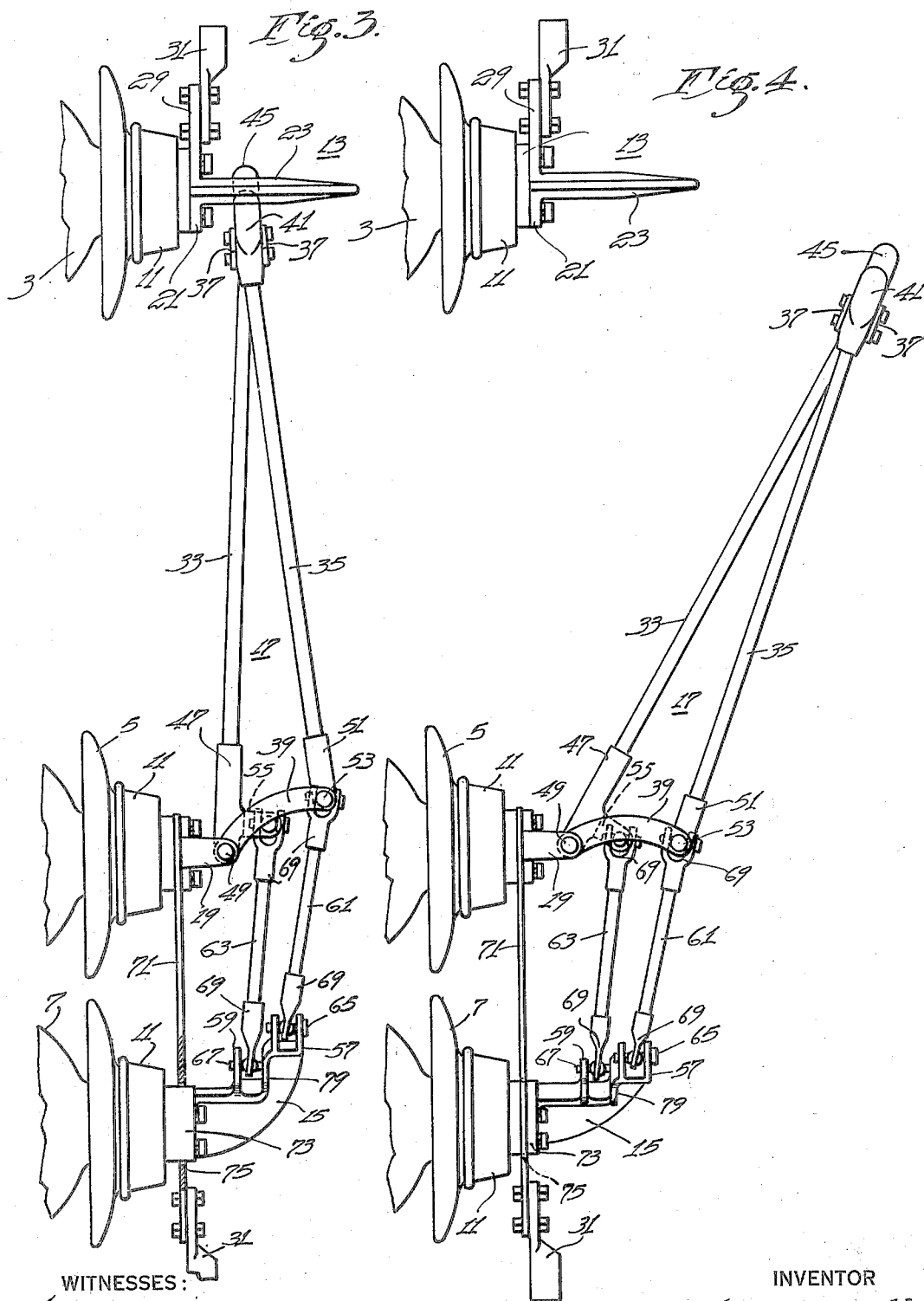
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CIRCUIT BREAKER

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3 Sheets-Sheet 2



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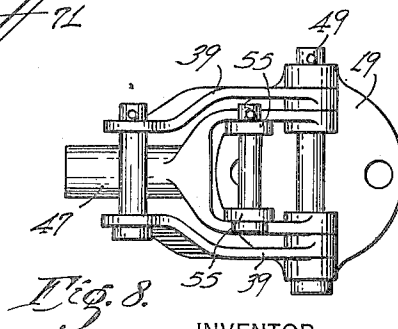
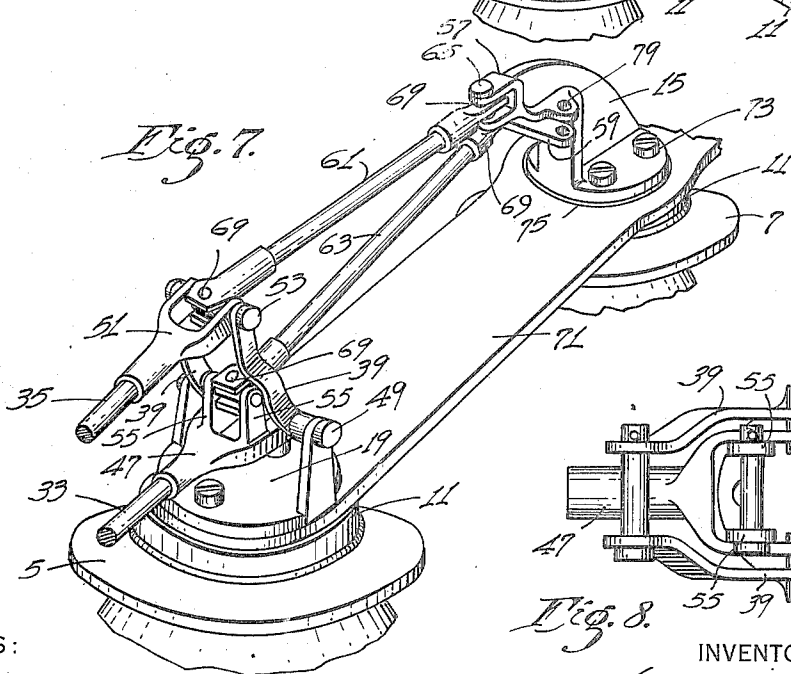
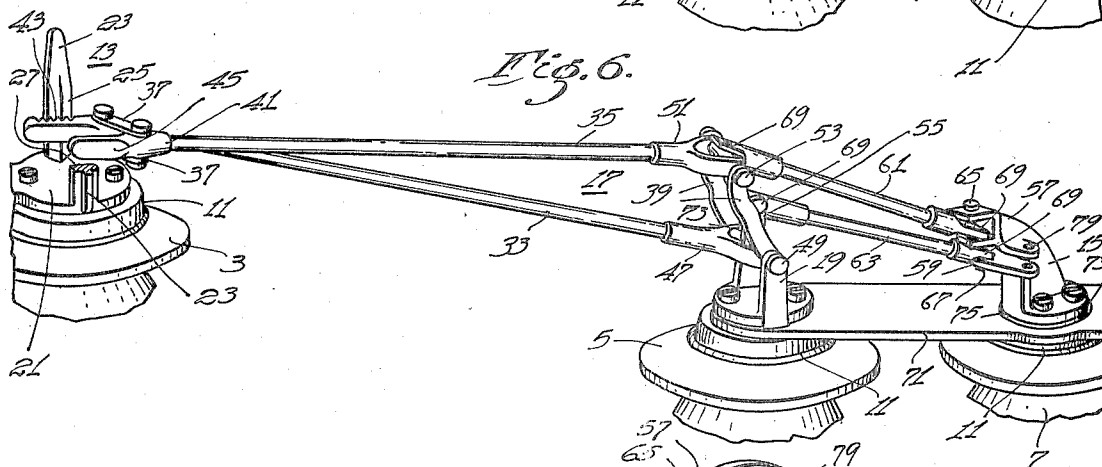
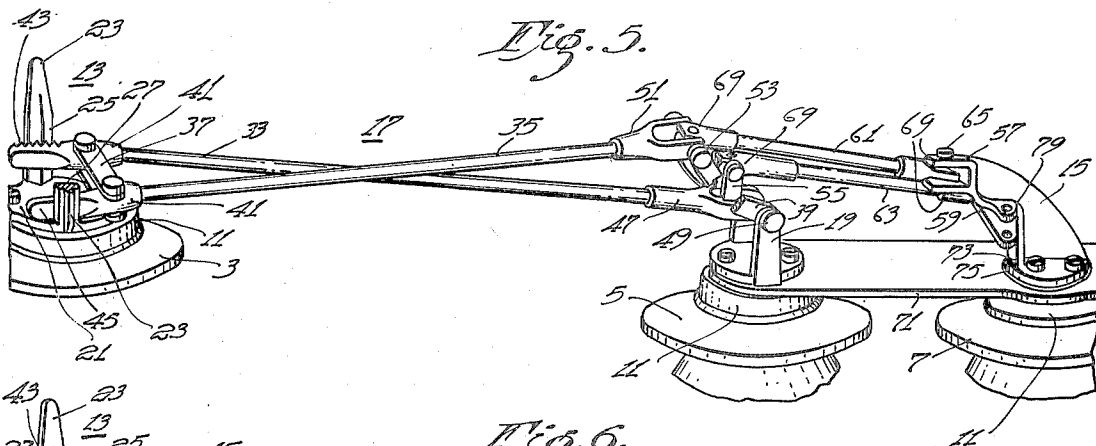
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CIRCUIT BREAKER

Filed Oct. 11, 1934

3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,039,059

CIRCUIT BREAKER

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Pennsylvania

Application October 11, 1934, Serial No. 747,900

19 Claims. (Cl. 200—48)

My invention relates to electrical switching equipment and particularly to outdoor disconnecting switches for use with moderate and high-voltage transmission circuits.

5 Disconnecting switches of this type are ordinarily used for isolating or sectionalizing portions of a distribution circuit, and their design presents a rather complex problem to the electrical art. Usually such switches are mounted
10 outdoors and are, therefore, subjected to very severe weather conditions, especially in the northern States due to ice and sleet formation. In ordinary service, the switches are operated comparatively infrequently, and this, in combination
15 with their normal exposed condition provides an almost ideal condition for oxide and corrosion formation.

In the interests of safety, the switches must include means for positively locking the blades
20 in the closed-circuit position, in order that the blades shall not be blown open by the magnetic forces incident to abnormal overload conditions. Further, they must be capable of reliable operation under the most adverse conditions without
25 unduly straining the supporting or actuating insulators. And lastly, to prevent welding of the contacts and undesirable heating of the cooperating contact parts, the contact mechanism must include means for cutting through corrosion dur-
30 ing the circuit closing operation.

In contrast to these exacting operational requirements, commercially successful switches must be simple in design to facilitate maintenance work and must be comparatively low in cost, due
35 to the large numbers which are used on even a small system. Most of the prior art devices have had to effect a compromise between operational characteristics and cost, and few of them have been entirely satisfactory. In my copending ap-
40 plications, Serial Nos. 697,611, 697,612 and 727,746, I have disclosed a switch which satisfactorily meets most of the above enumerated requirements. Even this switch, however, has certain undesirable features and the principal object of
45 the present invention is the overcoming of these difficulties.

The disconnecting switch of my invention preferably utilizes a blade structure which includes two (or more) blade members, at least one of
50 which is movable relative to the other, a means for securing high contact pressure between the cooperating contact surfaces of the blade and contact means during the circuit closing operation, and a switch actuating means which, during
55 the switch closing operation, successively swings

the blade structure into proximity with the co-
operating contact means and then moves one of
the blade members relative to the other in order
to actuate the contact pressure securing means
This arrangement makes possible a simple and
5 comparatively inexpensive switch which is ex-
tremely reliable in operation. The contacts may
be caused to engage with a wiping action, and by
proper design of the operating mechanism, the
stresses induced in the operating member may be
10 reduced to a very small magnitude. Further, it
is a simple matter, as pointed out in application
Serial No. 727,746, to provide a switch of this type
with means for rigidly connecting the spaced in-
sulators in order to prevent the inducing of large
15 cantilever stresses in either of those insulators
when the switch is being moved to either the
open or the closed circuit position.

None of the previously developed switches of
this multiple blade type have been provided with
20 means for positively controlling the movement of
the blade assemblage during the circuit closing
operation. In the vertical break switches
(shown in applications Serial Nos. 697,612 and
727,746), this is not important, since the force of
25 gravity would, in most instances, bias the blade
members so as to assure that the circuit closing
operation would take place in two successive
steps. In the side break and in certain applica-
tions of the vertical break structures, however,
30 it has been found desirable to provide a spring
or other means for biasing the blade elements to-
ward the open circuit position in order to assure
that the normal successive operation shall take
place. Such arrangements, however, do not posi-
35 tively determine the relative positions of the mov-
able elements of the switch during its operation,
and if the blade assemblage strikes an obstruction,
during the switch closing movement, the
movable elements which actuate the contact
40 pressure securing means will be moved relative
to one another and will thereby prevent the blade
means from engaging the cooperating contacts.
In the present invention one linkage is utilized
for swinging the blade assemblage from one po-
45 sition to the other, and a second linkage is uti-
lized for actuating the contact pressure securing
means. By proper design of these linkages the
closing operation may be positively controlled
and the proper sequence of operation is posi-
50 tively assured, regardless of the position of the
blade assemblage. Thus, the switch blade can
be hammered into position through an ice ob-
struction or the like without danger that the
cooperating contact portions cannot be engaged,
55

because of premature operation of the contact pressure securing means.

This linkage arrangement is applicable to other forms of switches and like equipment, and a further object of my invention is to provide an improved actuating mechanism for use with electrical switches and similar devices generally.

Another object of my invention is to provide an improved, simplified operating mechanism which shall be capable of effecting the actuation of the controlled equipment in two successive steps, while at the same time permitting the use of a rotatable actuating member which moves at a substantially constant speed.

A further object of my invention is to provide an actuating mechanism for a multiple blade switch which shall include means for swinging the blade assemblage from one position to the other and for moving one of the blade members relative to the blade assemblage, the two movements to take place in successive steps regardless of the position of the switch.

These and other objects of my invention will be made more apparent by reference to the following drawings and description, wherein I have particularly set forth the structural features of a preferred embodiment of my invention. Referring to the drawings,

Figure 1 is a side elevational view of a vertical brake disconnecting switch wherein are embodied the principal features of my invention,

Fig. 2 is a plan view of the switch shown in Fig. 1,

Fig. 3 is a fragmentary elevational view of the switch shown in Figs. 1 and 2, showing the relative position of the several elements during the initial stages of the switch opening operation,

Fig. 4 is a view similar to Fig. 3, showing the position of the switch elements shortly before the blade has been moved to the fully open position.

Figs. 5, 6, and 7 are fragmentary perspective views showing various steps in the switch opening operation, and

Fig. 8 is a fragmentary plan view showing certain of the details of the switch operating mechanism.

The preferred embodiment of my invention illustrated in the drawings is of the three-insulator, vertical break type. It includes a channel iron base 1, a pair of spaced insulators 3 and 5 rigidly supported upon the base 1, and a third insulator 7 rotatably supported upon the base, through a bearing 9, in order to permit the actuation of the switch. A metallic cap 11 is cemented to the top of each of the three insulators. A jaw member 13 is supported upon the cap 11 of the left-hand (Figs. 5 and 6) insulator 3; a cast double-crank member 15 is affixed to the cap member of the rotatable insulator 7, and the blade assemblage 17 is pivotally supported upon a U-shaped support member 19 affixed to the cap of the other stationary insulator 5.

The jaw contact 13 comprises a flat central portion 21 for engaging the cooperating cap member 11, and a pair of upstanding side members 23, which have flared outer ends in order to facilitate the engagement of the blade assemblage with the jaw contact. The inner contact surfaces of one of the upstanding side members terminates in a toothed portion 25, which is adapted to cooperate with the blade means 17 in order to permit the mechanical inter-connecting of the insulators 3 and 5 during the operation of the switch, and the inner contact surface 27

of the other member 23 is machined to an arcuate form in order that it may engage the cooperating portion of the blade means with a high pressure line contact. The central portion 21 of the jaw terminates in a projecting section 29, cast integral therewith, which serves to support one of the two switch terminals 31.

The blade assemblage 17 comprises a pair of tubular blade members 33 and 35 which are joined together adjacent their outer end by a linkage, which comprises two parallel link members 37, one end of which linkage is pivotally joined to each of the blade members. At their inner end, the blade members are joined together by a second linkage, which comprises two similar link members 39, and thus take the form of a quadrilateral linkage. The outer end of each of the blade members is provided with a contact portion 41, the one which is affixed to the inner blade member 39 having a toothed section 43 for cooperating with the toothed portion 25 of the jaw 13, and the other contact portion being formed with a substantially flat contact surface 45 for cooperating with the other jaw contact portion 27.

A Y-shaped support member 47 is brazed or otherwise rigidly affixed to the lower end of the inner blade member 33, and the bifurcated portion of this member engages a pin 49 which serves to pivotally support the entire blade assemblage upon the main U-shaped support member 19. A somewhat similar Y-shaped member 51 is affixed to the lower end of the outer blade member 35 and engages a pin 53 which serves to pivotally interconnect the outer blade member with one end of the links 39. The member 47 is provided with a pair of upstanding portions 55, cast integral therewith. These members are positioned so as to form a bell crank lever which is utilized for effecting the operation of the switch.

As is shown particularly in Figs. 2, 5, and 7, the disposition of the links 37 and 39 which connect the blade members at either end is such that the blades are skewed with respect to one another. This arrangement makes possible an extremely rigid structure and adds much to the reliability of operation of the device.

The switch actuating mechanism proper comprises a pair of offset crank members 57 and 59, and a pair of link members 61 and 63 which serve to connect each of the crank members with one of the two blade members. As mentioned above, the crank members are cast integral with each other in the member 15 which is rigidly bolted to the cap portion 11 of the rotatable insulator 7, and the desired offset is obtained (see Fig. 2) by angularly displacing the holes for the associated pivot pins 65 and 67 which operatively connect the cranks with the link members 61 and 63. Each of the link members engages its cooperating crank member, and the blade member which it is adapted to actuate through a universal joint 69, which is capable of accommodating itself to the normal relative movement of the several parts during the operation of the switch.

The quadrilateral linkage arrangement of the blade assemblage allows the outer blade member 35 to be moved longitudinal with respect to the other blade member during the operation of the switch, and through the arrangement of the offset crank members 57 and 59 and the other elements of the actuating mechanism, the normal swingable motion of the entire blade assemblage is prevented, during the switch opening and during the switch closing operation, while the desired

relative movement of the two blade members is being effected. By this means, the switch closing and the switch opening operations are both caused to take place in two successive steps and, as will be described in some detail in subsequent paragraphs, the improved operation of the device is thereby made possible. The cranks 57 and 59 and the link members 61 and 63 which serve to connect the cranks to the associated blades form a pair of toggle linkages, each of which is moved through its dead center position during the final stages of the circuit closing operation. Through this arrangement it is possible for the switch operating mechanism to exert extremely large forces during the normal operation of the switch without unduly stressing the insulator columns or other parts of the devices.

The cooperating tooth portions 43 and 25 of the inner blade member 33 and the contact jaw 13 are adapted to engage, during the switch closing operation, in such manner that the two spaced insulators 3 and 5 are rigidly interconnected, thereby distributing any stresses to which either insulator might be subjected equally between the two. A flat plate member 71, which is rigidly bolted to the central insulator 5 serves to mechanically connect that insulator with the rotatable insulator 7, the base portion 73 of the crank assemblage 15, which is circular in outline and mounted concentric with the axis of rotation of the rotatable insulator 7, being adapted to extend through a suitable opening 75 formed in the plate 71 in order to provide a bearing surface therewith. The other switch terminal 31 is bolted to the lower end of the plate 71.

The combined effect of mechanically interconnecting the two spaced insulators 3 and 5 by the blade assemblage 17, and of then mechanically connecting those two insulators with the other end of the toggle actuating linkage by the plate member 71, makes possible an almost complete elimination of any cantilever stresses on the insulator columns during the switch actuating operation. Danger of breakage of the insulators is thus reduced to a minimum and the safety factor of the switch is raised very considerably.

The switch is shown in the closed circuit position in Figs. 1, 2 and 5. To open the switch, the rotatable insulator 7 is turned in a counter clockwise direction. This movement immediately causes the center of the pivot pin 65 which connects the outer link 61 with the outer crank member 57 to be moved from the dead center position shown in Fig. 2 to a position where it begins to effect a longitudinal pull upon the outer blade member 35. The initial portion of this rotatable movement has no appreciable effect upon the other blade member 33 due to the fact that the center of the pivot pin 67 which connects the inner link 63 with the inner crank member 59 is being moved from an overcenter position through the dead center position. Thus, the effect of the initial portion of the switch opening operation is to move the outer blade member 35 longitudinally with respect to the inner blade member 33, while holding that blade member and the blade assemblage as a whole substantially in the closed circuit position. The angular displacement of the cranks and the arrangement of the linkages are so correlated, with respect to one another, that sufficient relative movement of the outer blade member 35 is effected to produce a disengagement of the cooperating contact surfaces 45 and 27 of the contact portion 41 and the jaw 13, which normally engage with a wiping action, and to

move the outer ends of the two blade members sufficiently close together to effect the removal of all pressure from the cooperating toothed portions 43 and 25. This position is illustrated in Figs. 3 and 6.

As the opening operation progresses, the entire blade assemblage 17 is swung out of engagement with the jaw 13, due to the fact that the passage of the center line of the pivot pin 67, which connects the inner link 63 to the lower crank member 59, over the dead center position results in the producing of a tensioning force upon the parallel, upstanding lever portions 55 which are formed integral with the support 47 for the inner blade member, there upstanding portions acting substantially as a bell crank lever. While a very slight amount of relative movement of the blade members 33 and 35 may take place during the remaining portions of the circuit opening operation, the effect of this movement is negligible, and as the angularity between the center line of the switch and the cranks increases, this relative movement becomes progressively less.

Figs. 3 and 6 illustrate the position of the blade members immediately following the movement of the center of the inner pin 67 to the dead center position. It will be seen that the upper blade member has moved the desired amount longitudinally with respect to the lower blade member. And Fig. 4 illustrates the position of the blade and linkage members at a subsequent position during the circuit opening operation. In this view, the blade assemblage has been swung completely out of engagement with the contact jaw.

When the switch is in the full open circuit position, the blade assemblage 17 is preferably moved to a substantially vertical position, this arrangement minimizing the stresses upon the several portions of the actuating mechanism.

During the switch closing operation, the rotatable insulator 7 is moved in a clockwise direction. The initial result of this movement is to cause the blade assemblage 17 to be swung from the full open circuit position to a position where the outer end of each of the individual blade members is in proximity to the contact jaw 13. At this point, the toggle linkage which is formed by the inner crank member 59 and the inner linkage member 63 is adapted to be in the fully extended position, or practically in that position. Then, when the rotatable insulator 7 is moved through the additional angle which is necessary to effect the complete closing of the switch, substantially no swingable movement of the inner blade member 35 of the blade assemblage 17 is produced. The toggle linkage formed by the outer crank member 57 and the outer link 61 does not, however, reach the extended position as soon as the inner linkage, and as a result, during the final portion of the circuit closing operation, the outer blade member 35 is moved longitudinally with respect to the inner blade member 33, while that member is held substantially stationary.

This longitudinal movement causes the outer blade member 35 to move laterally with respect to the inner blade member 33 by virtue of the quadrilateral linkage arrangement. The toothed members 25 and 43 are thus pushed into engagement with each other, and the other contact portions 27 and 45 are caused to engage with a high pressure wiping engagement.

When the switch is in the closed circuit position, the links 39 which pivotally join the two blade members at their outer ends are prefer-

ably in a position which is at right angles to the axes of the blades, in order that no force shall be exerted by the linkage biasing the switch in either direction. The inner toggle linkage, which effects the swingable movement of the blade assemblage, is in the overcenter position when the switch is closed, and the rotatable insulator 7 is preferably against a stop. This arrangement, and the positioning of the outer toggle linkage in substantially the extended position when the switch is closed, serves to provide an effective means for latching the blade assemblage in the closed position.

Since the links 39 which pivotally join the blade members at their outer ends, are displaced some distance from the point of engagement of the contact portions 41 with the jaw member 13, these links serve to form a fulcrum point for each of the two blade members. Thus, as the outer blade 35 is moved longitudinally and laterally with respect to the other blade 33 during the switch closing operation, the resilience of each of the blade members is utilized for resiliently biasing the cooperating contact portions of the switch into engagement with one another, each blade acting in substantially the manner of a simple crowbar type lever. This arrangement greatly reduces the cost of the switch by allowing rigid contact portions to be utilized, and since a very considerable movement of the blade members may take place without effecting any substantial reduction in the contact pressure, the device is practically self-compensating for wear. If it is desired that one of the blade members shall remain absolutely stationary while the other is being moved to effect the actuation of the contact pressure securing means, it is possible to introduce a small amount of play into the operating linkages. Ordinarily, however, any inaccuracies in manufacture or any slight relative movement of the two blades will be taken up by the natural resilience of those members.

The main crank means, as is shown particularly in Figs. 2, 6 and 7, is cast with a pair of projecting lug members 79 which form a continuation of the inner crank portion 59 thereof. This is done in order that the pin 67 which connects the inner tie member 63 to the inner crank member may be positioned at either side of the center line of the switch, thereby making it possible to operate the switch by rotating the rotatable insulator 7 in either a clockwise or a counter clockwise direction.

From the foregoing, it will be seen that I have disclosed the features of a new form of disconnecting switch wherein a high contact pressure is secured between the cooperating contact surfaces of the blade assemblage and the contact means through the provision of a multiple blade structure, one of the blade members being movable relative to the other (or others) in order to effect the actuation of the contact pressure securing means. Further, I have disclosed an improved operating mechanism suitable for switches of this type which is provided with a single rotatable actuating member, and means movable to successively cause the blade assemblage to be swung from the open to the closed circuit position and to then cause one of the blade members to be moved relative to the other in order to effect the actuation of the contact pressure securing device.

My improved operating mechanism utilizes a pair of toggle linkages for effecting the successive actuation of the blade and the contact

means, and it is so arranged that the movement of the blade assemblage and of the individual movable blade means is positively controlled at all times. Thus, any lateral movement of the blades which might tend to prevent the free movement of the switch to the closed circuit position is positively prevented, and the need for any biasing means whatsoever is eliminated. Through this arrangement, the improved switch which I have disclosed is capable of operating equally well in any position-vertically, horizontally or inverted.

In addition to the above, I have shown, in the preferred embodiment of my invention, how the novel principles disclosed may be utilized in a switch which is comparatively inexpensive to manufacture despite its great reliability in operation. Among the desirable features disclosed is the provision of an arrangement wherein the natural inherent resilience of the blades is utilized for biasing the cooperating contact surfaces into engagement with one another, and an improved linkage and crank assemblage which is extremely simple in design.

While in the foregoing description the various portions of the switch have been specified as being mounted upon insulators, it is to be understood that the term "insulator" shall include insulators or any combination of such devices into a column or the like. In the claims the term "insulator column" has been used, and it is my desire that this shall include either a single insulator or a multiplicity of insulators.

In accordance with the patent statutes, I have disclosed, in the foregoing, the structural details of a preferred embodiment of my invention. It is to be understood, however, that many of these details are merely illustrative, and the broad principles of the invention may be applied to numerous other structures and to numerous devices other than disconnecting switches. It is my intention, therefore, that the language of the accompanying claims shall be accorded the broadest reasonable interpretation, and that my invention shall be limited only by what is expressly stated therein and by the prior art.

I claim the following as my invention:

1. In an electric switch, a contact means, a pair of blade members for cooperating therewith, at least one of said blade members being movable longitudinally with respect to the other of said blade members during the operation of said switch, and actuating means for said switch, including means operable during the circuit closing operation to move both of said blade members into proximity with said contact means and to then move said one of said blade members longitudinally relative to the other of said blade members, said actuating means including means for positively determining the relative positions of said blade members at all times during the operation of said switch.

2. In an electric switch, a single contact means, a pair of blade members for cooperating therewith, at least one of said blade members being longitudinally movable relative to the other of said blade members, and actuating means for said switch, including means operable during the circuit closing operation to move both of said blade members into proximity with said contact means and to then move one of said blade members longitudinally with respect to the other of said members, said actuating means including rigid means for positively determining the rela-

tive positions of said blade members during the operation of said switch.

3. In an electric switch, a single contact means, a pair of blade members for cooperating therewith, one of said blade members being longitudinally and laterally movable relative to the other of said blade members, and actuating means for said switch including means operable during the circuit closing operation to move both of said blade members into proximity with said single contact means and to then move said one of said blade members longitudinally and laterally relative to the other of said blade members, said longitudinal and said lateral movement causing the cooperating contact portions of said contact means and said blade members to be moved into intimate engagement with one another, said actuating means positively preventing substantial relative longitudinally or lateral movement of said blade members except when those members have been moved into proximity with said contact means.

4. In an electric switch, a contact means, a blade assemblage, including a pair of blade members, for cooperating with said contact means, at least one of said blade members being movable relative to the other of said blade members, means for supporting said blade assemblage for swingable movement from one position to the other, and actuating means for said switch including means operable during the circuit closing operation to swing said blade assemblage into proximity with said contact means and to then move said one of said blade members relative to the other while the said other blade member is held substantially stationary, said actuating means including rigid means for positively determining the relative positions of said blade members at all times during the operation of said switch.

5. In an electric switch, a contact jaw, a pair of blade members, at least one of which is longitudinally and laterally movable with respect to the other, for cooperating with said contact jaw, and actuating means for said switch, including means operable during each circuit closing operation to successively move said blade members into proximity with said contact jaw, and to then move said one of said blade members longitudinally and laterally relative to the other in order to effect an intimate engagement between the cooperating contact portions of said jaw and said blade members, said actuating means positively preventing substantial, relative longitudinal or lateral movement of said blade members except when those members have been moved into proximity with said contact means.

6. In an electric switch, a single contact means, a pair of generally parallel blade members, at least one of which is longitudinally movable relative to the other, for cooperating with said contact means, means for producing a high pressure engagement between the cooperating contact surfaces of said blade members and said contact means when said switch is in the closed circuit position, and actuating means for said switch including a pair of crank members, means for mechanically connecting each of said crank members to one of said blade members, and a single rotatable means for actuating both of said crank members said crank members, said connecting means, and said blade members being so correlated that, during each switch closing operation, said blade members are moved into proximity to said contact means without sub-

stantial relative longitudinal movement and are then moved longitudinally relative to one another to effect the actuation of said contact pressure securing means.

7. In an electric switch, a single contact means, a blade assemblage, including a pair of generally parallel blade members, for cooperating with said contact means, at least one of said blade members being longitudinally movable relative to the other of said blade members, means for supporting said blade assemblage for swingable movement into and out of engagement with said contact means, and actuating means for said switch including a separate crank operated linkage for engaging each of said blade members and a single rotatable means for actuating said linkages, said linkages and said rotatable means being so correlated that, during each switch closing operation, said blade assemblage is first swung into proximity with said contact means, without substantial relative longitudinal movement of said blade members, and then, while the other of said blade members is held substantially stationary, said one of said blade members is moved longitudinally with respect to the said other blade member in order to effect an intimate engagement between the cooperating contact portion of said blade members and said contact means, said actuating means positively determining the relative positions of said blade members all times during the operation of the switch.

8. In an electric switch, a contact means, a pair of blade members, at least one of which is movable longitudinally relative to the other, for cooperating with said contact means, and actuating means for said switch, including a separate toggle linkage for engaging each of said blade members, said linkages being adapted to be in the collapsed position when said switch is in the normal open circuit position and being adapted to be moved to the extended position, at different times, during the switch closing operation, thereby causing both of said blade members to be moved substantially simultaneously into proximity with said contact means and then causing said one of said blade members to be moved longitudinally relative to the other blade member in order to effect an intimate engagement between the cooperating contact portions of said blade members and said contact means.

9. In an electric switch, a contact means, a blade assemblage, including a pair of blade members for cooperating, with said contact means, at least one of said blade members being movable longitudinally relative to the other of said blade members, means for supporting said blade assemblage for swingable motion, and actuating means for said switch, including a separate toggle linkage for operatively engaging each of said blade members and a single rotatable means for actuating both of said linkages, both of said linkages being adapted to be in the collapsed position when said switch is in the open circuit position and being moved toward the extended position by said rotatable means during the closing operation of the switch, and one of said linkages being adapted, during the switch closing operation, to reach the fully extended position before the other in order that said blade assemblage may be swung into proximity with said contact means during the initial stages of the switch closing operation and then

held in that position while said one of said blade members is moved longitudinally relative to the other, in order to effect an intimate engagement between the cooperating contact position of said blade members and said contact means.

10. In an electric switch, a single contact means, a pair of blade members, at least one of which is movable relative to the other, a linkage for connecting said blade members adjacent the end which engages said contact means, and actuating means for said switch, including means operable during each circuit closing operation to move both of said blade members into proximity with said contact means and to then move at least one of said blade members longitudinally relative to the other of said blade members, said relative longitudinal movement of said blade members, effecting the actuation of said linkage and thereby producing an intimate engagement between the cooperating contact surfaces of said blade members and said contact means, said actuating means including means for positively determining the relative positions of said blade members at all times during the operation of said switch.

11. In an electric switch, a contact means, a pair of blade members for cooperating therewith, at least one of said blade members being longitudinally movable relative to the other of said blade members, means, including a link member pivotally joined to each of said blade members adjacent the end which engages said contact means, for causing a high pressure engagement between the cooperating surfaces of said blade members and said contact means when said switch is in the closed circuit position, and actuating means for said switch, including means operable during each circuit closing operation to move both of said blade members into proximity with said contact means and to then move one of said blade members longitudinally relative to the other of said blade members in order to effect the actuation of said pressure securing means, said actuating means including rigid means for positively determining the relative positions of said blade members at all times during the operation of said switch.

12. In an electric switch, a unitary contact means, a blade assemblage, including a pair of blade members, for cooperating with said contact means, at least one of said blade members being movable relative to the other of said blade members, means for supporting said blade assemblage for swingable movement from one position to another, means, including a link member pivotally joined to each of said blade members adjacent the end which engages said contact means, for causing a high pressure engagement between the cooperating surfaces of said blade members and said contact means when said switch is in the closed circuit position, and actuating means for said switch including means operable during the circuit closing operation to swing said blade assemblage into proximity with said contact means and to then move said one of said blade members relative to the other, while the said other blade member is held substantially stationary, in order to effect the actuation of said pressure securing means, said actuating means positively determining the relative positions of said blade members at all times during the operation of said switch.

13. In an electric switch, a unitary contact means, a pair of blade members for cooperating

therewith, at least one of said blade members being longitudinally movable relative to the other of said blade members, means, including a link member pivotally joined to each of said blade members adjacent the end which engages said contact means, for causing a high pressure engagement between the cooperating surfaces of said blade members and said contact means when said switch is in the closed circuit position, and actuating means for said switch including a separate linkage for engaging each of said blade members, said linkages being so correlated that, during the switch closing operation, said blade members are moved substantially simultaneously into proximity with said contact means and then said one of said blade members if moved longitudinally relative to the other of said blade members in order to effect an intimate engagement between the cooperating contact portions of said blade members and said contact means.

14. In an electric switch, a unitary contact means, a blade assemblage, including a pair of blade members, for cooperating with said contact means, at least one of said blade members being longitudinally movable relative to the other of said blade members, means for supporting said blade assemblage for swingable motion, means, including a link member pivotally joined to each of said blade members adjacent the end which engages said contact means, for causing a high pressure engagement between the cooperating surfaces of said blade members and said contact means when said switch is in the closed circuit position, and actuating means for said switch including a separate, crank operated linkage for engaging each of said blade members and a common rotatable means for actuating said linkages, said linkages and said rotatable means being so correlated that, during each switch closing operation, said blade assemblage is swung into proximity with said contact means, without substantial relative movement of said blade members, and then, while the other of said blade members is held substantially stationary, said one of said blade members is moved longitudinally with respect to the said other blade member in order to effect the actuation of said pressure securing means.

15. In an electric switch, a pair of spaced insulator columns, conducting means mounted on each of said columns, a movable blade assemblage, including a pair of blade members, for bridging said conducting means to provide an electrical circuit therebetween, and actuating means for moving said blade assemblage to the open and to the closed circuit position, said blade assemblage and said conducting means including cooperating means operable to rigidly interconnect said insulator columns so as to prevent relative movement therebetween during at least a portion of the circuit closing operation, at least one of said blade members being movable longitudinally relative to the other during the circuit closing operation to effect the operation of said interconnecting means, said actuating means including means operable during the circuit closing operation to move both of said blade members into proximity with said contact means and to then move said one of said blade members longitudinally relative to the other of said blade members, said means positively determining the relative positions of said blade members at all times during the operation of said switch.

16. In an electric switch, a pair of spaced insulator columns, conducting means mounted on each of said columns, a movable blade assemblage, including a pair of blade members, for bridging said conducting means to provide an electrical circuit therebetween, and actuating means for moving said blade assemblage to the open and to the closed circuit position, said blade assemblage and said conducting means including cooperating toothed members, capable of accommodating themselves to a considerable amount of relative movement of said insulator columns, for rigidly interconnecting said insulator columns so as to prevent relative movement therebetween during at least a portion of the circuit closing operation, at least one of said blade members being movable relative to the other, during the circuit closing operation to effect the engagement of said cooperating toothed members, said actuating means including means operable during the circuit closing operation to move both of said blade members into proximity with said contact means and to then move said one of said blade members relative to the other of said blade members, said means positively determining the relative positions of said blade members at all times during the operation of said switch.

17. In an electric switch, a pair of spaced insulator columns, conducting means supported upon one of said columns, a blade assemblage, means for supporting said blade assemblage upon the other of said columns for swingable movement into and out of engagement with said contact means to close and to open the electrical circuit through said switch, and actuating means for moving said blade assemblage to the open and to the closed circuit position, said blade assemblage and said conducting means including cooperating means operable to rigidly interconnect said insulator columns so as to prevent relative movement therebetween during at least a portion of the circuit closing operation, at least one of said blade members being movable relative to the other during the circuit closing operation to effect the operation of said interconnecting means, and actuating means for said switch

including a plurality of cooperating linkages so arranged and so correlated that, during the switch closing operation, said blade assemblage is swung into proximity with said contact means and then said one of said blade members is moved relative to the other of said blade members in order to effect the operation of said interconnecting means, said linkages positively determining the relative positions of said blade members at all times during the operation of said switch.

18. In an electric switch, a contact means, a blade assemblage which includes a pair of blade members and which is movable between two extreme positions for cooperating therewith, at least one of said blade members being movable longitudinally relative to the other blade member during the operation of said switch, and actuating means for said switch, including means operable successively to move said blade assemblage from one position to the other and to then cause relative longitudinal movement between said blade members, said actuating means positively controlling the movement of said blade assemblage and the relative positions of said individual blade members at all times, in order that the movement of said blade assemblage and the relative movement of said blade members shall take place in successive steps.

19. In an electric switch, a contact means, a blade assemblage, including a pair of blade members, for cooperating with said contact means, at least one of said blade members being movable longitudinally relative to the other of said blade members, means for supporting said blade assemblage for swingable movement into and out of engagement with said contact means, and actuating means for said switch including means operable successively to swing said blade assemblage from one position to the other and to then move said one of said blade members longitudinally relative to the other, said actuating means positively determining the relative positions of said blade members at all times during the operation of said switch.

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