E. M. HEWLETT.

LINE DISCONNECTING SWITCH.

APPLICATION FILED MAY 5, 1909.

1,109,586.

Patented Sept. 1, 1914.

4 SHEETS-SHEET 1.

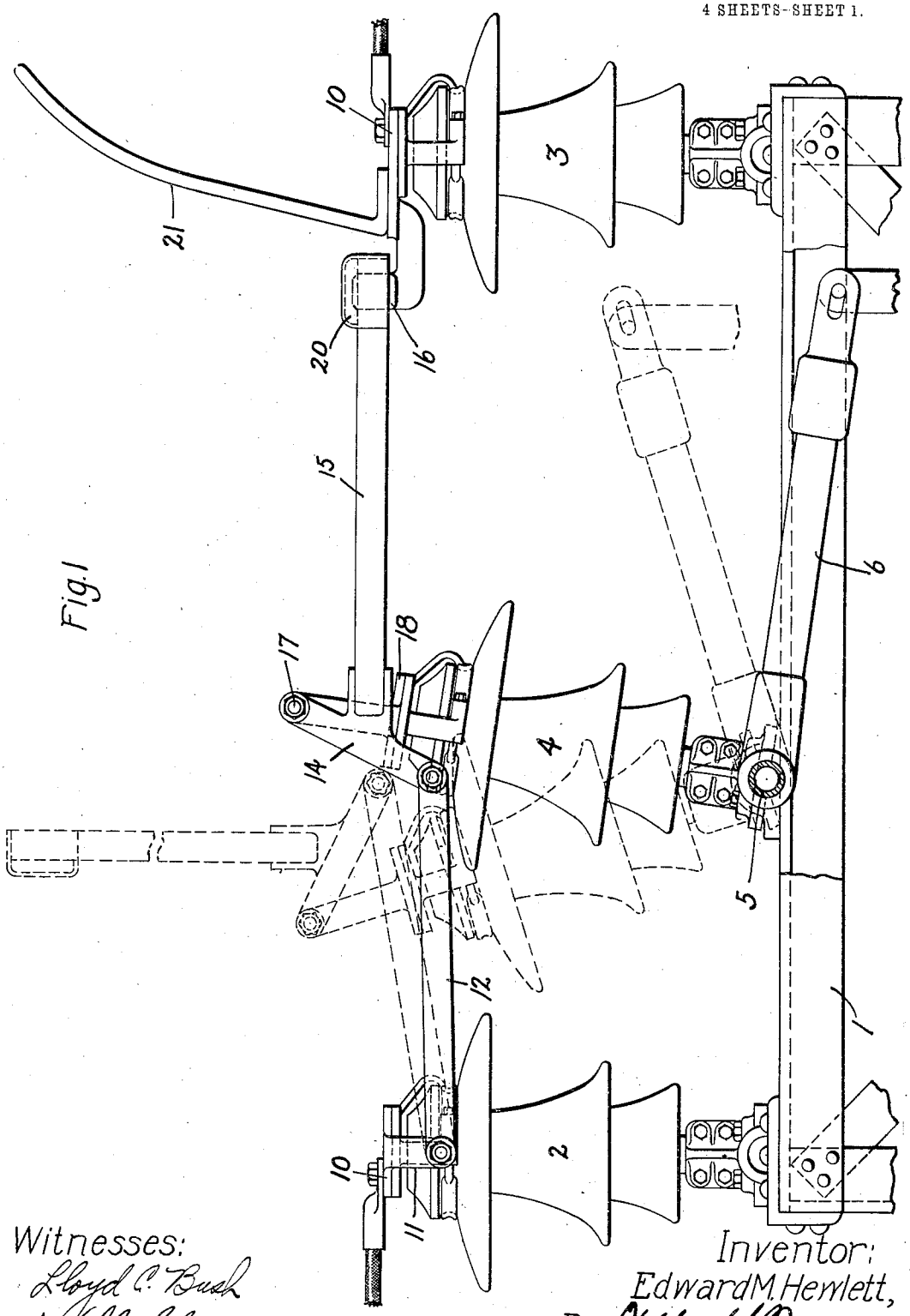


Fig. 1

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Lloyd C. Bush
J. Ellis Glen

Inventor:
Edward M. Hewlett,
By Albert G. Davis
Att'y

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4 SHEETS—SHEET 2.

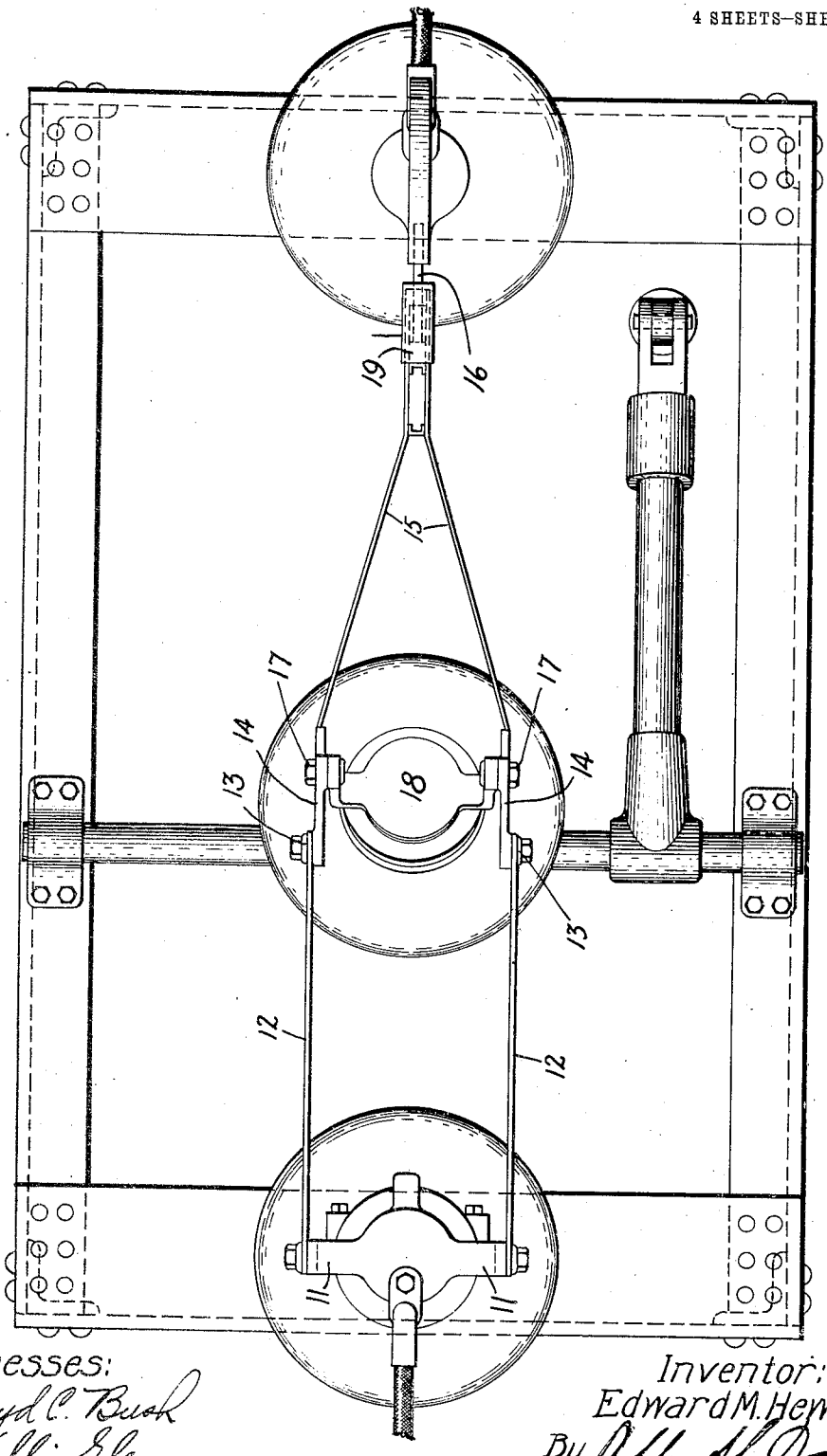


Fig. 2

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4 SHEETS—SHEET 3.

Fig. 3

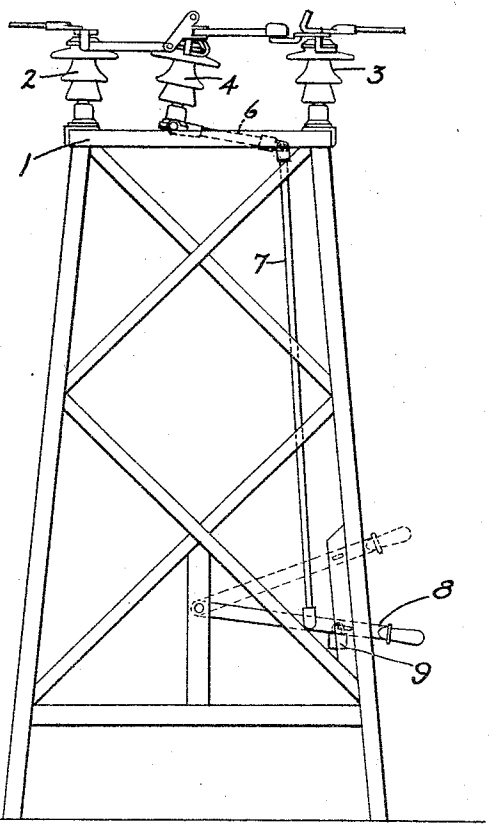
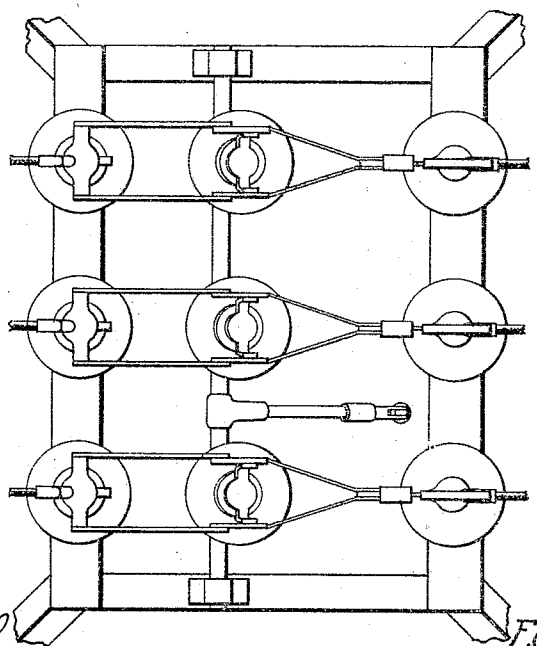


Fig. 4



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Fig. 5

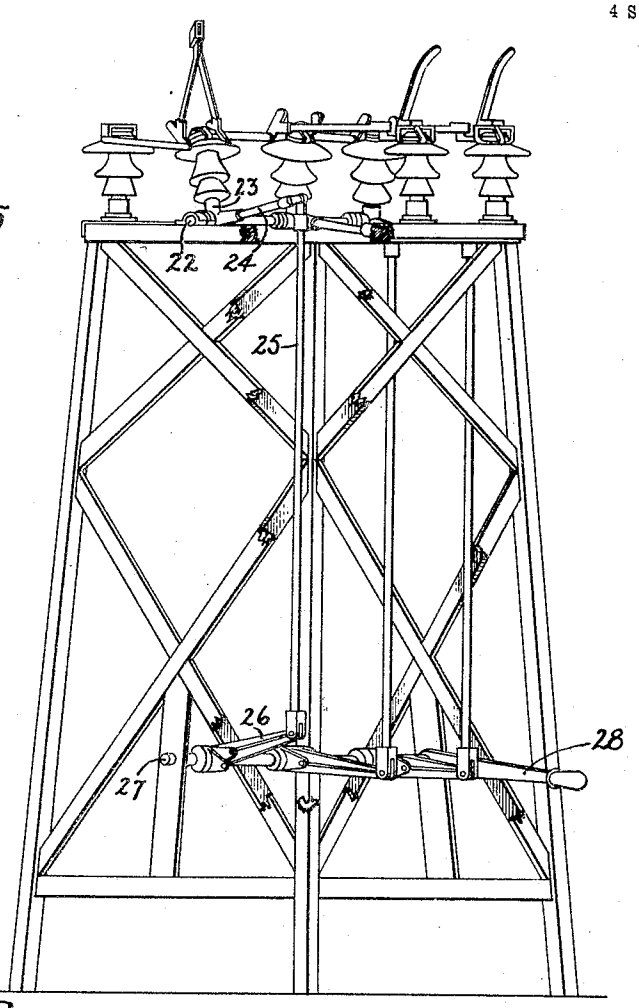


Fig. 7

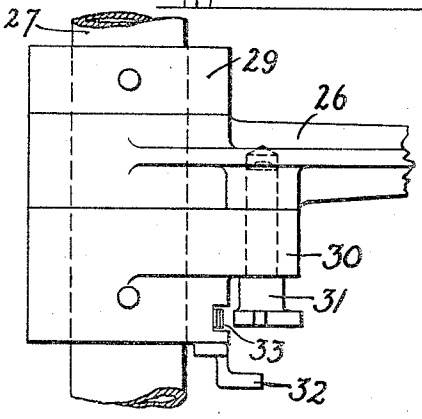
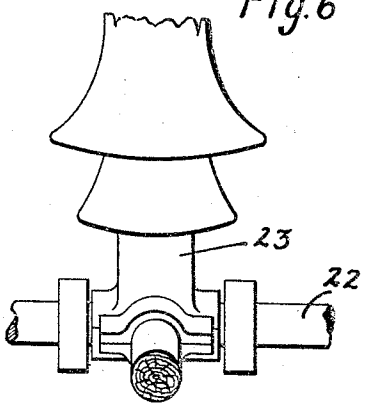


Fig. 6



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UNITED STATES PATENT OFFICE.

EDWARD M. HEWLETT, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

LINE-DISCONNECTING SWITCH.

1,109,586. Specification of Letters Patent. Patented Sept. 1, 1914.

Application filed May 5, 1909. Serial No. 494,060.

To all whom it may concern:

Be it known that I, EDWARD M. HEWLETT, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Line-Disconnecting Switches, of which the following is a specification.

This invention relates to electric switches and more particularly to disconnecting switches suitable for dividing a high potential transmission line into sections to facilitate inspection and repairs, and its object is to provide a simple, reliable and easily operated switch which can be mounted on the top of a tower or pole of a transmission line in alinement with the conductor controlled by it, thereby avoiding bends or turns in the conductor; which does not reduce the space between phases to an objectionable degree; in which the distance between the switches in the different phases is the same in both the open and closed position of the switch, and in which a comparatively slight rocking or angular movement of an actuating member causes the switch to open or to close.

In carrying out my invention, the switch for each conductor is made long and very narrow, the movable member being arranged to move perpendicular to the plane of the conductors of the transmission line. As a result of this construction, the switches may be mounted side by side and in alinement with the conductors controlled by them, since the space between the live parts of the switches in the different phases is substantially the same as the space between the conductors of the transmission line, in both the open and closed position of the switches. The live parts of the switch are mounted upon insulators of any suitable type, one of the insulators being mounted to rock or oscillate, and arranged to open and close the switch when rocked by the operator. Since the insulators and other moving parts of a switch for controlling a transmission line of high potential are necessarily comparatively heavy, the hand operation of the switch is facilitated by mounting the movable insulator to swing above the horizontal pivot on which it is balanced, so that it is easily swung from one side of the pivot to the other to open and to close the switch. The contacts preferably coöperate to cut away ice, snow and other foreign substances which may lodge upon them, and thereby the closing of the circuit is insured even during bad weather.

My invention will best be understood in connection with the accompanying drawings, which illustrate one of the various forms in which it may be embodied and in which—

Figure 1 is a side view in elevation of the switch mounted on the top of the tower, a portion of the base being cut away to show the actuating mechanism; Fig. 2 is a plan view of the switch shown in Fig. 1; Fig. 3 is a side elevation of the tower with the switch mounted on the top and showing the mechanism for operating the switch by hand; Fig. 4 is a plan view of the switch arranged to control a polyphase circuit; Fig. 5 is a view in perspective of a tower on which the switches may be operated independently or simultaneously, as desired; Fig. 6 is a detail of the insulator mounting shown in Fig. 5, and Fig. 7 is a detail of the latching arrangement shown in Fig. 5.

In the embodiment of my invention shown in the drawings, the parts of the switch for controlling each conductor are mounted upon any suitable framework 1, which is preferably made of angle iron, as shown in Figs. 1 and 2, and may be mounted either on the top of a tower or on one of the poles of the transmission line. At each end of the frame 1 insulators 2 and 3 are rigidly mounted in alinement with one conductor of the transmission line, these insulators being strong enough to resist the pull exerted by the conductor. The switch is operated by means of a movable insulator 4 mounted between the insulators 2 and 3 in alinement with them, and preferably mounted to rock or oscillate about a pivot 5, which in the specific arrangement shown in the drawings consists of a shaft or piece of iron pipe suitably journaled on the frame 1 and forming a rocking actuator by means of which the movable insulator 4 may be swung back and forth. The pivot or actuator 5 is rigidly connected to an arm 6, by means of which the insulator 4 may be rocked back and forth and the arm 6 is in turn connected, as shown in Fig. 3, by means of a rod 7 to an operating handle or lever 8 pivoted to the tower or pole and within reach of an operator standing on the ground. In

order to avoid unauthorized operation of the disconnecting switches, a suitable lock, such as padlock 9, holds the operating lever in either of its extreme positions.

The insulator 4 is comparatively heavy, especially when large enough to resist high potentials, and in order to facilitate the operation of the switch by hand, the insulator is preferably mounted, as best shown in Fig. 1, to bring its center of gravity above the pivot. Since the weight of the insulator is carried by the pivot 5, on which the insulator is practically balanced, in unstable equilibrium, a comparatively slight effort will move a heavy insulator from the position shown in full lines, in which the switch is closed, to the position shown in dotted lines, where the switch is open, and as the angular movement of the insulator is not great the insulator is almost directly above the pivot 5 in all positions of the switch. By means of this construction, large and heavy insulators can be used without rendering the switch too heavy and unwieldy for hand operation.

The conductors of the transmission line are connected to terminals 10 of any suitable type, mounted on the upper ends of the insulators 2 and 3. One of the terminals 10 is provided with projections 11, as best shown in Fig. 2, and to these projections the ends of side rods or pivoted members 12 are pivotally connected, the other ends of the rods being connected by means of pivots 13 to links or plates 14, which are riveted or otherwise rigidly secured to the sides of the movable contact blade or switch member 15, which is preferably V-shaped, as shown in Fig. 2, the sides of the V being secured to the plates 14 and the point being arranged to act as a contact which coöperates with a fixed contact 16 mounted on the terminal 10 on the insulator 3 and thereby opens and closes the circuit. The rocking or movable insulator 4 is connected to the contact blade in any suitable manner and by any suitable connections which will cause the angular movement of the contact blade about its pivot 13 to be greater than the angular movement of the insulator 4 about its pivot 5, so that a comparatively slight movement of the insulator will swing the contact blade 15 throughout its range of movement and thereby enable the switch to be opened and closed quickly. In the specific form shown in the drawings, the connection between the contact blade 15 and the movable insulator is of a type which permits a maximum break to be secured when the switch is opened. This connection comprises pivots 17 carried on the plates 14 which are between the pivots 13 and the tip of the contact blade and engages the arms of a yoke 18, which is rigidly secured to the upper end of the rocking insulator 4, and mounted in alinement with the end insulators 2 and 3, as shown in Fig. 2, with the yoke 18 between the plates 14. As the switch is opened, the insulator swings back between the two separated pivots 13 of the contact blade 15 until the length of the air gap between parts of opposite potential is the distance between the ends of the rods 12 and the fixed contact 16, and is greater than the distance between the fixed contact and the metal parts on the rocking insulator 4 when the switch is closed, as is apparent from Fig. 1. In order that the insulation of the live parts of the switch against ground may always be the same, the parts are so proportioned that the contact blade 15 and link 12 are always farther away from the pivot of the insulator 4 than the yoke 18. As the insulator swings about its pivot the minimum distance from any live part of the switch to ground is always the distance from the bottom of the yoke 18 to the pivot of the insulator, and this distance does not change when the switch is operated.

The side rods 12 and the rocking insulator 4 are linked to each other by the frames 14 to form a three link toggle, as best shown in dotted lines in Fig. 1, the terminal 10 and pivot 5 being fixed points and the pivot 17 being forced to the position shown in full lines as the rocking insulator is swung in a clockwise direction to close the switch. When the insulator 4 is rocked at a uniform rate the movement of the frame 14 about its pivot 17 is comparatively slow, when the frame 14 is perpendicular to the side rods 12, but becomes more rapid as the angle between the frame and the side rods becomes more acute; hence a slight angular movement of the insulator when in the position shown in dotted lines causes a comparatively great movement of the contact blade. The contact blade 15 is secured to the frames 14 at such an angle to a line joining the pivots 13 and 17, as best shown in Fig. 1, that when the insulator 4 is on one side of the pivot 5, in the position shown in full lines in Fig. 1, the contact blade 15 and the side rods 12 are nearly in alinement with each other and the switch is closed. Just as the contacts come into engagement, the rocking insulator 4 is in a position where the leverage tending to move the contact blade 15 downward and to close the switch is nearly at the maximum, and as the switch is fully closed the rocking insulator swings slightly beyond a vertical line through the pivot 5 to a point where the weight of the rocking insulator tends to hold the switch in the closed position.

When the switch is opened, the rocking insulator is swung from the position shown in full lines to the position shown in dotted lines through an angle of approximately 30°, while the connections of the insulator

to the contact blade, swing the blade from the position shown in full lines through an angle of about 90° to the position shown in dotted lines, hence a comparatively slight angular movement of the insulator causes a much greater angular movement of the contact blade. As the switch opens, the rocking insulator swings beyond a vertical line through the pivot, to the position shown in dotted lines, where the weight of the rocking insulator tends to hold the switch in the open position, although in both positions of the insulator the holding strain due to the weight of the insulator is not great enough to make the switch hard to operate.

The tip of contact blade 15 may coöperate with any suitable type of fixed contact to open and close the circuit, but in the preferred construction the tip of the contact blade is provided with a form of clip contact 19, shown in dotted lines in Fig. 2. The contact clip 19 coöperates with the fixed wedge-shaped contact 16, which is mounted on the terminal 10 of the insulator 3 with its narrow edge upward, so that as the clip is moved downward into engagement with the fixed contact the sides of the clip coöperate with the sharp upper edges of the stationary contact to cut through any sleet or ice which may be deposited upon the fixed contact and thereby a good metal to metal engagement of the contacts is assured. In the preferred construction, the contacts are protected from the weather when the switch is closed, by means of a cover 20 mounted on the contact blade 15 to inclose the clip contact 19 and shaped, as shown in Fig. 1, to protect both the fixed and the movable clip contact when the contacts are in engagement. In order to assist in the breaking of the arc, in case the switch is opened when current is flowing through the conductors, a horn 21 is mounted on the terminal 10 adjacent to the fixed contact 16 and is bent backward, as shown in Fig. 1, to coöperate with the end of the contact blade 15 and break the arc in much the same manner as a horn break lightning arrester.

A switch embodying my invention is particularly adapted to polyphase circuits, since the switch for each conductor can be mounted in alinement with the conductor and the switches can be arranged side by side, as shown in Fig. 4, without causing an objectionable reduction in the distance between live parts in different phases. In order to keep the distance between switches the same, whether open or closed, the switches are preferably arranged, as shown in Fig. 4, to cause all the contact blades 15 to move in vertical planes perpendicular to the plane of the conductors controlled by the switches, and since the conductors are usually strung in a horizontal plane the contact blades 15 will usually move vertically. The switches in the different phases are operated simultaneously by means of any suitable connection between the rocking insulators, and in the preferred construction the pivot 5 is extended across the frame 1, so that the rocking insulators of each switch can be mounted upon the rocking actuator or pivot 5. The arm 6 then turns the insulators simultaneously about the pivot 5, as is apparent from Fig. 4, and the several phases of the circuit are opened and closed simultaneously.

On polyphase transmission lines one conductor may be broken or become grounded while the other conductors remain intact, and in such cases it is advantageous to be able to entirely disconnect the damaged conductor and to use two of the uninjured conductors to form a single phase circuit over which energy can be transmitted until the damaged conductor is repaired. A circuit controller embodying my invention can be easily adapted to permit a three phase line, for instance, to be operated single phase by operating the switches from a common operating member, to which they are connected in such a manner that any of the switches can be disconnected and left open, while the other switches controlling the uninjured conductors are operated simultaneously. One arrangement which may be adopted is shown in Fig. 5, in which the switches for controlling a three phase transmission line are mounted on the top of a tower, the rocking insulator 4 being loosely mounted on a stationary axle or support 22 by means of castings or other suitable supports 23, rotatably mounted on the axle 22 and held in position by collars, as clearly shown in Fig. 6. Each casting or insulator support 23 is rocked about the axle 22 by any suitable connections to an operating member, the specific connections shown comprising a rod 24 connected through links or rods 25 to an arm 26 loosely sleeved or mounted on an operating member or shaft 27, which is common to all the switches and is mounted in a position where it can be easily reached by an operator standing on the ground.

The operating member is preferably made in the form of a rock shaft, as shown in Fig. 5, and is actuated by means of an operating handle 28, which can be grasped by the operator as he stands on the ground. The operator is thoroughly protected from the high potential of the transmission line, since the metallic parts of the switch are connected to the rock shaft or operating shaft through insulating connections consisting of the rocking insulator 4 and the rods 24 and 25, which are preferably made of wood. Since the switches are independently operable, any two of them can be operated simultaneously to control a single phase circuit by locking to the rock shaft 27 the

arms 26 of the switches to be operated, while the arm connected to the other switch is freed from the rock shaft. Any suitable form of locking mechanism may be used to secure at will any of the arms to the rock shaft, the preferred form being that shown in Fig. 7, in which the arm 26, loosely mounted on the rocking shaft 27, is held by means of a collar 29 in contact with a boss 30, rigidly mounted on the rocking shaft and provided with a rocking pin 31 slidably mounted in the boss to engage a recess in the arm 26, as indicated in Fig. 7, thereby locking the arm 26 to the boss 30 and consequently to the rock shaft 27. A stop 32 prevents the locking pin from being entirely withdrawn from the boss and the head of the locking pin is preferably provided with a notch in a position to be engaged by a spring or other yielding stop 33 for holding the locking pin in locking position.

In the particular arrangement shown in Fig. 5, two of the switches are shown closed and the arms corresponding to those switches are rigidly locked to the rock shaft 28, so that the two switches will be simultaneously operated to control two conductors of the transmission line which are being operated as a single phase circuit. The other switch shown in the open position is in series with the damaged conductor, and during the movement of the rock shaft 27 remains in the open position, as shown in the drawing, because its arm 26 has been unlocked from the rock shaft 27. It is obvious that if the middle conductor should be disabled, the middle switch would be left open, while the two outside switches would be operated simultaneously and that any two of the switches may be operated while the third switch is left open, or that under extreme conditions two switches might be left open, while one switch would be operated to control one uninjured conductor, which could be used in case of emergency to form a single phase circuit with ground return.

My invention may be embodied in many other forms than that shown and described, and I do not wish to be restricted to the precise arrangement disclosed, but intend to cover by the appended claims all modifications which are within the spirit and scope of my invention.

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

1. In an electric switch, the combination with a rocking insulator mounted on a fixed pivot, means for rocking said insulator, and a metal yoke mounted on said insulator, of a contact operatively related to said yoke and mounted to swing in the same plane as said insulator about a movable pivot, said yoke being connected to said contact at a point eccentric to said movable pivot, and actuating connections for swinging said contact through a path outside of the arc described by said yoke whereby said yoke is always as close to the pivot of said insulator as any other live part of the switch.

2. In an electric switch, the combination with stationary insulated terminals, of a member pivoted to one terminal, a contact blade pivotally connected with said member and coöperating with the other terminal, and a rocking insulator mounted to swing in the same plane as said blade and connected to said blade to move said blade about its pivotal connection to said member.

3. In an electric switch, the combination with stationary insulated terminals, of a member pivoted to one terminal, a contact blade pivotally connected with said member and coöperating with the other terminal, and a rocking insulator mounted between said terminals to support said member and said blade and to rock said blade about its pivotal connection.

4. In an electric switch, the combination with a fixed contact and a coöperating switch blade mounted on a pivot, of an insulator pivoted eccentric to said blade to swing toward and away from the fixed contact and from one side of said switch blade pivot to the other, and connections between said insulator and said blade whereby said insulator is brought between said switch blade pivot and said fixed contact when the switch is closed and said switch blade pivot is between the insulator and the fixed contact when the switch is opened.

5. In an electric switch, the combination with a fixed contact and a movable contact blade having arms mounted on separated pivots, of an insulator pivoted to move in a path eccentric to the path of movement of said blade to rock toward and away from said fixed contact and to pass between said separated pivots, a stationary insulator, and connections between said insulators and said blade for rocking said blade about said separated pivots to open the switch as said insulator is rocked away from said fixed contact and to a point beyond said pivots.

6. In a switch for polyphase circuits, the combination with a plurality of movable contacts mounted to move in parallel planes, of an actuator mounted to rock about a fixed axis, a plurality of rocking insulators mounted side by side on said actuator in alinement with said contacts and arranged to rock about the same axis as said actuator, said insulators being mounted to move severally or individually, a plurality of stationary insulators, and connections between said rocking and stationary insulators and said contacts for operating said contacts the weight of said rocking insulators tending to hold said contacts open or closed.

7. An electric switch comprising a fixed contact, a coöperating pivoted switch blade,

operating mechanism comprising a rocking insulator pivoted to move in a path eccentric to the path of movement of said blade and mounted to bring its center of gravity above its pivot, a stationary insulator, and actuating connections between said stationary and rocking insulators and said switch blade for moving said switch blade in the arc of a circle as said rocking insulator is rocked about its pivot to open and close the switch, the center of gravity of said rocking insulator being on one side of its pivot when the switch is closed and on the other side when the switch is open.

8. An electric switch comprising a fixed contact, a coöperating pivoted switch blade, operating mechanism comprising a rocking insulator pivoted to move in a path eccentric to the path of movement of said blade and mounted to bring its center of gravity above its pivot, a stationary insulator, and actuating connections between said insulators and said switch blade moving said switch blade in the arc of a circle as said rocking insulator is rocked about its pivot, said switch being closed as the center of gravity of said rocking insulator is brought a predetermined distance on one side of its pivot and is opened as said rocking insulator is rocked to bring its center of gravity at a greater distance on the other side of its pivot.

9. In an electric switch, the combination with a fixed contact, and a pivoted switch blade coöperating with said contact, of operating mechanism for moving said switch blade toward and away from said fixed contact in the arc of a circle and to open and close the switch comprising a rocking insulator having a horizontal pivot and mounted to move in the same plane as said switch blade, a stationary insulator, and actuating connections between said switch blade and said rocking and stationary insulators for operating said switch blade as said rocking insulator is rocked about its pivot whereby the weight of said insulator tends to hold the switch in either open or closed position.

10. In an electric switch, the combination with relatively movable coöperating contacts, of a pivoted member, a rocking insulator pivoted eccentric to said member and a link for carrying one of said contacts, said link being pivoted to said insulator and to said member to form a toggle which is collapsed as said insulator is rocked to separate said contacts.

11. In an electric switch, the combination with a fixed contact, of an insulated terminal, a member pivoted to said terminal, a rocking insulator pivoted eccentric to said member, a link connecting said member and said insulator to form a three link toggle, and a coöperating movable contact mounted on said link and moved toward said fixed contact as said toggle is straightened.

In witness whereof, I have hereunto set my hand this 4th day of May, 1909.

EDWARD M. HEWLETT.

Witnesses:

BENJAMIN B. HULL,

HELEN ORFORD.