

Sept. 28, 1937.

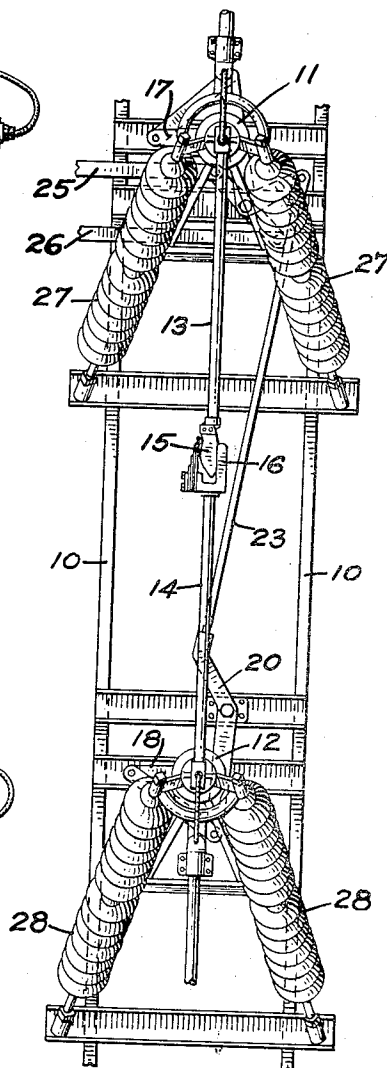
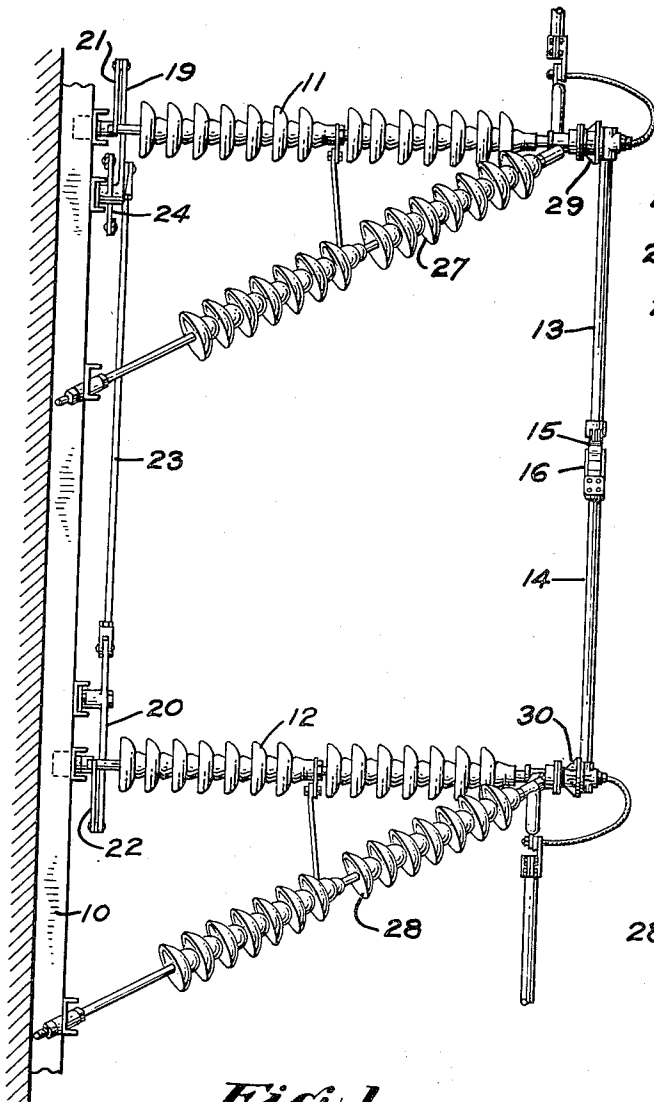
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2,094,087

DISCONNECTING SWITCH MECHANISM

Filed Nov. 11, 1935

2 Sheets-Sheet 1



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Fig. 3.

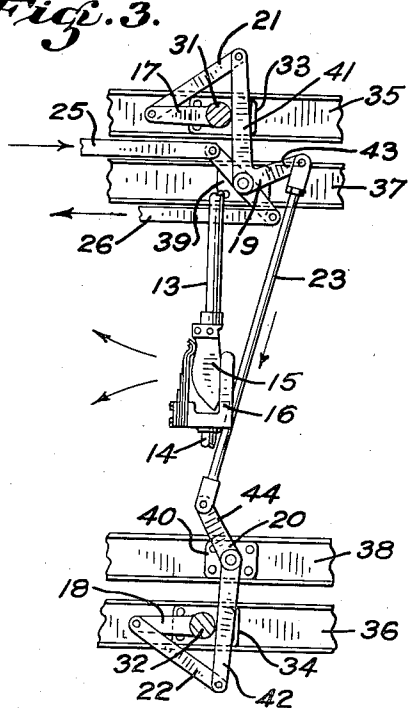


Fig. 4.

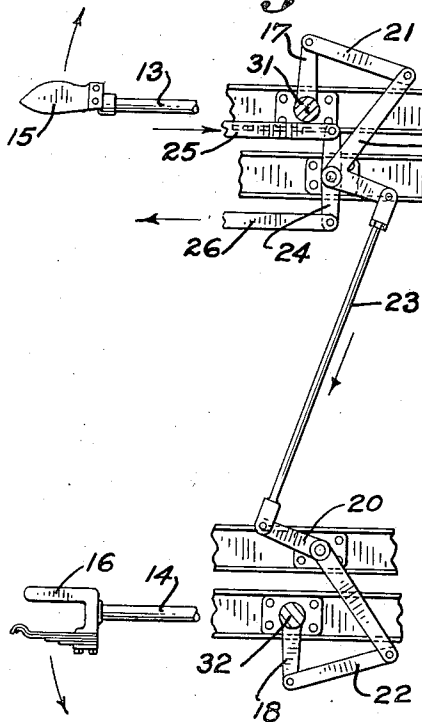
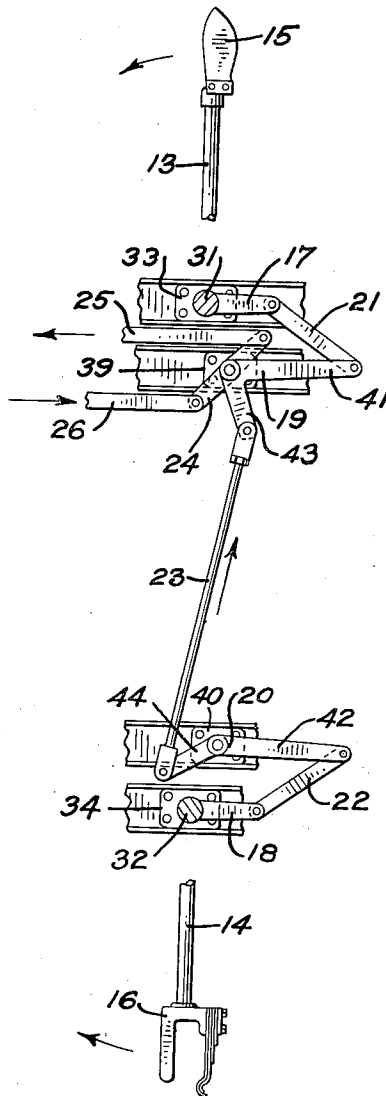


Fig. 5.



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DISCONNECTING SWITCH MECHANISM

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4 Claims. (Cl. 200—48)

The present invention relates to high tension disconnecting switches, and more particularly to an improved operating mechanism for such a switch which will give a maximum of switch arm movement with a minimum of operator movement in a positive and effective manner.

An object of the invention is to provide an efficient switch and operating means which is adapted to use in connection with either single or multiphase circuits where it is necessary to sectionalize a power transmission line or to open or close a branch circuit at the point of intersection with the main line, or for the protection of any other electrical equipment that may be operated from electrical high voltage transmission lines.

Another object of the invention is to provide a relatively inexpensive and effective switch which is particularly adapted to high tension transmission circuits and power systems for simultaneously opening and closing a plurality of lines by means of a single operating means.

Another and specific object of the present invention is to provide an operating means for a rotatable switch blade which is capable of imparting a 180° movement to a switch blade from an operating member having a rotation of only 90°.

Another object of the invention is to provide an operating means for a double bladed disconnecting switch which will impart a 180° movement to each of the switch blades and thereby produce among other advantages a maximum of separation between the switch contacts.

Another object of the invention is to provide a switch blade operating means which is capable of imparting a 180° rotation to the switch blade without resort to gears or a rack and gear arrangement.

Another object of the invention is to provide a straight line operating mechanism for a plurality of disconnecting switches such as are used on multiphase power systems in which movement is imparted to the rotatable switch blade supporting insulators in a positive manner by a link arrangement extending from each supporting insulator to a common operating means movable in a straight line transverse to the switch blades when in their normal closed positions.

With the above, and other objects which will appear as the description proceeds, the invention resides in the construction, combination and arrangement of parts, substantially as will be hereinafter described and more particularly defined by the appended claims.

For a better understanding of the invention reference should be had to the following description taken in connection with the accompanying drawings, wherein there is shown by way of illustration and not of limitation, a preferred embodiment thereof.

In the drawings;

Figure 1 is a side view of a single switch unit having an operating means constructed in accordance with a preferred embodiment of the invention,

Figure 2 is a front view of the switch unit shown in Figure 1 of the drawings, and

Figures 3, 4 and 5 are diagrammatic views with parts broken away to more fully disclose the details of the switch operating mechanism. Of these latter figures of the drawings, Figure 3 shows the position of the mechanism when the switch is in its closed condition, Figure 4 shows the position in the mechanism when the switch is in its half-opened condition and Figure 5 shows the position of the mechanism when the switch is in its fully opened condition.

The switch shown in the drawings for the purpose of illustrating the present invention, except for the operating means employed, is substantially similar to the switch units illustrated and described in my copending application for Letters Patent, Serial Number 46,973, filed October 28, 1935, and entitled High tension disconnecting switch.

In the drawings, only one switch unit is illustrated. It is to be understood, however, that any number of these switch units may be arranged side by side and simultaneously operated, as will hereinafter appear, to control any number of lines of a multiphase power distribution system. The switch unit is shown as mounted upon a suitable structural iron frame 10 that may be attached, as shown, to the side wall of a building or mounted in a horizontal position upon the roof of a building. The unit is also adapted to be mounted either with or without the frame 10 upon the side or top of a structural steel tower such as is commonly provided for supporting high tension transmission lines and associated switching equipment.

In the drawings, the frame 10 is shown as having rotatable insulator stands 11 and 12 mounted in spaced relation, and as having cooperating switch arms 13 and 14 mounted respectively thereupon. The insulator stands 11 and 12 may be of any preferred construction, and they are mounted upon bearings so that they may turn about their axis through an arc of substantially

180°. In the drawings, the insulator stands 11 and 12 are shown as forming one leg of a tripod insulator arrangement, such as has been illustrated and described in my aforementioned copending application for patent. The switch arms 13 and 14 are preferably mounted so that they extend at a right angle to the axis of rotation of their respective supporting insulator stands and they are of such a length that their ends may be moved into and out of circuit making engagement when the insulator stands are rotated in opposite directions. The ends of the switch arms 13 and 14 can be provided with any suitable form of contact making means which will provide a good electrical circuit through the switch when the switch arms are moved into engaging alignment. In the drawings, the switch arms 13 and 14 are shown respectively as having cooperating contact making members 15 and 16 of the type described and claimed in my copending application.

As a means to impart rotation to the insulator stands 11 and 12 and a consequent opening and closing of the circuit controlled by the switch arms 13 and 14, the insulator stands 11 and 12 are respectively provided with radially and outwardly extending crank arms 17 and 18. These crank arms 17 and 18 are preferably secured at the supported end of the insulator stands 11 and 12 and are thus insulated from the power circuit and the switch arms at the insulated end of the insulator stands. Mounted adjacent the insulator stand 11 and at an inwardly spaced point, there is a bell crank arm 19 which is journaled to rotate about an axis extending substantially parallel with the axis of rotation of the insulator stand 11, and at a similar inwardly spaced position with respect to the insulator stand 12 there is a second bell crank 20 which is adapted to rotate about an axis extending substantially parallel with the axis of rotation of the insulator stand 12. These bell cranks 19 and 20 and their mode of operation are to be described in greater detail hereinafter. It will be sufficient to here state that they each have a long and a short arm which extend at an angle to each other. The long arm of the bell crank 19 is connected to the crank 17 of the rotatable insulator stand 11 by means of a link 21, and the long arm of the bell crank 20 is connected to the crank 18 of the rotatable insulator stand 12 by means of a similar link 22. The short arms of the bell cranks 19 and 20 are then connected together by means of an additional link 23 which serves to transmit rotary movement from one bell crank to the other in a direction which will impart an opposite rotation to the rotatable insulator stands 11 and 12 when either of said bell cranks 19 or 20 is rotated about its axis. As a means for imparting rotation to the bell cranks and producing an operation of the switch, the bell crank 19 is shown as having a transversely extending cross arm 24 to the ends of which suitable straight line operating rods 25 and 26 are attached.

Before continuing the description of the invention with reference to Figures 3, 4 and 5 of the drawings, it should be pointed out that the rotatable insulator stands 11 and 12, with their diagonally disposed bracing insulator stands designated respectively by the numerals 27 and 28, provide insulated and rotatable switch arm supporting members 29 and 30. With this arrangement it will be understood that when the insulator stands 11 and 12 are rotated in opposite directions, the switch arms 13 and 14, with their contacts 15 and 16, will swing into and out of

engagement and through arcs having their centers at the axis of their respective rotatable insulator stands. This mode of operation of the switch arms is in accordance with the standard practice, but unlike all prior switches of this character, the present arrangement provides for a movement of each of the switch arms and their respective contacts through an arc of 180° by means of an operating member which rotates through an arc of only 90°.

Reference is now made to Figures 3, 4 and 5 of the drawings. In these figures of the drawings, the insulators and the switch arm supporting members 29 and 30 at the ends thereof have been omitted in order to expose the underlying linkage of the operating mechanism, and the switch arms 13 and 14, with their contacts 15 and 16, are shown in the relative positions assumed thereby when the linkage mechanism is in the positions illustrated. The cross-sectioned shafts, designated by the numerals 31 and 32, are to be understood to be the metallic bearing forming extensions which are provided at the lower ends of the rotatable insulator stands 11 and 12. These bearing forming extensions 31 and 32 are respectively journaled in bearings 33 and 34 mounted upon cross channels 35 and 36 carried by the frame 10. In inwardly spaced relation with respect to the cross channels 35 and 36, the frame 10 also carries channel members 37 and 38 upon which the crank arms 19 and 20 are respectively journaled by means of bearings 39 and 40. The bearings 39 and 40 are positioned slightly to one side of the center line of the insulator stands 11 and 12 so that one arm of each of the bell cranks 19 and 20 may extend along one side of the bearing extensions 31 and 32. When the switch arms 13 and 14 are in their circuit closing position, a long arm of the bell cranks 19 and 20, respectively designated by the numerals 41 and 42, will extend tangent to and outwardly beyond the centers of the adjacent insulator stands and at substantially a right angle to the crank arms 17 and 18 carried respectively by the insulator stands 11 and 12. This will provide for a diagonal disposition of the links 21 and 22. The relative lengths of the crank arms 17 and 18 upon the insulator stands, and the long arms 41 and 42 of the bell cranks, are such that the long arms 41 and 42 of the bell cranks 19 and 20 will, in rotating through an arc of 90°, move a linear distance which is equal to that traveled by the free ends of the crank arms 17 and 18 in rotating through an arc of 180°. This proportion in the lengths of the crank arms 17 and 18, and the long arms of the bell cranks 19 and 20 and the disposition of the links 21 and 22 connected therebetween, produces a 180° rotation of the insulator stands 11 and 12 when the bell cranks 19 and 20 are rotated through an arc of only 90°. In order to provide against a dead center condition in the linkage mechanism, the short arms of the bell cranks 19 and 20, designated by the numerals 43 and 44, are disposed at different angles with respect to the long arms 41 and 42 of their respective bell cranks. This angular disposition of the arms of the bell cranks is clearly illustrated in the figures of the drawings now under consideration.

The operation of the switch is as follows: When an operating force is exerted upon the operating rods 25 and 26, the cross arm 24 which is secured in the position shown upon the bell crank 19, will cause the bell crank 19 to rotate in a clockwise direction, and as a result a pulling force will be exerted through the link 21 upon the

crank arm 17 and produce a clockwise rotation of the insulator stand 11. This rotation of the insulator stand 11 will move the switch arm 13 in the direction indicated by arrows upon Figure 3 of the drawings. As the bell crank 19 is thus rotated, the short arm 43 thereof will exert an operating force through the link 23 and rotate the bell crank 20 in a counterclockwise direction. As the bell crank 20 is thus rotated, a pulling force will be exerted through the link 22 at the end of the crank arm 18 and produce a counterclockwise rotation of the insulator stand 12 and cause the switch arm 14 to move outwardly in the direction indicated by the arrow adjacent thereto. As the operating forces are continued to be applied to the cross arm 24, the bell cranks 19 and 20 will be rotated through the position illustrated in Figure 4 of the drawings, and into the final open position illustrated in Figure 5 of the drawings.

Upon comparing the positions of the linkage mechanism in Figure 3 of the drawings with the position of this mechanism in Figure 5 of the drawings, it will be noted that the crank arms 17 and 18 upon the insulator stands 11 and 12 have moved through an arc of 180°, whereas the long arms 41 and 42 of the bell cranks 19 and 20 will have moved through an arc of only 90°. It will be also noted that when the switches are fully opened, as illustrated in Figure 5 of the drawings, the switch arms 13 and 14 will project in opposite directions, and as a result the contacts 15 and 16 carried at the ends thereof, will be separated from each other with a maximum of separation, and into such a position that there will be no danger of a flashover over to an adjacent power line, such as would be the case if the switch arms 13 and 14 only rotated into the position illustrated in Figure 4, as is the usual condition where prior art switches of this character are used on a multiphase power system.

When a number of switch units of the character herein described are used on a multiphase power distribution system, it is to be understood that the switches can be disposed side by side so that the operating rods 25 and 26 can be connected to the cross arms 24, which will be provided upon each of the bell cranks 19 of the separate switch units, and as a result it will be possible to simultaneously operate any number of the switch units by means of a single operator.

It is to be also understood that the present invention is not limited to switch units having a plurality of rotatable and insulating switch arm supports. The invention is also applicable to switches in which a single switch arm is used in conjunction with a stationary cooperating contact. To be more explicit, it is conceivable that the switch arm 14 of the switch unit described, may be omitted and a stationary contact substituted therefor. In such an arrangement the switch arm 13 may or may not be lengthened, and its operating mechanism will be substantially similar to that illustrated and described above, except that the short arm 43 of the bell crank 19 and the link 23 will be omitted therefrom.

Another variation which is permissible with the arrangement shown, is that the operating rods 25 and 26 may be attached to the bell crank 20 rather than to the bell crank 19, as shown. It will also be understood that the operating forces may be applied to the switch operating mechanism by means of either one of the rods 25 and 26 without resort to the other.

While I have, for the sake of clearness and in

order to disclose the invention so that the same can be readily understood, described and illustrated specific devices and arrangements, I desire to have it understood that this invention is not limited to the specific means disclosed, but may be embodied in other ways that will suggest themselves to persons skilled in the art. It is believed that this invention is new and it is desired to claim it so that all such changes as come within the scope of the appended claims are to be considered as part of this invention.

Having thus described my invention, what I claim and desire to secure by Letters Patent is—

1. A disconnecting switch, the combination of a pair of rotatable insulator stands having their axes arranged in spaced substantially parallel relation, switch arms supported by said insulator stands extending therefrom and adapted to cooperate with each other, crank arms connected with said insulator stands and projecting at an angle to said switch arms, a bell crank pivotally mounted adjacent each of said insulator stands, a link connecting the end of each of said crank arms with an arm of the adjacent bell crank, means for imparting rotation to one of said bell cranks, and a single link connected between and connecting the other arms of said bell cranks, whereby each of said switch arms will be rotated through an arc of substantially 180° as said bell cranks are rotated through an arc of substantially 90°.

2. A disconnecting switch, the combination of a pair of rotatable insulator stands having their axes arranged in spaced substantially parallel relation, switch arms supported by said insulator stands extending therefrom toward each other, crank arms connected with said insulator stands and projecting at a right angle to said switch arms, bell cranks pivotally mounted adjacent each of said insulator stands, said bell cranks being rotatable about axes extending parallel with the axes of said insulator stands and having a long and a short arm, a link connecting the free end of each of said crank arms with the long arm of the adjacent bell crank, means for imparting rotation to one of said bell cranks, and a single link extending between and connecting the short arms of said bell cranks, whereby each of said switch arms will be rotated through an arc of substantially 180° as said bell cranks are simultaneously rotated through an arc of substantially 90°.

3. In a multipole disconnecting switch for high tension lines, the combination of a plurality of pairs of spaced switch arm supporting insulators, cooperating switch arms upon the insulated ends of each of said insulators adapted to rotate into engagement with each other when in a circuit closing position, a crank arm extending outwardly from the axis of each of said insulators, a bell crank mounted adjacent each of said switch blade supporting insulators rotatable about an axis extending substantially parallel with the axis of the adjacent insulator, a link connecting the crank arm upon each of said insulators with an arm of the bell crank adjacent thereto, means for simultaneously imparting rotation to one of the bell cranks of each pair of insulators, and a single link connected between the other arm of the bell cranks of each pair of insulators, whereby one insulator of each pair will rotate in one direction in unison with a corresponding insulator of the other pairs and the other insulators of each pair will rotate in unison in a reverse direction as said means is operated to impart

rotation to one of the bell cranks of each pair of insulators.

4. In a multipole disconnecting switch for high tension lines, the combination of a plurality of
5 pairs of spaced switch arm supporting insulators, cooperating switch arms upon the insulated ends of each of said insulators adapted to rotate into engagement with each other when in one position and project away from each other when in
10 another position, a crank arm extending outwardly from the axis of each of said insulators and at an angle to the switch arms carried thereby, a bell crank having a long and a short arm mounted adjacent each of said switch blade supporting
15 insulators and rotatable about an axis extending substantially parallel with the axis of

its adjacent insulator, a link connecting the crank arm upon each of said insulators with the long arm of the bell crank adjacent thereto, means for simultaneously imparting rotation to one of the crank arms of each pair of insulators, and a single link connected between the
5 short arms of the bell cranks of each pair of insulators, whereby one insulator of each pair will rotate in one direction in unison with a corresponding insulator of the other pairs and
10 the other insulators of each pair will rotate in unison in a reverse direction as said means is operated to impart rotation to one of the bell cranks of each pair of insulators.

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