June 10, 1924. 1,496,884

E. H. JACOBS

SWITCH

Filed May 14, 1920 3 Sheets-Sheet 1

Fig. 1

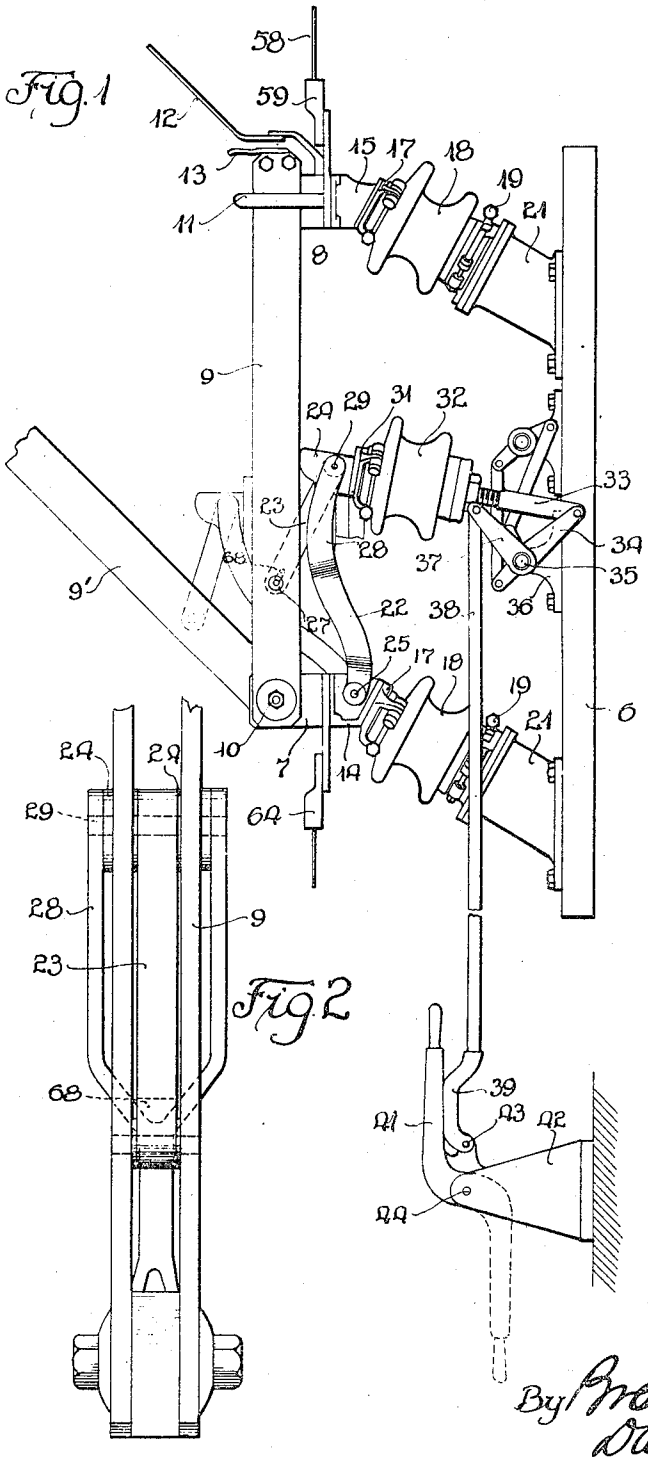
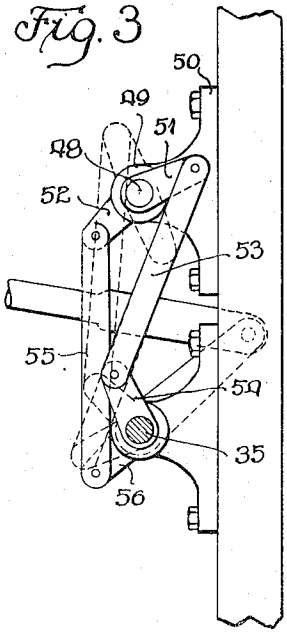


Fig. 2

Fig. 3



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SWITCH

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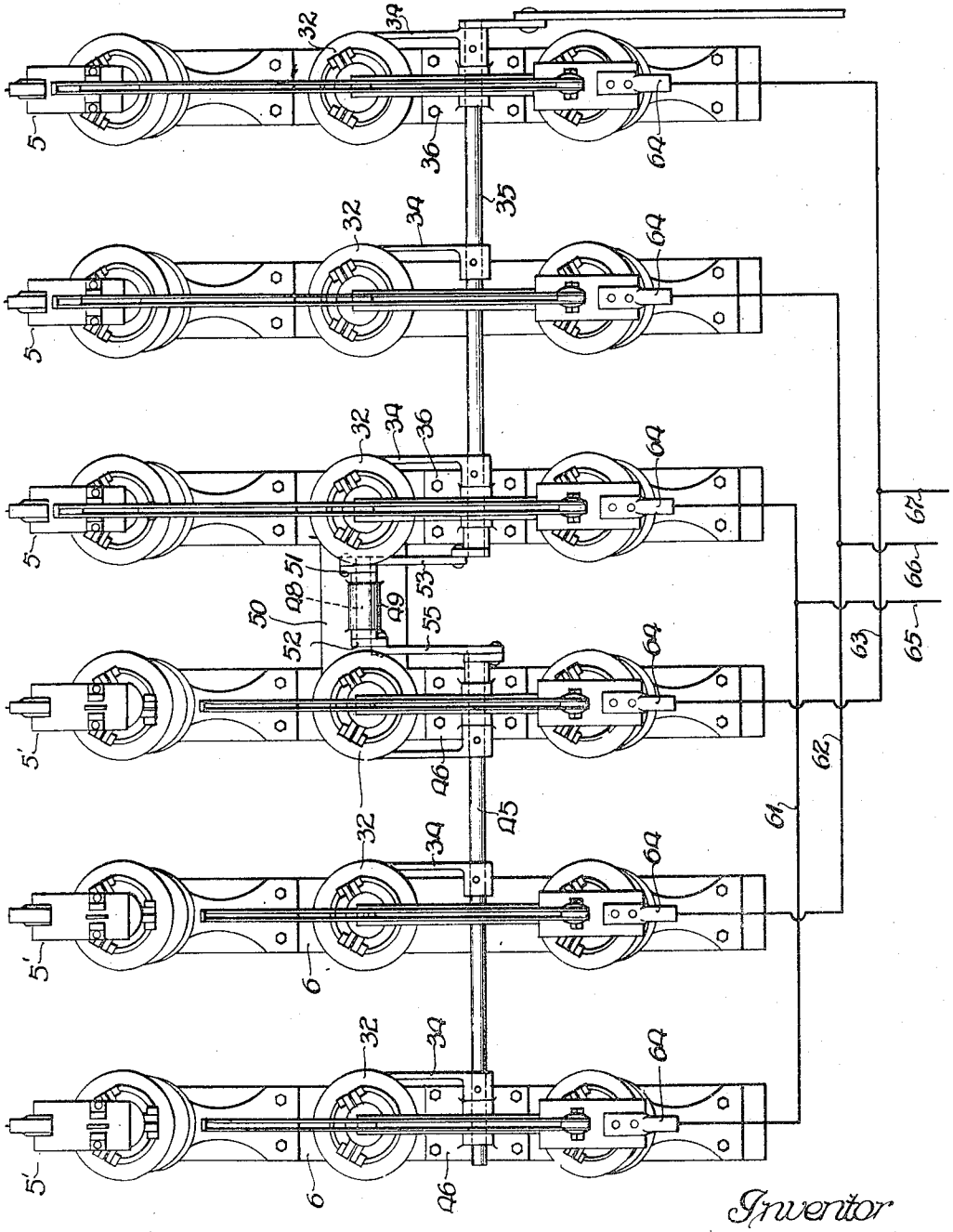


Fig. 2

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June 10, 1924. 1,496,884

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SWITCH

Filed May 14, 1920 3 Sheets-Sheet 3

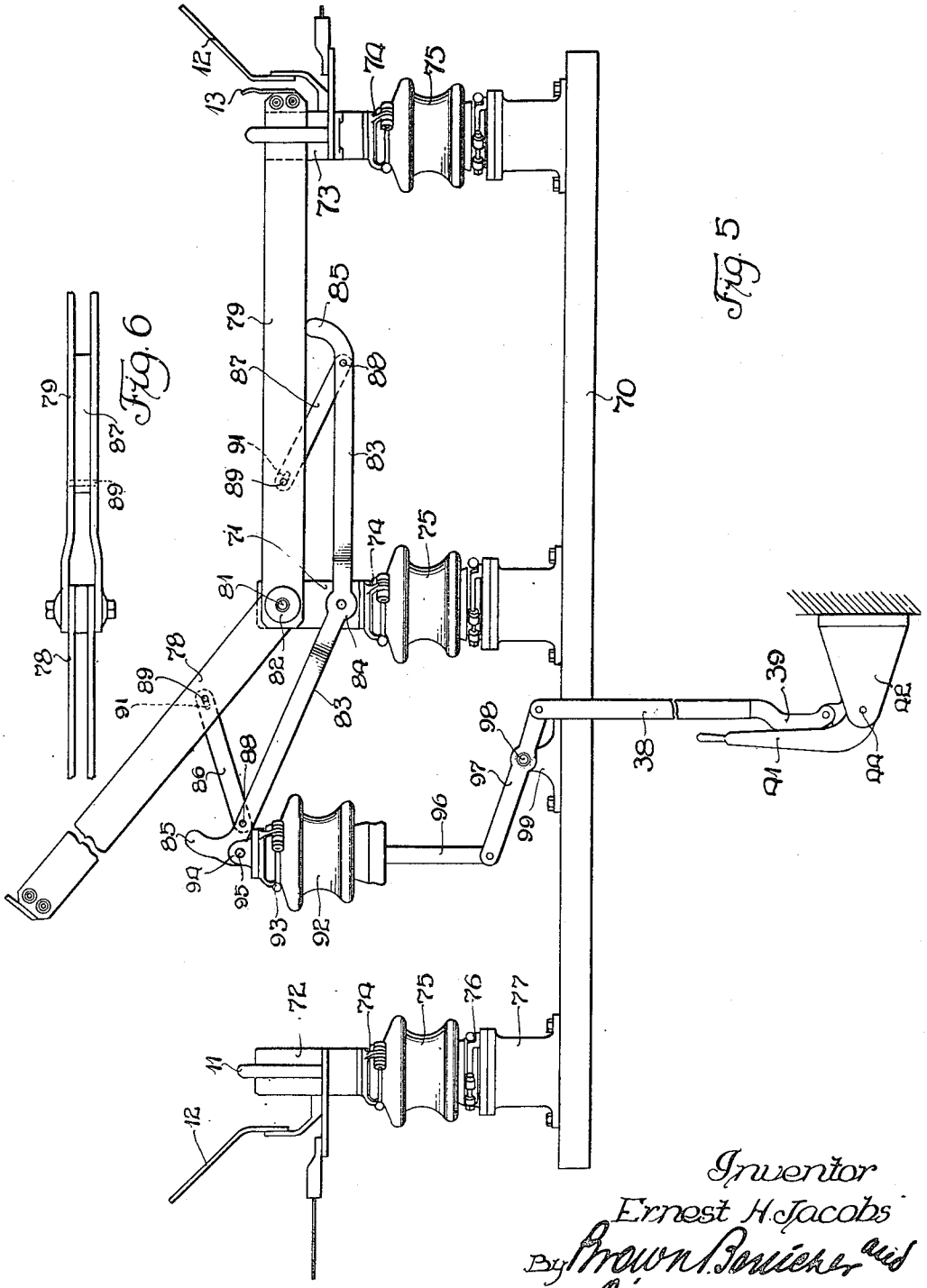


Fig. 5

Fig. 6

Inventor
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By Brown, Boulden and Dinner Att'ys

Patented June 10, 1924. 1,496,884

UNITED STATES PATENT OFFICE.

ERNEST H. JACOBS, OF CHICAGO, ILLINOIS, ASSIGNOR TO ELECTRICAL ENGINEERS EQUIPMENT COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

SWITCH.

Application filed May 14, 1920. Serial No. 381,235.

To all whom it may concern:

Be it known that I, ERNEST H. JACOBS, a citizen of the United States, residing in Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Switches, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

The present invention relates to switches, and is a development of the general construction of switch disclosed in the copending application of Christen Christensen, Serial No. 301,718, filed June 4, 1919.

The invention is primarily directed to a double throw type of switch, and more particularly to a double throw type of high tension switch designed for outside installation, such as on a pole top or switching tower. Switches of this general description are frequently used in connection with the overhead switching apparatus of power houses, substations, etc., for switching a single set of leads or taps into connection with one or the other of two independent sets of transmission lines, or for performing other similar switching operations. Two single throw switches are sometimes used in such situations, but this arrangement is objectionable: first, for the reason that there is a possibility of connecting both sets of transmission lines in simultaneous contact with the single set of leads, which, in the case of transmission lines considerably out of phase would produce serious disturbances, and second, for the reason that the provision of interlocking mechanism between the switches for overcoming this difficulty interposes an objectional degree of complexity in the structure and operation of the switch. The double throw type of switch entirely obviates these difficulties. The operation of the double throw type of high tension switch has, however, presented a considerable difficulty. Owing to the exposed installation, the high potentials and the large current flow to be interrupted, a switch for this class of service must necessarily be of heavy rugged construction with large switch blades and terminals and large insulators interposed in the operating mechanism. The weight of this construction is further augmented in three phase switches, owing to the additional number of blades required. In addition to the weight of the switch, the static and moving friction of the switch blade offers a further resistance to the operation of the switch. A switch exposed to the weather and left with the blades in one position for a considerable time frequently becomes corroded at the terminals or frozen in place by sleet and ice, so that there is a very considerable static friction necessary to be overcome in initiating the opening movement of the blades. On the other hand, it is essential that the switch be opened with a quick, positive motion, owing to the high potential, and the large current flow to be interrupted, in order to effectively quench the arc without undue burning of the blades and terminals. The practical difficulties associated with this type of switch will thus be apparent.

In the copending application above referred to, there is disclosed a form of switch operating mechanism embodying a novel relation of toggle link motion for actuating the switch blade. The particular attribute of this toggle motion is a changeable ratio of leverage which takes place between the actuating mechanism and the switch blade during the operation of the switch, whereby there is exerted, during the initial opening motion of the blade, a powerful leverage on the switch-blades to overcome the static friction of the switch, and during the remaining portion of the throw, an accelerating motion of the switch blades through a lengthening ratio of lever arms, so that a quick break of the arc is assured.

It is a primary object of the present invention to provide a construction of double throw switch embodying this improved toggle link motion.

It is a secondary object of the invention to provide a switch of the above general type, having an improved and simplified construction consisting of a minimum number of parts.

Another object of the invention is to provide a balanced construction of double throw switch, wherein the weight of the switch blades and operating mechanism will be

largely balanced in all positions of the switch.

In the following detail specification, I have described a specific embodiment of double throw switch, particularly designed for high tension exposed installations, but I wish it to be understood that the essence of the invention is not limited thereto, but may be extended to other types of switches designed for other purposes as well.

Referring to the drawings:

Figure 1 is a side elevational view of one form of my improved switch,

Figure 2 is an enlarged detail view illustrating the toggle link mechanism in front elevation;

Figure 3 is an enlarged fragmentary view of the reversing link mechanism;

Figure 4 is a front elevational view of the switch illustrating diagrammatically the various circuit connections between the switch blades, the switch being of the three-phase type;

Figure 5 is a side elevational view of a horizontal type of double throw switch, particularly designed for horizontal mounting on the switching tower or other supporting structure; and

Figure 6 is a detail plan view illustrating the pivotal mounting of the switch blades thereof.

The switch illustrated in Figures 1 and 4 is of the three phase gang type of vertical switch, and comprises six independent switch units, the three switch units 5 on the right hand side of the switch being connected to one three phase circuit, and the three switch units 5 on the left side of the switch being connected to a second three phase circuit. These switch units are supported in parallel alignment on individual vertical channel members 6, which may be mounted upon a supporting frame, or upon the switching tower in any suitable manner. Referring to Figures 1 and 3 wherein one of the switch units is illustrated in detail, it will be noted that each switch unit comprises a lower hinge terminal 7 and an upper contact terminal 8, which are adapted to be connected by a switch blade 9. In the embodiment illustrated the terminals 7 and 8 each consist of a single tongue or terminal lug, and the blade structure 9 comprises two parallel blades which embrace these terminal lugs. It will be understood, however, that this construction is merely exemplary, and that the switch blade may be of the trussed type or any other type and may be arranged to cooperate with other arrangements of terminals. The switch blade is pivoted upon the hinge terminal 7 by a pivot bolt 10, which is provided with the usual spring washers to resiliently press the two switch blades into contact with the terminal. The upper end of each switch blade 9 is guided over its respective contact terminal 8 by guide members 11, which extend outward from the base of the terminal in spaced relation to the terminal lug. Extending upwardly from the base of the upper terminal 8 is an arcing horn 12, which cooperates with a small arcing horn 13 mounted on the upper end of the switch blade 9. These arcing horns are provided to carry the arc drawn in opening the switch, and thereby prevent burning of the terminal and switch blade, as is well understood by those skilled in the art.

The bases of the switch terminals 7 and 8 are mounted on angle brackets 14 and 15 respectively, which are in turn bolted or otherwise mounted on universal insulator clamps 17—17 on the insulators 18. The insulators 18 are inclined and have their lower ends supported in insulator clamps 19—19, which are mounted on the inclined pedestals 21—21. The inclined pedestals 21 are bolted to the channel sections 6 or other frame structure.

The toggle link mechanism for operating the switch comprises an arm or lever 22 and a link 23, which have concentric pivotal connection with a switch opening shoe 24. The lower end of the lever 22 has pivotal connection with the angle bracket 14 as indicated at 25, the end of the lever 22 being forked to embrace the web of the angle bracket 14. The link 23 is extended between the parallel blades of the blade structure 9 where it has pivotal support at its end on a pivot pin 27 extending through the switch blades and through the link 23.

As shown in Figure 2, the shoe 24 is bifurcated to receive the upper end of the link 23, the bifurcated portions being arranged to engage the rear of the two parallel switch blades. The upper end of the lever 22 is forked, as indicated at 28, to engage over the bifurcated shoe 24. The pivot pin 29 is extended through the forked arms of the lever 22 and through the shoe 24 and central link 27. The shoe 24 is provided with a suitable base which is secured to a clamp 31 on the outer end of an operating insulator 32. The insulator 32 is adjustably carried on a stem 33, which screws up into a threaded socket cemented in the bottom of the insulator. This stem has pivotal support on an arm 34 which is rigidly secured on an operating shaft 35. The stem 33 is preferably bent laterally to extend back alongside of the channel member 6 for pivotal connection with the arm 34; or the stem 33 may be forked to extend back on each side of the channel member 6 for pivotal connection with separate arms 34 on each side of the channel member. The operating shaft 35 extends horizontally across the channel members 6, or other supporting

structure, to have operative connection with all of the three right hand switch units 5, as will be noted from Figure 3. The shaft is journaled in suitable bearing brackets 36, mounted on the first and third channel members 6 of the three right hand switch units 5. The outer end of the operating shaft 35 carries an operating arm 37 which has pivotal connection with an operating rod 38 extending down to the base af the switching tower or pole. At this point the operating rod 37 has pivotal connection through a recurved link 39 with an operating lever 41. The link 39 is pivotally connected through a pivot pin 43 with a lug projecting from the operating lever 41. The operating lever 41 is pivotally supported on a pivot pin 44 extending through a forked bracket 42 mounted on the tower structure or pole. When the operating handle 41 is in the upper position illustrated, the pivotal connection 43 is in the vertical plane of the pivotal center 44, or is thrown past said plane, whereby the operating mechanism is locked against accidental opening. In actuating the lever 41 the same is thrown downward through approximately 180 degrees to the position indicated in dotted lines. By this motion the pivotal center 43 is carried into or past the vertical plane of the center 44, so as to again lock the operating mechanism in its lower position. Signal mechanism, such as is described in the copending application of Christen Christensen, Serial No. 301,718, may be embodied in the operating mechanism for indicating the position of the switch.

Each of the switch units 5, of the right hand three phase circuit have operative connection with the operating shaft 35 through operating arms 34 and insulators 32 as previously described. Each of the switch units 5′ of the left hand three-phase circuit are arranged to be operated from a second operating shaft 45 through a similar arrangement of operating arms 34 and insulators 32. This second operating shaft is entirely independent of the first operating shaft 35, and is journaled in bearing brackets 46 on the first and third channel members 6, in axial alignment with the first operating shaft.

The second operating shaft 45 is arranged to receive its operating motion from the first operating shaft 35 through a system of reversing links operating through the medium of a short countershaft 48. Referring particularly to Figures 2 and 3 this countershaft 48 is journaled in a bearing 49, the base plate of which is extended between the two central channel members 6 and is bolted thereto. The countershaft 48 projects from each end of the bearing portion 49, and at one end has rigidly fastened thereto a rearwardly projecting arm 51 and at the other end a forwardly projecting arm 52. The right hand arm 51 has pivotal connection through a link 53 with a forwardly inclined arm 54, which is rigidly mounted on the end of first operating shaft 35, adjacent the bearing bracket 36. The left hand arm 52 has similar pivotal connection through a link 55, with a forwardly extending arm 56, which is rigidly mounted on the right hand end of the second operating shaft 45, adjacent the bearing bracket 46. The length of the various arms 51, 52, 54 and 56 and their angular relation relative to their respective shafts is so designed as to transmit the same degree of angular motion from the first operating shaft 35 to the second operating shaft 45, but in a reverse direction. This reversal of direction of the second shaft 45 will be apparent from the fact that a counter clockwise rotation of the first shaft 35 will act through the link 53 and arm 51 to produce clockwise rotation of the countershaft 48, which will in turn act through the link 55 and arm 56 to produce clockwise rotation of the second operating shaft 45. The extent of angular movement of each shaft is approximately 90 degrees. The position of the reversing link mechanism in the other extreme position of the operating mechanism is illustrated in dotted lines in Figure 3.

As hereinbefore described, the three right hand switch units 5 are included in circuit with the respective lines of one three-phase circuit, and the three left hand switch units 5′ are included in circuit with the lines of a separate three-phase circuit. The connection of the line wires or taps 58 (Figure 1) is effected through terminal connectors 59, which bolt to the upwardly extending base of each of the upper contact terminals 8. As illustrated diagrammatically in Figure 3, the corresponding switch units of each three-phase circuit are cross-connected through busses or leads 61, 62 and 63. These cross-connecting leads have connection with the lower hinge terminals 7 of the corresponding switch units through terminal connectors 64 which are bolted to the downwardly extending base portions of the hinge terminals 7. Taps are made on these cross connecting leads through wires 65, 66 and 67 which extend down to the source of power generator or consumption as the case may be.

The operation of the embodiment thus far described is as follows:

In the position of the switch illustrated, the three right hand switch units 5 are closed and the three left hand switch units 5′ are open. Assume now that the operating handle or lever 41 is thrown downwardly into the dotted line position. The operating rod 38 is thereby drawn downwardly and the first operating shaft 35 is revolved in a counter clockwise direction. This rotation is transmitted through the

countershaft 48 and reversing link mechanism and imparts a clockwise rotation to the second operating shaft 45, as has been heretofore described. The initial rotation of the first operating shaft 35 acts directly through the insulators 32 and switch opening shoes 24 against each of the switch blades 9. During this initial outward motion of each switch opening shoe 24 the associated toggle link mechanism is non-effective by reason of a short slot 68 cut in the link 23, which permits a longitudinal shifting motion of the link relative to its pivot pin 27 during this initial outward motion of the shoe 24. The slot 68 is not essential and may be dispensed with by relying on the natural play between the pivoted links for affording the lost motion between the link 23 and the switch blade 9. As a result of this lost motion the initial motion of the shoe 24 acts on each switch blade 9 with the full force and leverage which is transmitted through the short lever arm 34, whereby a powerful leverage is exerted on the switch blade 9, and its static friction from corrosion or ice is overcome. As soon as the switch blade 9 clears the end of the upper contact terminal 8 the toggle link mechanism becomes effective by the longitudinal motion of the link 23 in bringing the other end of the slot 68 up against the pivot pin 27. Thereafter the outward motion of the insulator 32 and shoe 24 is multiplied through the action of the toggle links 22 and 23. This multiplying action of the toggle links results from their action of tending to straighten out in alignment by the continued outward motion of the pivot pin 29. This will be evident from the fact that the pivot pin 29 tends to revolve in a circle eccentric to the hinge bolt 10, by reason of the pivot 25 of the link 23 being disposed in back of the hinge bolt 10, while the pivot pin 27 tends to revolve in a circle concentric to the hinge bolt 10. Consequently the arc of motion of the pivot pin 29 is toward or across the arc of motion of the pivot pin 27, and as a result of these eccentric motions the two toggle links tend to straighten out, thereby multiplying the motion transmitted to the blade 9 and insuring a quick, positive quenching of the arc and a full opening of the switch. The operation may be more apparent by likening the link mechanism to a series of four links interconnected in the form of a closed polygon. In this analogy the hinge terminal 7 may be considered a stationary link, the switch blade 9 a movable link, and the toggle links 22 and 23 the remaining movable links in completing the polygonal series of four. It will be noted that the sum of the lengths of the two links 22 and 23 is considerably greater than the sum of the length of the two links 9 and 7. Consequently an outward motion of the pivot 29 produces a considerably accelerated outward motion of the pivot 27 (and switch blade 9) by reason of the greater combined length of the two links 22 and 23 straightening out than the combined length of the two links 7 and 9.

Simultaneously with this opening motion of the three right hand switch units 5, the three left hand switch units 5′ are being closed by the reverse rotation of the second operating shaft 45, which tends to draw the switch blades 9′ into closed position. The action of closing each switch unit is effected entirely through the link 23, which by the retracting motion of the operating insulator 32 and switch opening shoe 24, draws the switch blade into closed position. The opening and closing motions of each group of switch units occurs simultaneously but the actual making and breaking of contacts in each group of switch units is so timed that the circuit connections through one group is entirely interrupted before the circuit connections through the other group is established, and consequently there is no possibility of the taps or leads being simultaneously connected with two separate circuits, which might happen to be out of phase. The reverse operation of closing the switch units 5 and opening the switch units 5′ will be obvious from the foregoing description. It will be apparent that the above form of switch can be constructed in gangs of two pairs of switch units, or even one pair of switch units for single phase use, or the like, and can be mounted horizontally if desired instead of vertically.

In Figure 5, I have illustrated a more simplified construction of my improved switch, embodied in a form particularly adapted for horizontal mounting. In this construction the three switch terminals constituting each separate switch unit are disposed in alignment on the horizontal supporting channel 70. The hinge terminal 71 and the two contact terminals 72 and 73 are suitably mounted on insulator clamps 74, which clamp over beads on the tops of the supporting insulators 75. The insulators 75 are supported in clamps 76, which are mounted on pedestals 77 bolted to the supporting channel 70. Each of the contact terminals 72 and 73 is substantially similar to the contact terminal 8 of the preceding form of switch and comprises the spaced guide members 11 and the arcing horns 12 adapted for cooperation with the arcing horns 13 on the ends of the switch blades. Each switch unit is provided with two independent switch blades 78 and 79 adapted for contact with the switch terminals 72 and 73 respectively, both switch blades being separately pivoted on the hinge terminal 71 for independent pivotal motion

thereon. Each blade structure 78 and 79 preferably comprises two separate blades in trussed or parallel arrangement, similar to the previous embodiment. As shown in Figure 6 one pair of blades is arranged to closely embrace the hinge terminal 71 and the other pair of blades is made to embrace this innermost pair of blades. A hinge bolt 81 is extended through both pairs of blades and through the hinge terminal 71, being provided with spring washers 82 to impose frictional tension on the hinge mounting of the blades.

The toggle link mechanism for operating the switch blades comprises a long toggle arm 83, which is pivoted at the center on a pivot pin 84 extending through the hinge terminal 71 in vertical alignment with the hinge bolt 81. Each lateral extension of this toggle arm extends to a point approximately in the center of its respective blade 78 or 79, where it is formed with an upturned end 85 which is adapted to engage the under surface of the switch blade and function as a switch opening shoe. These toggle arm extensions have connection with their respective switch blades 78 and 79 through toggle links 86 and 87. These toggle links have pivotal connection with the toggle arm 83 through pivot pins 88, and have pivotal connection with the switch blades 78 and 79 through pivot pins 89, which are extended through both lateral blades and through the toggle link. Each link 86 and 87 is provided with a short slot 91 for receiving the pivot pin 89, to permit of the slight degree of lost motion in the toggle link mechanism during the initial opening of the switch blade. The toggle arm 83 may be provided with a central longitudinal slot for embracing the terminal lug 71, and may be provided with a similar slot for receiving the toggle links 86—87; or may simply be pivoted on the side of the terminal lug 71 and have the toggle links 86 and 87 pivotally connected to the side of the toggle arm in an obvious manner.

The toggle arm 83 is adapted to be actuated by an operating insulator 92, which insulator has pivotal connection with the toggle arm through a pivot lug 94 on the top of the insulator clamp 93. This pivot lug is connected with the end of the toggle arm by a pivot pin 95. The operating insulator 92 preferably has connection with the toggle arm 83 at a point approximately midway between the hinge terminal 71 and the contact terminal 72 in order to afford a maximum sparking distance between these terminals and the operating mechanism. The insulator 92 is mounted on a stem 96 which is pivotally supported on a rocking lever 97. The lever 97 is pivoted intermediate its ends on an operating shaft 98, which is journaled in bearings 99 mounted on the supporting structure. The other end of the lever 97 has pivotal connection with the operating rod 38 which extends down to the switch operating handle 41 at the base of the switching tower or pole. In a three-phase switch, three switch units of the above construction would be arranged in parallel relation, similar to the gang switch illustrated in Figure 4. These several switch units would all have operative connection with the operating shaft 98 through operating insulators 92 connecting with their respective toggle arms 83.

In the operation of the switch it will be obvious that the actuation of the switch operating handle 41 will result in the rotation of the operating shaft 98 and thereby raise or lower the switch operating insulators 92 of the several switch units. The resulting rocking motion which is thereby imparted to each toggle arm 83 is first effective through the switch opening shoe 85 upon the closed switch blade. The full leverage of the operating mechanism is exerted on this closed switch blade until the static friction of the switch blade is overcome and the blade clears its contact terminal. Thereupon the toggle link mechanism becomes effective to transmit a multiplied motion to the switch blade and quickly moves it to full open position. Simultaneously with this action the other extension of the toggle arm 83 moves downwardly and draws the other switch blade into closed position through the medium of the intermediate toggle link 86 and 87. The simplicity of this construction of switch will be apparent. For each complete switch unit there is only required one operating insulator and one toggle mechanism. It will also be noted that the weight of the series of blades moving into closed position is effective through the toggle arms 83 and tends to balance the weight of the series of blades moving into open position. Consequently the weight of the switch blades imposes no hindrance on the operation of the switch. It will furthermore be noted that the operating insulators in this form of switch as well as in the preceding form, are subjected only to forces acting longitudinally of their axes. Such forces are only productive of tension and compression stresses, which the insulator is perfectly capable of withstanding. This is distinctive from prior forms of switches wherein the operating insulators are subjected to torsional and twisting stresses, or lateral bending stresses, against which the composition and structure of an ordinary insulator has a very low factor of strength.

While I have described my invention in connection with the details of a particular structure, I do not intend thereby to limit the invention to such embodiment as I am aware and contemplate that modifications

may be made without departing from the invention as set forth in the appended claims.

I claim:

1. In a switch, the combination of a pair of contact terminals, movable switch mechanism having a contact movable into and out of contact with one of said contact terminals and a contact movable into and out of contact with the other of said contact terminals, and means for imparting great initial leverage followed by increased velocity to each of the contacts of said switch mechanism in its opening movement and connected to close one contact with the opening of the other and vice versa.

2. In a switch, the combination of a pair of contact terminals, movable switch mechanism having a contact movable into and out of contact with one of said contact terminals and a contact movable into and out of contact with the other of said contact terminals, and means for imparting a variable ratio of force and velocity to each of the contacts of said switch mechanism in its opening movement and connected to close one contact with the opening of the other and vice versa.

3. In an electrical switch, the combination of a pair of contact terminals, switch blade mechanism pivotally supported for motion into and out of contact with either of said contact terminals, an operating member for moving said switch blade mechanism, changeable ratio mechanism cooperating with said operating member, said changeable ratio mechanism comprising a first link connected to said operating member and having stationary pivotal support, eccentric to the pivotal mounting of said switch blade mechanism and a second link pivotally connected between said operating member and switch blade mechanism.

4. In a double throw switch, a pair of contact terminals, an independent switch blade associated with each of said contact terminals, each of said switch blades having stationary pivotal mounting for alternate motion into and out of contact with its respective contact terminal, an operating member for each of said switch blades, toggle link mechanism connecting said operating member with said switch blade, said toggle link mechanism comprising a first link pivotally connected to said operating member and having stationary pivotal mounting at a point eccentric to the pivotal mounting of its respective switch blade, and a second toggle link pivotally connected to said operating member and said switch blade.

5. In a double throw switch, a pair of contact terminals, an intermediate hinge terminal, a pair of switch blades pivoted to said hinge terminal, operating mechanism for each of said switch blades adapted to impart an opening motion of great initial force followed by increased velocity to its respective switch blade, and connected to close one blade with the opening of the other, and an operating member connected to said operating mechanism.

6. In a double throw switch, the combination of a pair of contact terminals, an intermediate hinge terminal, a pair of switch blades pivoted to said hinge terminal, a switch blade for each of said contact terminals, both of said switch blades being pivoted to said hinge terminal, a toggle arm pivoted to said hinge terminal, toggle links connecting said toggle arm with each of said switch blades, and operating mechanism operable to actuate said toggle arms.

7. In a double throw switch, the combination of a pair of contact terminals, a hinge terminal, independent switch blades pivoted to said hinge terminal and adapted to contact with said contact terminals, a toggle arm pivoted to said hinge terminal, eccentric to the pivotal point of said switch blades, toggle links pivotally connected to the ends of said toggle arm and said switch blades, an operating member connected to said toggle arm and an insulator interposed in said operating member.

8. In a switch the combination of a pair of contact terminals, movable switch mechanism having a contact movable into and out of contact with one of said contact terminals and a contact movable into and out of contact with the other of said contact terminals, and means for imparting an opening movement to each of the contacts of said switch mechanism first by a force applied at one point and then by a force applied at another point and connected to close one contact with the opening of the other and vice versa.

9. In a switch, a pivot terminal, a contact terminal on one side of said pivot terminal, and a second contact terminal on the other side of said pivot terminal, movable switch mechanism having a contact arm movable into and out of contact with said first contact terminal and a contact arm movable into and out of contact with the second contact terminal, pivoted means cooperating with said switch mechanism to break contact between each contact and its cooperating contact terminal, a link connection between said means and one contact arm and a second link connection between said means and the other contact arm.

10. In a switch, a pair of contact terminals, movable switch mechanism having a contact arm movable into and out of contact with one contact terminal and a second contact arm movable into and out of contact

with the other contact terminal, a common pivot terminal for said first and second contact arms, pivoted means cooperating with said switch mechanism to break contact between each contact and its cooperating contact terminal, a link connection between said means and one contact arm and a second link connection between said means and the other contact arm.

11. In a switch, the combination of a movable switch member, a pivot terminal for said member, a contact terminal for said member, a pivoted lever adapted for cooperating at one side of its pivot with the movable switch member to break contact between said member and said contact terminal, a link connection between said pivoted lever and said movable switch member through which said member is thereafter swung about the pivot terminal at increased speed and an operating member connected to said pivoted lever at the other side of its pivot.

12. In combination, a pair of contact terminals, an intermediate pivot terminal, switch mechanism pivoted on said intermediate pivot terminal and having arms cooperable with said contact terminals, a lever pivoted eccentric to the pivot of said switch mechanism and having an arm engageable with one arm of the switch mechanism and a second arm engageable with the other arm of the switch mechanism and means for actuating said lever.

13. In combination, a pair of contact terminals, an intermediate pivot terminal, switch mechanism pivoted on said intermediate pivot terminal and having arms cooperable with said contact terminals, a lever pivoted eccentric to the pivot of said switch mechanism and having an arm engageable with one arm of the switch mechanism and a second arm engageable with the other arm of the switch mechanism, means for actuating said lever, and link connections between said lever and each of the arms of the switch mechanism.

In witness whereof I hereunto subscribe my name this 11th day of May, A. D. 1920.

ERNEST H. JACOBS.