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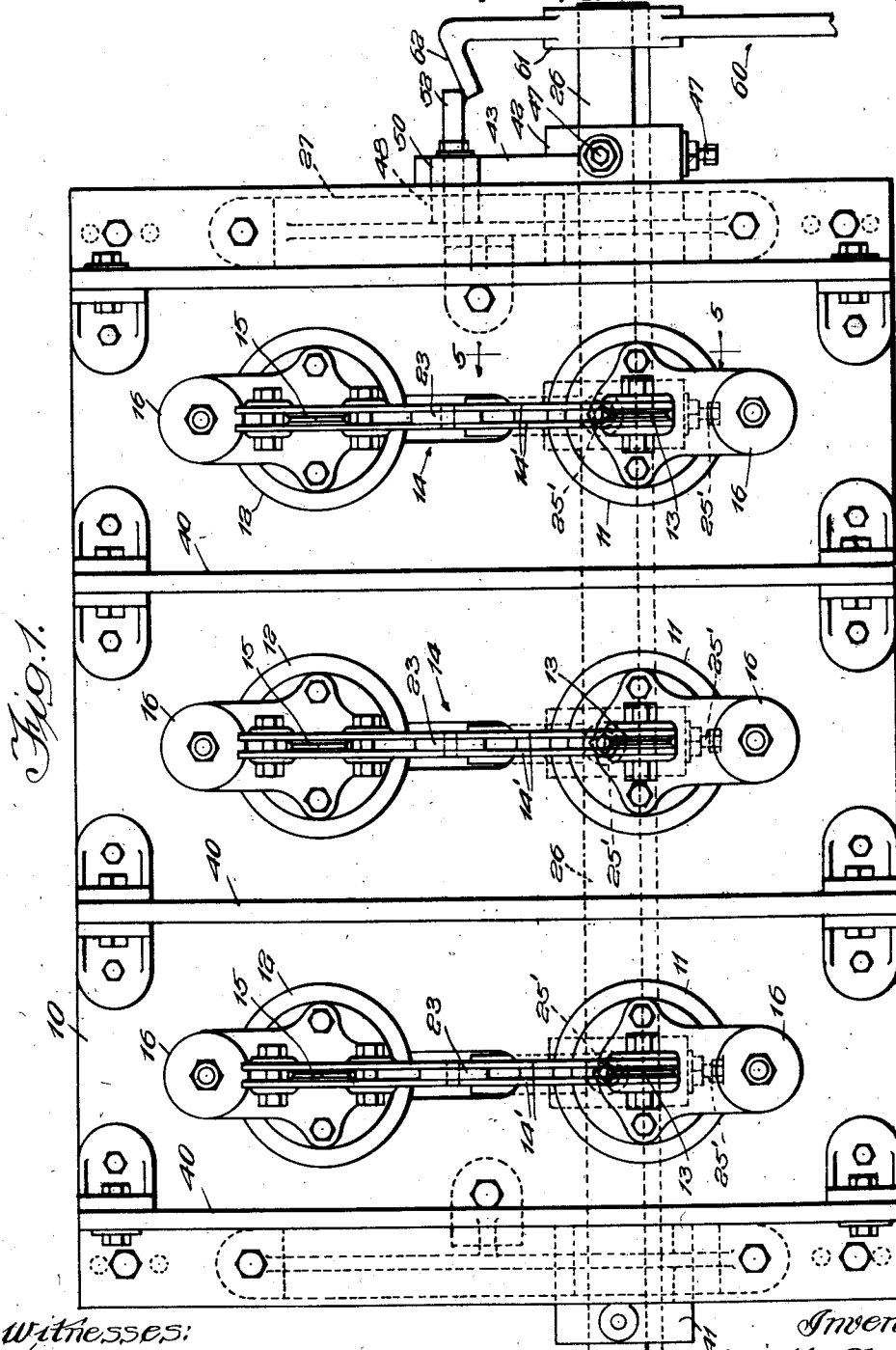
C. CHRISTENSEN

1,826,734

SWITCH

Filed Sept. 19, 1925

4 Sheets-Sheet 1



Witnesses:

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Harry R. White

Inventor:

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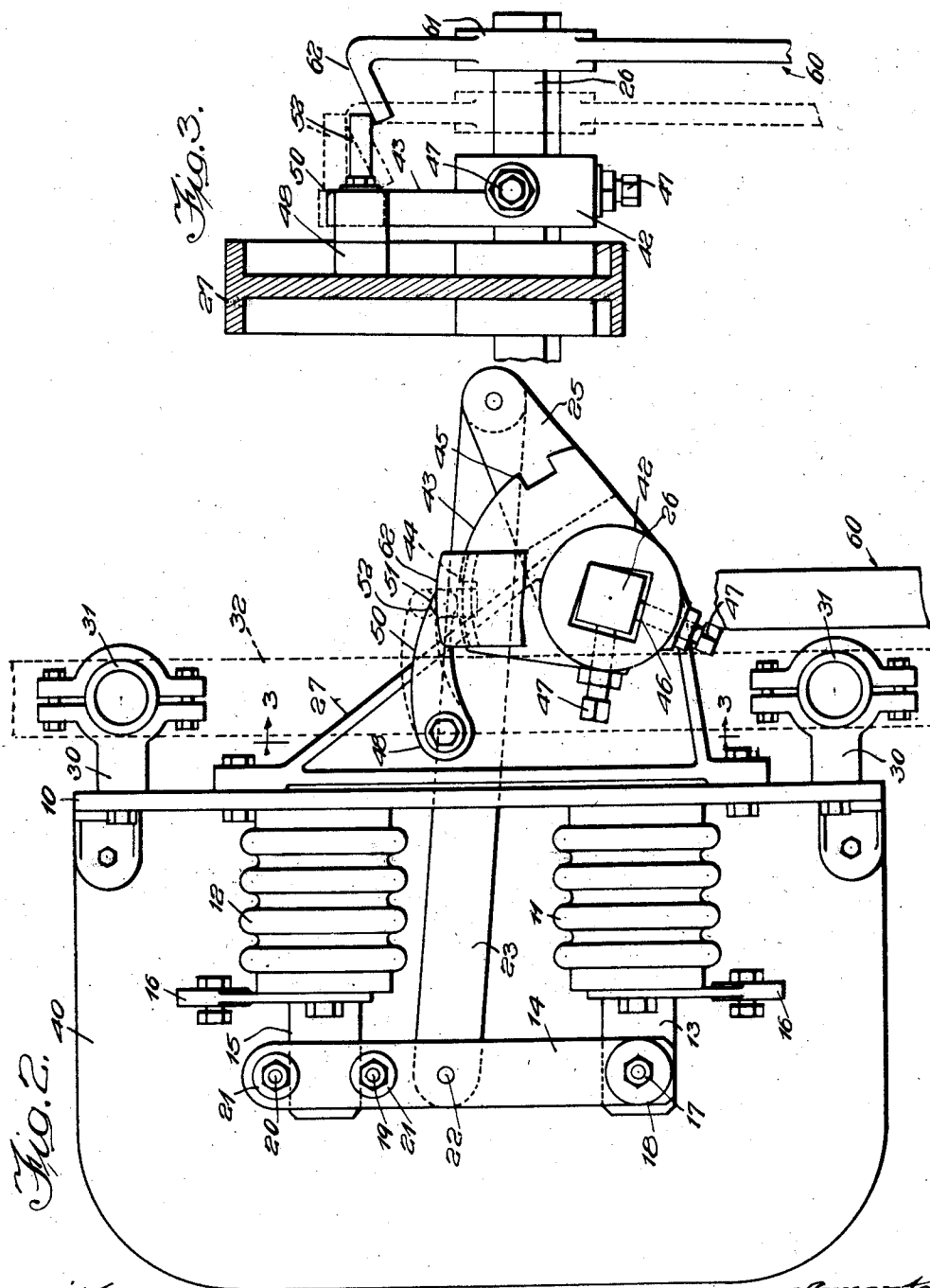
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SWITCH

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4 Sheets-Sheet 2



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Oct. 13, 1931.

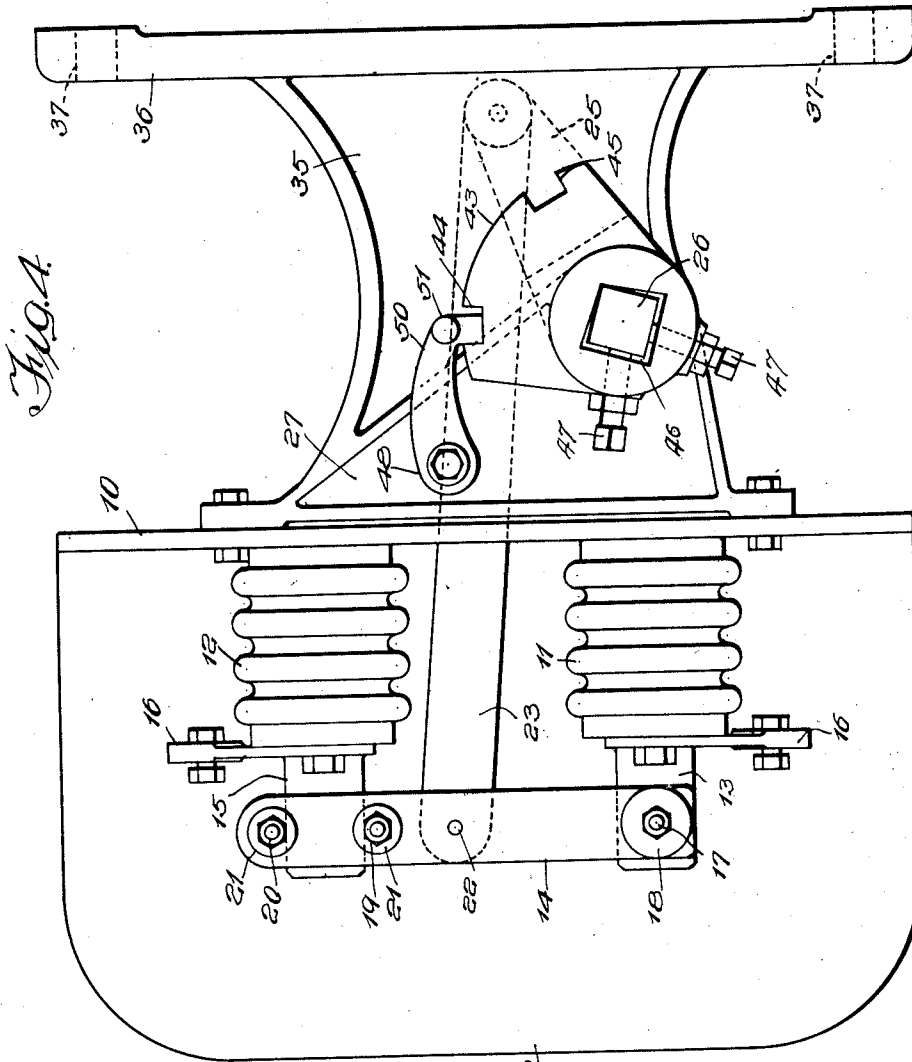
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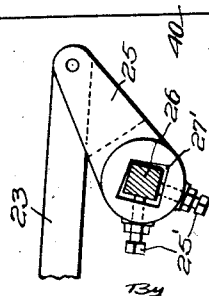
4 Sheets-Sheet 3



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Fig. 5.



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Oct. 13, 1931.

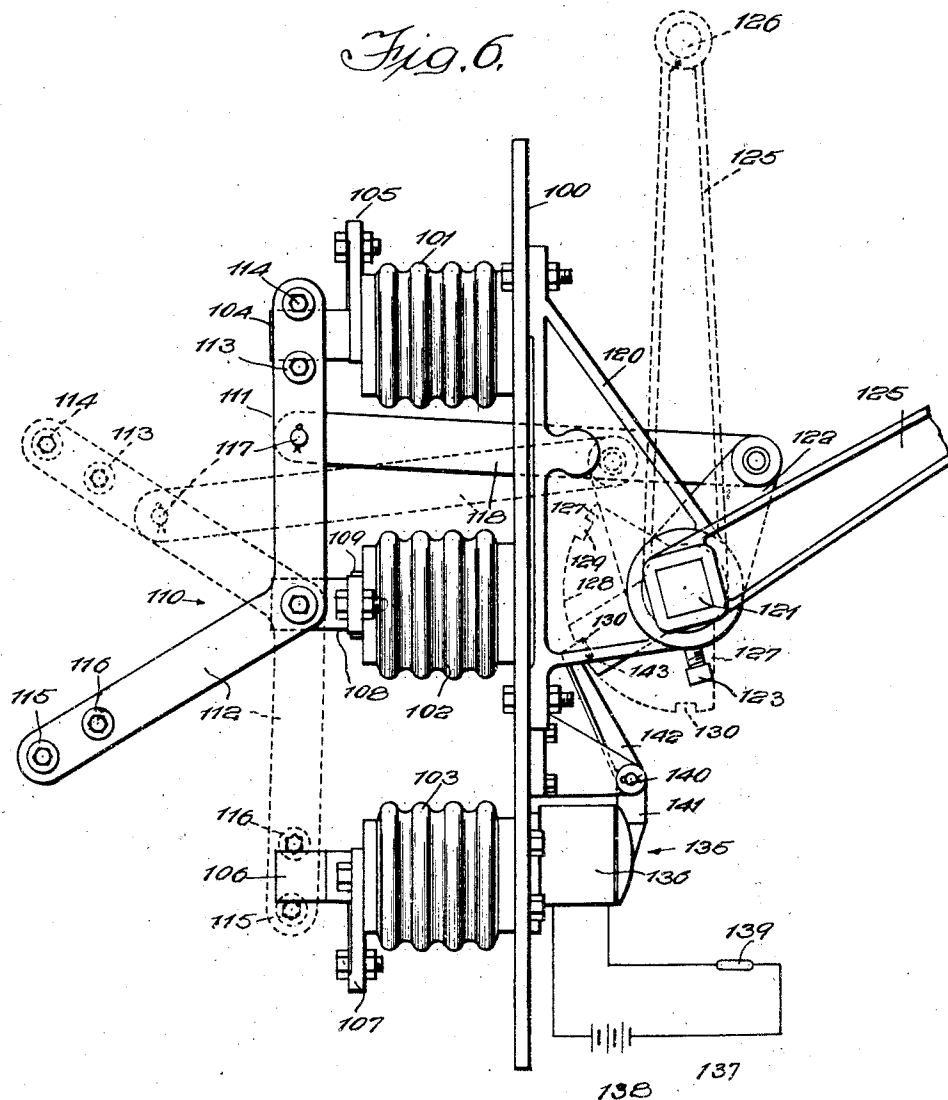
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1,826,734

SWITCH

Filed Sept. 19, 1925

4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

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SWITCH

Application filed September 19, 1925. Serial No. 57,322.

My invention relates in general to electrical switches, and more particularly to locking mechanism therefor.

The present invention has particular reference to switches employed in connection with high tension transmission service, such as, for example, disconnecting switches. It is well known to those versed with the present subject matter that disconnecting switches are adapted to function as auxiliary switching elements and to operate in conjunction with any switching device of high power interrupting capacity.

In transmission installations, such as power house and sub-station installations, it is the general practice to use a disconnecting switch in the line immediately before the typical oil circuit breaker. Also, when the circuit breaker is associated with an omnibus bar, it is customary to employ a disconnecting switch in the line leading from the circuit breaker intermediate the breaker and the omnibus bar. The duty of initially interrupting the current flow is performed by the oil circuit breaker, while the function of the disconnecting switch is to thereafter enable the opening of the line whenever it is so desired where it enters the station and to thus disconnect all of the station apparatus, including the circuit breaker, from the line. Also, if it is desired, the disconnecting switch intermediate the circuit breaker and the omnibus bar may be operated. This, as is apparent, enables the repair and adjustment of the circuit breaker and other station apparatus to be performed without danger of injury from the line potential.

In practice, I have found that the ordinary type of switch locking mechanisms do not function properly when the switch is subjected to stresses and strains. This is particularly true of high tension switches or switches designed for outdoor installation and switches which employ long insulator pillars. In the case of switches employing long insulator pillars, there is quite a considerable amount of play or deflection between the terminals of the switch. I propose, in accordance with the present invention, to provide locking mechanism for electrical switches which will remain positive and re-

liable in operation even under a relatively large deflection of the insulator and switch terminals.

Now, in the case of gang operated switches, it, as is evident, is desirable to provide locking means for contemporaneously locking all of the switch units. The switches I have reference to, are of the type disclosed in my Patent No. 1,584,732 granted May 18, 1926 on my co-pending application, Serial No. 646,750, filed June 21, 1923, and are commonly referred to as "single throw gang operated switches". Due to the play existent between the switch units, I found it impracticable to employ locking mechanism connected to the switch blades of all the units. Moreover, it was far more desirable to provide a single locking mechanism independent of the units, but adapted to contemporaneously lock all of them in their closed positions.

I propose in accordance with other features of the present invention, to provide a switch having a plurality of switch units wherein a single locking device serves to contemporaneously lock all of the switch units in their closed positions.

An object of the present invention is to provide improved switch locking mechanism.

Another object of the present invention is to provide a switch having a plurality of switch units wherein one lock suffices to lock all of the units thereof.

Other objects and advantages of the present invention will more fully appear from the following detailed description taken in connection with the accompanying drawings which illustrate one embodiment thereof and, in which,

Fig. 1 is a front elevation of a switch embodying the features of the present invention;

Fig. 2 is an end elevation of the switch illustrated in Fig. 1;

Fig. 3 is an enlarged sectional view taken on the line 3—3 of Fig. 2;

Fig. 4 is a modification of the structure illustrated in Fig. 2 showing another manner in which the switch may be mounted;

Fig. 5 is a view taken on the line 5—5 of

Fig. 1, showing the link mechanism for operating each switch unit; and

Fig. 6 is a view of a modification of my invention showing an electrically operated lock.

Referring now to the drawings in detail, in which like reference numerals designate similar parts throughout the several views, 10 denotes a base or supporting frame upon which the switch is erected and which may be of any conventional form. The base 10 may be mounted on pole tops, switching towers, or in any other desired location. The switch I have illustrated comprises three switch units and, in practice, is termed a "three single pole, single throw gang operated switch." It is, of course, to be understood that my invention is not to be limited to the number of units shown, nor to the number of poles in each unit.

All of the three units illustrated in the accompanying drawings are identical in construction, and therefore, a description of one of the units will suffice for all of them.

Each unit comprises a pair of suitable insulators 11 and 12 which may be attached to the base 10 in any desirable manner. The free end of the insulator 12 carries the hinge terminal 13 to which the switch blade 14 is pivoted, and the free end of the insulator 11 carries the contact terminal 15. Each terminal has extending therefrom a connecting lug or clip 16 to which are connected the opposite sides of the line (not shown).

The switch blade 14 comprises two spaced blades 14' engaging its pivot on opposite sides of the hinge terminal 13. A pivot bolt 17 passes through the switch blade and through the hinge terminal. The hinge terminal is provided with the usual spring washers 18 which function to normally urge the switch blades into firm contact with the sides of the terminal 13. The other end of the switch blade 14 has passing therethrough a pair of bolts 19 and 20, one on each side of the terminal 15, which are also provided with spring washers 21. These spring washers function to draw the blades 14' together, thus enabling the blades to fit tightly on the terminal 15 and causing the switch blades to form a contact with the sides of the terminal 15.

Located intermediate the ends of the switch blade 14 is a pivot pin 22, to which one end of an element or link 23 is pivoted. The pivoted end of the link 23 preferably projects intermediate the blades 14'. If it is so desired, spring washers may be mounted on the pivot pin 22, one on each side of the blade 14. The link 23 passes through a suitable aperture in the base 10 and is pivotally attached at its other end to the free end of an arm 25 attached to a shaft 26. The shaft 26 is shown as being of a square cross section and is journaled in suitable bracket-like ele-

ments 27, carried by the base or frame 10. The arm 25 of each unit may be rigidly attached to the shaft 26 and held in place thereon by any suitable means as, for an example, set screws 25'. Also the aperture 27' in the arm 25 for receiving the shaft 26, is preferably a little larger than the cross section of the shaft, so as to permit the arm 25 to be adjusted on the said shaft (Fig. 5). This is highly advantageous, inasmuch as quite frequently one switch unit becomes a little loose with respect to the other switch units, and it is necessary to tighten it up in order for it to work in harmony with the other units. That is to say, for an example, the link 23 of one of the units may not function as readily as the links of the other units, and it is therefore desirable to so adjust the arm associated therewith that it will function contemporaneously with the other units. As may be clearly seen in Fig. 5 of the drawings, the arm 25 may be given a slight angular adjustment with respect to the shaft 26 by loosening one of the set screws 25' and tightening the other set screw. Thus these set screws constitute a micrometer adjustment for the arm 25.

The arm 25 of each switch unit is mounted on the shaft 26, which is common to all units. Therefore, by operating one switch blade about its hinge terminal, it will necessarily follow that the switch blades of the other units must be contemporaneously operated. Obviously, by locking the shaft 26 against rotation, all of the units may be locked in either their open or closed position simultaneously.

In Fig. 2 I have illustrated one way in which the base 10 may be supported. It consists essentially in rigidly attaching the base 10 to a plurality of arms 30 which are in turn bolted to transverse pipes 31 suitably attached to and carried by vertical pipes 32. It is evident by removing the bolts associated with the ends of the arms 30, the base 10 may be easily removed from the pipe supporting structure.

In Fig. 4 I have illustrated an alternative way of supporting the base 10. This consists briefly in casting the bracket-like element 27 with a web portion 35 and an integral plate 36 equipped with apertures 37. The plate 36 may be attached to any wall or other analogous supporting structure by bolts (not shown), passed through the apertures 37 and attached to the supporting structure.

Suitably attached to the upper part of the base 10 are a plurality of barriers 40 for separating the switch units from each other. Each of these barriers are preferably made of some insulating material, as for an example, asbestos wood.

As illustrated in Fig. 1, a collar 41 is suitably attached to one end of the shaft 26 to

aid in maintaining the shaft in position. Mounted on the other end of the shaft 26 is a segment-like arm 42 which has an arcuate portion 43. The arcuate portion 43, as is clearly illustrated in Fig. 2, is provided with two slots 44 and 45. The arm 42 is provided with a square aperture 46 which is somewhat larger in size than the shaft 26, on which it is mounted, so as to permit the arm 42 to be adjusted on the shaft 26 in much the same manner as the arm 25. The arm 42 may be held in place on the shaft 26 by any suitable means, such as set screws 47.

Attached to the bracket element 27 adjacent the arm 42 is a stud 48, to which one end of a small pawl or arm 50 is pivoted. The free end 51 of the arm or pawl 50 is adapted to always engage the top of the arcuate portion 43 of the arm 42. The end 51 of the pawl 50 is of such a shape as to be adapted to enter the slots 44 and 45 when either of them are positioned directly thereunder. Naturally, whenever the end 51 of the arm 50 is in either of the slots 44 or 45 in the arcuate portion 43, the shaft 26 will be prevented from being turned, due to the fact that the arm 42 is rigidly attached to the shaft 26 by the set screw 47. The end 51 of the pawl 50 is provided with a lateral projection 52 which serves to disengage the pawl 50 from the arcuate portion 43, as will now be described.

In Fig. 3 I have clearly illustrated my novel handle 60 which is adapted to be used to disengage the end 51 of the pawl 50 from the arcuate portion 43 and to turn the shaft 26. The handle 60 is provided with a square aperture 61 for receiving the end of the shaft 26. The upper end of the handle 60 is bent downwardly forming a lateral projection 62. It should be noted that this projection 62 is at less than a right angle with respect to the main body portion of the handle 60 and that it slopes downwardly. The handle 60 is first placed on the shaft 26 and then is slowly moved forward towards the arm 42. In its forward movement, the top surface of the projection 62 comes into engagement with the stud or projection 52 on the pawl 50. As indicated by the dotted lines in Fig. 3, the projection 62 of the handle 60 is adapted to cam the projection 52 of the pawl 50 upwardly until the end 51 is out of engagement with either of the slots 44-45 in which it may happen to be at any one time disposed. In other words, the handle serves to disengage the pawl 50 from the arm 42 so as to permit the shaft 26 to be turned to either open or close the switch units comprising the switch.

The operation of the switch is briefly as follows:—

Normally, when all of the switch blades of the switch are in their respective closed positions, the end 51 of the pawl 50 will fall

into the slot 44 due to gravity, and will prevent the shaft 26 from turning. Naturally, this will result in the switch blades being locked in their closed positions. Should, for any reason, one of the switch blades 14 or its associated link 23 become loose or too tight with respect to the other switch units, it may be adjusted through the arm 25. That is to say, due to the fact that the aperture 27' in the arm 25 is somewhat larger in size than the shaft upon which it is mounted, the arm 25 may be moved slightly with respect to the shaft. It is evident that by simply tightening or loosening the set screws 25', as the case may be, the necessary adjustment can be very easily accomplished.

The above described adjusting feature is a highly advantageous and desirable one, since switches of the type above described are quite frequently affected by the stresses and strains to which they are subjected.

Now since all of the switch units are connected to a common shaft, it is apparent that by locking that shaft against rotation, all of the units comprising the switch may be locked in either their closed or open positions. I accomplish this by my novel locking mechanism associated with one end of the shaft as described above. Normally, when the switch units are in their closed positions, the end 51 of the pawl 50 will be disposed in the slot 44 of the arm 42. Similarly, when the units are in their respective open positions, the end 51 of the pawl 50 will be disposed in the slot 45 of the arm 42. The arm 42 may also be adjusted with respect to the shaft 26 in the same manner as the arms 25, due to the fact that its aperture 46 is considerably larger than the shaft 26. In other words, by turning the set screws 47', the arm 42 may be moved slightly relative to the shaft 26 to bring it into its proper position with respect to the pawl or dog 50. This adjusting feature is also novel and highly useful and advantageous, since it enables the slots 44 and 45 to be maintained at all times in a proper relation with respect to the end 51 of the pawl 50.

Another novel feature of the present invention is the handle 60. This handle serves two purposes; one to disengage the pawl 50 from the arm 42, and the other to enable the turning of the shaft 26.

In Fig. 6 I have illustrated a modification of my invention showing an electrically operated lock. The switch comprises a plurality of switch units mounted upon a common base 100 which may be of any conventional form. Although only one switch unit is illustrated in Fig. 6, it is of course to be understood that the other switch units on the base 100 are identical in construction, and, hence, a description of one will suffice for all.

Each switch unit includes three insulators 101, 102 and 103, which are fastened to the

base 100 in any usual manner. The free end of the insulator 101 has mounted thereon a contact terminal 104 equipped with a lug or clip 105. Similarly, the insulator 103 has mounted on and secured to its free end a contact terminal 106 provided with a lug or clip 107. The central insulator 102 is provided with a pivot or hinge terminal 108 equipped with a lug or clip 109.

Each unit is designed to control two circuits. The lead of one circuit is connected to the lug 105 and its other lead is connected to the lug 109. One lead of the other circuit is connected to the lug 107 and its other lead is connected to the lug 109. Thus it will be seen that the lug or clip 109 has connected thereto two conductors or leads. This type of switch unit is often referred to as a double throw gang operated construction, as will become more apparent as the description progresses.

Pivoted intermediate its ends to the hinge terminal 108 is a bent or angular switch blade 110 which comprises two legs 111 and 112. The switch blade 110 may comprise two spaced elements, such as that disclosed in connection with the switch blade 14. That is to say, blade 110 may be composed of two spaced blades, such as the blades 14' of the switch blade 14, which engage the hinge and the contact terminal on opposite sides. The free end of the leg 111 of the blade 110 is adapted to engage the contact terminal 104. This leg of the blade may be equipped with spring washers 113 and 114, one on each side of the contact terminal, the construction of which is well known in the art. The free end of the leg 112 is adapted to engage the terminal 106. It is provided with washers 115 and 116, whose functions are obvious.

Located intermediate the free end of the leg 111 and the pivot terminal 108, is a pivot pin 117, to which one end of a link 118 is connected. The link 118 extends inwardly intermediate the insulators 101 and 102 and passes through a suitable aperture to the opposite side of the base. Now I desire it understood that the link 118 could equally well have been pivotally attached to the leg 112 instead of the leg 111 without deviating from the features of my invention.

Attached to the rear face of the base 100 are a plurality of bracket members 120 which carry a shaft 121 common to all switch units. The shaft 121 is shown as being of square cross section and is substantially the same as shaft 26 in my other modification. Attached to this shaft are a plurality of arms 122, one for each switch unit. Each arm may be attached to the shaft by any suitable means, as, for an example, a set screw 123. The free end of each arm 122 is pivotally attached to the other end of the link 118. Attached to one end of the shaft 121 is a handle-like member 125 equipped with eye hole or

aperture 126 for receiving a pull hook or the like.

Also secured to the shaft 121 intermediate its ends, is a segment-like arm 127 equipped with an arcuate portion 128. The periphery of this arm 127 is provided with two spaced notches 129 and 130. In Fig. 6 I have shown this arm 127 in its other position in dotted lines. Since it is behind one of the brackets 120, it of necessity, is shown in its other position also in dotted lines. The arm 127 is substantially like arm 42 in Fig. 1 and is mounted on the shaft 121 in the same manner as the arm 42 is mounted on shaft 26.

Attached to the lower part of the base 100 intermediate its ends, is a device which I term broadly "a release mechanism". I have designated this mechanism in general by the reference numeral 135. It comprises a low voltage solenoid 136 connected to a circuit 137 including the battery 138 and a switch 139. Pivotally attached at 140 to the solenoid 136 is an armature member 141 which is adapted to be drawn to a vertical position when the solenoid is energized by the closing of the switch 139. Attached to this armature member 141 is an arm 142 equipped with a lateral projection 143 on its free end adapted to fit in either of the slots 129 or 130 in the segment-like arm 127 on the shaft 121.

The operation of the modification illustrated in Fig. 6 is believed to be obvious from the foregoing description. The switch blade 110 is adapted to be moved into contact with either the terminal 104 or the terminal 106. That is to say, it is movable from one position to another position. On the drawing the leg 111 of the switch blade is shown locked in engagement with the terminal 104. This is accomplished by the projection 143 of the arm 142 engaging in the slot or groove 130 of the arm 127. The arm 142 is held in its engaged position as long as the solenoid 136 is energized. That is to say, as long as the switch 139 is closed, the armature member 141 will be attracted by the solenoid and the arm 142 will be moved upwardly into engagement with the arm 127. Whenever it is desired to relieve the locking mechanism, the switch 139 is opened and the arm 142 of its own weight drops, separating the armature 141 from the end of the solenoid 136. Then by operating the handle 125, the leg 111 may be moved out of engagement with the terminal 104 and the leg 112 moved into engagement with the terminal 106. Next, by closing the switch 139, the arm will engage in the slot 129 of the aperture 126 and lock the switch blade in a second position.

I desire it understood that my invention is not to be limited to a switch blade movable into only two positions. It is evident that the segment-like arm 127 may be provided with more than two slots, such as slots 129

and 130. In other words, it could equally well be provided with a slot or groove on its periphery intermediate the two disclosed, by which the switch blade 110 could be locked in an open position away from both the terminals 104 and 106.

I desire it understood that although I have disclosed and described specifically what I deem my preferred embodiment of my invention, that the invention is not to be limited thereby, but only in so far as defined by the scope and spirit of the appended claims.

I claim:—

1. In combination, a switch comprising a plurality of switch units, a frame upon which the said units are disposed, a shaft common to all of these units for operating them, a lock member carried by the said shaft equipped with a pair of slots, one of the said slots being adapted to lock the switch units in their open position, and the other slot being adapted to lock the switch units in their closed position, a pawl carried by the frame of the switch having its free end in engagement with the said lock member, the said pawl being adapted to co-operate with the said slots in locking the switch units, and means for controlling the position of the pawl including an electric solenoid and an armature associated therewith.

2. In combination, a non-circular operating shaft, a plurality of switch operating means operated by said shaft, said means having a slight angular motion with respect to the shaft, and each of said means including two screws for locking it to said shaft, said screws being disposed at an angle to one another whereby the screws constitute means for moving the operating means with respect to the shaft for adjusting the relative positions of the shaft and the operating means.

3. In combination, a non-circular operating shaft, means mounted on the shaft to have a slight angular motion with respect to the shaft, and two screws locking the means to the shaft, said screws being disposed at an angle to one another whereby said screws constitute means for moving the first named means with respect to the shaft for adjusting their relative positions.

4. In a gang operated switch, a plurality of switch units, a common operating shaft for operating the units, and positive operating means associated with each switch unit and operable while the unit is connected to the shaft for imparting a limited adjusting motion to the switch unit for adjusting the position of the individual units with respect to the shaft.

5. In combination, a non-circular shaft, means mounted on the shaft and having a limited angular motion with respect thereto, and set screw means extending between the shaft and the first named means and rotatable to impart a relative motion to said means

with respect to the shaft for adjusting the position of said means on said shaft.

6. In combination, a switch comprising a plurality of switch units, a shaft common to all of the switch units for opening and closing them, locking means for locking the shaft against movement, and operating means removably mounted on the shaft for operating the shaft, said operating means including means for disengaging the locking means responsive to the insertion of the operating means on the shaft.

7. In combination, a switch comprising a plurality of switch units, a shaft common to all of the units for operating them, a lock member carried by said shaft and including a pair of slots, a locking pawl cooperating with the slots for locking the shaft against movement when the shaft is in the open position and when the shaft is in the closed position, an operating member on the shaft for operating said shaft, and means on the operating member and rigid therewith for releasing said pawl.

In witness whereof, I hereunto subscribe my name this 15th day of September, 1925.

CHRISTEN CHRISTENSEN.