No. 836,994. PATENTED NOV. 27, 1906.

O. O. RIDER.

INTERLOCK FOR ELECTRIC SWITCHES.

APPLICATION FILED SEPT. 28, 1905.

2 SHEETS—SHEET 1.

Fig. 1

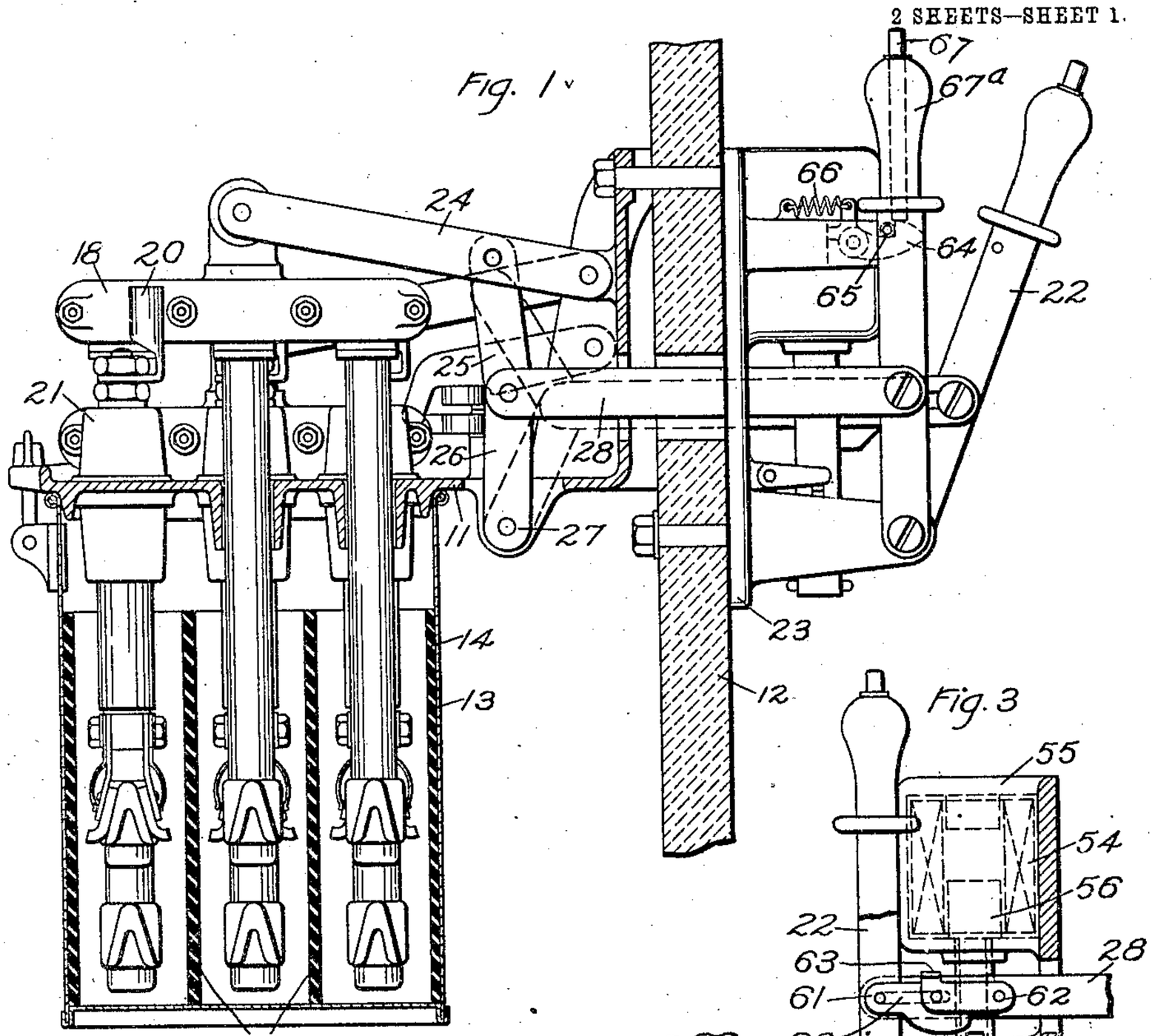
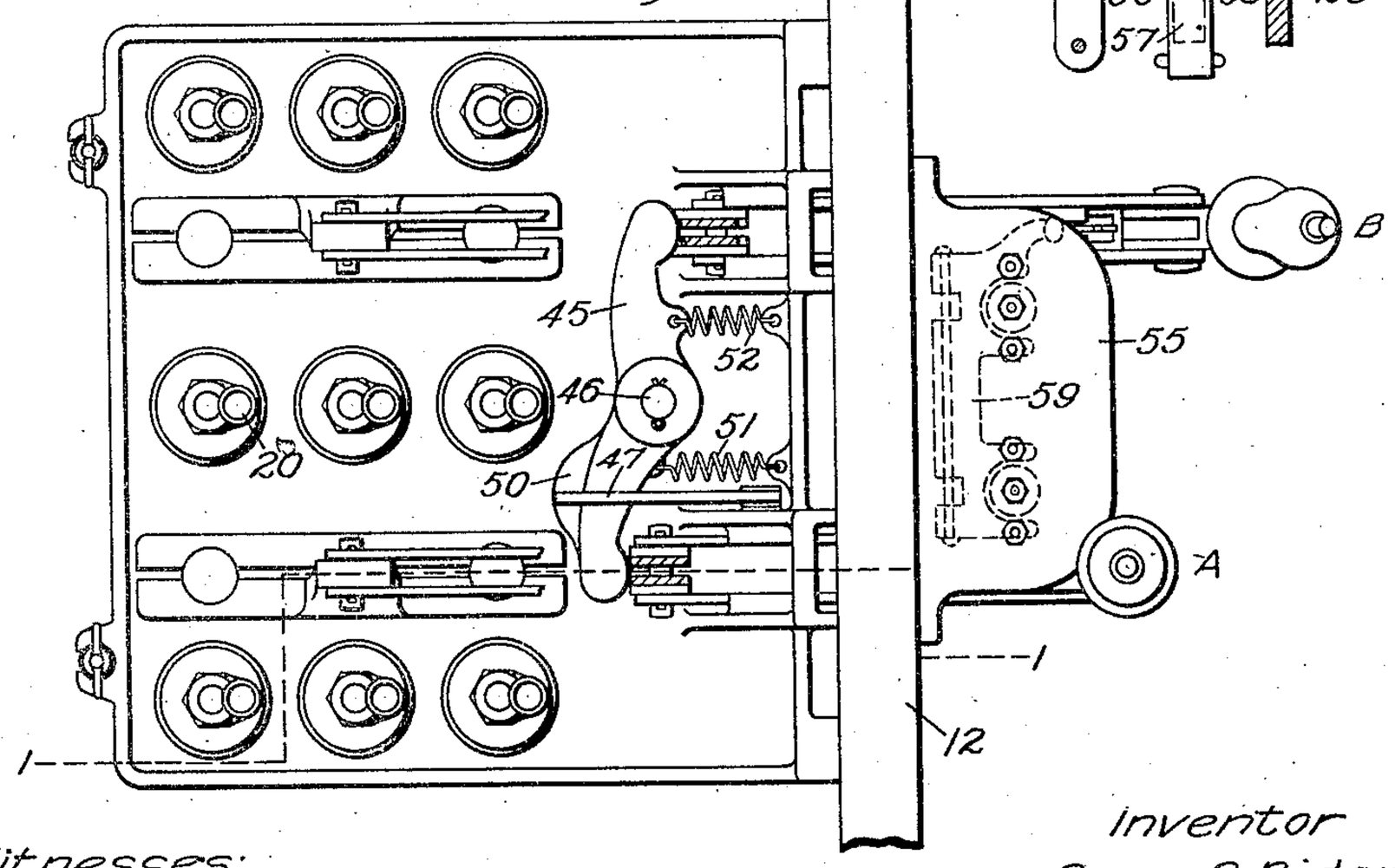


Fig. 3

Fig. 2



Witnesses:
Murray D. Baldwin
Helen Orford

Inventor
Oran O. Rider
By Albert G. Davis
Atty

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2 SHEETS—SHEET 2.

Fig. 4

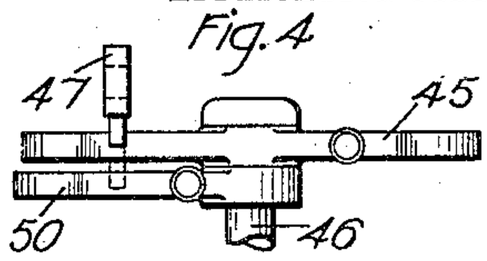


Fig. 6

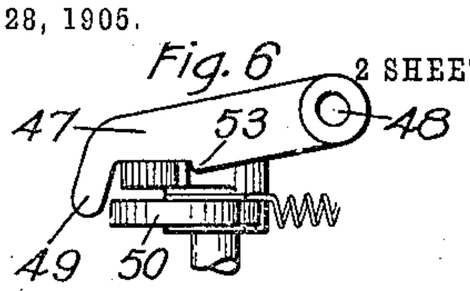


Fig 5

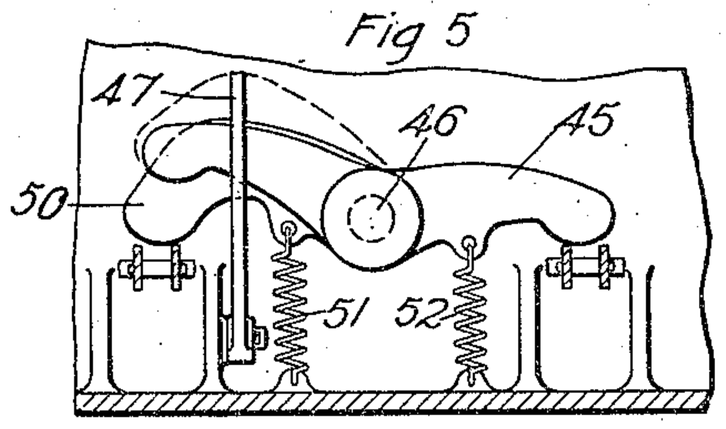


Fig. 7

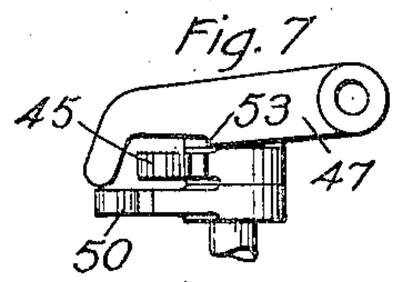


Fig. 8

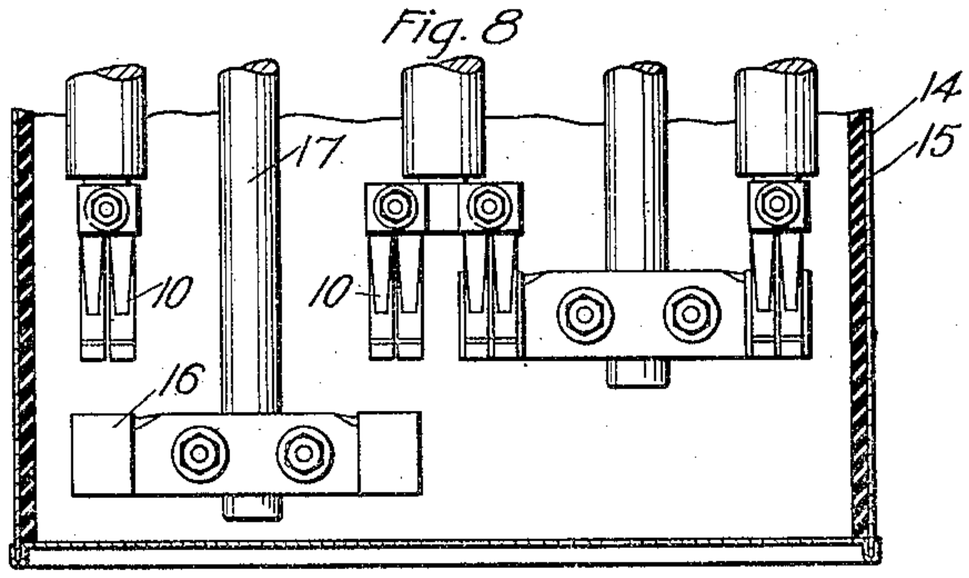


Fig. 9

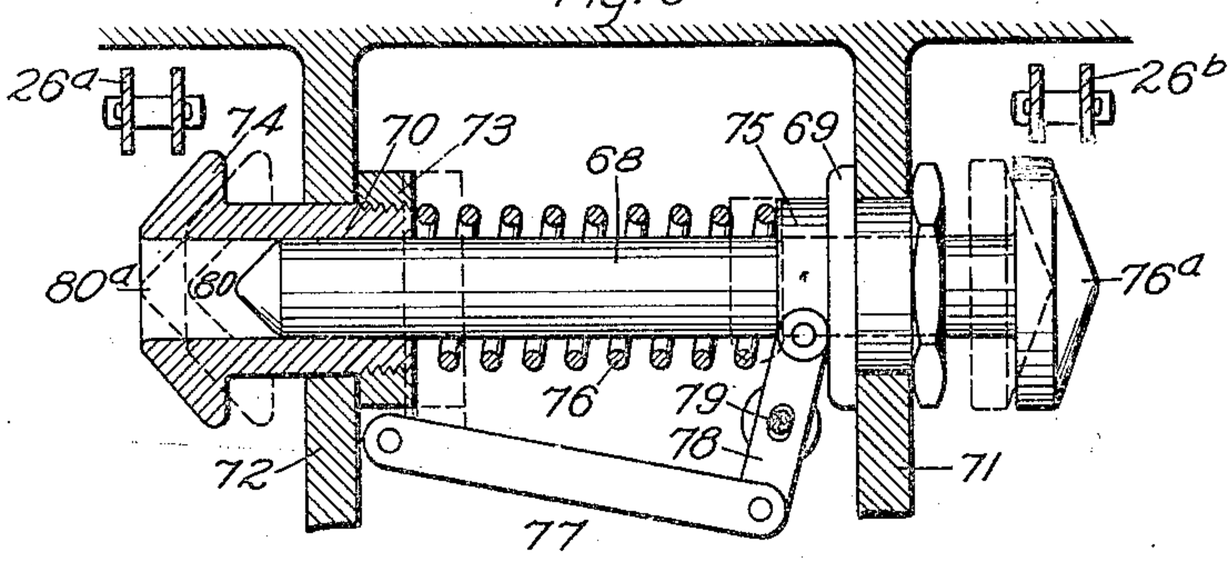
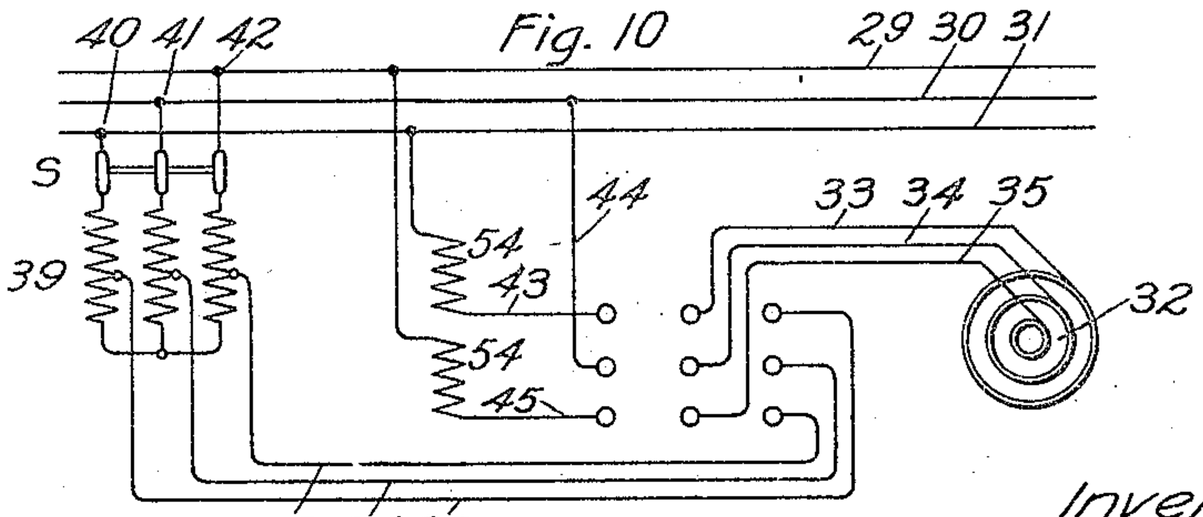


Fig. 10



Witnesses,
Murray D. Padgley
Helen Alford

Inventor.
Oran O. Rider.
By Albert G. Davis
Atty.

UNITED STATES PATENT OFFICE.

ORAN O. RIDER, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

INTERLOCK FOR ELECTRIC SWITCHES.

No. 836,994. Specification of Letters Patent. Patented Nov. 27, 1906.

Application filed September 28, 1905. Serial No. 280,490.

To all whom it may concern:

Be it known that I, ORAN O. RIDER, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Interlocks for Electric Switches, of which the following is a specification.

The present invention relates to electric switches, and more particularly to interlocking means which will permit their operation only in a definite manner.

In many electrical systems it is absolutely necessary in order to insure safety to the operation of the system that the switches employed therein be operated in a particular way.

The present invention consists in interlocking mechanism of this sort which when used with a plurality of switches requires their operation not only in a definite order, but the restoration of the switch last operated to its former position before operating the next.

The invention is particularly applicable to switches employed in starting and running induction-motors and although capable of other uses will be described in that connection.

Referring to the accompanying drawings, in which two forms of the invention are disclosed, Figure 1 is a partial sectional elevation of an oil-switch to which interlocking mechanism constructed in accordance with the present invention is applied, the section being taken on a plane indicated by the line 1 1 of Fig. 2. Fig. 2 is a plan view of the same; Fig. 3, a detail illustrating the automatic trip mechanism. Figs. 4, 5, 6, and 7 illustrate different views of the interlocking mechanism. Fig. 8 is a detailed view illustrating the arrangement of the switch-contacts. Fig. 9 is a view of a modified form of the invention, and Fig. 10 is a diagram of electric connections.

Throughout the views like characters refer to like parts.

The switch to which I have shown my invention applied is a three-phase oil-switch of a well-known type and comprises a plurality of fixed contacts 10, projecting downwardly from a horizontal supporting-frame 11, suitably secured to a switchboard or other support 12. The contacts 10 are surrounded by an oil-can 13, provided with a suitable insulating-lining 14 and partitions 15 between the contacts of the different phases. Coöperating with these fixed contacts are the bridging-contacts 16, carried at the lower ends of reciprocating rods 17, which are secured at their upper ends to a yoke 18, directly connected to the operating mechanism of the switch. The contacts 10 are provided at their upper ends with suitable terminals 20 and are maintained out of electrical engagement with the supporting member 11 by porcelain insulators 21 in a well-known manner. Each set of bridging-contacts 16 is operated by an independent operating-lever 22, pivotally secured to a plate 23; carried on the front of the switchboard 12. The movements of the operating-levers 22 are communicated to the yokes 18 and thence to the bridging-contacts by means of a system of links and levers. This system comprises a lever 24, pivotally secured at its opposite ends to the yoke 18, and the vertical portion of the frame 11. This lever is rocked about its fixed pivotal point so as to reciprocate the yoke 18 and movable contacts of the switch by means of a toggle consisting of the links 25 26, acting between said lever and a fixed point 27 on the supporting-frame 11. The toggle is collapsed and extended through the agency of the link 28, which is connected at its outer end to the lever 22.

The mechanism thus far described constitutes practically two independent operable switches, which in the starting and running of an induction-motor are intended to be operated successively and so that at any time only one switch will be closed. If one of these switches, which may be designated A, be considered as the starting-switch, and the other, which may be designated B, the running switch, the switch A will first be thrown when starting the motor, and when the motor has speeded up somewhat the switch A will be opened and the switch B simultaneously closed, so as to disconnect the motor from the compensator and connect it directly to the line. This simultaneous movement of the switches is brought about by the operator holding one switch-lever in each hand and simultaneously throwing one lever in and the other out. This operation will be clearly apparent from Fig. 10, where 29, 30, and 31 designate the three legs of a three-

phase supply-circuit for the induction-motor 32. The closing of the starting-switch A connects the motor-leads 33, 34, and 35 and the leads 36, 37, and 38, running to the compensator 39, which is directly connected, through a disconnecting-switch S, to the three legs of the line at the points 40, 41, and 42. When the running-switch B is closed, the leads 33, 34, and 35 of the motor are connected to the leads 43, 44, and 45, respectively, which are directly connected to the three legs of the line through the trip-coils, which open the switch from its running position. In such a system it is necessary that the circuit through the compensator be broken by opening the switch A before the switch B is closed to establish direct connection with the line, since the reactive coil of the compensator would burn out or in any event waste energy. This object is obtained by the use of the interlocking mechanism constituting the subject of the present invention. This interlocking mechanism is preferably located on the upper side of the supporting-frame 11 of the switch in a position to obstruct the movement of certain parts of the operating mechanism. According to one form of the invention a lever 45 is centrally pivoted at the point 46 to the upper side of the frame 11 midway between the actuating-toggles of the two switches. The outer ends of the lever 45 are adapted to engage the rear faces of the links 26 of the toggles, thus serving as stops, and the pivot 46 is so positioned that the outer ends of the lever will prevent both of the toggles being extended at the same time. In other words, this lever will prevent the closing of both switches at the same time. In the operation of the mechanism this necessitates the opening of the switch A before it is possible to close the switch B. Now in order to insure the operation of the switch A before the operation of the switch B, I employ a vertically-movable latch 47, pivoted at the point 48 to a portion of the supporting-frame 11 and provided with a tail 49 at its outer end, which may be engaged by a lever 50, carried by the pivot 46 and projecting into the path of movement of the toggle-link 26 of the switch A. The lever 50 is drawn at all times against the link 26 of the switch A by a spring 51, while the opposite end of the lever 45 is drawn similarly against the corresponding toggle-link of the switch B by the spring 52, these springs being connected, respectively, between the said levers and fixed points on the frame 11. The latch 47 through the agency of a shoulder 53, which normally engages the edge of the adjacent portion of the lever 45, locks said lever in the position shown in Fig. 5, and thereby prevents the closing of switch B until the latch is removed. This latter function is performed by the lever 50, which engages the tail 49 of the latch and removes it from latching position whenever the switch A is closed. With this arrangement of the parts it will be seen that both switches may be open at the same time, while the switch A must be closed before the switch B, as only one switch can remain in a closed position at any time. The switch-levers are placed side by side, so that one may be held in each hand of the operator. A quick movement, simultaneously closing one and opening the other, permits transfer without stopping the motor. For instance, if it be assumed that both switches are open and it is desired to start up the motor the switch B cannot be thrown, since the lever 45 will be held in the position illustrated in Fig. 5 by the latch 47. It will therefore be necessary to first close the switch A. The closing of this switch will distend its actuating-toggle and force the toggle-link 26 against the lever 50 and carry it outward, so as to release the latch from engagement with the lever 45. This will then free the lever 45 and permit the throwing of the switch B. The throwing of the latter switch will in turn force its toggle-link 26 against the adjacent end of the lever 45, and in order that the toggle may be properly extended, so as to close the switch B, it will be necessary to open the switch A in order to remove the obstruction from the other end of the lever 45.

In the system outlined when the motor 32 is once started the switch B will remain closed. In order that this switch may therefore be automatically tripped in case of overload, I have illustrated a well-known type of trip-loose connection between the operating-lever 22 of this switch and the connecting-link 28, which is adapted to be operated by trip-coils 54, inclosed in a casing 55, formed integral with the plate 23, carried on the face of the switchboard 12. These trip devices are also of a well-known construction and comprise a movable core 56, extending downward within a calibrating-tube 57 and provided with a projection 58, adapted to engage a tripping-lever 59 upon the energization of the coil 54. A three-phase switch being shown, two of these coils 54 are employed in two legs of the circuit and each is arranged to operate on the same trip mechanism, so as to insure a tripping of the circuit in case of dangerous conditions therein, as is well known in the art. As it is unnecessary to trip the switch while the motor is fed through the compensator, only the running-lever is provided with the trip-loose connection. The trip-loose connection between the lever 22 and its connecting-link 28 is provided by slotting the link, as indicated at 60, so that said link may move independently of the lever 22 far enough to permit the switch to open under the action of gravity. A positive connection is established between lever 22 and the link 28 by the employment of a toggle consisting of a link 61 and 62. These

links are pivoted at their non-adjacent ends to the lever 22 and to link 28, respectively. Fig. 3 shows the toggle formed by these links distended and forming a positive connection between the lever 22 and the link 28. In this position the toggle is slightly overset, and its downward movement is limited by the engagement of the stops 63 on the link 62 with the upper edge of the adjacent portion of the link 28. In operation when either of the coils 54 becomes unduly energized by reason of the overloaded condition of the circuit the trip-arm 59 will be forced upward against the adjacent portion of the toggle-link 61 with sufficient force to break the toggle, and thereby permit the link 28 to be thrown outward independently of the movement of the operating-lever 22 in response to the normal tendency of the switch parts. For the purpose of maintaining switches closed suitable latches 64 are provided for the operating-levers 22. These latches cooperate with pins 65 upon the levers and are normally held in engaging position by the springs 66, being removed from said position by the push-pins 67, extending through the handle 67ª at the outer end of the lever.

In the alternative form of the invention (illustrated in Fig. 9) 26ª and 26ᵇ represent movable portions of the switches A and B, respectively, corresponding to the toggle-links 26, described heretofore, and the movement of these members is obstructed, so as to require a like movement of the switches A and B. The mechanism for accomplishing this consists of a bolt or pin 68, slidable within a fixed bearing 69 and a movable member 70.

The bearing 69 is secured to a flange 71 of the fixed supporting structure, such as the supporting-frame 11 of the switch previously described, while the member 70 is slidable through an opening in a similar flange 72. The movements of member 70 are limited by a collar 73, secured to its inner end, and a head 74, secured to its outer end. The member 68 has secured to it a collar 75, and a coiled compression-spring 76 surrounds the shank of the member 68 and bears at its opposite ends against the collars 73 and 75. The outer end of the member 68 is provided with a head 76ª, similar to the head 74 on the member 70. Any sliding movement given to the member 70 will be transmitted to the member 68 by means of a link 77, connecting the collar 73 on the member 70 with a lever 78, which is pivotally supported midway of its length by a pivot 79 and pivotally secured at its opposite end to the collar 75 on the member 78. The parts have definite proportions, which will be best understood by considering the operation of the device. As assumed, the member 26ª is connected with the starting-switch and the member 26ᵇ with the running-switch, and the parts are in the positions corresponding to the open positions of the switches. It will be seen that the running-lever cannot be closed, first by reason of the square shoulder on head 76ª, which lies in the path of the toggle. If now the starting-switch be operated, the member 26ª will be drawn outward into engagement with the inclined surface of the head 74, thereby forcing the member 70 inward to the dotted-line position. This movement will be transmitted through the links 77 and lever 78 to the member 68, and the latter will be drawn inward to its dotted-line position. This movement will carry the head 76ª far enough to allow the member 26ᵇ to be drawn downward against the inclined surface of said head. If this is attempted before the member 26ª is returned to the position illustrated, the point 80 at the opposite end of the member 68 will come up against the member 26ª, thereby stopping its movement before the head 76ª has been moved far enough to allow the member 26ᵇ to clear. From this it is apparent that the running-switch cannot be closed until the starting-switch is opened. It is also clear that the starting-switch must have been moved part way, so as to clear shoulder on 76ª. In fact, as already said, the movements of the two levers are simultaneous. As soon, however, as the starting-switch is opened the member 26ᵇ is unobstructed, and the closing movement of the running-switch may be completed. This will force the head 80 of the member 68 into the dotted-line position 80ª, and, as is clearly shown, this will prevent the closing of the starting-switch by obstructing the movement of the member 26ª. However, as soon as the running-switch is opened the spring 76 will return the parts to the full-line position, and the operation above outlined may be repeated.

From the above it will be apparent that many modifications and alterations may be made in the specific forms of the invention disclosed without departing from the spirit and scope of the present invention. I therefore do not wish to be limited to the exact matter disclosed, but aim to cover by the terms of the appended claims all such alterations and modifications.

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

1. The combination of a plurality of electric switches, and means for compelling both the operation of the switches in a definite order and the restoration of the switch last operated to its former condition before operating the next.

2. The combination of a plurality of electric switches, and means for compelling both the closing of the switches in a definite order and the opening of the switch last closed before closing the next.

3. The combination of a plurality of switches, a movable stop for one of said switches, means for holding said stop in engaging position, and means actuated by another switch to release said holding means and to control the position of said stop.

4. The combination of a plurality of electric switches, a movable stop for each switch, means for holding the stop of one switch in engaging position and means actuated by the movement of another switch to release said holding means.

5. The combination of a plurality of electric switches, a pivoted stop for each switch, means for holding the stop of one switch in engaging position, and means actuated by the movement of another switch to release said holding means.

6. The combination of a plurality of electric switches, a single stop member movable into different positions to engage the different switches, means for holding said member in engaging position for one of said switches, and means actuated by the movement of another switch to release said holding means.

7. The combination of two electric switches, comprising two movable elements, a stop-arm pivoted between said elements and movable into alternate engagement therewith, a latch for holding said arm in the path of movement of one of said elements, and means actuated by the other element to release said latching means.

8. The combination with a pair of switches, of means permitting a free simultaneous movement of both in opposite directions, and a lock engaging said means to compel the operation of the switches in a different order and actuated by one of said switches.

In witness whereof I have hereunto set my hand this 27th day of September, 1905.

ORAN O. RIDER.

Witnesses:
BENJAMIN B. HULL,
MARGARET E. WOOLLEY.