

Sept. 8, 1942.

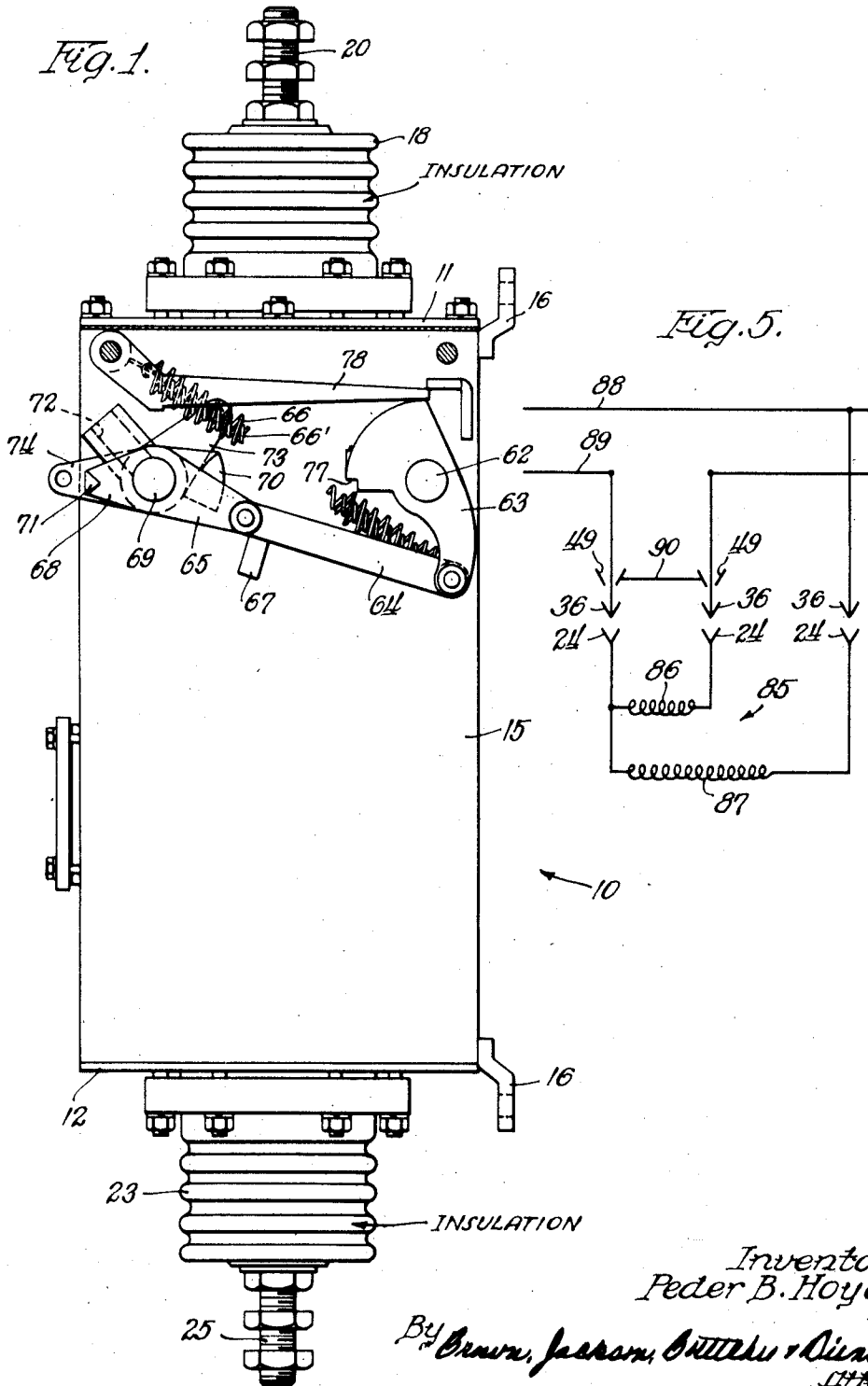
P. B. HOYE

2,295,175

SWITCH CONSTRUCTION

Filed May 5, 1941

3 Sheets-Sheet 1



Sept. 8, 1942.

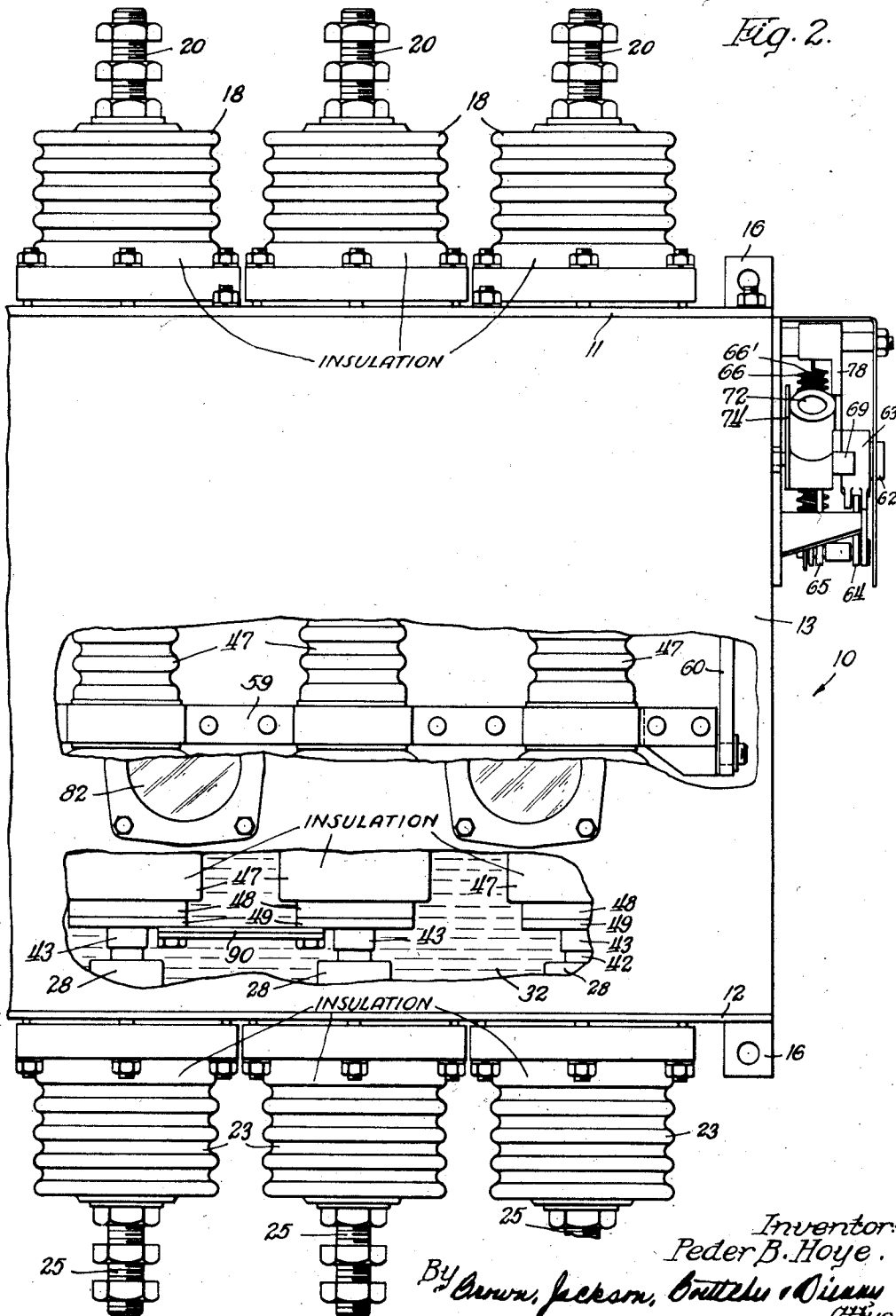
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SWITCH CONSTRUCTION

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3 Sheets-Sheet 2



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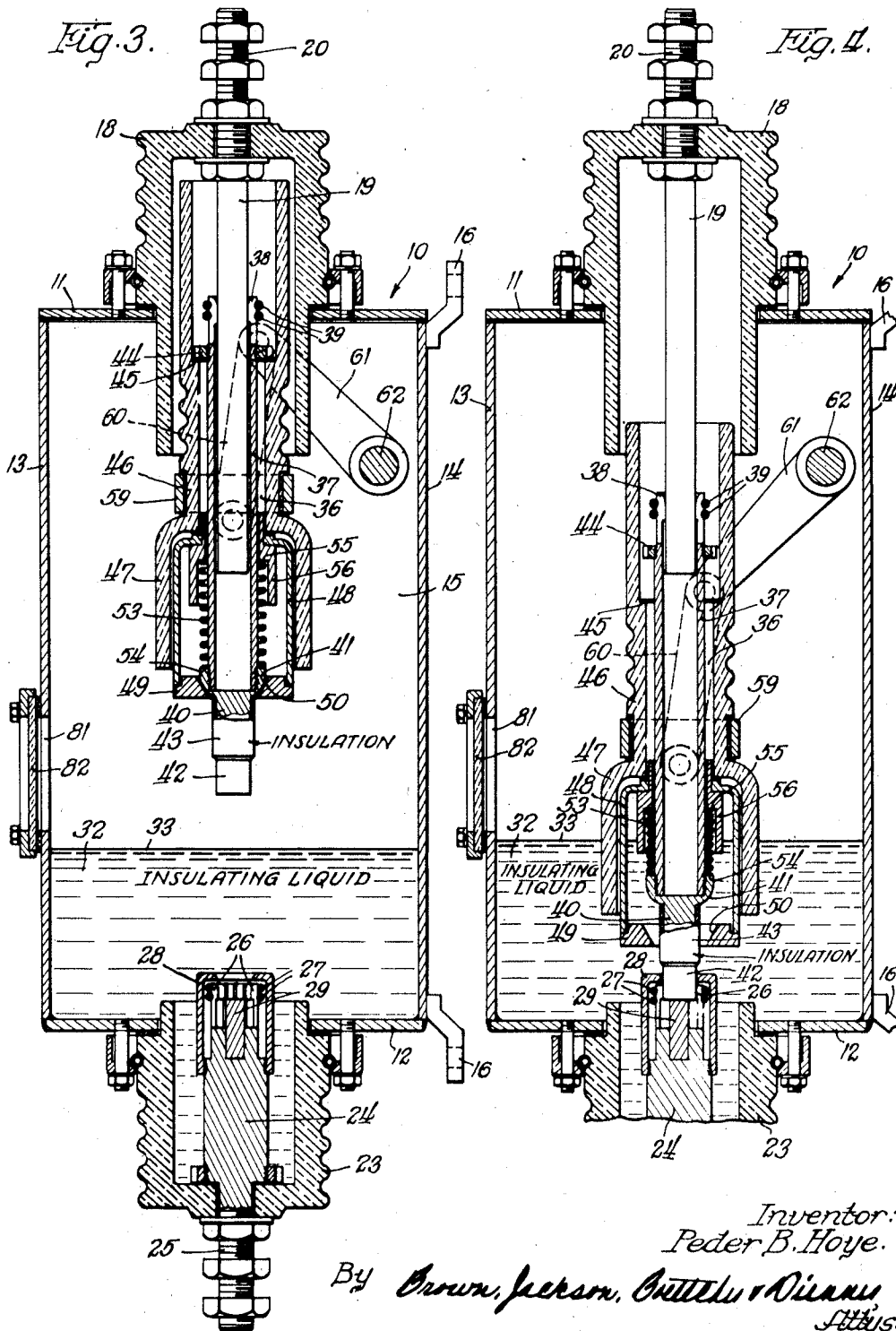
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UNITED STATES PATENT OFFICE

2,295,175

SWITCH CONSTRUCTION

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10 Claims. (Cl. 200—150)

My invention relates, generally, to electric circuit interrupting apparatus, and it has particular relation to switch constructions.

An object of my invention is to improve the insulating qualities of an electric switch constructed as disclosed herein when it occupies the open circuit position.

Another object of my invention is to provide a switch construction in which a relatively small amount of insulating liquid is required for insulating the separable switch members when the switch occupies the open circuit position.

A further object of my invention is to provide a movable switch member construction so that accurate adjustment of the throw of the operating mechanism therefor is not required for effecting proper operation in the switch closed position.

It is also an object of my invention to provide for short circuiting certain of the switch members of a switch comprising a plurality of switch members when the switch occupies the open circuit position.

Other objects of my invention will, in part, be obvious and in part appear hereinafter.

For a more complete understanding of the nature and scope of my invention, reference can be had to the following detailed description, taken in connection with the accompanying drawings, in which:

Figure 1 is a view, in end elevation, of a preferred embodiment of my improved switch construction;

Figure 2 is a view, in front elevation, of the switch construction shown in Figure 1, certain parts being broken away for convenience and for illustrating the details of construction;

Figure 3 is a longitudinal sectional view of the switch construction shown in Figures 1 and 2, which illustrates the arrangement of the parts when the switch is in the open circuit position;

Figure 4 is a view, similar to that shown in Figure 3, illustrating the positions of the various parts when the switch is in the closed circuit position; and

Figure 5 illustrates, diagrammatically, how the switch construction disclosed herein can be employed for controlling the connections to a voltage regulator.

Referring now to Figures 1, 2, 3, and 4 of the drawings, it will be observed that the reference character 10 designates, generally, a metallic housing which is constructed so as to be fluid tight. The housing 10 comprises top and bottom plates 11 and 12, and front and back plates 13

and 14. The plates 11, 12, 13 and 14 are suitably fastened together, as by welding, and to end plates 15 so as to form a relatively strong construction for the housing 10. Lugs 16 are suitably secured to the rear plate 14 to permit mounting of the housing 10 on any suitable means.

The switch construction disclosed herein is of the three pole type, and, accordingly, three insulator bushings 18 are mounted on the top plate 11 and suitably secured thereto. It will be observed that the insulator bushings 18 are hollow and that they extend through suitable apertures in the top plate 11 downwardly to well within the housing 10. Each of the insulator bushings 18 carries an upper switch member 19 in the form of a metallic rod that is threaded at its upper end, as indicated at 20, to facilitate connection of a line conductor thereto, as will be readily understood.

The bottom plate 12 likewise carries three insulators 23 that are suitably secured thereto from underneath. The insulators 23 are hollow, as shown, and each carries a lower switch member 24 having, at its lower end, a threaded portion 25 to facilitate connection of a line conductor thereto.

At the upper end of each of the lower switch members 24 there are provided individually flexible contact fingers 26 that are biased inwardly by garter springs 27. A guard and guide fitting 28 is threaded onto the upper end of the lower switch member 24 in each case, and serves to protect the flexible contact fingers 26 and to guide a movable switch member therebetween as will be set forth hereinafter. A stop member 29 extends upwardly from each of the lower switch members 24 for limiting the downward movement of the movable switch member.

A body 32 of insulating liquid is located in the lower portion of the housing 10, and its level 33 is such that it fully covers the lower switch members 24 as shown. However, only a sufficient amount of the liquid is provided so that the movable switch members are withdrawn wholly therefrom when they are operated to the open circuit position. There will then be no leakage path through the insulating liquid when the switch is in the open circuit position. Also, a relatively small amount of the insulating liquid is required since it is only necessary to provide a sufficient amount to fully cover the lower switch members 24.

The construction of each movable switch member is shown in Figures 3 and 4 of the drawings.

Each movable switch member, designated generally at 36, comprises a metallic tubular portion 37 that is telescoped with the rod-like upper switch member 19 associated therewith. Its upper end terminates in contact fingers 38 which are biased by garter springs 39 into contact engagement with the associated upper switch member 19. At its lower end the tubular member 37 is threaded into the upper end of a contact plug 40 which is provided with a spherical contact portion 41 for a purpose which will be set forth hereinafter. The lower portion of the contact plug 40 is reduced as indicated at 42, and it is arranged to interfit with the contact fingers 26 of the associated lower switch member 24, with its lower end in butt contact engagement with the stop 29. A sleeve of insulation 43 surrounds the intermediate portion of the contact plug 40 for a reason which will presently be apparent.

A nut 44 is threaded on the upper end of the tubular portion 37 of the movable switch member 36, and it bears against the shoulder 45 of an insulating sleeve 46 which, as will now be apparent, carries the movable switch member 36. The insulating sleeve 46 is telescoped with the associated upper switch member 19 and also with the associated insulator bushing 18, as illustrated. The lower end of the insulating sleeve 46 is belled outwardly as indicated at 47, and it carries a cup-shaped metallic member 49 that has a contact member 49 at its lower end provided with an upwardly opening conical contact surface 50 for engagement with the contact surface 41 of the contact plug 40. A coil compression spring 53 surrounds the lower portion of the tubular portion 37 of the movable switch member 36 and reacts against a shoulder 54 on the upper end of the contact plug 40 and against a shoulder 55 on a metallic sleeve member 56 which interfits with the cup-shaped member 49, as shown.

It will be observed that, when the switch is in the open circuit position, as shown in Figure 3 of the drawings, the spring 53 maintains the contact surfaces 41 and 50 in engagement, and also holds the movable switch member 36 in its lowermost position with respect to the insulating sleeve 46. Now when the movable switch member 36 is moved to the switch closed position, as shown in Figure 4 of the drawings, by means which will presently be described, the lower end of the contact plug 40 engages the stop member 29 while the contact surface 42 thereof is engaged by the contact fingers 26 of the associated lower switch member 24. While the downward movement of the movable switch member 36 is thus arrested, movement of the insulating sleeve 46 continues, since this is permitted by the coil compression spring 53 which is compressed by this further movement. It is thus unnecessary to accurately adjust the throw of the operating means for moving the movable switch members into the switch closed position since considerable freedom of relative movement between the movable switch member 36 and the associated insulating sleeve 46 is permitted by the coil compression spring 53.

It will be observed that the continued downward movement of the insulating sleeve 46 carries the contact surface 50 of the contact member 49 out of contact engagement with the contact surface 41 of the contact plug 40. The circuit therebetween is opened, and the insulating sleeve 43 prevents accidental contact engagement between the central portion of the contact plug 40 and the adjacent portions of the contact mem-

ber 43. The insulating sleeves 46, which carry the movable switch members 36, are commonly mounted for movement together on suitable support means in the form of a frame 59 to which each of the insulating sleeves 46 is secured intermediate its ends, as shown in Figures 3 and 4 of the drawings. At each end of the frame 59 there is pivotally connected a link 60, one of which is shown by broken lines in Figures 3 and 4. Another link 61, as there shown, is connected to the link 60, and is mounted for rotation with a transverse shaft 62 that extends out through the end plate 15 as shown in Figure 1 of the drawings. A sector-shaped member 63 is secured to the outer end of the shaft 62, and it has connected thereto links 64 and 65 which provide an over-center operating mechanism that is biased to such position by double springs 66 and 66' against the stop 67. In Figure 1 of the drawings, the operating mechanism is shown in the position which corresponds to the switch closed position, as shown in Figure 4 of the drawings. It will be understood that the over-center toggle formed by the links 64 and 65 is locked in this position, and the lock must be broken manually before the switch can be operated to the open circuit position.

An operating member 68 is mounted for rotation on a pin 69 about which the link 65 also rotates, and it is provided with lugs 70 and 71 for engaging opposite sides of the link 65 for moving it from one operative position to another. The operating member 68 is also provided with a socket 72 for receiving an operating bar or lever which is used for operating the switch. An arm 73 is provided on the operating member 68 having an aperture which is arranged to register with a corresponding aperture in a stationarily mounted member 74 when the operating mechanism is moved to the open circuit position for receiving a padlock or other suitable locking means through the registering apertures to prevent unauthorized operation of the switch.

The sector 63 is provided with a notch 77 into which one end of a pivotally mounted locking member 78 is adapted to interfit for locking the switch in the open circuit position. When the switch is to be closed, the locking member 78 is moved upwardly slightly so as to disengage the shoulder 77 and permit operation of the switch to the closed circuit position.

With a view to permitting inspection of the interior of the housing 10, the condition of the insulating liquid, and the switch members, openings 81 are provided in the front plate 13 over which transparent windows 82 of suitable material, such as glass, are provided.

In order to make the housing 10 fluid tight, suitable gaskets are provided, where required, in conjunction with the insulating bushings 18, insulators 23, and windows 82.

The switch construction disclosed herein is particularly adapted for use in controlling the connections of a voltage regulator or voltage regulating transformer in a single phase alternating current circuit. Referring now particularly to the diagram shown in Figure 5 of the drawings, it will be observed that the reference character 85 designates, generally, a voltage regulator having a current winding 86 and a voltage winding 87. The voltage regulator 85 is intended for connection in a single phase alternating current circuit represented by conductors 88 and 89. The current winding 86 is arranged to be connected in series circuit relation with

conductor 89, while the voltage winding 87 is arranged to be connected across the conductors 88 and 89 in accordance with standard practice. When the regulator 85 is to be taken out of service, it is desirable that the circuit, which, under normal operating conditions, extends through the current winding 86, be completed, or that the circuit through conductor 89 be completed.

As shown in the diagram, the two left hand poles of the switch are associated with the current winding 86, and that the outside poles are associated with the voltage winding 87. For illustrative purposes, the switch is shown diagrammatically in a position intermediate the open and closed circuit positions.

When the switch is in the closed circuit position and the movable switch members 36 are in engagement with their corresponding lower switch members 24, the current winding 86 is connected in series circuit relation with the conductor 89 while the voltage winding 87 is connected across the conductors 88 and 89. Now when the switch is operated to the open circuit position, the voltage winding is disconnected from both of the conductors 88 and 89 and the current winding 86 is disconnected from the conductor 89. When the switch is operated to the full open position, the movable switch members 36 engage their respective contact members 43. As shown diagrammatically in Figure 5, these contact members 49 are interconnected by a conductor 90. The conductor 90 is shown in Figure 2 of the drawings, and may comprise one or more flexible or solid conductors. Since contact members 49 are interconnected by the conductor 90, the movable switch members 36 associated therewith are short circuited in the open circuit position of the switch, and, consequently, the circuit through conductor 89 is uninterrupted.

It will be obvious that the switch construction disclosed herein can be employed for other purposes in addition to the specific illustration just set forth. Accordingly, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim as my invention:

1. In a switch, in combination, a housing, an upper switch member in the form of a rod vertically mounted in said housing, a lower switch member in said housing aligned with said upper switch member, a movable switch member having a sleeve portion telescoped with said upper switch member and a lower portion for butt contact engagement with said lower switch member, a sleeve of insulation telescoped with said movable switch member, spring means interconnecting said sleeve of insulation and said movable switch member, and operating means attached to said insulating sleeve and extending out of said housing for moving said movable switch member along said upper switch member and into and out of engagement with said lower switch member, said sleeve of insulation being movable relative to said movable switch member when movement thereof is arrested whereby accurate adjustment of the throw of said operating means is not required.

2. In a switch, in combination, a metallic housing, an insulator bushing carried by the upper side of said housing, an upper switch member in the form of a rod carried in a vertical position by said bushing, a hollow insulator carried by the lower side of said housing and opening up-

wardly, a lower switch member carried by said insulator and spaced therefrom to provide an annular space therebetween, said lower switch member being positioned in alignment with said upper switch member, a movable switch member having a sleeve portion telescoped with said upper switch member and a lower portion for contact engagement with said lower switch member, a sleeve of insulation carrying said movable switch member and telescoped with said insulator bushing, operating means attached to said insulating sleeve and extending out of said housing for moving said movable switch member along said upper switch member and into and out of engagement with said lower switch member, and a body of insulating liquid filling said annular space and covering said lower switch member with the level thereof a substantial distance below said upper switch member, said movable switch member in the open circuit position being wholly withdrawn from said liquid.

3. In a switch, in combination, a metallic housing, an insulator bushing carried by the upper side of said housing, an upper switch member in the form of a rod carried in a vertical position by said bushing, an insulator carried by the lower side of said housing, a lower switch member carried by said insulator in alignment with said upper switch member, a movable switch member having a sleeve portion telescoped with said upper switch member and a lower portion for butt contact engagement with said lower switch member, a sleeve of insulation telescoped with said movable switch member and also telescoped with said insulator bushing, spring means interconnecting said sleeve of insulation and said movable switch member, and operating means attached to said insulating sleeve and extending out of said housing for moving said movable switch member along said upper switch member and into and out of engagement with said lower switch member, said sleeve of insulation being movable relative to said movable switch member when movement thereof is arrested whereby accurate adjustment of the throw of said operating means is not required.

4. In a switch, in combination, a housing, upper switch members in the form of rods vertically mounted in said housing, lower switch members in said housing each individual to and aligned with said upper switch members, movable switch members one for each pair of upper and lower switch members each having a sleeve portion telescoped with the upper switch member and a lower portion for butt contact engagement with the lower switch member, a sleeve of insulation telescoped with each movable switch member, spring means interconnecting each sleeve of insulation and its movable switch member, support means common to said sleeves of insulation, and operating means attached to said support means and extending out of said housing for moving said movable switch members along their respective upper switch members and into and out of engagement with their respective lower switch members, said sleeves of insulation being movable relative to their individual movable switch members when movement thereof is arrested whereby accurate alignment of said movable switch members and accurate adjustment of the throw of said operating means are not required.

5. In a switch, in combination, a metallic housing, a plurality of insulator bushings carried by the upper side of said housing, upper switch mem-

bers in the form of rods one for each bushing and carried thereby in a vertical position, a plurality of hollow insulators carried by the lower side of said housing and opening upwardly, lower switch members one for each insulator carried thereby and spaced therefrom to provide an annular space therebetween, said lower switch members being positioned in alignment with corresponding ones of said upper switch members, a plurality of movable switch members one for each set of upper and lower switch members and each having a sleeve portion telescoped with its upper switch member and a lower portion for contact engagement with its lower switch member, a sleeve of insulation carrying each movable switch member and telescoped with the corresponding insulator bushing, support means common to said sleeves of insulation, operating means attached to said support means and extending out of said housing for moving said movable switch members along their respective upper switch members and into and out of engagement with their respective lower switch members, and a body of insulating liquid filling each of said annular spaces and covering said lower switch members with the level thereof a substantial distance below said upper switch members, said movable switch members in open circuit position being wholly withdrawn from said liquid.

6. In a switch, in combination, a metallic housing, a plurality of insulator bushings carried by the upper side of said housing, upper switch members in the form of rods one for each bushing and carried thereby in a vertical position, a plurality of insulators carried by the lower side of said housing, lower switch members one for each insulator carried thereby in alignment with corresponding ones of said upper switch members, a plurality of movable switch members one for each set of upper and lower switch members and each having a sleeve portion telescoped with its upper switch member and a lower portion for butt contact engagement with its lower switch member, a sleeve of insulation telescoped with each movable switch member and also telescoped with the corresponding insulator bushing, spring means interconnecting each sleeve of insulation and its movable switch member, support means common to said sleeves of insulation, and operating means attached to said support means and extending out of said housing for moving said movable switch members along their respective upper switch members and into and out of engagement with their respective lower switch members, said sleeves of insulation being movable relative to their individual movable switch members when movement thereof is arrested whereby accurate alignment of said movable switch members and accurate adjustment of the throw of said operating means are not required.

7. In a switch, in combination, a housing, a plurality of upper switch members in said housing, a plurality of lower switch members in said housing each individual to and aligned with one of said upper switch members, a plurality of movable switch members each individual to one of said upper switch members and always connected thereto and movable into and out of contact engagement with the corresponding lower switch member, insulating means in said housing carrying each movable switch member, contact members carried by said insulating means and individual to two of said movable switch members and normally engaged thereby when they are out of contact engagement with their respective lower

switch members, conductor means interconnecting said contact members whereby the two upper switch members individual thereto are short circuited when said movable switch members occupy the open circuit position, frame means common to said insulating means, and operating means attached to said frame means and extending out of said housing for moving said movable switch members together to open and closed positions.

8. In a switch, in combination, a housing, a plurality of upper switch members in said housing, a plurality of lower switch members in said housing each individual to and aligned with one of said upper switch members, a plurality of movable switch members each individual to one of said upper switch members and always connected thereto and movable into and out of contact engagement with the corresponding lower switch member, insulating means in said housing carrying each movable switch member, contact members carried by said insulating means and individual to two of said movable switch members and normally engaged thereby when they are out of contact engagement with their respective lower switch members, conductor means interconnecting said contact members whereby the two upper switch members individual thereto are short circuited when said movable switch members occupy the open circuit position, frame means common to said insulating means, operating means attached to said frame means and extending out of said housing for moving said movable switch members together to open and closed positions, and a body of insulating liquid covering said lower switch members with the level thereof a substantial distance below said upper switch members out of which said movable switch members are withdrawn when they are moved to the open circuit position.

9. In a switch, in combination, a housing, upper switch members in the form of rods vertically mounted in said housing, lower switch members in said housing each individual to and aligned with said upper switch members, movable switch members one for each pair of upper and lower switch members each having a sleeve portion telescoped with the upper switch member and a lower portion for butt contact engagement with the lower switch member, a sleeve of insulation telescoped with each movable switch member, contact members carried by two of said sleeves of insulation, spring means interconnecting each sleeve of insulation and its movable switch member, said spring means effecting contact engagement between said contact members and the movable switch members associated therewith when they are out of contact engagement with their respective lower switch members, conductor means interconnecting said contact members whereby the two upper switch members individual thereto are short circuited when said movable switch members occupy the open circuit position, support means common to said sleeves of insulation, and operating means attached to said frame means and extending out of said housing for moving said movable switch members together to open and closed positions.

10. In a switch, in combination, a housing, upper switch members in the form of rods vertically mounted in said housing, lower switch members in said housing each individual to and aligned with said upper switch members, movable switch members one for each pair of upper and lower switch members each having a sleeve portion telescoped with the upper switch member and a lower

portion for butt contact engagement with the lower switch member, a sleeve of insulation telescoped with each movable switch member, contact members carried by two of said sleeves of insulation, spring means interconnecting each sleeve of insulation and its movable switch member, said spring means effecting contact engagement between said contact members and the movable switch members associated therewith when they are out of contact engagement with their respective lower switch members, conductor means interconnecting said contact members whereby the two upper switch members individual thereto are

5 short circuited when said movable switch members occupy the open circuit position, support means common to said sleeves of insulation, operating means attached to said frame means and extending out of said housing for moving said movable switch members together to open and closed positions, and a body of insulating liquid covering said lower switch members with the level thereof a substantial distance below said upper switch members, said movable switch members in open circuit position being wholly withdrawn from said liquid.

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