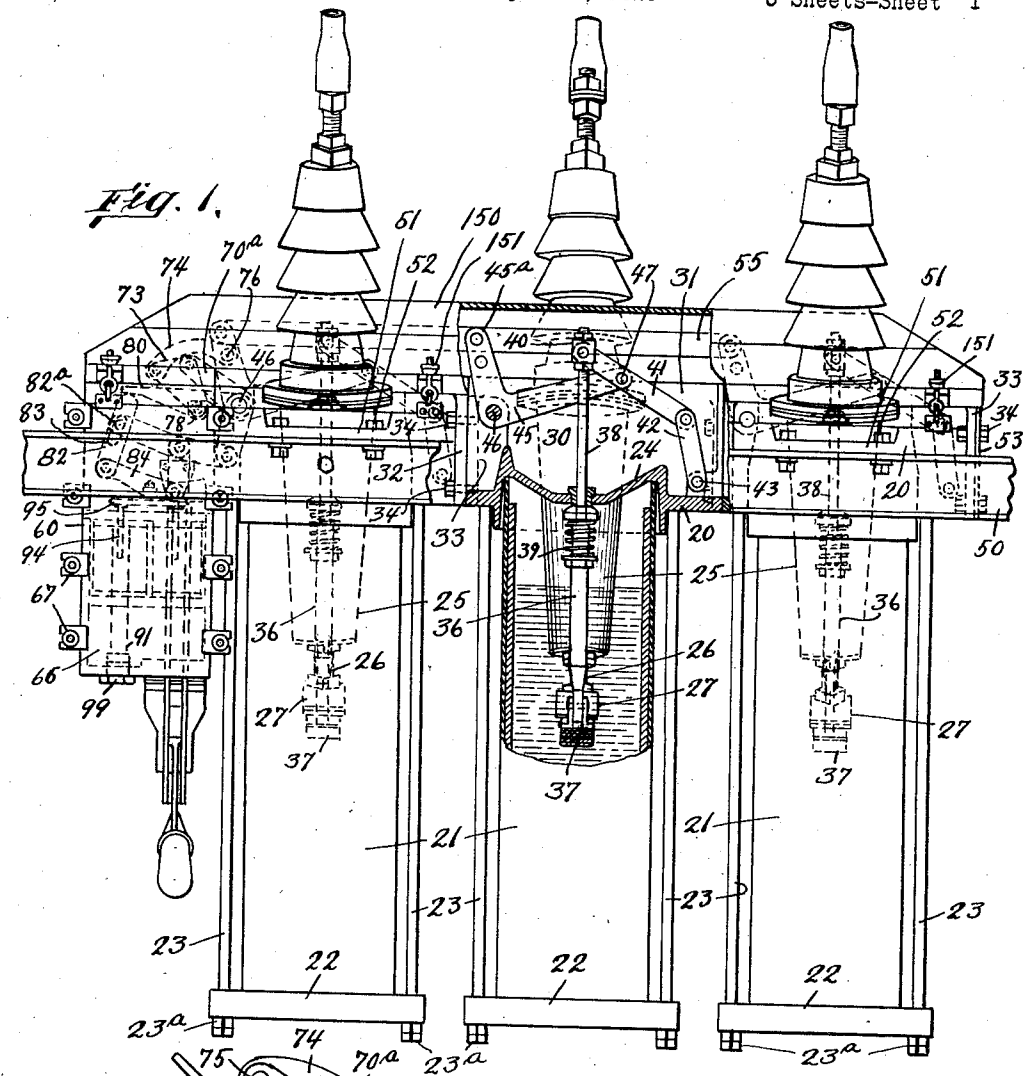
Dec. 24, 1929. C. D. AINSWORTH 1,740,558

ELECTRIC SWITCH

Filed April 2, 1923 5 Sheets-Sheet 1

Fig. 1.



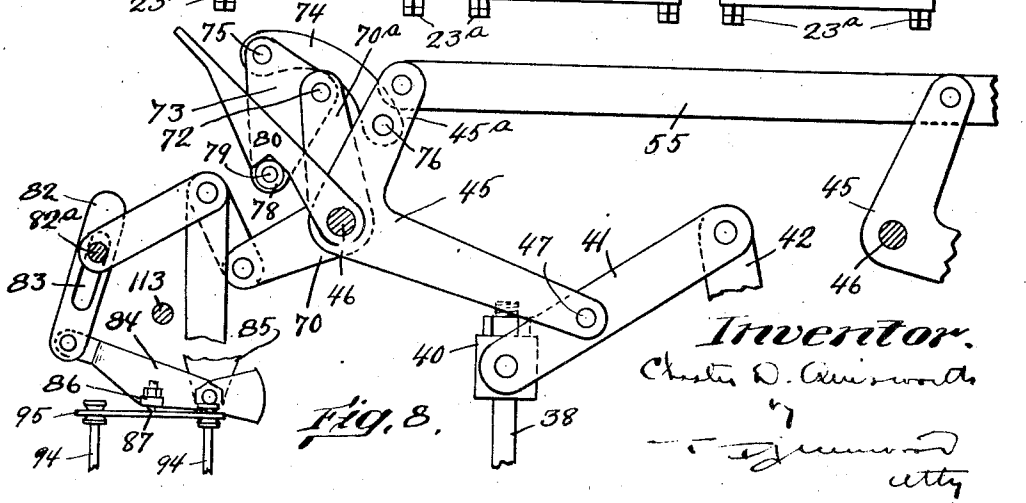


Fig. 8.

Inventor.

Charles D. Ainsworth

by

Atty

Dec. 24, 1929. C. D. AINSWORTH 1,740,558

ELECTRIC SWITCH

Filed April 2, 1923 5 Sheets-Sheet 2

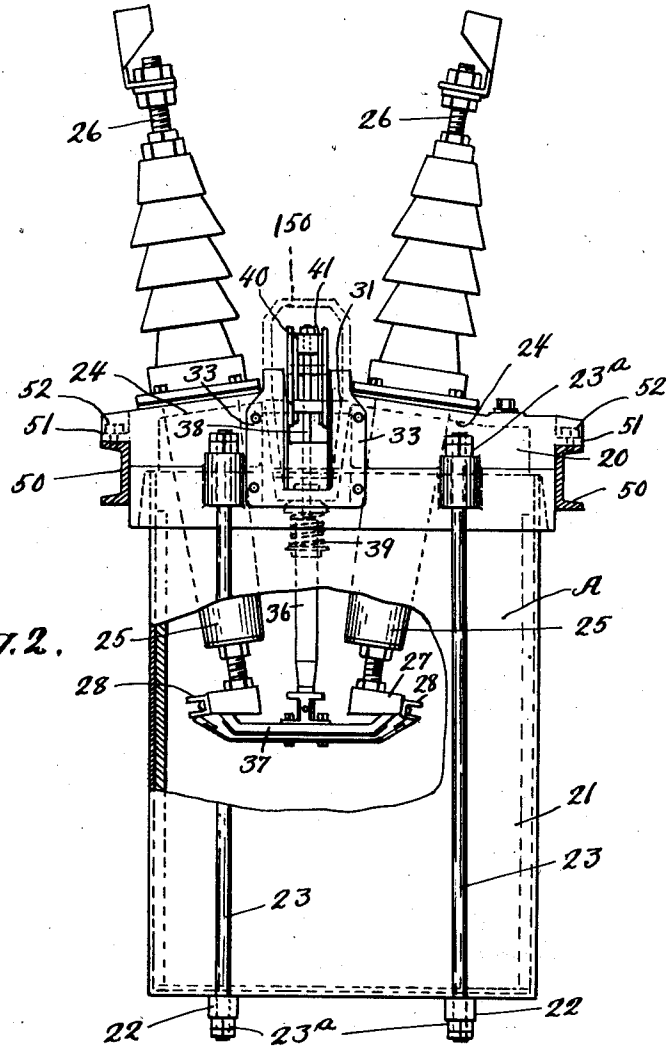


Fig. 2.

Inventor.
Chester D. Ainsworth
by
[illegible]
atty

Dec. 24, 1929. C. D. AINSWORTH 1,740,558

ELECTRIC SWITCH

Filed April 2, 1923 5 Sheets-Sheet 3

Fig. 3.

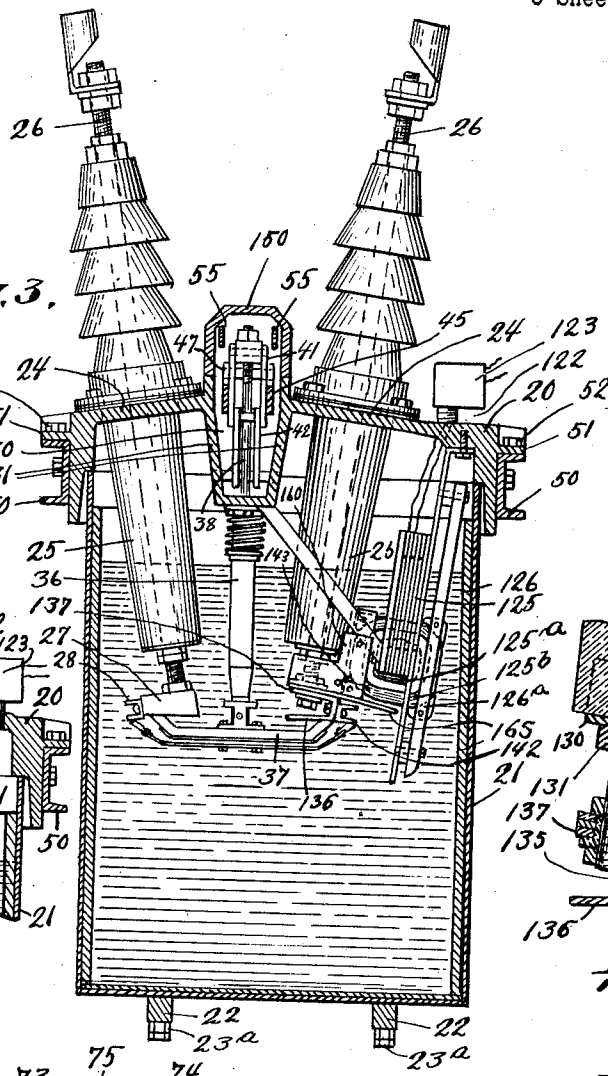


Fig. 4.

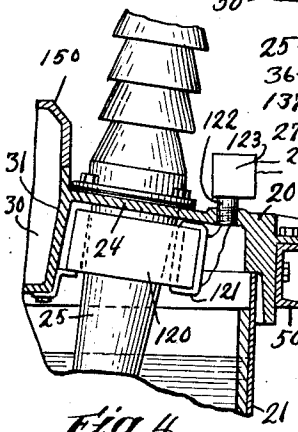


Fig. 10.

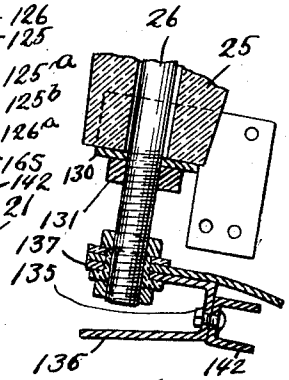
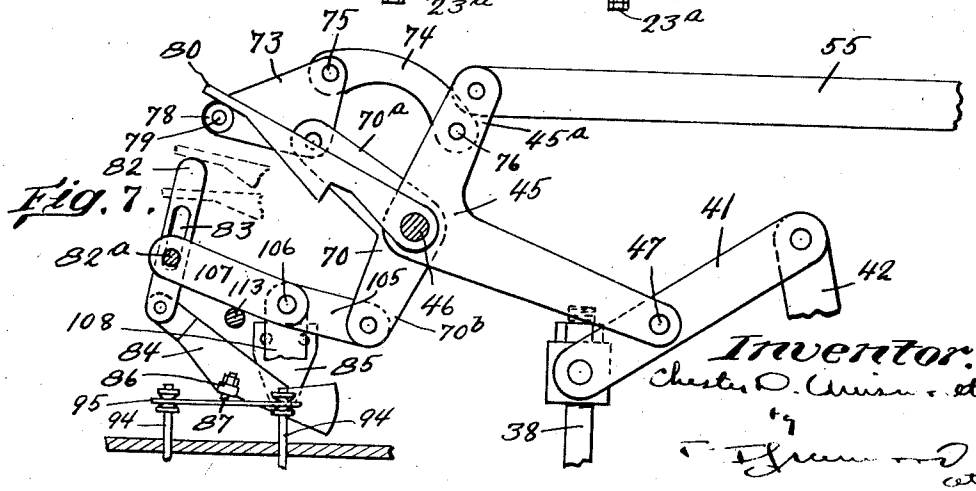


Fig. 7.



Inventor:
Chester D. Ainsworth
by
Attorney

Dec. 24, 1929. C. D. AINSWORTH 1,740,558

ELECTRIC SWITCH

Filed April 2, 1923 5 Sheets-Sheet 4

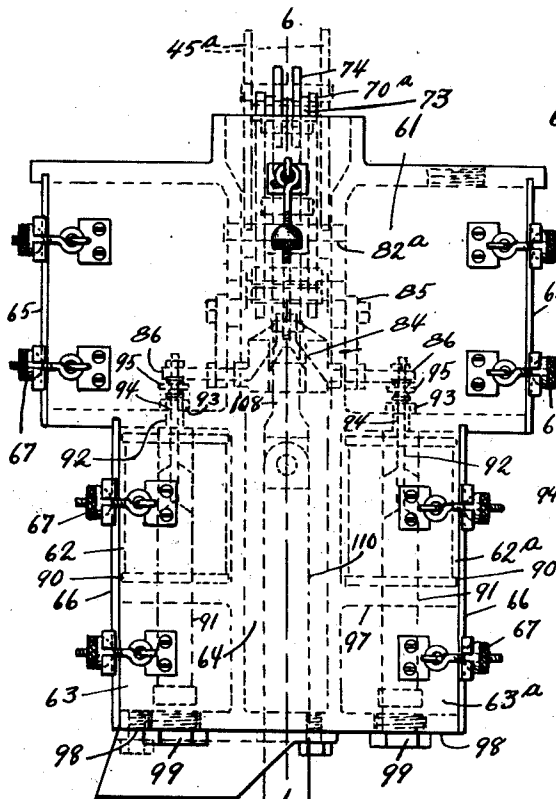


Fig. 5.

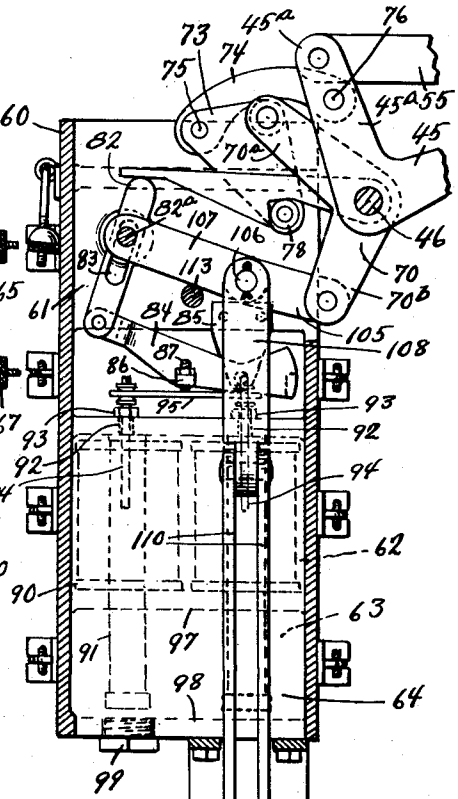


Fig. 6.

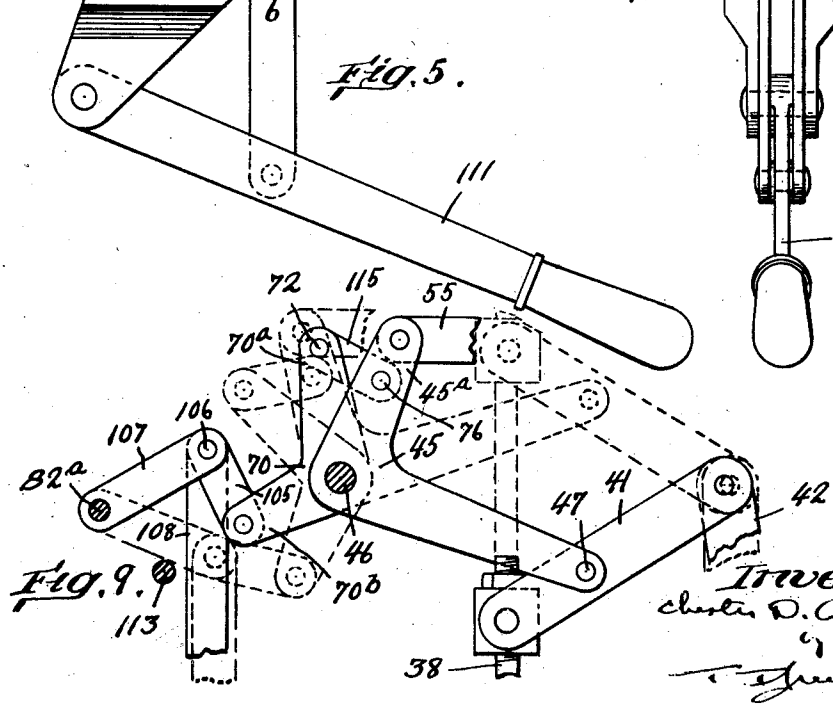


Fig. 9.

Inventor,
Charles D. Ainsworth
by

Dec. 24, 1929. C. D. AINSWORTH 1,740,558

ELECTRIC SWITCH

Filed April 2, 1923 5 Sheets-Sheet 5

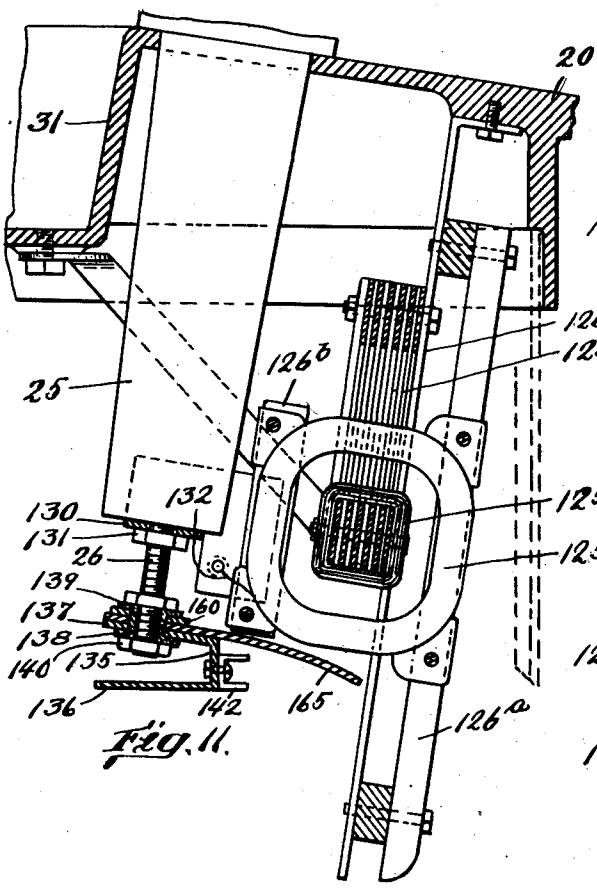


Fig. 11.

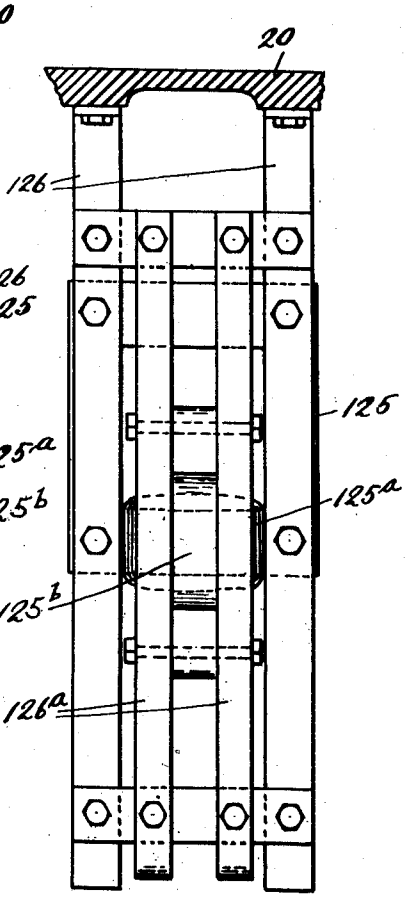


Fig. 12.

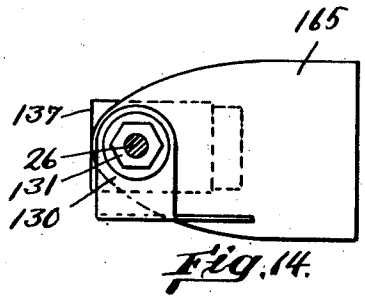


Fig. 14.

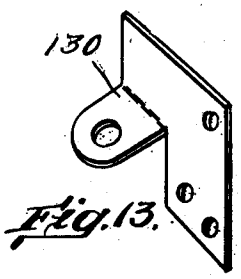


Fig. 13.

Inventor.
Chester D. Ainsworth
by
Atty

Patented Dec. 24, 1929 1,740,558

UNITED STATES PATENT OFFICE

CHESTER D. AINSWORTH, OF WOLLASTON, MASSACHUSETTS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO CONDIT ELECTRICAL MANUFACTURING CORPORATION, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS

ELECTRIC SWITCH

Application filed April 2, 1923. Serial No. 629,252.

This invention relates to oil immersed electric switches especially adapted for outdoor installations, although not necessarily limited to such use.

An object of this invention is the provision of a switching apparatus made up of switch units of interchangeable construction so that one or several units may be connected together to form a unitary switching apparatus having a variable number of poles.

A further object is to provide switch operating mechanism adapted to permit the switch to have a relatively high rate of opening movement.

A yet further object is generally to improve the construction and operation of electric switches.

Certain features of this invention are disclosed in my co-pending application Serial No. 606,678, filed December 13, 1922, which has eventuated into Patent No. 1,729,859, issued October 1, 1929.

Fig. 1 is a side elevation of a three pole switch embodying my invention, the switch comprising the center pole being partially in section.

Fig. 2 is a front elevation of one of the switch units of Fig. 1.

Fig. 3 is a sectional view of a modified form of switch unit, the unit being similar to a switch unit illustrated in Fig. 1 but having added thereto a current transformer.

Fig. 4 is a sectional detail illustrating the application of a bushing type transformer to the switch.

Fig. 5 is a detailed front elevation of an enclosing casing for the control mechanism of the switch.

Fig. 6 is a sectional detail along line 6—6 of Fig. 5, illustrating the relative position of the component parts of the control mechanism in switch-closed position.

Fig. 7 is a detail illustrating the relative position of the component parts of the switch control mechanism when tripped electrically.

Fig. 8 is a similar view illustrating the relation of the parts of the control mechanism when the switch is opened manually.

Fig. 9 is a view of the control mechanism adapted for manual control only, the dotted position of the mechanism illustrating the switch-open condition of the mechanism.

Fig. 10 is a detail illustrating especially an insulated fixed contact member adapted for use with a core-type of current transformer.

Fig. 11 is an elevation, in detail, of the oil immersed transformer and its supporting means.

Fig. 12 is an end view of Fig. 11.

Fig. 13 is a perspective detail of one of the coil-supporting brackets.

Fig. 14 is a sectional detail illustrating the arc deflector for the transformer.

The switching apparatus here shown is adapted for the control of a three phase circuit and comprises three similar switch units. Each switch unit is or may be so constructed and arranged that a switching apparatus adapted to control circuits of various phases may be built up by assembling and connecting together in line a suitable number of switch units. Each switch unit may comprise a frame 20 of more or less rectangular shape, which frame is adapted to comprise a cover for the oil receptacle 21. Said oil receptacle is received within said frame and depends therebelow and may rest upon the cradle 22. Said cradle is or may be secured removably to the switch frame by suitable means as the rods 23 and nuts 23^a, whereby the oil receptacle is also secured removably to the switch frame. The top walls 24 of said switch frame are preferably inclined downwardly from the the middle portion thereof and stationary switch members comprising the insulators 25 and the conducting studs 26 are inserted through said inclined walls and secured thereto. Said studs 26 are or may be provided with the screw-threaded lower end portions on which the main stationary contact members 27 are secured. Auxiliary stationary contact members 28 may be detachably secured to said main contact members 27 and are adapted to cooperate with the auxiliary contact members of the movable switch member in the usual manner.

Said switch frame 20 is or may be provided with a transverse mechanism-containing compartment 30 disposed between the stationary

switch members; and the side walls 31 of said compartment may be extended laterally in opposite directions beyond the body of the switch frame and may terminate in vertically extended flanges 32 and 33 which are adapted to be secured to similar flanges of adjacent switch units by suitable means as the bolts 34, whereby to tie together the various switch units and form a unitary switch structure.

The movable switch member may include the insulating rod 36 provided with the brush member 37 at the lower end thereof. A metal rod 38 is or may be fixed to the upper end of said insulating rod 36 and extends slidably through an aperture in the bottom wall of the mechanism compartment and may carry a block 40 adjustably threaded on the upper end thereof. Said block 40 is or may be disposed between and pivoted to the upper ends of guide links 41 of the switch mechanism. The lower end of said guide links are or may be pivotally connected with the pair of strut links 42; and said latter links are or may be pivoted on a pin 43 extended through the opposite walls 31 of the mechanism compartment. A pair of bell crank levers 45 are pivotally mounted on a pin 46 extended through the opposite end of the side walls 31 of the mechanism compartment and the long arms of said bell crank levers are pivotally connected by suitable means, as the pins 47, to an intermediate portion of the guide links 41. This construction and disposition of mechanism provides means to guide the upper end of the movable switch member in substantially a straight line.

The various and similar switch units are adapted to be assembled together in line and united with each other, as above described, by the bolts 34. The switch units may be supported on a suitable frame 50 and, for this purpose, the switch frames 20 may be formed or provided with the lateral extensions 51 adapted to rest upon said frame 50. Bolts 52 may be passed through said extensions 51 into said frame 50 whereby to secure the switch units to said frame. The rear end of the mechanism compartment of the rear switch unit may be closed, preferably removably, by suitable means as the cover plates 53.

The switch mechanisms of all the switch units are or may be connected together for conjoint operation by the two spaced bars 55 which are extended through the upper portion of the connected mechanism compartments of the switch units and are or may be pivotally connected with the short arms 45^a of the bell crank levers 45 of the separate switch mechanisms.

The switch operating or control mechanism is adapted to be contained mainly within a separate casing 60 which is or may be secured against the free flange of the foremost switch unit. Said casing 60 is or may be divided into an upper compartment 61 adapted to contain switch operating mechanism, two spaced intermediate compartments 62 and 62^a adapted to contain the tripping coils and two spaced lower compartments 63 and 63^a arranged below said intermediate compartments and adapted to contain the calibration extensions of the tripping coils. Said casing is or may be also formed with a central vertical passage 64 which is in communication with the upper compartment 61 and is adapted to contain a member of the operating mechanism adapted to provide for the manual control of the switch. Said various compartments may be closed by the cover plates 65 and 66 and said cover plates may be secured removably in position by any suitable means as the thumb nuts 67.

The switch mechanism herein illustrated is adapted to provide for the manual opening and closing of the switch and also for the automatic tripping of the switch by electrically controlled tripping means.

The switch operating mechanism includes a pair of spaced bell-crank levers 70 which are or may be disposed between the bell-crank levers 45 of the foremost switch unit and pivotally supported on the pivot pin 46 of said bell crank levers. The upper arms 70^a of said bell crank levers are or may be pivotally connected by the pin 72 to triangularly shaped and spaced plates 73 which constitute members of a locking toggle for all of the switch units. A link 74 is or may be disposed between said plates and pivotally connected to said plates by suitable means as the pin 75. The other end of said link may be disposed between the arms 45^a of said foremost bell crank lever 45 and pivotally connected thereto by the pin 76. The connections between said link 74 and the bell crank lever 45 and the plate 73, and between said plate 73 and the bell-crank lever 70 are adapted to be such as to form an inverted toggle which when substantially in an on-center position is adapted to hold the switch units closed. A latch roller 78 is or may be disposed between the lower ends of said plates 73 and rotatably supported on a pin 79 passed through said plates. A latch 80 may be disposed between said plates and pivotally supported on the pin 46. Said latch is arranged to engage said latch roller 78 and releasably hold the inverted toggle and consequently the switch closed; and said latch is adapted to be raised whereby to release said latch roller and permit the toggle to be broken by the weight of the movable switch member, or accelerating springs 39, whereby to permit the switch to open. Said latch 80 is adapted to be raised to trip the switch by means including the link 82 which is disposed beneath said latch and is formed or provided with an elongated slot 83 in which the fixedly supported pin 82^a is or may be received. Said pin 82^a is adapted to guide said link 82 in the tripping move-

ment thereof. Said link 82 is or may be pivotally connected at its lower end to the forwardly extended arm of a tripping frame 84. Said frame is pivotally supported by the fixed brackets 85 and has laterally extended extensions or arms 86 through which pins 87 may be adjustably extended for engagement with tripping members of the tripping coils.

The tripping coils are adapted to be contained in the compartments 62 and 62[a] and disposed beneath the tripping frame 84. Each tripping coil may comprise the coil bobbin 90 in which a tube 91 is movably extended; and said tube 91 may contain the plunger of the coil. Said tube 91 may be formed or provided with a reduced upper end portion 92 which is adapted to be extended through an aperture in the top compartment 61 and a nut 93 may be threaded on said reduced portion 92 whereby to secure said tube 91 and consequently the coil bobbin in place.

Each coil compartment may contain a plurality of, as two, coils. Tripping pins 94 may be slidably extended through said tubes 91 into the top compartment and are adapted to be engaged by the movable plungers. A tripping plate 95 is extended between and pivotally received or fulcrumed on each pair of tripping pins and the arrangement is or may be such that each coil may act independently to raise said tripping plate to trip the switch or the coils may act conjointly to trip the switch. This arrangement may be substantially as set forth in my above-named co-pending application.

The lower or calibration ends of the tubes 91 of said tripping coils are extended slidably through the bottom walls 97 of the coil compartments and into the lowermost compartments 63 and 63[a] and adjustments of the current settings of said coils may be made in these compartments. The bottom walls 98 of said lowermost compartments are or may be formed with apertures therein which are aligned with the tube apertures in the upper wall 97. The trip coils may be removed from their enclosing compartments by first withdrawing the tubes 91 through said aligned apertures. Said apertures in said lowermost walls 98 are or may be normally closed by the plug 99.

The switch operating components adapted to provide for the manual opening and closing of the switch include the pairs of links 105 which are or may be pivotally connected to the lower arms 70[b] of the bell-crank lever 70. Said links 105 are also pivotally connected by suitable means as the pivot pin 106 with a pair of links 107 and said links 107 are in turn pivotally supported on the fixed pin 82[a]. Said pairs of links 107 and 105 constitute toggle members adapted to be actuated manually to effect the opening and closing of the switch. A link 108 is or may be disposed between said links 105 and 107 and pivotally supported on the pivot pin 106. The lower end of said link is or may be pivotally connected to the connecting bars or rods 110 which extend downwardly through the central passage 64 of the casing. The lower ends of said bars 110 are adapted to be pivotally connected to an operating handle 111 and said handle is or may be pivoted to a bracket 112 secured to the lower wall 98 of the casing 60.

When the switch is closed, the switch operating mechanism is or may be in a position similar to that illustrated in Fig. 6. When the mechanism is tripped electrically, the bell-crank levers 70 and the toggle comprising the links 107 and 105 and the operating handle 111 are adapted to remain stationary and said members will be held in such position by the toggle links 107 and 105, which toggle is adapted to be in somewhat overshot position and in contact with a stop-member as the pin 113. With this arrangement, the upper arm 70[a] of the bell-crank lever 70 forms a pivotal support for the toggle comprising the plates 73 and the link 74. When the over-load coils are energized to trip the switch, the latch 80 is raised from holding engagement with the latch roller 78 carried by the lower end of the plates 73 and, inasmuch as the toggle including said plates as a member is in a slightly under-shot position, the weight of the switch members, or accelerating springs associated therewith, serves to move the movable switch members rapidly into open position.

The switch-open position of the mechanism when tripped electrically is or may be similar to that illustrated in Fig. 7. It is to be noted that with this arrangement, the only part of the operating mechanism that moves is the toggle comprising the plates 73 and the link 74. Inasmuch as said toggle may have very little weight and inertia, this arrangement provides a switch having a relatively high rate of opening movement.

As here shown, the switch is arranged to be closed manually after it has opened electrically. For this purpose, the handle is adapted to be raised whereby to break the toggle comprising the links 107 and 105 and rotate the bell-crank lever 70 in a clockwise direction. This movement causes the plates 73 to rotate in a counter-clockwise direction whereby to move the latch roller 78 into holding engagement with the latch 80. The connection between the switch operating mechanism and the movable switch mechanism is thereby restored and when said operating handle 111 is moved downwardly, the operating mechanism is restored to a condition illustrated in Fig. 6.

When the switch is opened manually, the handle 111 is raised as before and the bell

crank levers 70 remain connected with the switch mechanisms through the latch 80 to effect the manual opening of the switch and remain connected therewith when the operating handle 111 is moved downwardly to effect the manual closing of the switch.

The switch mechanism herein illustrated may also be arranged solely for manual opening and closing and the switch mechanism so arranged is illustrated in Fig. 9. For this arrangement, the toggle comprising the plates 73 and link 74 may be removed and a link 115 may be connected between the pivot pin 72 carried in the arms 70^a of the bell-crank levers 70 and the pivot pin 76 carried in the arms 45^a of the bell-crank levers 45. This arrangement serves to connect said bell-crank levers 70 fixedly to the bell-crank levers 45 whereby the operation of said handle 111 serves to open and close the switch units; and the switch units will remain in closed position until the handle is moved downwardly as the toggle comprising the members 107 and 105, in the switch closed condition, is adapted to be in slightly over-shot position.

It is to be noted that the stationary and movable switch members of the switch units are or may be unsymmetrically disposed with relation to the vertical axis of the switch frame and the oil receptacle, or displaced laterally toward an end wall of the casing, whereby to provide an enlarged space A between a stationary switch member and the opposite end wall of the casing in which a transformer, as a current transformer, is adapted to be received.

Fig. 4 illustrates a bushing type transformer 120 contained within the switch unit and disposed to encircle one of the stationary switch members adjacent the top wall of the switch frame. The coil 121 thereof is adapted to occupy the enlarged space provided by the displacement of the switch members. The terminals of said coil may extend through a suitable pipe 122 into a terminal box 123 secured to the upper end of said pipe whereby connection may be made to a suitable control or indicating circuit.

In Fig. 3 there is illustrated a core type current transformer disposed in the enlarged space and immersed in the oil of the switch and arranged substantially in line with the stationary switch members. Said transformer may comprise the iron core 125 and the secondary coil 125^a, which latter is wound on said core, and the primary coil 125^b which latter is or may be spaced from said secondary coil and also from the core, and insulated from both by the oil of the switch, which oil is adapted to fill the space between the primary coil and the core and secondary coil. The transformer core may be secured to the frame 126, which latter is or may be secured to and depend from the switch frame; and said frame may carry insulating members 126^a adapted to engage and hold said primary coil. The stationary switch member may also be provided with insulating members 126^b, which latter also are adapted to engage and support said primary coil in position.

In connection with said oil immersed current transformer a modified arrangement of contact member is or may be provided (Figs. 10 and 11). The primary coil of said current transformer is adapted to be connected in series with the circuit through the switch. For this purpose, the lower end of the stud 26 is or may be provided with a conducting plate 130 (Fig. 13) which may be secured to said stud by the nut 131; and said plate is or may be arranged to support an insulating member 126^b. Said plate 130 is adapted to be connected with one terminal 132 of the primary winding of the transformer. A stationary contact member is carried by said stud and insulated therefrom. Said stationary contact member may comprise a substantially U-shaped member or frame 135 having the lower arm 136 adapted to provide a contact face for the movable brush member. The upper arm 137 is or may be formed with an aperture therein in which an insulating bushing 138 is received. Said arm 137 of said contact member is received upon the lower end of the stud 26 and between insulating washers 139. Nuts 140 are or may be threaded on said stud 26 on the opposite sides of said insulating washers whereby to secure said contact member 135 firmly to said stud but insulated therefrom. An auxiliary contact member 142 may be secured to said contact member and a terminal 143 of the primary coil of the transformer may also be secured to said contact member 135 as, for instance, through the bracket 160, and said bracket may be arranged to support an insulating member 126^b for said primary coil. This arrangement provides means whereby the current transformer may be connected in series with the circuit through the switch and the terminals of the transformer may be carried by one of the stationary switch members.

Preferably, an arcing shield 165 is carried by said stud 26 and extended therefrom to a position below and spaced from the primary coil 125^b of the transformer, whereby to protect said coil from the hot arc gases and divert said gases away from contact with the coil.

The open tops of the connected switch mechanism compartments and the mechanism compartment of the casing 60 may be closed by a single cover 150 which extends over all compartments; and said cover may be secured removably in position by suitable means as the thumb bolts 151.

The structure may be otherwise modified without departing from the spirit of the invention.

I claim:

1. Electric switching apparatus comprising the combination of a plurality of switch casings having transversely disposed mechanism-containing compartments, said casings being arranged in line and in abutting relation with each other and secured in such relation whereby to connect all mechanism-containing compartments, switch mechanism contained in the mechanism compartment of each casing, and means extended through said compartments and operatively connected with said mechanisms, whereby to operate all mechanisms conjointly.

2. Electric switching apparatus comprising the combination of a plurality of switch casings having transversely disposed mechanism-containing compartments, said casings being arranged in line and in abutting relation with each other and secured in such relation whereby to connect all mechanism-containing compartments, a cover extended across said casings and arranged in covering relation with all of said compartments, switch mechanism contained in the compartment of each casing, and means extended through said compartments under said cover and operatively connected with said mechanisms, whereby to operate all mechanisms conjointly.

3. Electric switching apparatus comprising the combination of a plurality of switch casings having transversely disposed mechanism-containing compartments, said casings being arranged in line and in abutting relation with each other and secured in such relation whereby to connect all mechanism-containing compartments, said connected compartments being open at the top and at each end, a cover extended over said casings and arranged to cover the top of all of said connected compartments, a cover plate secured to the switch casing of an end switch over one open end of said connected compartments, a closure for the other open end of said connected compartments comprising a control-mechanism enclosing casing arranged in communication with said casing-compartments, inter-connected switch mechanism contained in each switch casing compartment, and control mechanism containec in said control casing and connected with said interconnected switch mechanisms.

4. Electric switching apparatus comprising the combination of a plurality of switch casings having transversely disposed mechanism-containing compartments, said casings being arranged in line and in abutting relation with each other and secured in such relation whereby to connect all mechanism-containing compartments, said connected compartments being open at the top and at each end, a cover plate secured to a switch casing over an open end of said connected compartments, a closure for the other open end of said connected compartments comprising a control-mechanism enclosing casing having an open top and secured to a switch casing over said other end of said connected compartments, a cover extended over the open top of said connected compartments and said control-mechanism casing, inter-connected switch mechanisms contained in said switch casing compartments, and control-mechanism contained in said control-mechanism casing and connected operatively with said inter-connected switch mechanisms.

5. In an electric switch, an enclosing casing for the switch-operating mechanism having a top compartment for the operating mechanism, two spaced side compartments and a vertical passage extended between said side compartments and in communication with said top compartment, and removable covers for said compartments.

6. In an electric switch, an enclosing casing for the switch-operating mechanism having a top compartment for the operating mechanism, two spaced side compartments and a vertical passage extended between said side compartments and in communication with said top compartment, switch operating mechanism contained in said top compartment, an operating member connected with said mechanism and extended downwardly through said vertical passage, and trip coils contained in said side compartments having movable members extended into said top compartment and operatively associated with the mechanism contained therein.

7. In an electric switch, an enclosing casing for the switch-operating mechanism having a top compartment for the operating mechanism, two spaced side compartments and a vertical passage extended between said side compartments and in communication with said top compartment, switch operating mechanism contained in said top compartment, an operating member connected with said mechanism and extended downwardly through said vertical passage, an operating handle disposed beneath and pivoted to the bottom wall of said casing and connected with said downwardly extended operating member, and trip coils contained in said side compartments having movable members extended into said top compartment and operatively associated with the mechanism contained therein.

8. In an electric switch, an enclosing casing for the switch-operating mechanism having a top compartment adapted to contain the operating mechanism, pairs of bottom and intermediate compartments disposed below said top compartments, said casing having a vertical passage disposed between said pairs of compartments and communicating with said top compartment, switch operating mechanism contained in said top compartment having an operating member extended downwardly in said vertical passage, and trip coils contained in said intermediate compart-

ments and having movable members extended into said top compartment and operatively associated with the mechanism therein contained, said trip coils also having calibration members extended into said lower compartments.

9. In an electric switch, an enclosing casing for the switch-operating mechanism having a top compartment adapted to contain the operating mechanism, pairs of bottom and intermediate compartments disposed below said top compartments, said casing having a vertical passage disposed between said pairs of compartments and communicating with said top compartment, switch operating mechanism contained in said top compartment having an operating member extended downwardly in said vertical passage, and trip coils contained in said intermediate compartments and having movable members extended into said top compartment and operatively associated with the mechanism therein contained, said trip coils also having calibration members extended into said lower compartments, said compartments having openings at the sides, and removable covers for said openings.

10. In an electric switch, an enclosing casing having a top compartment adapted to contain the switch operating mechanism, and having two spaced lower compartments and a vertical passage between said compartments communicating with said top compartment, switch-operating mechanism contained in said top compartment including a tripping frame extended above both lower compartments, tripping coils contained in said lower compartments having movable members extended into said top compartment and arranged to actuate said tripping frame, and an operating member connected with said operating mechanism and extended downwardly in said vertical passage.

11. An electric switch having a substantially rectangular fluid-containing enclosing casing, and insulated stationary switch members carried by the top wall of and depending into said casing and laterally displaced within the casing toward a side wall thereof, whereby to provide an enlarged and unobstructed space between a stationary switch member and the opposite side wall, contact members carried by said switch members beneath the fluid, one of which contact members is insulated from its switch member, and a series transformer contained in said enlarged space of the casing beside said stationary switch members and in the general plane thereof and above said contact member and having a connection with said insulated contact member and also with its switch member.

12. An electric switch having an enclosing casing, stationary and movable switch members carried by the top wall of and depending into said casing and displaced laterally therein toward a wall of the casing, whereby to provide an enlarged space between a stationary switch member and the opposite wall of the casing, a transformer disposed within said enlarged space and supported by the adjacent stationary switch member, and a bracket connecting said transformer with the top wall of the casing.

13. An electric switch having an enclosing casing comprising an oil receptacle and a switch frame comprising a cover for said oil receptacle, means removably connecting said switch frame and oil receptacle, stationary and movable switch members carried by said switch frame and depending into and displaced laterally toward an end wall of the oil receptacle, whereby to provide an enlarged space between a stationary switch member and the opposite end wall of the casing, a bracket secured to said switch frame between the aforesaid stationary switch member and opposite wall of the casing and depending therebelow, and a transformer carried by the lower end of said bracket and by said aforesaid stationary switch member and disposed in said enlarged space of said casing.

14. An electric switch including a stationary switch member, a contact member carried by and insulated from said switch member, a transformer connected between said stationary switch member and insulated contact member, and a movable switch member arranged to engage said insulated contact member, whereby to include said transformer in the circuit through the switch.

15. An electric switch including an enclosing casing, a pair of stationary switch members carried by said casing and extended therein, a contact member carried by and insulated from one of said stationary switch members, a transformer disposed within said casing and connected within said casing to said insulated contact member and the switch member supporting said contact member, and a movable bridging member arranged to connect said insulated contact member and the other stationary switch member, whereby to include said transformer in the circuit through the switch.

16. An electric switch including a stationary switch member having a screw-threaded lower end, a contact member comprising a U-shaped frame having spaced upper and lower arms through the upper arm of which the lower end of said stationary switch member is extended, a nut disposed between the arms of said frame and threaded on the end of said stationary switch member, and a second nut threaded on said stationary switch member above said upper arm of said frame, said nuts arranged to clamp said frame to said stationary switch member, and a movable switch member engageable with said lower arm, and means establishing an electric con-

nection between said contact member and stationary switch member.

17. An electric switch including a stationary switch member having a screw-threaded lower end, a contact member comprising a U-shaped frame having an insulation-bushed aperture in the upper arm thereof in which the lower end of said stationary switch member is extended, a nut disposed between the arms of and insulated from said frame and threaded on the end of said stationary switch member, and a second nut threaded on said stationary switch member above said upper arm of said frame and insulated from said upper arm, said nuts arranged to clamp said insulated contact member to said stationary switch member, a transformer connected between the lower end of said stationary switch member and said insulated contact member, and a movable switch member arranged to engage said insulated contact member, whereby to include said transformer in the circuit through the switch.

18. An electric switch having the combination of an oil receptacle, movable and stationary contact members and a transformer immersed in the oil therein adjacent the arc zone and above said stationary contact members, and a deflector plate arranged above one of said contact members and below and in shielding relation with said transformer and in the path of the arc gases from said contact members.

19. An electric switch having the combination of an oil receptacle, movable and stationary contact members and a transformer immersed in the oil therein adjacent the arc zone and above said stationary contact members and a deflector plate carried by a stationary contact member and arranged above it and below and in shielding relation with said transformer and in the path of the arc gases from said contact members.

In testimony whereof, I have signed my name to this specification.

CHESTER D. AINSWORTH.