H. L. VAN VALKENBURG.

CIRCUIT BREAKER.

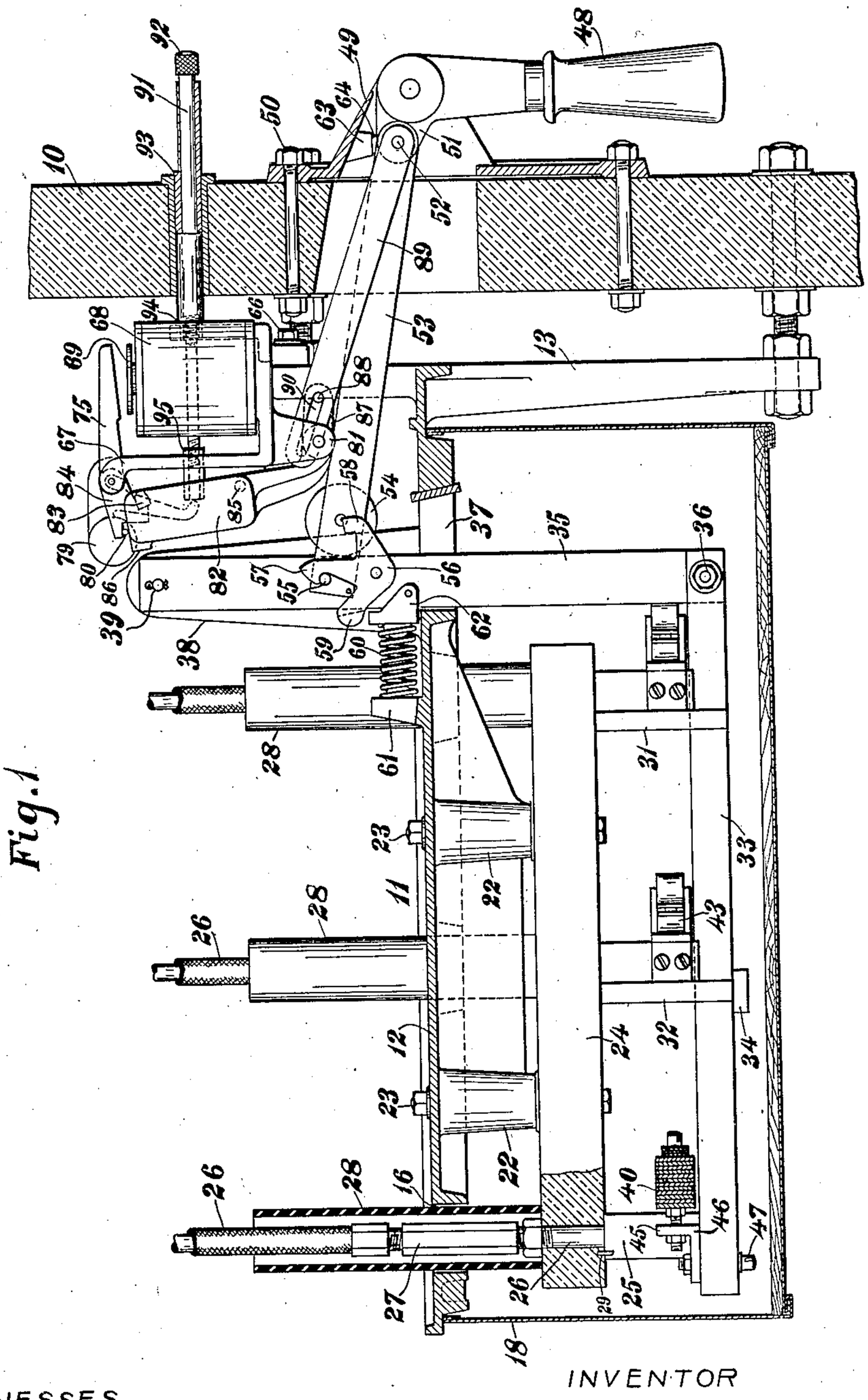
APPLICATION FILED JUNE 16, 1906.

969,813.

Patented Sept. 13, 1910.

5 SHEETS—SHEET 1.

Fig. 1.



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5 SHEETS—SHEET 2.

Fig. 2

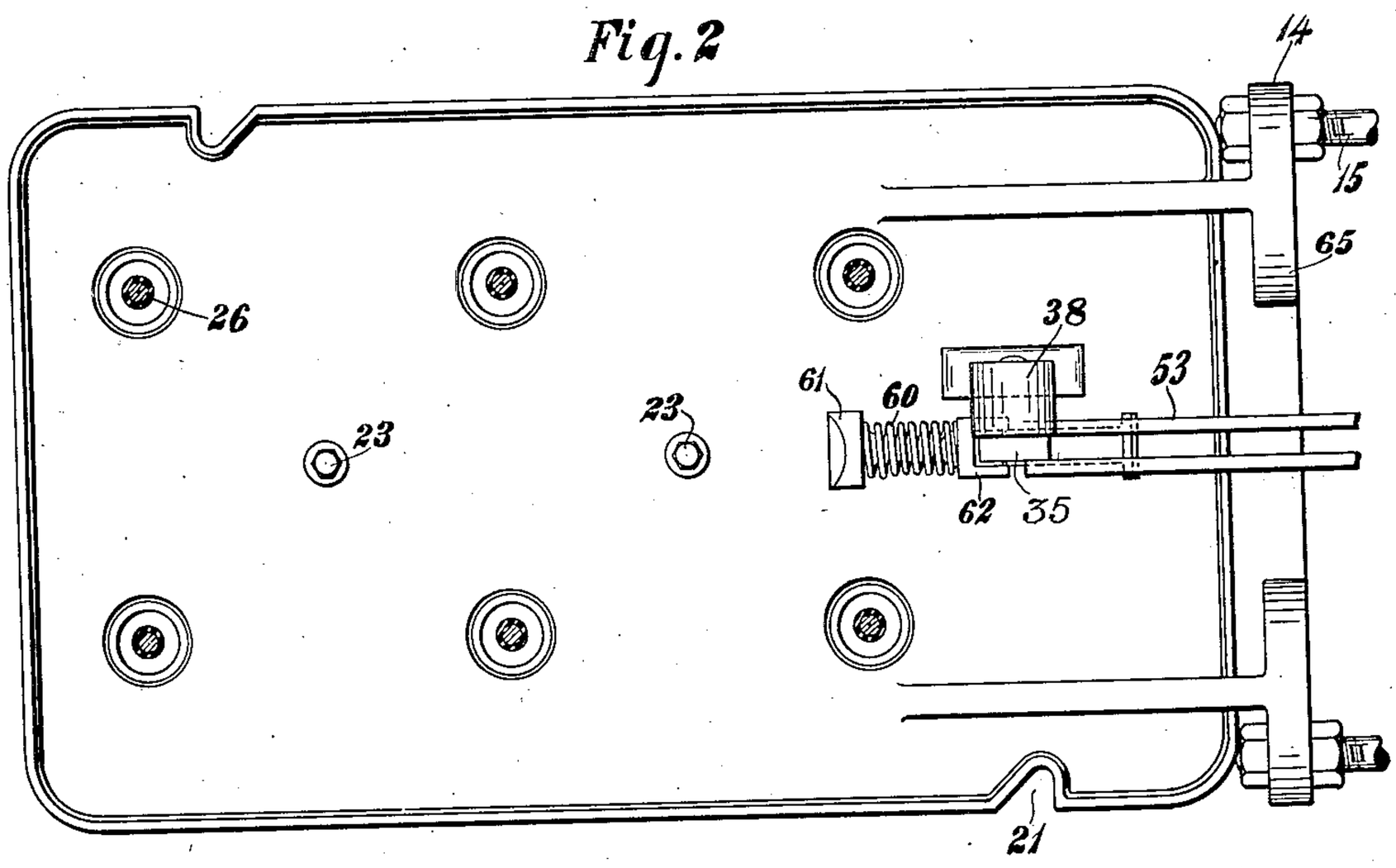
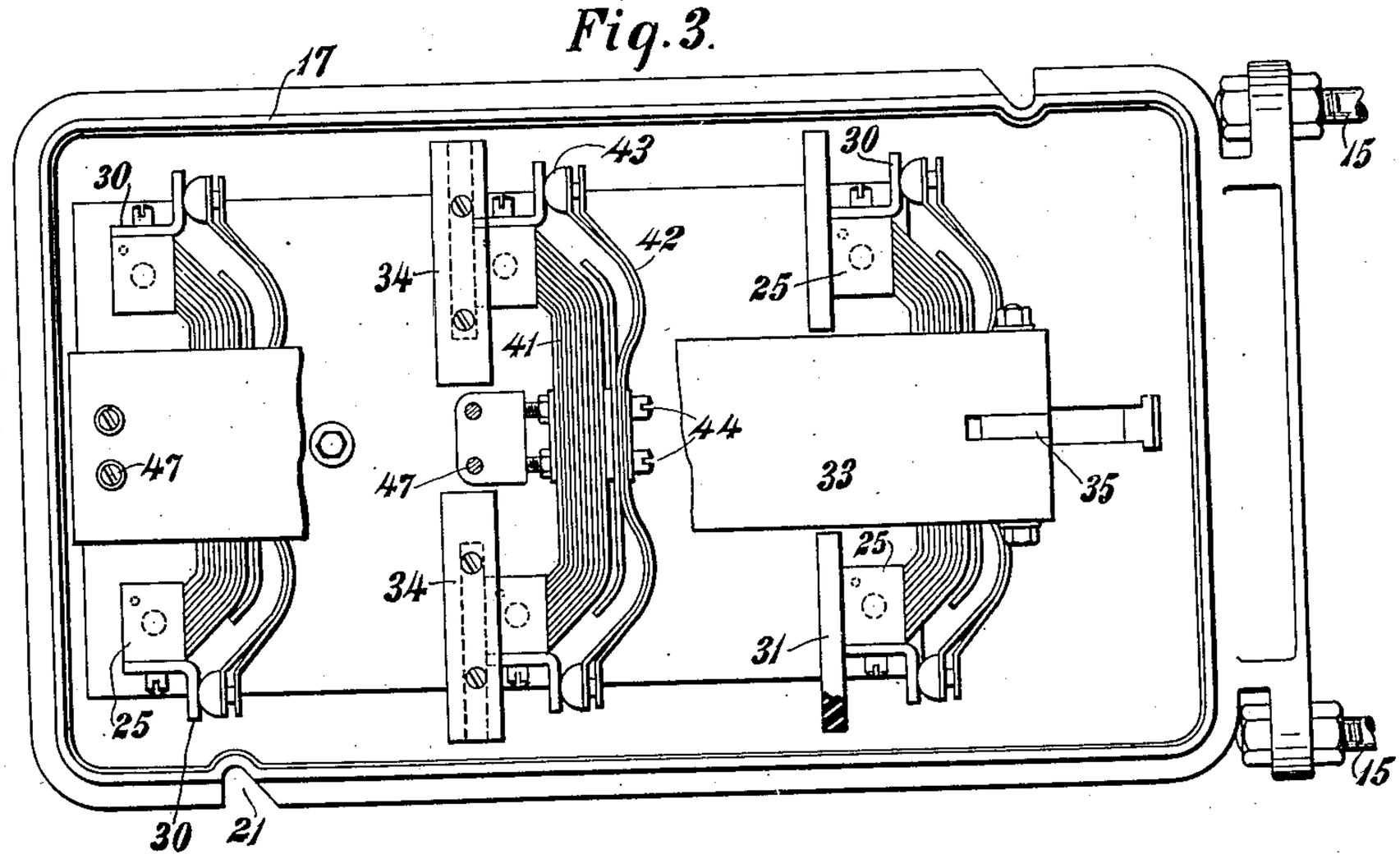


Fig. 3.



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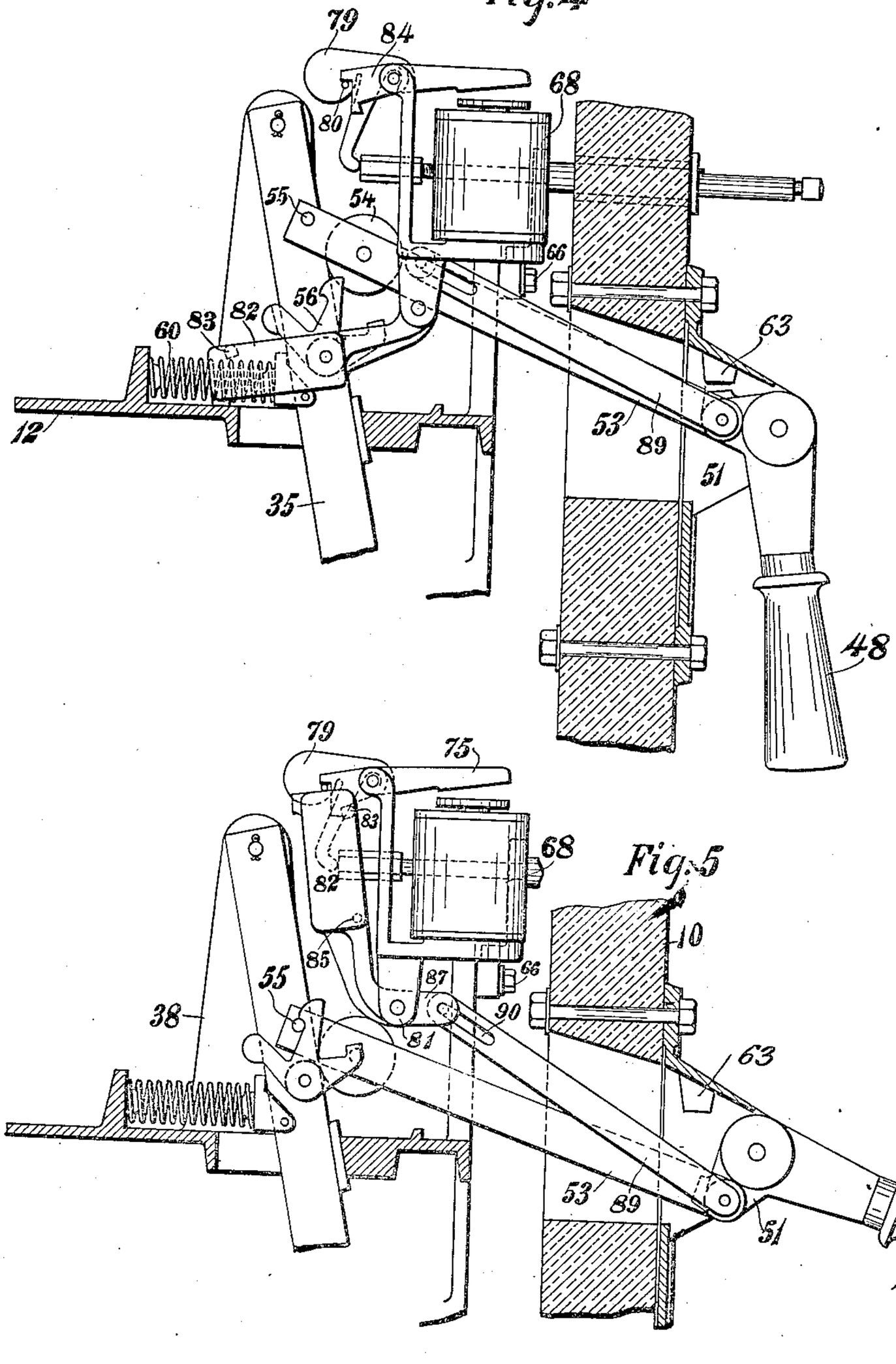
5 SHEETS—SHEET 3.

Fig. 4



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5 SHEETS—SHEET 4.

Fig. 6

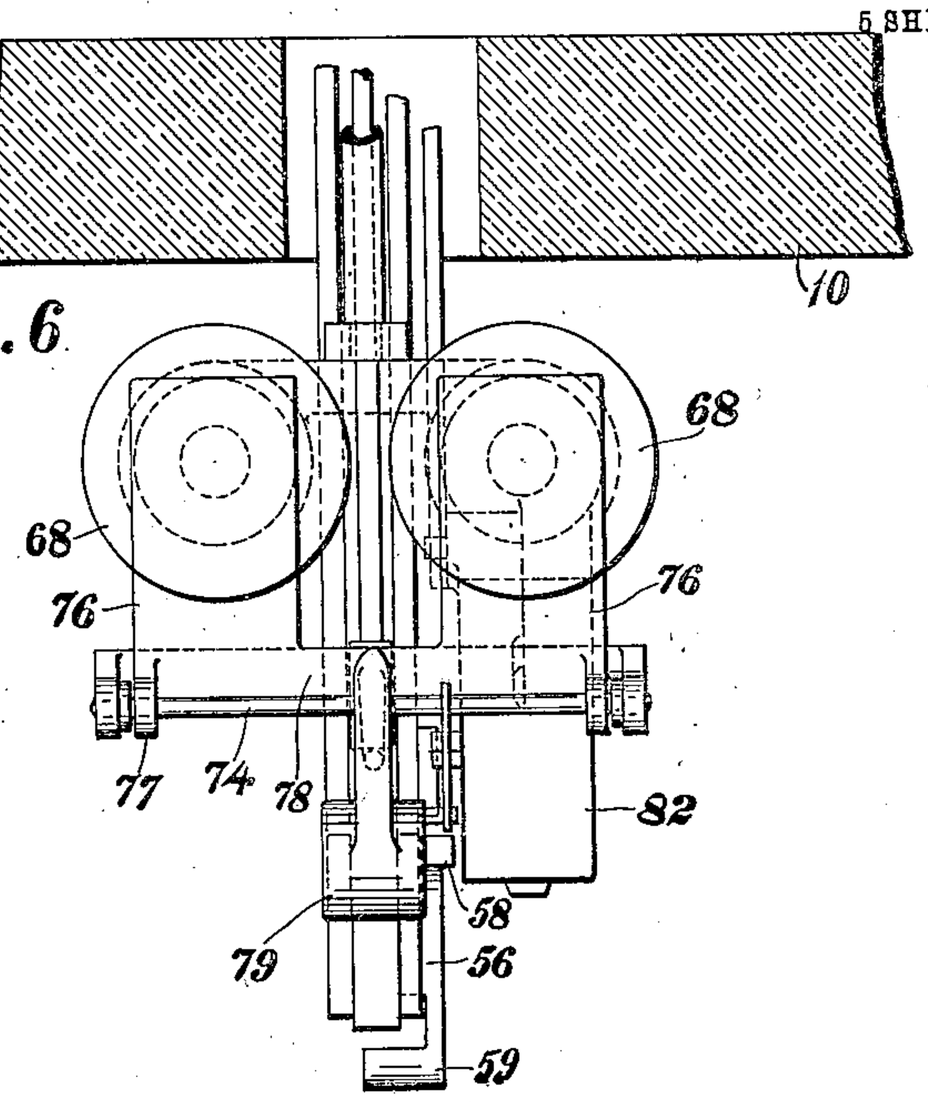
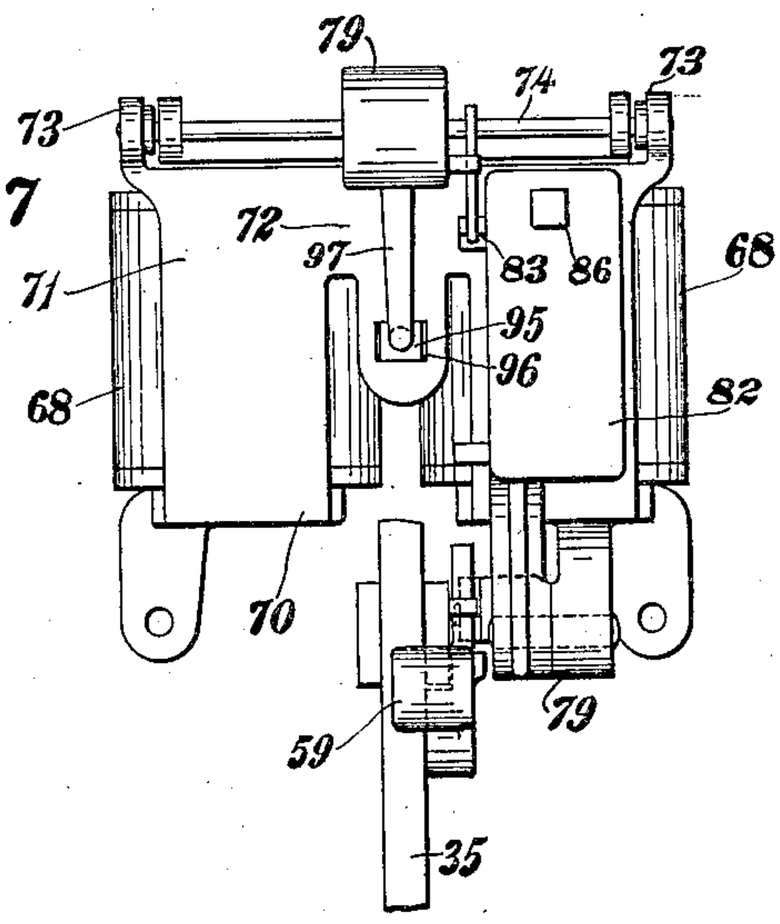


Fig. 7



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5 SHEETS—SHEET 5.

Fig. 8

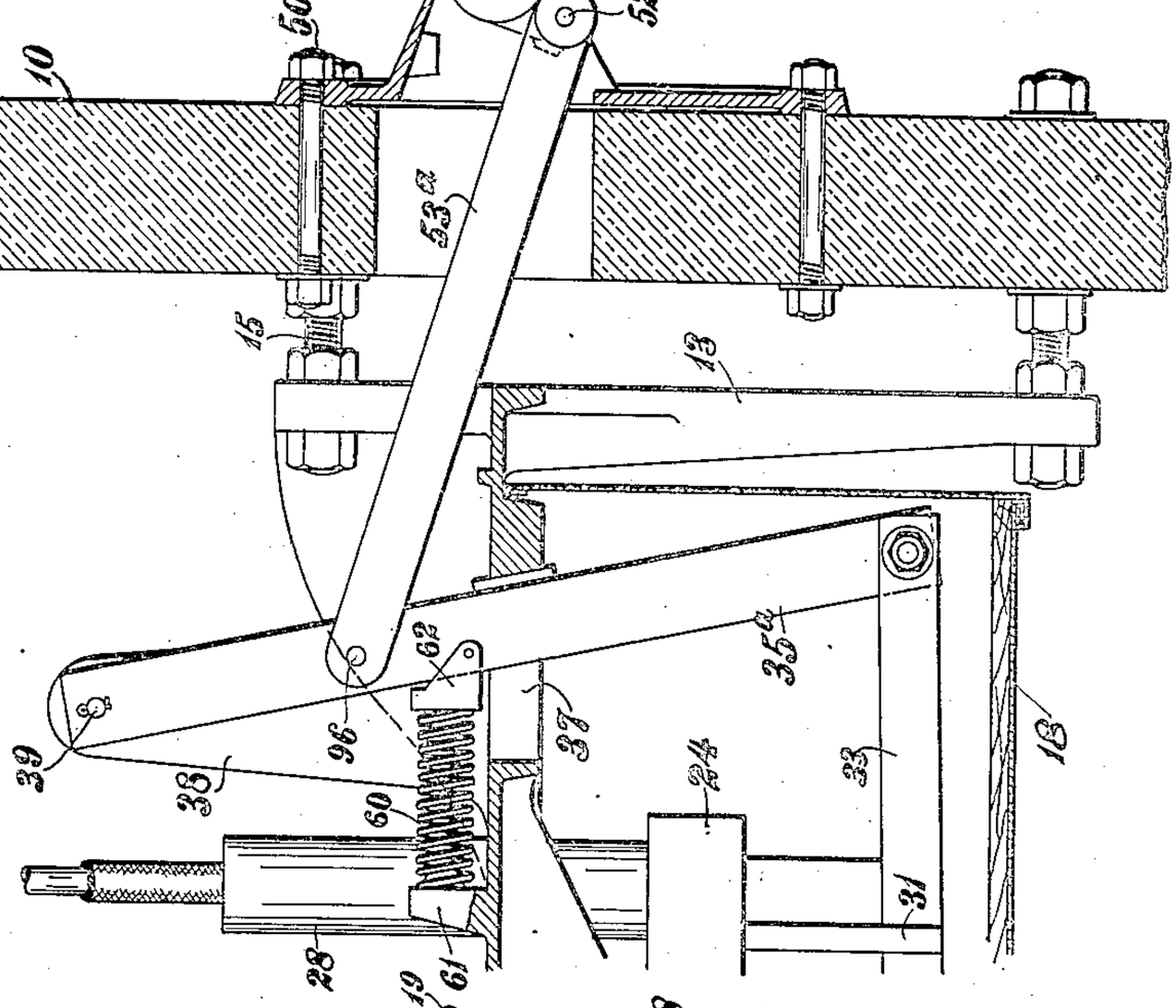
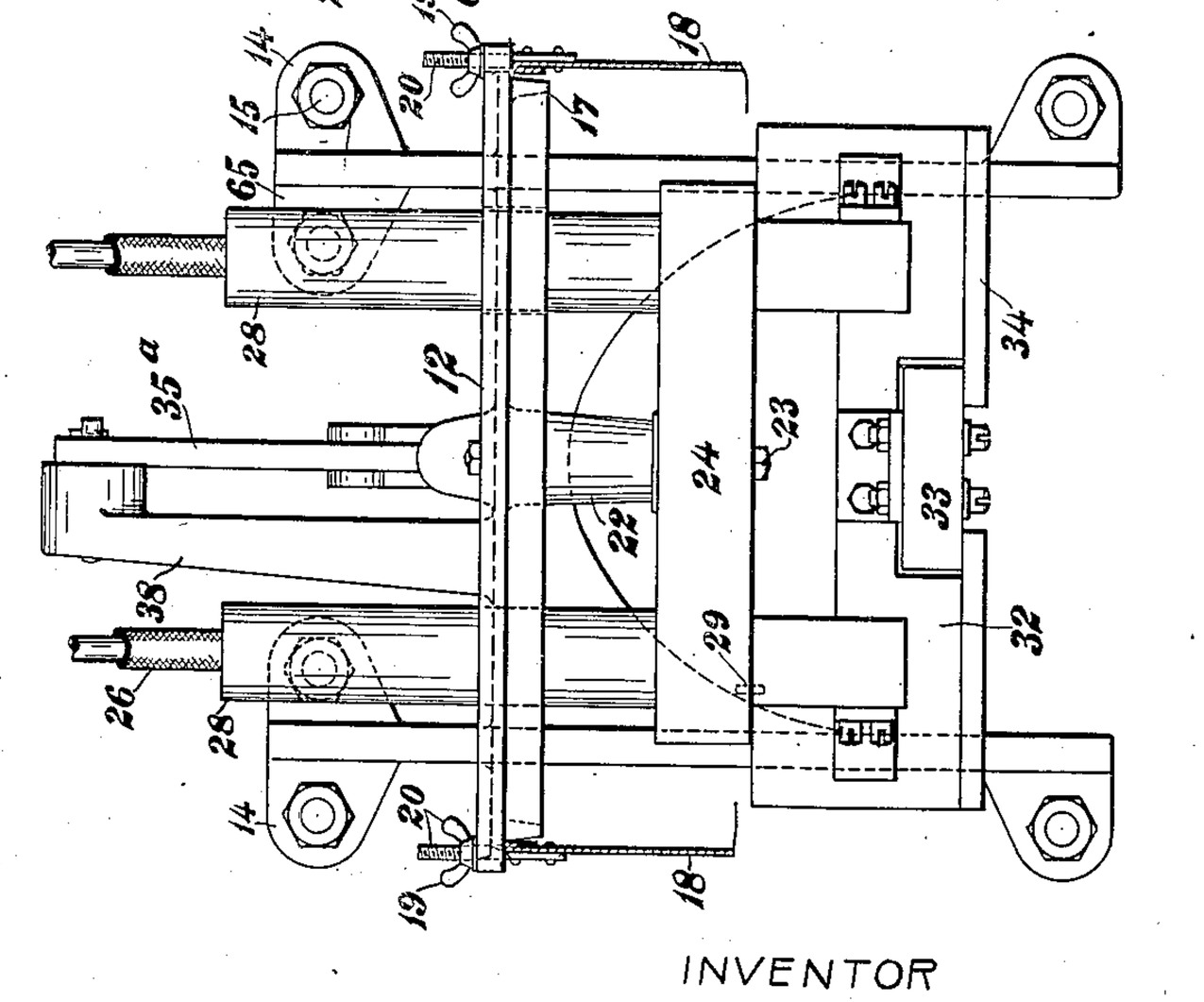


Fig. 9



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UNITED STATES PATENT OFFICE.

HERMON L. VAN VALKENBURG, OF NORWOOD, OHIO, ASSIGNOR TO ALLIS-CHALMERS COMPANY, A CORPORATION OF NEW JERSEY, AND THE BULLOCK ELECTRIC MANUFACTURING COMPANY, A CORPORATION OF OHIO.

CIRCUIT-BREAKER.

969,813. Specification of Letters Patent. **Patented Sept. 13, 1910.**

Application filed June 16, 1906. Serial No. 321,961.

To all whom it may concern:

Be it known that I, HERMON L. VAN VALKENBURG, citizen of the United States, residing at Norwood, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Circuit-Breakers, of which the following is a full, clear, and exact specification.

My invention relates to oil switches or circuit-breakers, adapted either for automatic or manual operation.

One of the objects of my invention is to provide an oil switch or circuit-breaker which is simple in construction, compact and effective in operation.

A further object is to provide an improved automatic tripping mechanism which will effect a release of the switch operating mechanism to open the switch with the expenditure of very little energy in the tripping coil or coils.

My invention consists in the details of construction and in the combinations and arrangements of parts described in the specification and set forth in the appended claims.

For a better understanding of my invention, reference is had to the accompanying drawings in which—

Figure 1 is a side elevation of an automatic oil switch or circuit-breaker equipped with my invention, parts being in section and broken away for the sake of clearness; Fig. 2 is a plan view of the same, the tripping mechanism being omitted and parts being broken away; Fig. 3 is a bottom view of the same, the oil tank and operating mechanism being removed, and parts being broken away; Fig. 4 is a detail of the operating and tripping mechanism, showing the parts in the position after the switch has been automatically opened; Fig. 5 is a similar view showing the tripping mechanism reset and the parts in position for the switch to be closed; Fig. 6 is a plan view of the tripping mechanism, the switch-board panel being shown in section; Fig. 7 is an elevation of the same; Fig. 8 is a partial sectional side elevation of my improved switch adapted to be operated manually; Fig. 9 is an end view of the same, parts of the oil tank being removed.

Referring now to the figure of the drawing, I have shown at 10, a switch-board panel upon the rear side of which is mounted the frame 11 supporting a switch mechanism. The frame 11 consists of a horizontal portion 12 and vertical portions consisting of upwardly and downwardly extending arms 13 having outwardly extending ears 14, through which pass bolts 15 by which the switch is secured to the panel. The horizontal portion of the frame is substantially rectangular in outline as is shown in Fig. 2 and is provided with six openings 16, arranged in pairs to receive the conductor terminals, the switch here shown being a three-pole double break switch adapted for a three-phase circuit. The frame is provided on its lower face and around the outer edge with a flange 17 around which the oil tank 18 engages, the latter being suspended from the frame and held in position by winged nuts 19 and upwardly extending pins 20 engaging open slots 21 on the opposite sides of the horizontal extension of the frame, the slots on the two sides being adjacent the diagonally opposite corners as shown in Fig. 2. To remove the tank the two winged nuts are loosened, permitting the tank to be lowered until the top of the tank is below the flange 17. All that is necessary now is to turn the tank until the pins move out from the slots 21 when the tank can be removed. The horizontal extension 12 of the frame is also provided, on a line through its center, with two downwardly extending lugs 22 to which is secured by bolts 23 an insulating slab or plate 24 carrying the stationary contacts, which slab is preferably made of soapstone.

Three pairs of stationary contacts 25 are secured to the lower face of the insulating slab by contact rods 26 extending through the slab which rods are connected with the conductor terminals 26 by means of connectors 27 which extend through the openings 16 previously referred to. The connectors and terminals are surrounded by sleeves 28 of insulating material such as porcelain which also pass through the openings 16 and rest upon the insulating slab 24. These porcelain sleeves can be slipped up onto the leads, if it is desired to repair the connections or to disconnect the leads. The stationary contacts 25 consist of blocks of good conducting material such as copper or brass secured to the ends of the contact rods and prevented from turning thereon by pins 29 engaging the insulating slab. Secured to the lower ends of the contact blocks

25 are auxiliary or stationary arcing contacts 30.

The poles of the switch are separated from each other by two insulating barriers 31 and 32 which are notched on the under side to receive the laterally movable insulating bar or base 33 upon which the movable bridging contacts are secured. The insulating bar or base 33 is in this case provided with two supports, one a guide 34 consisting of strips secured to the lower surface of the insulating barrier 32 and extending toward each other partially bridging the notch in the lower face of the barrier 32 as is clearly shown in Figs. 1 and 3. The other support for the bar consists of a link or rod 35 which is pivoted at its lower end to the end of the bar by means of a screw or bolt 36, extends upward through a slot 37 in the horizontal extension 12 of the frame, and is pivoted at its upper end to a lug or upward projection 38 by a pin or bolt 39. This link or rod serves also as a part of the operating mechanism for the switch as will be explained. If desired the movable insulating bar 33 carrying the movable contacts can be supported independently of the pivoted link or rod, by two or more supports similar to guide 34, in which case the link or rod 35 would serve only as an operating rod to move the bar 33 longitudinally to open and close the switch.

The movable bridging contacts 40 consist of groups of main laminæ 41 forming the main contacts, and auxiliary laminæ 42 carrying at their ends the auxiliary contacts or arcing tips 43. All the contacts are secured together by screws 44 which pass through the upwardly extending portions 45, of the L-shaped clips 46, secured to the top of the insulating bar by screws or bolts 47. The ends of each group of main laminæ are adapted to bear upon the two main stationary contacts 25 of each pole, and the arcing tips 43 carried thereby are adapted to bear upon the auxiliary stationary contacts 30 which are secured to the main contacts 25. As in the usual construction when the switch is opened the main laminæ 41 first leave the stationary contact members, and the contact is finally broken at the auxiliary or arcing contact members. The screws 44 pass through threaded openings in the upwardly extending portions 45 of the clips 46. By adjusting the screws the position of the bridging contacts and hence the pressure of the latter on the stationary contacts can be adjusted.

At 48 is shown an operating handle pivoted in a frame or casting 49 secured by bolts 50 to the front of the switch-board panel. The operating handle is provided with an integral arm 51 to which is pivoted at 52 an arm 53 extending through an opening in the switch-board, which arms 51 and 53 form a toggle joint for closing the switch. The arm 53 is provided near its outer end with a roller 54, which rests upon or bears against the pivoted link or rod 35. The arm 53 is also provided between the roller and the outer end of the arm with a lateral pin or projection 55. Pivoted to the link or rod 35, a short distance above the horizontal extension of the frame is a holding latch 56 provided with a finger having a nose or hook 57 adapted to be engaged by the pin 55 upon the end of the arm 53, with a finger 58 which extends substantially at right angles to the nose 57 and is adapted to receive the blow or impact of the tripping mechanism to trip the latch as will be explained, and with a small weight 59 acting to tip the latch toward the rear of the switch.

At 60 is shown an operating spring which bears at one end on the lug 61 at the top of the supporting frame and at the other end upon a cradle 62 pivoted on the link or rod 35 below the latch 56. This spring is compressed when the switch is closed and serves to open the switch when the holding latch is tripped.

As is clear from Figs. 1, 4, 5, of the drawing, to close the switch the operating handle is first drawn outward and upward from the position shown in Fig. 4 to the position shown in Fig. 5, the arm 53 moving downward and also longitudinally so that the outer free end drops down toward the frame until the pin 55 is engaged by the hook or nose of the finger 57 of the tripping latch. The arm 53 and link or rod 35 are now held in locked engagement. To close the switch all that is now necessary is to throw the handle to the position shown in Fig. 1, the movement of the handle being transmitted by arm 53 to the pivoted link or rod 35 which is turned about its pivotal point 39 moving the insulating bar 33 longitudinally and substantially horizontally until the bridging contacts are held in firm engagement with the stationary contacts. When the handle is thrown to the position shown in Fig. 1, the toggle mechanism is cramped holding the switch in the closed position. The frame 49 is provided with a downwardly extending lug 63 against which the lug 64 on the arm 51 bears to limit the movement of the handle and the toggle mechanism.

Secured to the inwardly extending ears 65 at the ends of the upwardly extending arm of the frame or casting 11 by means of bolts 66, is a casting 67 forming yokes for two tripping coils 68 and the supporting frame for the tripping mechanism. The casting consists essentially of two upwardly extending arms forming cores 69 for the two tripping coils, two horizontal base portions 70, and two upwardly extending portions 71

which are joined together near the top by a connecting or bridging portion 72, shown in Fig. 7. The upwardly extending portions 71 are provided at their ends with two parallel ears 73, in which is mounted the pivotal support 74 of the movable member 75 forming the armature for the tripping coils. As is shown in Fig. 6 the armature consists of two rectangularly shaped arms 76 provided with ears 77 at the rear ends mounted on the pivotal support 74 and with a connecting portion 78. Integral with the armature and extending rearwardly thereof on the opposite side of the pivotal support 74 is a member 79 acting as a weight to normally hold the armatures away from the coils. It is seen that each magnet has a separate magnetic circuit and if there is a predetermined rise of current in either coil the armatures of both magnets are moved downwardly, since they are connected together. The rearwardly extending portion 79 is provided with a laterally extending pin 80 the purpose of which will be explained later. Pivoted to the downwardly extending lug 81 of the casting is a weight 82. This weight is adapted to be held in its upper or raised position when the switch is closed and on the occurrence of a predetermined line condition such as overload, to be released and in falling to strike and trip the holding latch. This weight is provided with a lug or projection 83 adapted to be engaged by a latch 84 pivoted on the member 74 so as to be retained in its upper position. On the side of the weight is a lug, pin or projection 85 which is so situated that when the weight falls, it strikes the projecting arm 58 of the holding latch and trips the latter. The weight is also provided with a lug 86 to engage the frame or casting 11 to limit its downward movement. The weight has an extension 87 near the pivotal point having a lateral pin 88.

At 89 is shown a link pivoted on the pin 52 of the toggle joint at one end and having a slot 90 through which extends the pin 88 on the extension 87 of the weight. The purpose of this link 89 is to reset the weight after it has been released and the switch is opened.

I have here shown two tripping coils which are adapted to be connected to two of the conductors of the three-phase circuit. If desired, however, a single coil or more than two coils may be employed. The armatures of the magnets are normally held by weight 79 in the position shown in Fig. 1 when the switch is closed, *i. e.*, away from the cores of the magnets. As here constructed therefore the armatures are adapted to be moved downward into engagement with the cores on the occurrence of an overload in any one or in all of the phases, and consequently by a predetermined current in either one of the tripping coils. The value of the current in the tripping coils necessary to cause movement of the armature depends upon the gap between the armature and the cores. To adjust the tripping mechanism so that it may operate on any desired overload, I provide means for adjusting this air gap. Extending through the switch-board is a rod 91 having a knurled head 92. This rod has a bearing 93 in the switch panel and passes through a threaded vertical extension 94 (see Figs. 1 and 6) of the supporting frame for the tripping mechanism. The outer end of this adjusting rod 91 is also threaded this threaded portion having a less pitch than the threaded portion which engages the lug or extension 94. The end of the rod is provided with a squared nut 95 shown in Figs. 1 and 7, which is mounted in an opening or slot 96 of a downward extension of the portion 72 connecting the yokes of the two tripping magnets as is shown in Fig. 7. When the knurled head 92 is turned in one direction or the other, the nut 95 is given a very slow longitudinal movement, which movement depends upon the difference in the pitches of the threads.

At 97 is shown an arm extending downwardly from the rearwardly extending portion 79 of the movable member forming the armature 75, into engagement with this squared nut 95; thus it is seen that by turning the knurled head 90, the position of the armature can be delicately adjusted.

The operation of the mechanism so far described will now be explained.

When the switch is closed and the current in the line and in the tripping coil is normal all the parts are in the position shown in Fig. 1, the armature of the field magnets being held out of engagement with the cores of the magnets, the weight being retained in its raised or upper position by the pivoted latch 84, and the link or arm being held in locked engagement by the holding latch 56. Should an overload occur in any phase the armature 75 is attracted, raising the rearwardly extending portion 79, the laterally extending pin 80 striking the latch 84 which holds the weight in its raised position, moving the said latch out of engagement with the lug 83 and permitting the weight to fall. The weight in falling strikes the arm 58 of the holding latch with sufficient force to trip the latter so that the nose or hook 57 moves out of engagement with the pin 55. When the holding latch is tripped the spring 60 forces the pivoted link or rod 35 to the inclined position shown in Fig. 4, the free end of the arm 53 riding upward on the link or rod to the position shown in Fig. 4. The pivoted weight 82 now rests with the lug 86 in engagement on the top of the frame. To reset the tripping mechanism and to close the

switch the operator moves the handle from the position shown in Fig. 4 to the position shown in Fig. 5 moving the arm 53 longitudinally as well as downwardly, permitting the outer free end of the arm to drop down until the pin 55 is engaged by the nose or hook 57 of the holding latch, at the same time link 89 is given a downward and forward movement and by its engagement with the pin 88 on the arm 87 integral with the weight, lifts the weight to its normal position, the latch 84 automatically engaging the projection 83 to retain the weight in its raised position. By a downward movement of the operating handle 48, the arm being still locked into engagement with the pivoted link, the latter is swung to the vertical position against the tension of the spring 60, closing the switch. The parts are held in this position by the arms of the toggle joint.

I have provided means for preventing the switch from being closed in case the latch 84 fails to retain the weight in its upper position. In case the weight is not retained by the latch 84, in its upper position on being lifted to position by the link 89, the weight will again move down slowly as the operating handle 48 is thrown to the downward position to close the switch, the lug or pin 85 resting in the path of the head of the finger 58 of the holding latch. The result is when the handle is thrown to the position shown in Fig. 4 the head of the finger 58 of the holding latch strikes the lug or pin 85 moving the latch a sufficient amount to release the pin 55 from the head or nose of the finger 57 of the latch whereupon the spring 60 immediately throws the switch open.

In Figs. 8 and 9 I have shown a switch adapted to be opened manually. The switch structure is the same as that first described and differs only in the operating mechanism, the pivoted link 35^a and arm 53^a being pivoted together at 96. Thus by a downward movement of the operating handle the switch is closed and by an outward movement the arm 53^a and link 35^a move the insulating bar 33 to open position, spring 60 being employed to hold the parts in the open position. I have in this case shown a three pole double break switch; it is evident, however, that my invention is not limited to a switch of this type. Many changes can be made in the details shown and described without departing from the spirit and scope of my invention, and I aim in my claims to cover such modifications.

What I claim as new and desire to secure by Letters Patent is:—

1. In an oil switch or circuit-breaker, a horizontal supporting member, stationary contacts supported below said member, a movable bridging contact, a longitudinally movable support therefor, a link pivoted to said horizontal supporting member, and extending downward below the same into engagement with the movable support, said support being adapted to move the bridging contact into and out of engagement with the stationary contacts, and means for operating the link.

2. In an oil switch or circuit-breaker, a supporting frame, stationary contacts supported from the lower side thereof, a movable contact, a longitudinally and horizontally movable operating bar upon which the movable contact is mounted, means for supporting and operating said bar comprising a guide and a link mounted on said supporting frame, and means for operating said link.

3. In an oil switch or circuit-breaker, a supporting frame, an insulating support mounted thereon, stationary contacts mounted on the lower side of said insulating support, a movable bridging contact, a member upon which said contact is mounted, said member being movable in a substantially horizontal plane, means for supporting said member comprising a link pivoted to the horizontal supporting frame, and means for moving said link.

4. In an oil switch or circuit-breaker, a supporting frame, an insulating support mounted on said frame, stationary contacts supported from the lower face thereof, one or more movable bridging contacts, a member upon which said contact or contacts are mounted, said member being movable in a substantially horizontal plane, and means for supporting said member comprising a guide mounted on the insulating support.

5. In an oil switch or circuit-breaker, a horizontal supporting frame, stationary contacts supported on the lower side of said horizontal frame, one or more movable bridging contacts adapted to move into and out of engagement with the stationary contacts, a longitudinally movable insulating bar upon which the bridging contact or contacts are mounted, and means for supporting said longitudinal movable bar comprising a stationary guide and a pivoted link.

6. In an oil switch, a horizontal supporting frame, an insulating support mounted on the lower face of said supporting frame, stationary contacts mounted on said insulating support, movable bridging contacts, a longitudinally movable base on which said contacts are mounted, means for supporting said base comprising a guide secured to the under side of said insulating support and a link pivoted to the horizontal supporting frame, means for operating said link, and an oil tank inclosing all of said contacts.

7. In an oil switch or circuit-breaker, a horizontal supporting frame, stationary contacts supported on the lower side of said

frame, a movable bridging contact adapted to move into and out of engagement with the stationary contacts, a movable insulating base upon which the bridging contact is mounted, means for supporting said movable base comprising a stationary guide, and a pivoted link extending through the horizontal supporting frame, and means for moving said pivoted link.

8. In an oil switch or circuit-breaker, a horizontal supporting frame, stationary contacts supported on the lower side of said frame, a movable bridging contact adapted to move into and out of engagement with said stationary contacts, an insulating base on which the movable contact is mounted, means for supporting said base comprising a stationary guide, and means for operating said base comprising a pivoted link extending through said horizontal supporting frame, and a member engaging said pivoted link.

9. In an oil switch or circuit-breaker, a horizontal supporting frame, stationary contacts supported by said frame on the lower side thereof, a plurality of bridging contacts, a movable insulating base upon which the bridging contacts are mounted, means for supporting and operating said movable insulating base comprising a stationary guide and a link pivoted to said frame at its upper end and extending through said horizontal supporting frame and engaging said movable base, and a rod engaging said link for moving the base laterally to carry the bridging contacts into engagement with the stationary contacts.

10. In an oil switch, a horizontal supporting frame, stationary contacts supported from said frame and on the lower side thereof, movable bridging contacts, an insulating base on which said contacts are mounted, said base being adapted to move in a substantially horizontal plane, a stationary guide or support for said base, and means for operating said base comprising a link or rod pivoted to said frame at the top thereof and extending downward through an opening or slot in the frame, and engaging the lower end of said base, and means comprising a handle and a longitudinally movable arm for operating said link, and an oil tank inclosing said contacts.

11. In an oil switch, a horizontal supporting frame, an insulating member mounted on the lower face of said horizontal supporting frame, stationary contacts mounted on said insulating member, one or more bridging contacts, a support therefor, said support being adapted to move in a substantially horizontal plane to carry the movable contacts laterally into and out of engagement with the stationary contacts, means for operating said support comprising a link pivoted at a point above the horizontal supporting frame and extending downward through the latter and engaging at its lower end the support, means for moving said pivoted link to close and open the switch, and an oil tank inclosing all of said contacts.

12. In combination, a switch-board, a support for switch mechanism mounted on the rear thereof, movable and stationary contacts supported thereby, a longitudinally movable member carrying the movable contacts, an oil tank inclosing the contacts, and an operating mechanism comprising a link or rod pivoted to said support above the tank and extending downward into the latter and engaging said movable contact carrying member, a spring for moving said link or rod in one direction to open the switch, and toggle mechanism adapted to engage the pivoted link or rod to close the switch.

13. In combination, a switch-board, a horizontal frame for supporting switch mechanism mounted on the rear of said board, movable and stationary contacts, a longitudinally movable support for the movable contact or contacts, a link or rod pivoted above said frame and extending downward through the latter into engagement with said movable support for moving said link or rod toward or away from the board to open or close the switch.

14. In combination, a horizontal frame for supporting switch mechanism, movable and stationary contacts, a support for the movable contacts movable in a substantially horizontal plane, a link or rod pivoted above the frame and extending through the latter into engagement with said movable support, and means for moving the link or rod in one direction to close the switch and in the opposite direction to open the switch.

15. In an oil switch or circuit-breaker, a supporting frame, stationary contacts carried thereby, movable contacts, a longitudinally movable support therefor also carried by said frame, a link pivoted at a fixed point above the frame and extending through the latter into engagement with the support, operating means engaging the link for moving the latter in one direction to close the switch, and means for automatically moving the link in the opposite direction to open the switch.

16. In an oil switch or circuit-breaker, a supporting frame, stationary contacts carried thereby, movable bridging contacts, a movable support therefor also carried by said frame, a link pivoted at a fixed point above the frame and extending through the latter into engagement with the support, operating means engaging the link for moving the latter in one direction for closing the switch, and means for automatically breaking the engagement between the link and the operating means, and for moving

the link in the opposite direction to open the switch.

17. In an oil switch or circuit-breaker, a supporting frame, stationary contacts carried thereby, one or more movable bridging contacts, a movable support therefor also carried by said frame, a link or rod engaging the movable support and extending upwardly through said frame, operating mechanism comprising a handle and a rod connected to said handle and having one end adapted to be placed in locked engagement with said link to hold the switch closed, a latch for holding said rod and link in engagement, means for automatically tripping the latch for breaking the connection between the rod and the link, and a spring for opening the switch.

18. In an oil switch or circuit-breaker, a substantially horizontal supporting frame, stationary contacts carried thereby on the lower side thereof, one or more bridging contacts, a movable support therefor also carried by said frame, an oil tank secured to said frame and inclosing all the contacts, a link or rod engaging the movable support and extending upwardly through said frame, mechanism for closing the switch comprising an operating handle and a longitudinally movable arm, means for locking the link and arm together, and automatic means for releasing the link and arm for opening the switch.

19. In combination, a switch board, an oil switch secured on the rear side thereof, said switch comprising a supporting frame, stationary contacts carried on the lower side of said frame, one or more bridging contacts, a movable support therefor also carried by said frame, a pivoted link or rod engaging the movable support and extending upwardly through said frame, means for closing the switch, comprising an operating handle on the front of the switch-board and a toggle arm, means for locking the link and arm into engagement, an automatic means for releasing the link and arm, and a spring for opening the switch.

20. In an oil switch or circuit-breaker, a supporting frame, stationary and movable contacts supported therefrom, an oil tank inclosing the contacts, switch operating mechanism comprising a toggle, a pivoted link or rod extending downward through the frame and in operative relation to the movable contacts and a toggle arm, means for holding the link and arm in locking engagement comprising a latch on one of said members, and means for tripping said latch to break the locking engagement between the link and the arm.

21. In an oil switch or circuit breaker, a horizontal supporting frame for switch mechanism, stationary and movable contacts supported on the lower side of said frame, a movable member carrying said movable contacts, an oil tank inclosing the contacts, an operating mechanism comprising a handle, a toggle connected thereto, and a link pivoted to said horizontal support and extending downward through the same into engagement with said movable contact carrying member, means for holding the link and one arm of said toggle in locked engagement comprising a pivoted latch on one of said parts and a pin or projection on the other and adapted to be engaged by said latch, and means for tripping said latch to break the locked engagement and to permit the switch to be opened.

22. In an oil switch or circuit breaker, a horizontal support for switch mechanism, stationary and movable contacts supported below the same, a movable member carrying the movable contacts, an oil tank inclosing the contacts, an operating mechanism comprising a handle, a toggle connected thereto, and a link pivoted to said horizontal support and extending downward through the same into engagement with said movable contact carrying member, a latch for holding one arm of the toggle and said link in locked engagement to hold the switch closed, means for tripping said latch to break the locked engagement and to permit the arm to ride upward on the link, and means for opening the switch when the latch is tripped.

23. In an oil switch or circuit-breaker, a supporting frame, stationary and movable contacts supported therefrom, an oil tank inclosing the contacts, a switch operating mechanism comprising a toggle arm and a pivoted link or rod in operative relation to the movable contacts and extending upward above the supporting frame, a roller on said toggle arm adapted to engage the pivoted link, means for holding the link and arm in locking engagement comprising a latch on one of said members, and means for tripping said latch for breaking the locking engagement and to cause the roller to ride upward on the pivoted link and the switch to open.

24. In an oil switch or circuit breaker, a horizontal support for switch mechanism, stationary and movable contacts on the lower side of said support, a movable member carrying the movable contacts, and an oil tank inclosing said contacts, an operating mechanism comprising a handle, a toggle connected thereto, and a link pivoted to said support and extending downward below the same into engagement with said movable contact carrying member, means for holding the link and one arm of the toggle in locked engagement so as to hold the switch closed, said means consisting of a pivoted latch on the link and a pin or projection on said toggle arm, and means for tripping said latch to break the locked engagement between the

link and toggle arm and to permit said arm to ride upward on the link above the latch and the switch to be opened.

25. In an oil switch, a horizontal support for switch mechanism, stationary and movable contacts on the lower side thereof, a member carrying the movable contacts, an oil tank inclosing the contacts, an operating mechanism comprising an operating handle, a toggle connected thereto, and a link pivoted to said horizontal support at one end and extending downward below the same into engagement with said movable contact carrying member, one of the toggle arms having a normally free end adapted to be placed in locked engagement with the link, a latch for holding said link and toggle arm in locked engagement, means for tripping the latch to cause said toggle arm to ride upward on the link and the switch to open, and means whereby said toggle arm will drop downward and be engaged by said latch when the handle is raised.

26. In an oil switch or circuit breaker, a horizontal support for switch mechanism, stationary and movable contacts on the lower side of said horizontal support, a member carrying the movable contacts, a switch operating mechanism comprising an operating handle, a toggle connected to said handle, and a link having a fixed pivotal support above said horizontal support, and extending downward through the latter into engagement with the movable contact carrying member, said toggle having an arm, the end of which rests freely on said link when the switch is open, a pivoted latch below the free end of said arm, and means whereby when said operating handle is shifted in one direction, said arm drops downward and is locked by said latch to the link, and when the handle is shifted in the opposite direction, the switch is closed.

27. In an oil switch or circuit breaker, a horizontal support for switch mechanism, stationary and movable contacts on the lower side of said horizontal support, a member carrying the movable contacts, an oil tank inclosing all said contacts, a switch operating mechanism comprising an operating handle, a toggle connected to said handle, and a link or rod extending downward through said horizontal support into engagement with the movable contact carrying member, said toggle having an arm which is locked to said link when the switch is closed, but is disconnected therefrom when the switch is open, a latch for locking said arm and link together, and means whereby when said operating handle is shifted in one direction said arm is locked to the link by said latch, and when the operating handle is shifted in the opposite direction the switch is closed.

28. In an oil switch, a horizontal supporting frame for switch mechanism, movable and stationary contacts on the lower side of said frame, a movable member carrying the movable contact, an operating mechanism comprising a handle, a toggle connected to said handle, and a link pivoted at a fixed point above said frame and extending downward through the latter into engagement with said movable contact carrying member, one arm of the toggle resting freely on the link when the switch is open, a latch pivoted on said link below said toggle arm, and means whereby when said handle is shifted in one direction the free end of said toggle arm drops downward and is locked by said latch to the link, and when the handle is shifted in the opposite direction the switch is closed.

29. In an oil switch, a horizontal supporting frame for switch mechanism, movable and stationary contacts on the lower side of said frame, a movable member carrying the movable contacts, a switch operating mechanism comprising an operation handle, a toggle connected to said handle, and a link having a fixed pivotal support above said horizontal frame and extending downward through the latter into engagement with the movable contact carrying member, a latch on said link, said toggle having an arm, the end of which rests freely on said link above said latch when the switch is open, and means whereby when the handle is shifted in one direction the end of said toggle arm drops downward and is locked to the link by said latch, so that the switch can be closed by shifting the handle in the opposite direction, and means for tripping the latch to break the locked engagement between said link and toggle arm and to cause the latter to ride upward on the link to permit the switch to be opened.

30. In an oil switch or circuit breaker, a horizontal supporting frame for switch mechanism, movable and stationary contacts on the lower side thereof, a movable member supporting the movable contact, an oil tank inclosing all said contacts, a switch operating mechanism comprising an operating handle, a toggle connected thereto, and a link pivoted at a fixed point above said frame and extending downward through the latter into engagement with said movable contact carrying member, said toggle having an arm, one end of which is provided with a roller which rests freely on the link when the switch is open, means for locking said toggle arm and link together when the handle is shifted in one direction so that the switch can be closed by shifting the handle in the opposite direction, means for breaking the locked engagement between said link and toggle arm, so that the latter can ride freely upward on said link and the switch can be opened.

31. In an oil switch or circuit breaker, a horizontal support for switch mechanism, stationary contacts secured to the lower side thereof, a bridging contact and a movable member carrying the same, an oil tank secured to said frame and inclosing all of the contacts, a switch operating mechanism comprising an operating handle, a toggle connected to the same, and a link pivoted above said frame and extending downward through the latter into engagement with said bridging contact carrying member, one arm of said toggle having a roller which rests freely on said link when the switch is open, means for locking said toggle arm to the link comprising a latch pivoted to the link below said toggle arm, means whereby when the handle is shifted in one direction said toggle arm drops downward and is locked by said latch to the link so that the switch can be closed by shifting the handle in the opposite direction, and means for tripping the latch so that said toggle arm can ride upward on the link and the switch can be automatically opened.

32. In an oil switch or circuit-breaker, a support for switch mechanism, movable and stationary contact members, switch operating mechanism comprising an operating handle, a toggle arm and a pivoted link or rod in operative relation to the movable contact members, a pivoted latch on said link, a roller on the free end of said arm, normally resting on said link above the latch, a lateral pin or projection on said arm whereby when the operating handle is moved outward the arm drops down and the pin or projection thereof is engaged by said latch, and when the handle is moved in the opposite direction, the arm and link are moved to close the switch, means for automatically tripping the latch, and a spring under stress when the switch is closed for opening the switch when the latch is tripped.

33. In an oil switch or circuit-breaker, switch operating mechanism, a holding latch, a movable weighted member adapted in falling to trip said latch, and means for resetting said member during the manipulation of the operating mechanism incident to the closing of the switch.

34. In an oil switch or circuit-breaker, switch operating mechanism including an operating handle, and a pivoted holding latch, means for tripping the latch including a weight adapted when released to strike the latch, and means for resetting the weight by a movement of the switch handle incident to the closing of the switch.

35. In an automatic switch or circuit breaker, an operating mechanism, a tripping mechanism including a pivoted latch, a pivoted weight adapted to strike and trip the latch, and means in operative relation to said operating mechanism and to said weight for resetting the latter by a movement of the operating mechanism incident to the closing of the switch.

36. In an automatic switch or circuit breaker, a switch operating mechanism, a holding latch, a tripping coil, an armature therefor, a pivoted weight normally retained in its upper raised position and adapted to be released by a movement of said armature to trip said latch, and means connected to said operating mechanism and to said weight for resetting the latter by a movement of said operating mechanism incident to the closing of the switch.

37. In an automatic switch or circuit-breaker, switch operating mechanism, a holding latch, a pivoted weight for tripping said latch, a catch for holding the weight in its raised position, a tripping coil, an armature therefor adapted to release said weight on predetermined current or voltage changes, and means connected to said operating mechanism for resetting said weight by a manual movement of the switch handle given to the same prior to the closing of the switch and incident thereto.

38. In an automatic oil-switch or circuit-breaker, switch mechanism including a handle, a toggle arm, and a link or rod in operative relation to the movable switch member, a latch for holding the arm and link in locked engagement, a pivoted weight adapted to be released on the occurrence of predetermined line conditions and in falling to trip said latch, to release said arm and link whereby the switch is opened, and means operated by a movement of the switch handle for lifting the weight simultaneously with the locking of said arm and link.

39. In an automatic oil switch or circuit-breaker, switch mechanism including a handle, a toggle arm, and a link or rod in operative relation to the movable switch member, a latch for holding the arm and link in locked engagement whereby the switch can be closed, a tripping coil, a pivoted weight adapted to be released by said coil and in falling to trip said latch, whereby the arm and link are released and the switch is opened, and means for resetting said weight by a movement of the switch handle which simultaneously shifts the arm to a position to be locked to the link by said latch.

40. In an automatic switch or circuit breaker, stationary and movable contacts, an operating mechanism comprising an operating handle and two members which when locked together hold the switch closed, a latch for locking said members together when the handle is shifted manually in one direction, a movable weight for tripping said latch to break the locked engagement between said members, and means for raising said weight by the same movement of

the handle which causes said members to be locked by said latch.

41. In an automatic switch or circuit breaker, stationary and movable contacts, an operating mechanism comprising a handle and a pair of relatively movable members, a latch for locking said members together when said handle is shifted manually in one direction, a weight for tripping said latch, a second latch for retaining said weight in its normal upper position, and means operative by the same manual movement of the handle which causes said members to be locked together, for raising said weight, said weight serving to break the locked engagement between said members before the switch is closed on the failure of the weight retaining latch to operate.

42. In an automatic non-closable circuit breaker having separable contacts, the combination with an operating member and a normally positive collapsible connection between said member and said contacts, said connection being set in non-collapsed position by movement of said member in one direction, whereby movement of said member in the other direction actuates said contacts, of a trip member for collapsing said connection, an energy-storing operating device for said trip member, and means whereby said operating member during its movement to set said connection in non-collapsible position stores energy in said operating device.

43. In an automatic non-closable circuit breaker, the combination of switch contacts, switch operating mechanism comprising a normally positive collapsible connection, energy-storing means adapted when released to cause said connection to collapse, and means for storing energy in said energy-storing means during the operation of the operating mechanism incident to closing the switch.

44. In an automatic non-closable circuit breaker, the combination of switch contacts, switch operating mechanism comprising a normally positive collapsible connection, energy-storing means adapted when released to cause said connection to collapse, means for releasing said energy storing means upon the occurrence of predetermined abnormal conditions, and means for storing energy in said energy-storing means during the operation of the operating mechanism incident to closing the switch.

In testimony whereof I affix my signature, in the presence of two witnesses.

HERMON L. VAN VALKENBURG.

Witnesses:
ARTHUR F. KWIS,
FRED J. KINSEY.