H. W. CHENEY.

AUTOMATIC CIRCUIT BREAKER.

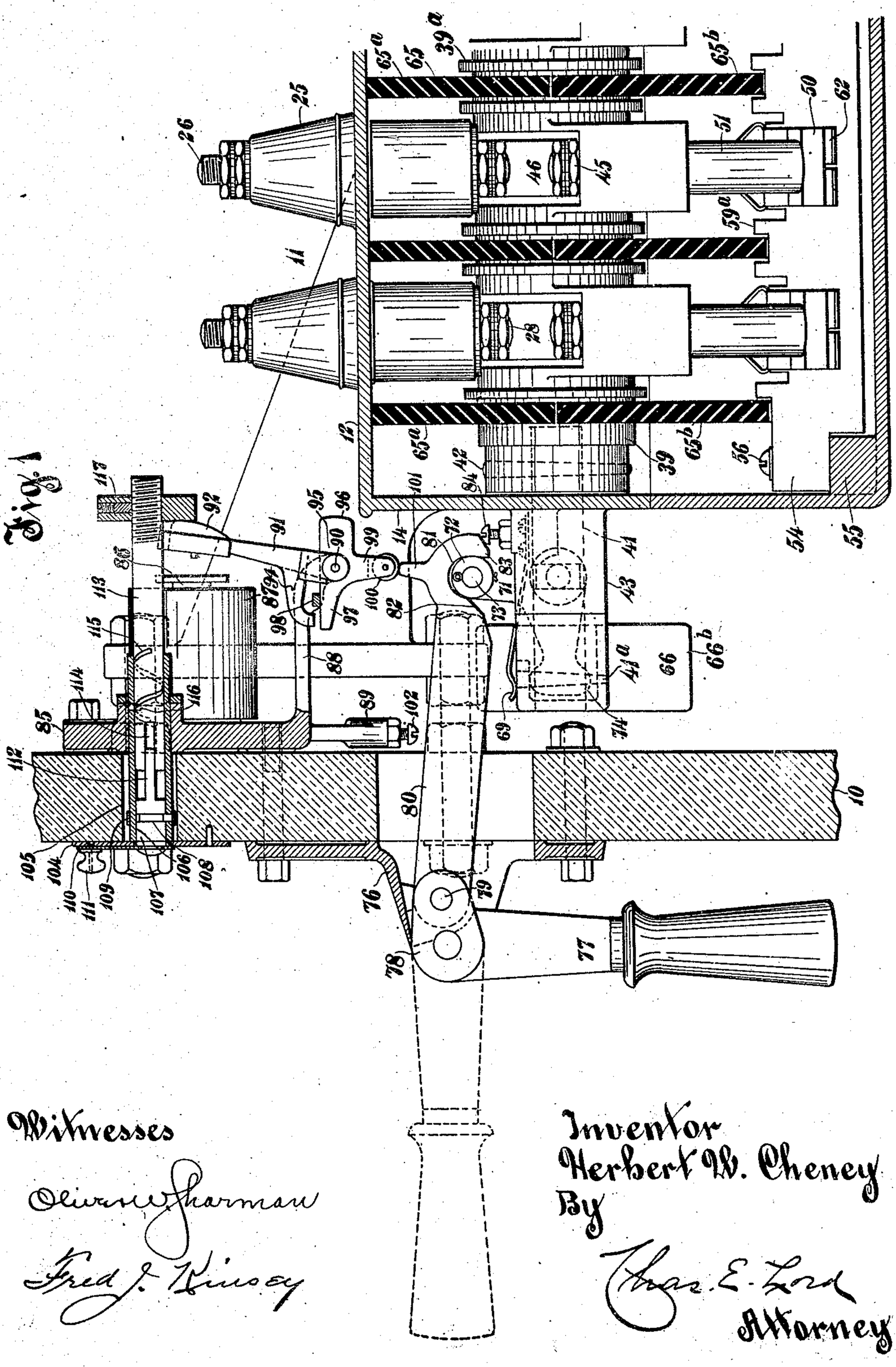
APPLICATION FILED OCT. 22, 1906.

928,901.

Patented July 20, 1909.

5 SHEETS—SHEET 1.

Fig. 1




Witnesses

Oliver W. Sharman

Fred'k Kinsey

Inventor

Herbert W. Cheney

By

Thos. E. Lord

Attorney

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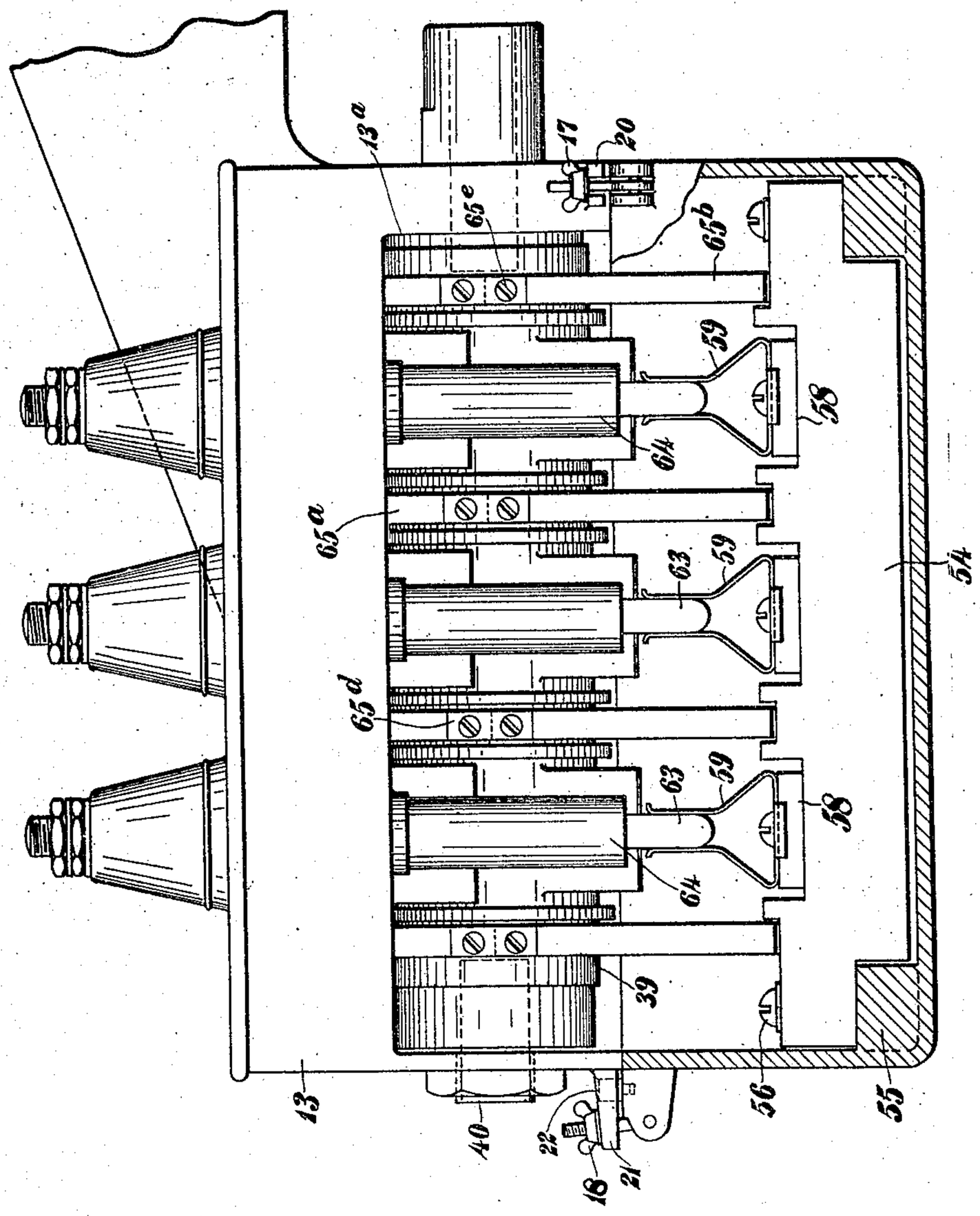
5 SHEETS—SHEET 2.

Fig. 2.

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5 SHEETS—SHEET 3

Fig. 3

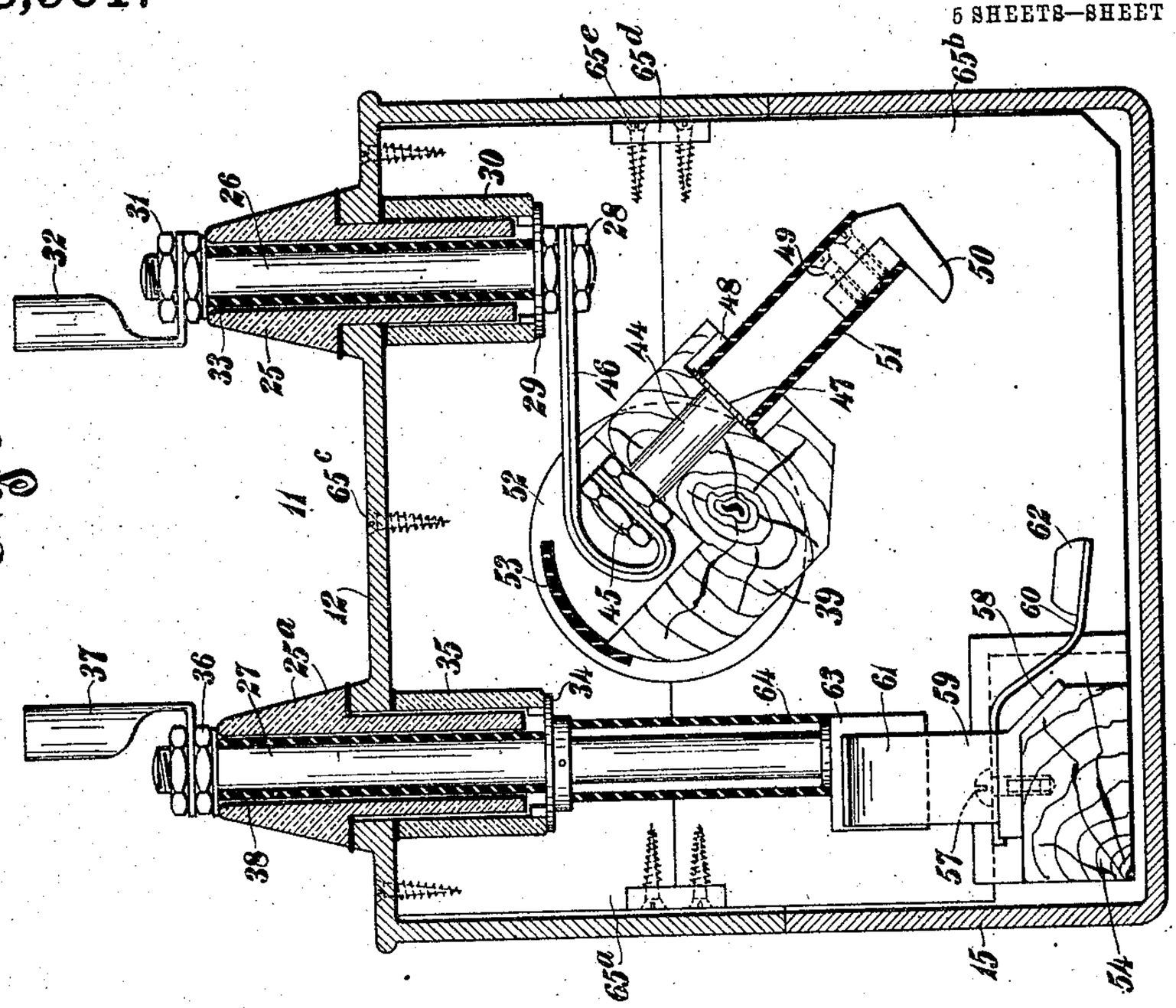
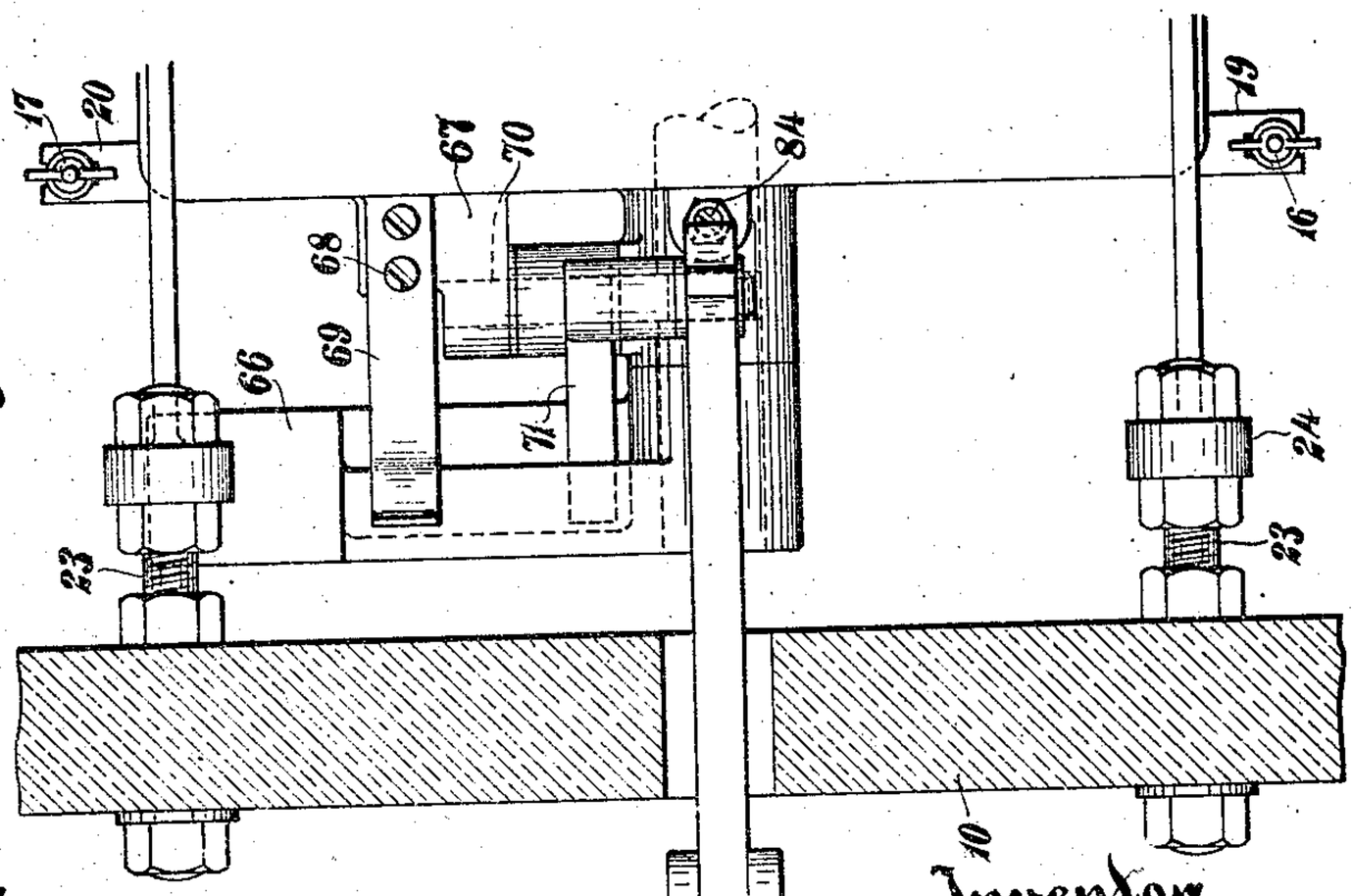



Fig. 4

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5 SHEETS—SHEET 4

Fig. 4.

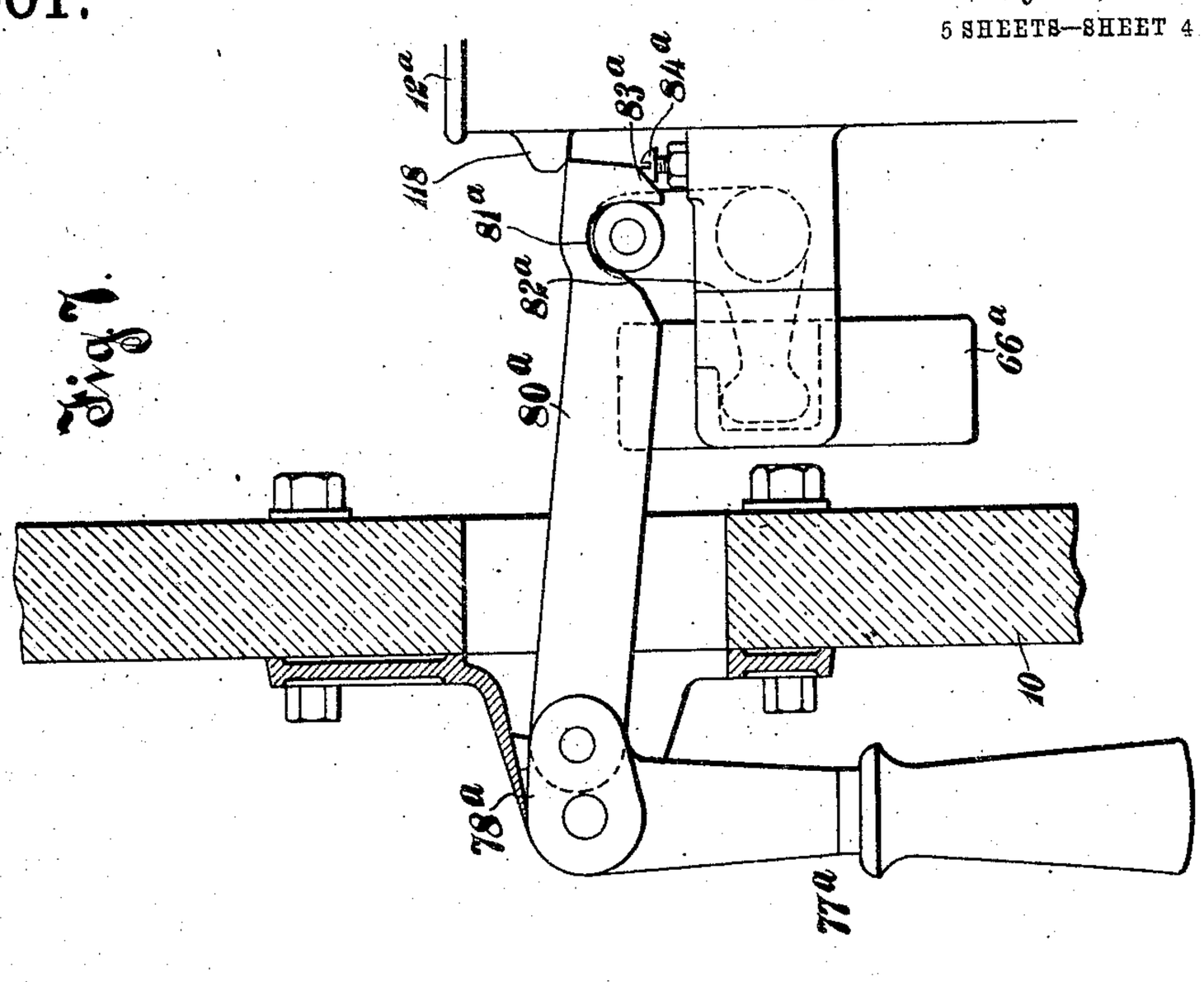
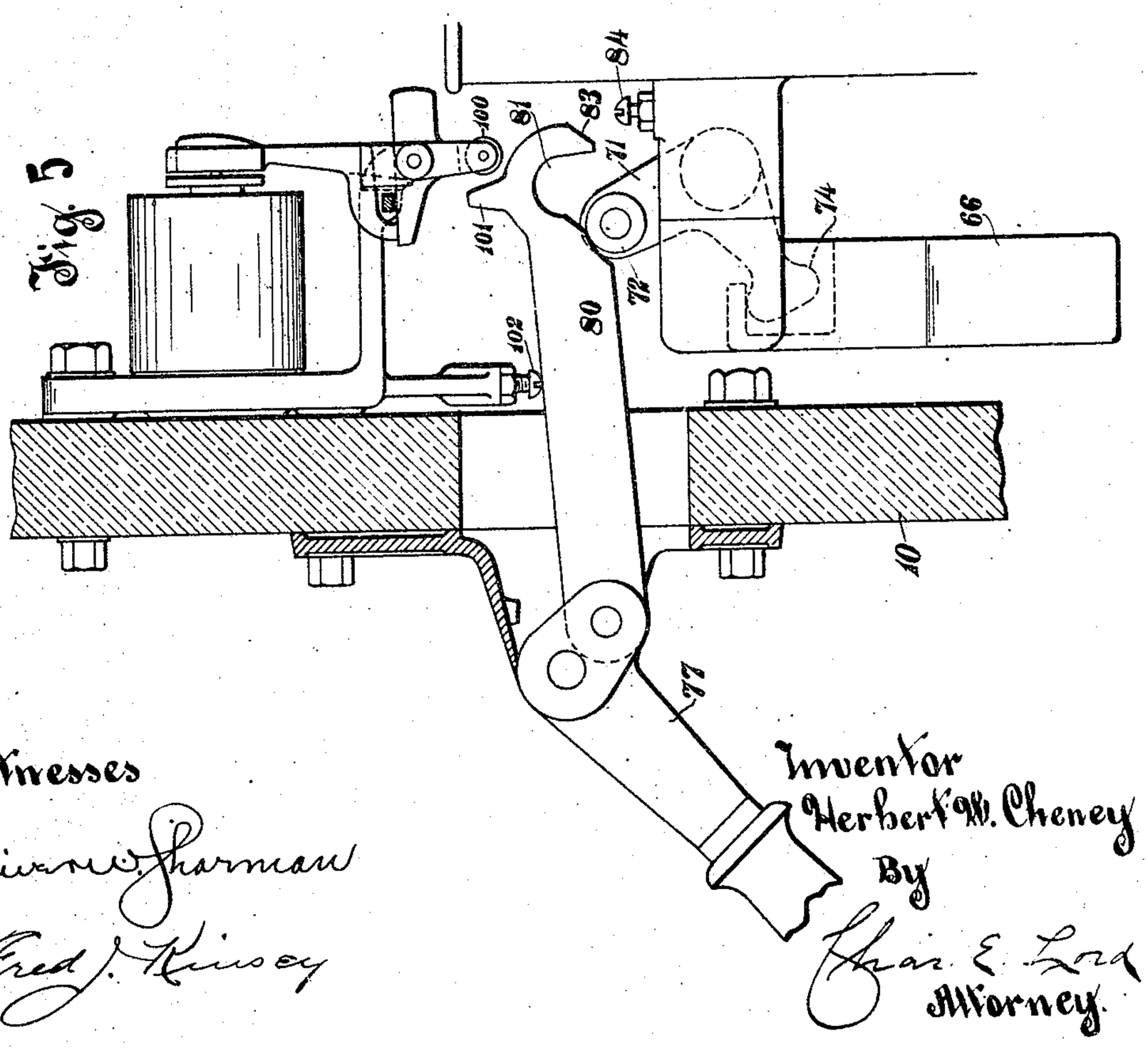



Fig. 5

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5 SHEETS—SHEET 5.

Fig. 8

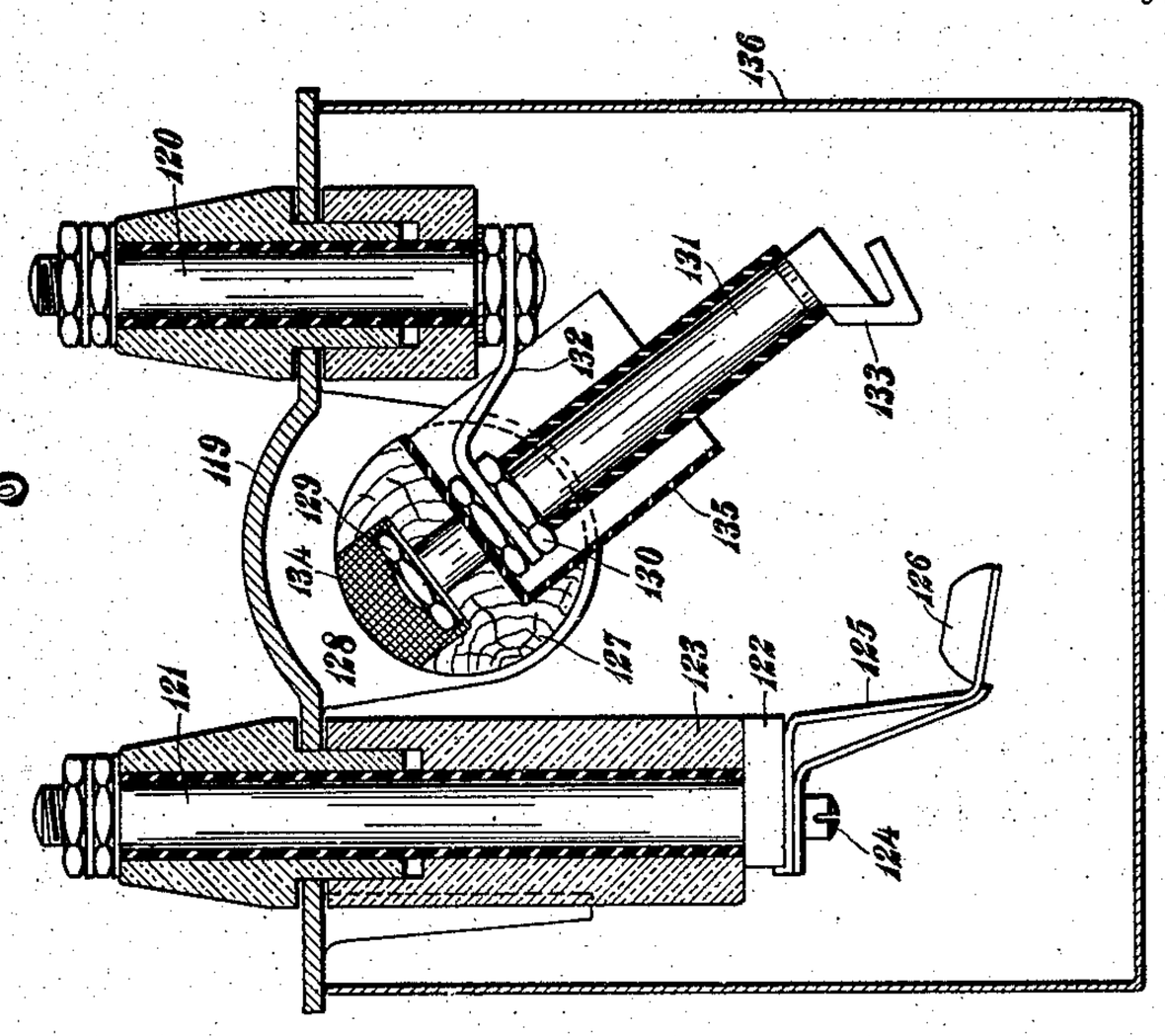
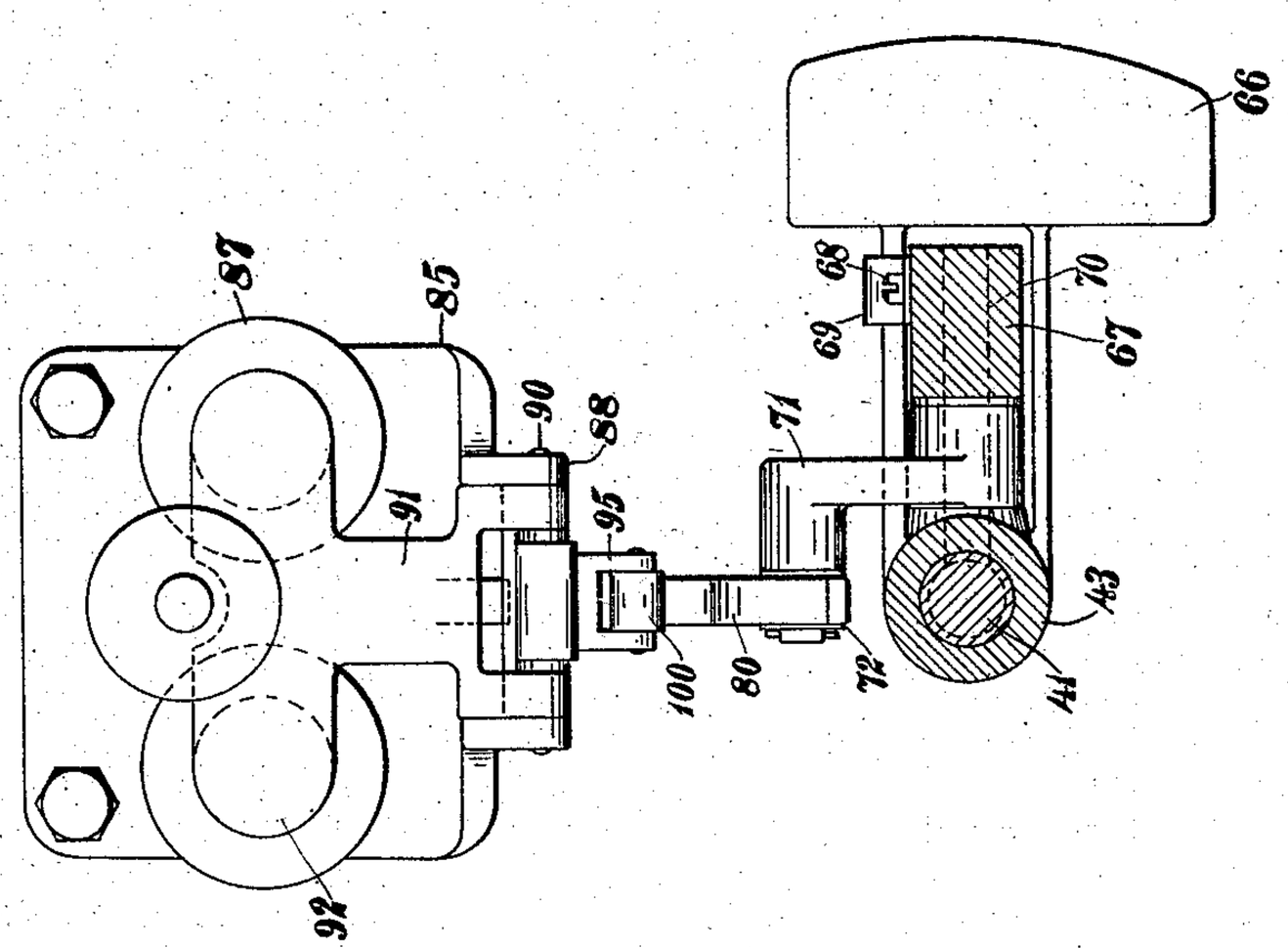



Fig. 6.

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Fred J. Kinsey

Inventor

Herbert W. Cheney

By

Chas. E. Lord

Attorney

# UNITED STATES PATENT OFFICE.

HERBERT W. CHENEY, OF NORWOOD, OHIO, ASSIGNOR TO ALLIS-CHALMERS COMPANY, A CORPORATION OF NEW JERSEY, AND THE BULLOCK ELECTRIC MANUFACTURING COMPANY, A CORPORATION OF OHIO.

## AUTOMATIC CIRCUIT-BREAKER.

No. 928,901. Specification of Letters Patent. Patented July 20, 1909.

Application filed October 22, 1906. Serial No. 339,905.

*To all whom it may concern:*

Be it known that I, HERBERT W. CHENEY, 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 Automatic 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 and effective in operation.

A further object is to provide for a system of any number of phases, a switch which can be readily attached to a narrow switchboard panel.

A further object is to provide an improved switch operating mechanism.

A still further object is to provide improved means for adjusting the position of the armature of the tripping magnet in the automatic form of my switch.

Other objects will appear from the following detailed description.

My invention consists in certain novel details of construction and 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 partial sectional elevation of my improved oil switch and operating mechanism; Fig. 2 is an elevation of my improved switch, parts being in section and broken away, the view being taken from the opposite side to that shown in Fig. 1; Fig. 3 is a transverse section through the switch looking toward the rear of the switch. Fig. 4 is a plan view of the switch operating mechanism and of a portion of the switch, the switch-panel being shown in section; Fig. 5 is a side elevation of the switch operating mechanism showing the position of the parts when the switch has been automatically opened; Fig. 6 is a sectional elevation looking toward the switch-panel from the rear showing portions of the switch operating mechanism and the tripping mechanism; Fig. 7 is an elevation of a manual switch operating mechanism showing also portion of the switch in elevation, and the switch panel in section; Fig. 8 is a section similar to Fig. 3 showing a modified form of switch.

Referring now to the figures of the drawing I have shown at 10 a switch-board panel on the rear of which the oil switch 11 is mounted. The switch is provided with an upper horizontal casting 12 which supports part of the switch elements and forms the cover for the oil tank. The casting 12 is provided with downwardly extending portions 13 and 14 on the sides and ends respectively. Bearing against the lower extremities of the casting 12 is an oil tank 15 made from cast metal such as iron, in the preferred construction of my switch. This tank also serves to support parts of the switch as will be explained. The tank is supported on the upper casting in this instance by three pivoted bolts and winged nuts 16, 17 and 18 mounted on lugs on the oil tank 15, the pivoted bolts fitting into slots of lugs 19, 20 and 21 on the upper casting. It is seen from Figs. 2, 3 and 4 that the winged nuts 16, 17 and slotted lugs 19 and 20 are on the sides of the switch adjacent the panel, and the pivoted bolt and winged nut 18, and slotted lug 21 are on the end of the switch most remote from the panel. The tank is made from cast metal for the reason that in the preferred construction part of the switch elements are supported thereby. It is necessary, therefore, that the tank after removal be restored to the exact position that it occupied before removal. For this purpose I provide in one or more of the slotted lugs which receive the pivoted tank retaining bolts, dowel-pins 22 which engage sockets or recesses in the lugs on which the pivoted bolts and winged nuts are pivoted. After the position of the tank has once been ascertained, the dowel-pin or pins are secured in position. The tank can then after removal be easily and accurately replaced to its proper position.

The switch is secured to the switch panel by bolts 23 which pass through the switch panel and through lugs 24 on the end of the upper casting. The switch here shown is a three-phase switch but my invention is not limited to a switch for a three-phase circuit. The top of the casting is provided with three pairs of terminal openings, the pairs

of openings being arranged in lines successively away from the panel. Referring now particularly to Fig. 3 it is seen that in each pair of openings are porcelain bushings 25 and 25ª which rest upon the top of the casting. Mounted in the porcelain bushings are two sets of terminal rods 26 and 27. Each terminal rod 26 is provided on its lower end with a pair of nuts 28 and a collar 29. Between the collar 29 and the top of the casting is a porcelain sleeve 30. At the top of the terminal rod 26 above the casting are a pair of nuts 31, by means of which the terminal rod 26, bushing 25 and sleeve 30 are rigidly held in position. The nuts 31 also serve to clamp in position the terminal lead 32. The terminal rods 26 are surrounded in this case by insulating sleeves 33. Secured to each terminal rod 27 at a suitable distance from the casting 12 is a collar 34. Located upon the collar 34 and the upper casting 12 is a sleeve 35 similar to the sleeve 30. At the top of each terminal rod 27 are a pair of nuts 36 by means of which the terminal rod 27, porcelain bushing 25ª and sleeve 35 are rigidly held in position. Between the two nuts 36 the second terminal lead 37 is clamped. Each terminal rod 27 is surrounded by an insulating sleeve 38 which rests upon the collar 34.

At 39 is shown a rotary contact drum which carries the movable switch contacts as will be explained. As is seen, the drum is arranged at right angles to the switchboard, and is mounted in the two downwardly extending portions 14 of the upper casting 12. In this instance the end of the drum remote from the switch panel is provided with a socket which receives a trunnion 40 mounted in the end of the casting as is shown in Fig. 2 and the end of the drum adjacent the switch-panel is provided with a socket which receives the end of a spindle 41 which is secured to the drum by a transverse pin 42. The downwardly extending end-portion 14 of the casting is provided on its outer side with a lug 43 having an opening through which the spindle 41 passes.

The drum 39 is provided with three equally spaced openings through which pass three movable contact rods 44 which are provided at the upper ends with nuts 45. At 46 are shown flexible leads or connectors which are clamped at one end between the nuts 28 on the lower ends of terminal rods 26 and at the other end between the nuts 45 on rods 44. Contact rods 44 are each provided with a shoulder 47 which enters a recess 48 in the lower part of the drum and the rod is clamped in position by tightening the nuts at the top of the rod. Secured to the lower end of each contact rod 44 by screws 49 is a movable contact member 50. The portion of the contact rod 44 which extends below the drum is surrounded by an insulating sleeve 51. The top of each contact rod 44 and a portion of the flexible connecting lead 46 secured thereto is seated in a recess 52 in the drum, which recess is partially closed by an insulating shield 53. Thus it is seen that the live portions of the movable members are well insulated from the live portions of the stationary members now to be described.

Mounted in the bottom of the oil tank 15 is a wooden or other insulating bar 54 which rests on lugs 55 and is secured thereto by screws 56. This bar also extends at right angles to the switch panel and is located below the terminal rods 27. Secured to the insulating bar 54 by screws 57, opposite the movable contacts 50 are three equally spaced contact finger bases 58. Secured to each finger base by one of the screws 57 is a stationary contact member 59, consisting of a contact finger 60 and a pair of upwardly extending spring jaws 61 shown most clearly in Figs. 1 and 3. The contact finger and spring jaws 61 are integral with each other and are preferably punched from sheet metal. At the end of each contact finger 60, is a contact 62 adapted to be engaged by the corresponding movable contact 50. The terminal rods 27 are longer than the terminal rods 26 and are provided at their lower ends with plugs 63 which engage the contact jaws 61. The jaws 61 and plugs 63 are so arranged that when the tank is raised in position each of the plugs 63 engages a pair of contact jaws 61. The portion of each terminal rod 27 between the collar 34 and the block 63 is surrounded by an insulating sleeve 64.

The different poles of the switch are separated from one another and from the ends of the switch castings by vertical insulating barriers 65. Each barrier consists of two portions 65ª and 65ᵇ which are in engagement with each other along the center of the rotary drum 39 the upper and lower portions each being provided with a semi-circular opening so as to fit closely around the drum adjacent circular flanges 39ª integral with the latter. The upper portions of the barriers are preferably secured to the top of the casting by screws 65ᶜ and the lower barriers are preferably secured to the upper barriers by connecting strips 65ᵈ and screws 65ᵉ. The lower portions of the barriers are provided with notched portions so as to fit closely over the insulating bar 54. The bar is provided with flanges 59ª adjacent the barriers so as to more completely insulate the poles from each other and from the ends of the castings. If desired the lower portions of the barriers may be secured to the tank or bar 54 so as to be removable therewith.

By referring to Figs. 2 and 3 it is seen

that the sides 13 of the upper switch casting 12 are partially removed forming openings 13ª. These openings so formed are preferably covered with removable sheet metal coverings (not shown) to prevent the oil from splashing out of the tank and also to prevent dirt or sediment from entering the tank. The openings and removable covers or doors provide convenient means for inspecting the contacts without removing the tank.

The automatic switch operating mechanism will now be described. The outer end of the spindle 41 which is secured to the end of the drum extends through the lug 43 and is provided at its end adjacent the switch panel with a weighted lever arm 66, secured to the end of the spindle 41 by a pin 41ª. The weighted lever arm 66 which is provided with an enlarged outer end 66ᵇ is so secured to the spindle 41 that when the switch is closed the lever arm is substantially horizontal. It may be stated at this time that the purpose of the weighted lever is to assist in opening the switch, the switch being preferably opened by the combined action of the weight and a spring as will be explained. Extending out from the end of the casting 12 and spaced a short distance from the lug 43 is a lug 67. Secured to the lug by screws 68 is a leaf spring 69 which bears upon the weighted lever and assists in opening the switch. This spring may, if desired, be dispensed with. Mounted in the two lugs 43 and 67 is a pin 70 one end of which preferably engages a groove in the shaft to prevent a longitudinal movement thereof. Mounted on a pin 70 is a bell crank lever 71 having at the end of the upwardly extending arm a roller 72 mounted on a transverse pin 73, which roller is substantially in line with the axis of the spindle 41, and drum 39 of the switch. The opposite arm of the bell-crank lever 71 is provided with a slightly enlarged end 74 shown in dotted lines. This end 74 of the arm of the bell-crank lever is located in a hollowed or recessed portion of the weighted lever arm 66, the recess portion being located between the enlarged end of the lever arm and the spindle 41 as is shown in Figs. 1 and 4. Thus it is seen that if the bell-crank lever is rocked about its pivoted center that the weighted lever 66 and hence the rotary drum 39 are also rocked or rotated.

Pivoted at 75 in a casting 76 which is secured to the front of the switch-panel 10, is a switch operating handle 77. Secured to the operating handle is one arm 78 of the toggle. Pivoted to the arm 78 at 79 is the second arm 80 of the toggle. The arm 80 extends through an opening in the switch panel and has a free outer end adjacent the switch. The switch handle and toggle mechanism are so arranged that the operating handle 77 and the arms 78 and 80 are substantially in line with the axis of the switch drum. The outer free end of the arm 80 is provided on its under side with an open slot 81 which is adapted to receive the roller 72 upon the upper end of the arm of the bell-crank lever 71. One side of this slot 81 extends downward substantially in a straight line, while the opposite side is partly inclined as is shown at 82. The end of the arm 80 is provided with an inclined nose shown at 83. In line with the arm 80 and in path of movement with the inclined portion 83, is an adjustable screw 84 secured to the top of the lug 43 adjacent the end 14 of the casting 12. The purpose of this screw will be explained later.

Located on the rear side of the switch-panel and secured thereto by screws or bolts is a frame or casting 85 for the tripping mechanism. The casting is provided with a rear portion in engagement with the panel, with two horizontal projections 86 forming cores for tripping coils 87, and a forked horizontal portion 88, and with a downwardly extending lug 89. Mounted between the arms of the horizontal portion 88 of the casting on a horizontal pin or spindle 90 is a pivoted armature 91 having an enlarged portion 92 adapted to be drawn into engagement with the cores of the tripping magnets, and a projecting portion 94, the purpose of which will appear later. The armature is also provided with two arms through the lower ends of which passes the spindle 90 as is shown in Figs. 1 and 6. Also mounted on the pin or spindle 90, is a movable latch 95 having at one side a weighted portion 96 and on the opposite side a finger 97 located beneath and normally in engagement with the lower side of a bar 98 extending between the arms 88 of the casting 85. The pivoted latch 95 is also provided on its lower side with a projection 99 which is recessed or forked at its lower end in which forked portion is mounted a small roller 100 which is adapted to be engaged by a projection 101 on the upper side of the toggle arm 80 opposite the slot 81. As will be explained later the purpose of the roller is to hold the toggle arm 80 and the roller 72 on the end of the arm of the bell-crank lever in engagement with each other when the switch is closed. The lug or projection 89 on the lower side of the casting or frame 85 is directly above the toggle arm 80 and is provided on its lower side with an adjustable screw 102, which as will be explained acts as a stop to limit the upward movement of the toggle arm when the switch is opened.

I have provided novel means for adjusting the position of the armature 91 of the tripping coils, so that the switch can be caused to open at any desired predetermined line condition. On the front of the switch-board

opposite the tripping coils 87 is a plate 104. Extending through an opening 105 of the switch-board panel is a tube 106 supported at one end by the plate 104 at the front end of the switch-board, and by the casting 85 at the rear of the switch-board. Located within the tube and near the front end thereof is a short rotary plug or spindle 107. The spindle is provided with a groove 108 which is engaged by a pin 109 extending through the wall of the tube 106 so as to permit a rotary movement of the plug or spindle but to prevent the latter from moving longitudinally in the tube. At the front of the switch-board I provide means for rotating the spindle. In this case I provide a spring crank 110 having a knob 111. The plate 104 may be provided with a series of holes or notches to receive a projection on the crank so that the latter may be set at definite positions. The rear of the plug or spindle 107 is provided with a tongue 112. Extending from the rear end of the tube and beyond the ends of the tripping coils is a second spindle 113. This spindle is provided with a slot 114 into which the tongue 112 extends and is also provided with a spiral groove 115 engaged by a pin 116 extending through the wall of the tube 105. The rear end of the spindle 113 is threaded and is provided with an adjustable nut or collar 117 against which the armature 92 normally rests. It is seen that when the spindle 107 is rotated, both rotary and longitudinal movements are given to the spindle 113. Thus the position of the armature can be adjusted by revolving the crank 110

The operation of the switch and switch operating mechanism will now be more fully explained. In Fig. 3 the switch is shown in its open position, and in Fig. 5 the switch operating mechanism is shown in the position when the switch is open. It is seen that the weighted lever arm is below its horizontal position, the roller 72 rests on the toggle arm 80 out of the slot 81, the outer free end of the toggle arm is raised above the opposite end and is in engagement with the screw 102, and that the operating handle 77 is at an angle of about 45° with the switch-panel. Now if it is desired to close the switch the operating handle is raised to the horizontal position shown in dotted lines in Fig. 1, thus moving the toggle arm 80 forward until its slotted end drops down over the roller 72 on the end of the bell-crank lever. The switch handle is then thrown downward into the position shown in full lines in Fig. 1 moving the toggle arm 80 rearward, rocking the bell-crank lever about the spindle 70, raising the weighted lever 66, and hence rotating the contact carrying drum to its closed position. As the switch handle and toggle arm are near the completion of the stroke, the inclined portion 82 at the end of the arm 80 engages the screw 84 and the toggle arm rides up on the screw. The screw 84 is so adjusted that the toggle arm is lifted a sufficient amount so that the roller now rests at the edge of the inclined portion 82 and the end of the projection 101 on the top of the toggle arm engages the roller 100 on the latch 95. The purpose of the roller 100 is to hold the toggle arm and bell-crank lever into the position shown in Fig. 1, for otherwise the switch could not be held in its closed position. Now in case of an abnormal line condition such as overload in the main distributing conductors, the armature 92 of the tripping magnets is attracted by the coils and the projection 94 strikes the horizontal finger 97 of the latch with sufficient force to rock the latch 95 about its pivotal center, and thus moving the roller 100 away from the projection 101 on the toggle arm, permitting the arm to be thrown upward by the pressure of the bell-crank lever arm due to the weight 66 and the spring 69 and permitting the weight to drop and the switch to be opened. When the toggle arm 80 is thrown upward it strikes the screw 102 causing the operating handle to be moved outward to the position shown in Fig. 5 which position of the handle serves as an indication that the switch is open. Thus it will be seen that the arm 80 and the bell crank lever 71 together with the roller 72 which is carried thereby and is adapted to engage the notch 81 of the arm 80, constitute a separable connection or coupler between the operating handle 77 and the switch. It will be seen also that when the end of the arm 80 engages the screw 84 during the final closing movement of the handle, there is a slight relative movement between the parts of the coupler or a partial disengagement thereof and that when the roller 100 is moved out of engagement with the projection 101 on the arm 80, total disengagement or separation of the parts of the coupler occurs.

In Fig. 7 is shown the switch operating mechanism adapted for manual operation alone. The manual operating mechanism is similar in the main to the automatic operating mechanism first described. As is in the first case the switch drum is adapted to be opened by a weighted lever $66^a$ which in this case however, must be released by hand and not automatically. The operating handle and toggle arms are shown respectively at $77^a$, $78^a$ and $80^a$. The outer free end of the toggle arm $80^a$ is provided with a slot $81^a$ and an inclined portion $82^a$ at the forward side thereof and with an inclined end $83^a$, adapted to engage the screw $84^a$ in substantially the same manner as first described. In this case, the upper casting $12^a$ is provided with a forwardly extending lug or projection 118 which serves to hold the tog-

gle arm and roller 72ª, and the bell-crank lever in position. The switch is closed by moving the handle first to the horizontal position and then to the position shown in Fig. 7. as in the first case. Near the completion of this stroke of the toggle arm 80ª its forward inclined end 83ª engages the screw 84ª and the toggle arm is lifted a short distance upward away from the roller 72ª until the rear upward end of the arm engages the lower side of the lug or projection 118. When it is desired to open the switch the handle is moved manually outward, a sufficient distance to move the end of the toggle arm out of engagement with the lower side of the lug 118. At the instant the end of the toggle arm moves beyond the lug 118 the bell-crank lever throws the lever arm upward and the switch is opened by the weight and spring. It is seen that both in this construction and in the first construction that the switch is quickly opened, the hand operation differing from the automatic operation merely in the release of the toggle arm and bell-crank lever.

In Fig. 8 I have shown a modified form of the switch. The switch here shown is in its essential points similar to the switch first described, the main difference being the manner of supporting the stationary contacts. In this case the latter are supported from the upper casting independently of the switch tank, which can therefor be removed without disturbing the contacts. The switch casting 119 supports the terminal rods 120, 121 in substantially the same manner as the terminal rods 26 and 27 shown in Fig. 3. Each of the terminal rods 121 however is provided at its lower end with a base 122 which rests against the porcelain sleeve 123. Secured to the lower side of the base 122 by a screw 124 is a flexible contact finger 125 which supports a stationary contact 126. At 127 is shown a rotary drum mounted in lugs 128 (only one of which is shown) extending downwardly from the lower part of the casting 119. The drum is provided on opposite sides with recesses in which are located nuts 129 and 130, which clamp the movable contact rod 131 into position. A flexible lead 132 connects the movable contact rod 131 to the terminal rod 120 as in the first construction. Each contact rod 131 is provided on its lower end with movable contacts 133 adapted to engage a stationary contact 126. The recess in the upper part of the drum which receives the nut 129 is preferably filled with cement 134 after the contact rod 131 is tightened in position. Each flexible terminal 132 and nuts 130 are preferably partially surrounded by an insulating shield 135. The purpose of the cement 134 and shield 135 is to protect the live parts on the movable members and prevent flashing between such parts and the live parts of the stationary contact members. Secured to the lower side of the casting 119 is an oil tank 136 made preferably from sheet metal. The drum 127 is adapted to be operated in exactly the same manner as drum 39 of the first construction.

From the above it is apparent that I have devised a high voltage switch which is simple in construction and operation. It will also be seen that since the compartments for the different phases are arranged in a line at right angles to the switch-board that the width of a two or three-phase switch is no greater than for a single phase switch, and therefore the switch can be easily applied to narrow panels. It is also apparent that many alterations can be made in the switch mechanism and construction without departing from the spirit and scope of my invention. I therefore do not wish to be limited to the details shown but aim in my claims to cover all such alterations.

What I claim as new is:—

1. In combination, a switch board, an oil switch on the rear thereof, said switch having an oil tank, a rotary switch drum or shaft carrying a movable contact member and having one end projecting beyond the oil tank, the axis of said drum being substantially at right-angles to the switch board, an operating handle on the front of said switch board and pivoted to swing toward and away from the same, and connecting means between the handle and said end of the drum, said connecting means comprising a longitudinally movable rod pivoted to the handle.

2. In a rotary oil switch, stationary and movable contact members, a rotary drum on which the movable contact member is mounted, a weight on said drum for opening the switch, and means for closing the switch comprising an operating handle and mechanism connected to said handle and to said weight.

3. In a rotary oil switch, stationary and movable contact members, a rotary drum on which the movable contact member is mounted, means including an operating handle and a longitudinally movable rod for turning said drum in one direction to close the switch, means for causing said rod to become disengaged from said drum, and means for turning the drum in the opposite direction to open the switch.

4. In a rotary oil switch, stationary and movable contacts, an oil receptacle inclosing the contacts, a rotary drum on which the movable contact is mounted, said drum having an end extending outward from the receptacle, means exterior to said receptacle for turning said drum in one direction to close the switch, said means including a han-

dle and a longitudinally movable rod arranged to be placed in operative relation with said end of the drum, and means for causing the connection between said drum and rod to be broken so that the drum can turn in the opposite direction to open the switch.

5. In a rotary oil switch, stationary and movable contact members, a rotary drum on which the movable contact member is mounted, means including an operating handle and a longitudinally movable rod for turning said drum in one direction to close the switch, means for causing said rod to become disengaged from said drum, and a weighted member on said drum for opening the switch.

6. In a rotary oil switch, a supporting frame, stationary and movable contacts, an oil receptacle inclosing the contacts, a rotary drum on which the movable contact is mounted, said drum being journaled in the frame and having an operative end extending outward from the receptacle, means exterior to the said receptacle including an operating handle and a longitudinally movable rod adapted to be connected to said drum for turning the latter in one direction to close the switch, means for causing the connection between the rod and drum to be broken, and a weighted member on said drum for opening the switch.

7. In a rotary oil switch, stationary and movable contacts, an oil receptacle inclosing said contacts, a rotary drum on which the movable contact or contacts are mounted, said drum having a portion extending outward from the receptacle, a weight mounted on said outwardly extending portion of the drum, means including an operating handle and toggle arm adapted to be connected to said weight for raising the weight and for turning the drum to close the switch, and means whereby the connection between the toggle arm and weight may be broken so that the drum can be turned by the weight to open the switch.

8. In a rotary oil switch, stationary and movable contacts, a rotary drum on which the movable contact is mounted, an arm extending outward from said drum, means including an operating handle and toggle mechanism connected thereto and arranged to be placed in operative relation with said arm for turning the drum in one direction to close the switch, and means for causing said toggle mechanism and arm to be disconnected whereby the drum can turn in the opposite direction to open the switch.

9. In a rotary oil switch, stationary and movable contacts, an oil receptacle inclosing the contacts, a rotary drum carrying the movable contacts and having a portion extending outward from said receptacle, an arm secured to said outwardly extending portion of the drum, means including an operating handle and toggle mechanism adapted to be placed in operative relation with said arm for turning the arm and drum to close the switch, and means whereby the connection between said arm and the toggle mechanism may be broken, so that the drum can turn to open the switch.

10. In combination, a switch-board, an oil switch mounted on the rear thereof, said switch comprising a frame having downwardly extending portions, a rotary drum or shaft at right angles to the switch board and journaled in said downwardly extending portions of the frame, said drum having an operative end extending beyond one of said downwardly extending portions and located between the latter and the switch-board, a plurality of movable contacts mounted on said drum, an operating mechanism for moving the drum in one direction to close the switch comprising a handle pivoted to swing toward and away from the switch-board, and means for moving the drum in the opposite direction to open the switch.

11. In an oil switch, a rotary drum or spindle carrying movable contacts, an oil receptacle inclosing said contacts, said drum having an operative end extending outward beyond the receptacle, an operating mechanism exterior to said receptacle for moving the drum in one direction to close the switch, means for causing the connection between said drum and the operating mechanism to be broken whereby the drum can turn in the opposite direction to open the switch.

12. In an oil switch, a supporting frame, a rotary drum journaled in said frame, a plurality of movable contacts mounted on the drum, an oil receptacle inclosing the contacts, said drum having a portion extending outward beyond the receptacle, an operating mechanism including a pivoted handle and a longitudinally movable rod connected to the handle and in operative relation with said outwardly extending portion of the drum, the axis of the drum being in the plane of movement of the operating handle.

13. In an oil switch, a rotary drum carrying movable contact members, an oil tank inclosing the contact members, a portion of the drum extending outward beyond the receptacle, and an operating mechanism including an operating handle and a longitudinally movable rod in operative relation with said outwardly extending portion of the drum, the axis of the drum being in the plane of movement of the longitudinally movable rod.

14. In combination, a switch-board, an oil switch mounted on the rear thereof, said switch comprising a rotary drum at right angles to the switch-board, one or more movable contacts mounted on the drum, an oil receptacle inclosing the contacts, said drum having one end extending outward beyond

the receptacle toward the switch-board, a lateral arm or extension on said outer end of the drum and movable therewith, an operating mechanism including a pivoted handle, a longitudinally movable rod connected thereto, and means for transmitting the movement of said rod to said lateral arm or extension.

15. In combination, a switch-board, an oil switch mounted on the rear thereof, said switch comprising a rotary drum at right angles to the switch-board, one or more movable contacts mounted on the drum, an oil receptacle inclosing said contacts, said drum having one end extending outward beyond the receptacle toward the switch-board, a lateral arm or extension on said outer end of the drum and movable therewith, an operating mechanism including a pivoted handle and a longitudinally movable rod connected thereto, and means comprising a bell-crank lever connected to said lateral arm or extension for transmitting the movement of said rod to said arm or extension and to said drum.

16. In combination, a switchboard, an oil switch on the rear thereof, said switch having a rotary drum at right angles to the switchboard, one or more movable contacts carried by the drum, an operating mechanism including a pivoted handle on the front of the switch-board and a longitudinally movable rod connected to said handle, means connected to said drum and arranged to be placed in locked engagement with said rod so that said drum can be turned in one direction to close the switch by a movement of said handle, and to be released from said rod to permit the drum to turn in the opposite direction to open the switch.

17. In combination, a switch-board, a switch mounted on the rear thereof, said switch having a rotary drum at right angles to the switch-board, one or more movable contact members mounted on the drum, an operating mechanism including a pivoted handle on the front of the switch-board, a longitudinally movable rod connected to said handle, a lever connected to said drum and arranged to be placed in locked engagement with said arm so that said drum can be turned in one direction and the switch closed by a movement of the handle, and to be released therefrom so that said drum can turn in the opposite direction and the switch opened.

18. In combination, a switch-board, a switch mounted in the rear thereof, said switch having a rotary contact drum at right angles to the switch-board, an arm or extension movable with said drum, a bell-crank lever engaging said arm, operating mechanism including a longitudinally movable rod adapted to engage said bell-crank lever to move the drum in one direction to close the switch and to be disengaged therefrom to permit the drum to be automatically moved in the opposite direction to open the switch.

19. In a switch or circuit-breaker, stationary and movable contact members, an operating mechanism including a longitudinally movable arm or rod, a movable member adapted to be engaged by said arm or rod for closing the switch, and means adapted to be engaged by said arm or rod in its forward movement for causing a slight predetermined relative movement between said arm or rod and said member so that said arm or rod and member may be disengaged permitting the switch to be quickly opened.

20. In a switch or circuit-breaker, an operating mechanism including a toggle arm having an open slot in one side, a movable switch member, a lever arm connected thereto adapted to engage the slot in said toggle arm whereby the switch can be closed, a projection in the path of said toggle arm to raise the latter a predetermined amount relative to the lever arm, a stop for limiting the upward movement of said toggle arm, said stop and toggle arm being relatively movable whereby the toggle arm and lever arm can be thrown out of engagement with each other and the switch opened.

21. In a switch or circuit breaker, a switch member rotatable about its axis, contacts for a plurality of poles carried by said member, a lever arm operatively connected to said member, an operating mechanism including an operating handle and toggle arm, said toggle arm being adapted to engage said lever arm and to close the switch when moved longitudinally, a movable stop for holding the toggle arm in engagement with said lever arm, and means for moving the stop relative to said toggle arm to permit the connection between said toggle arm and lever arm to be broken, whereby said switch member can turn to open the switch.

22. In a switch or circuit breaker, a switch member rotatable about its axis, contacts for a plurality of poles carried by said member, a pivoted lever operatively connected to said member, an operating handle, a toggle arm connected to said handle and having a separable connection with said lever, a movable device adapted to hold the toggle arm and lever in engagement, and means for automatically shifting said device out of engagement with said toggle arm whereby the drum is free to turn to open the switch.

23. In a switch or circuit-breaker, a movable switch member, switch operating mechanism comprising a lever and toggle arm, said toggle arm having an open slot to receive the lever arm, means for moving the toggle arm longitudinally to close the switch, means for causing a slight relative movement of the toggle arm relative to the lever near the completion of its longitudinal movement,

means for holding the lever and toggle arm in engagement comprising a pivoted latch above said toggle arm and engaged thereby, means comprising a tripping coil and armature for moving the latch out of engagement with the toggle arm, and means for opening the switch.

24. In an automatic switch or circuit-breaker, a tripping coil, an armature therefor, and means for adjusting the position of said armature comprising a spindle having a spiral groove, a stationary pin engaging said spiral groove a revoluble adjusting member, said member and spindle having a loose connection, whereby a longitudinal movement can be imparted to said spindle by the rotation of said member.

25. In combination, a switch-board, an automatic switch secured to the rear thereof, a tripping coil, an armature for said coil, and means for adjusting said armature comprising a spindle normally supporting at its outer end said armature, a tube extending through said switch-board, said spindle being located in said tube, said spindle having a spiral groove, a pin extending inward and engaging said groove, a second spindle within said tube, means for rotating said second spindle from the front of the switch-board, said spindles having a loose connection, whereby a longitudinal movement is imparted to the first mentioned spindle by the rotation of the second mentioned spindle.

26. In combination with a switch, an operating mechanism comprising a handle and a coupler through which said handle may operate the switch, said coupler comprising two parts which are connected together in driving engagement when the switch is being closed by a movement of said handle, and means for causing a slight relative movement between said parts of the coupler during the said movement of the handle, so that after the switch is closed said parts are biased toward disengagement.

27. In combination with a switch, an operating mechanism comprising a handle and a coupler through which said handle may operate the switch, said coupler comprising two parts which are connected together in driving engagement when the switch is being closed by a movement of said handle, means for causing a slight relative movement between said parts of the coupler during the final closing movement of the handle so that said parts are biased toward disengagement after the switch is closed, and means for normally preventing the disengagement of said parts.

28. In combination with a switch, an operating mechanism comprising a handle and a connection through which said handle may operate the switch, said connection comprising two parts which are in driving engagement when the switch is being closed by a movement of said handle, means for causing a slight relative movement between said parts of the coupler during the final closing movement of the handle so that said parts are biased toward disengagement after the switch is closed, and a latch for normally preventing the disengagement of said parts.

29. In combination with a switch, an operating mechanism comprising a handle and two members, one connected to the handle, and the other to the switch, said members constituting a coupler and being connected together when the switch is closed by a movement of the handle, means for causing one of the parts of the coupler to be moved to a position such that it tends to move out of engagement with the other part of the coupler, and means for normally preventing the disengagement of said parts.

30. In combination with a switch, an operating mechanism comprising a handle and a separable coupler through which said handle may operate the switch, said coupler comprising two parts, one having a notch and the other a projection which engages said notch while the switch is being closed, and means for causing a slight relative movement between said projection and the part having a notch so that said parts tend to move out of engagement, said relative movement taking place during the final closing movement of the switch handle.

31. In combination in a switch operating mechanism, an operating handle and two members, one connected to the handle and adapted to shift the other, said members constituting a separable connection, and one having a notch and the other a projection, which, when in full engagement with said notch, permits one of said members to be shifted by the other, means for causing a slight relative movement between said parts or members of the coupler during a final movement of the handle in one direction, so that said parts are partially disengaged, and means for stopping said relative movement and for holding the parts of the coupler in positions such that they are biased toward total disengagement.

32. In combination with a switch, a switch operating mechanism comprising a handle and two members, one connected to the handle and the other to the switch, and the two forming a separable connection, one of said members having an open notch and the other a device which is adapted to engage said notch when the handle is moved to one position and to remain in engagement therewith while the switch is being closed by a further movement of the handle, and a member for causing said device to be moved partially out of said slot during the final closing movement of the handle, to a position

such that said device tends to emerge from said slot and permit the parts of the coupler to move relative to each other.

33. In combination with a switch, a switch operating mechanism comprising a handle and two members, one connected to the handle and the other to the switch, said members forming a separable connection and one having an open notch and the other a device which is adapted to engage said notch when the handle is moved to one position and to remain in engagement therewith while the switch is being closed by a further movement of the handle, a member for causing said device to be moved partially out of said slot during the final closing movement of the handle, to a position such that said device tends to emerge from said slot and permit said members of the separable connection to move relative to each other, and a movable member for preventing movement of said device from the notch until after the occurrence of a predetermined abnormal line condition.

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

HERBERT W. CHENEY.

Witnesses:

ARTHUR F. KWIS,

FRED J. KINSEY.

Corrections in Letters Patent No. 928,901.

It is hereby certified that in Letters Patent No. 928,901, granted July 20, 1909, upon the application of Herbert W. Cheney, of Norwood, Ohio, for an improvement in "Automatic Circuit-Breakers," errors appear in the printed specification requiring correction, as follows: In line 20, page 5, after the word "weight" the reference-numeral and words *66ª, or by the weight.* should be inserted; page 6, line 99, the words "cap turn" should read *can be turned;* and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 7th day of September, A. D., 1909.

[SEAL.]

F. A. TENNANT,

*Acting Commissioner of Patents.*