H. W. CHENEY.

SWITCH CONSTRUCTION.

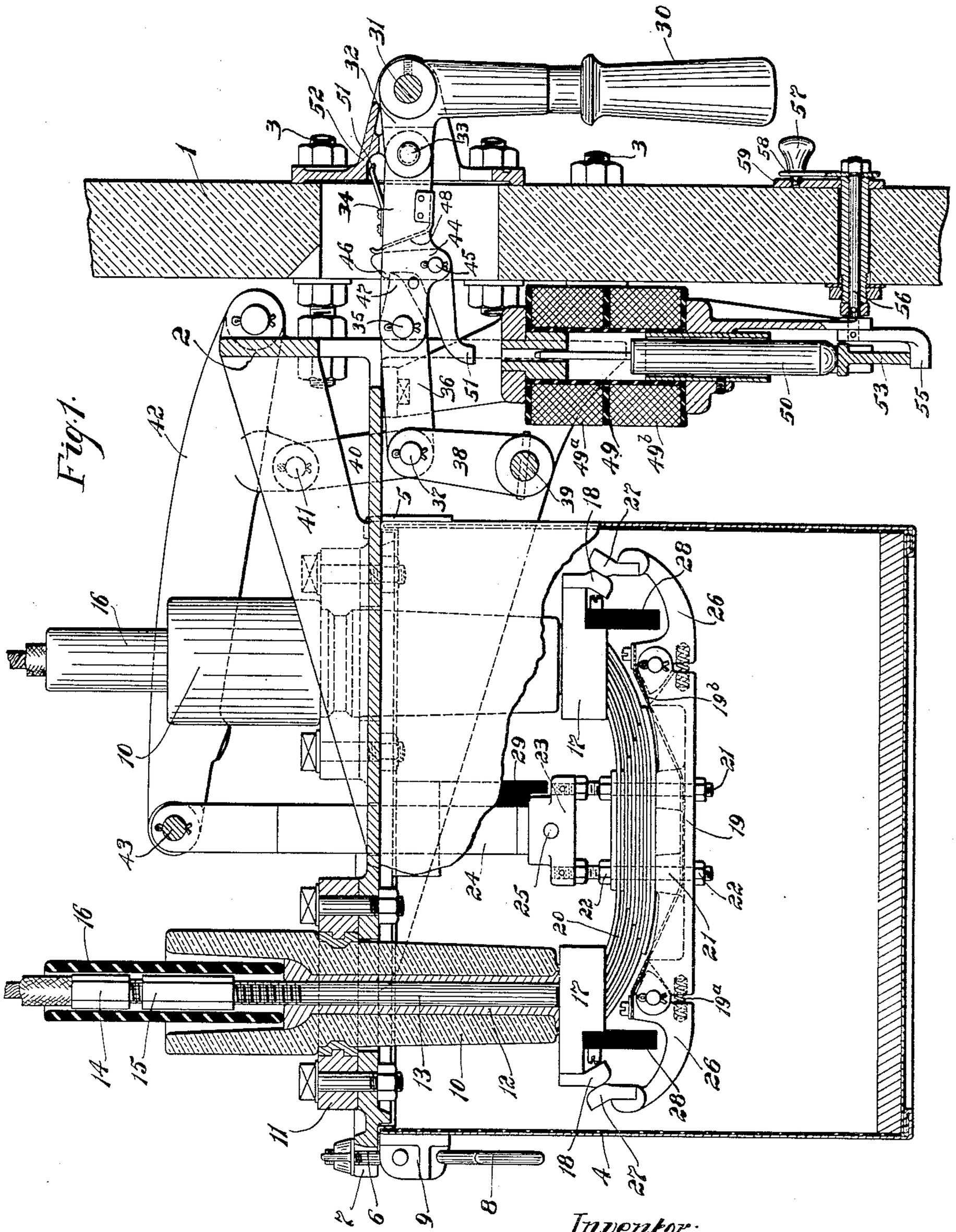
APPLICATION FILED AUG. 25, 1905.

917,542.

Patented Apr. 6, 1909.

4 SHEETS—SHEET 1.

Fig. 1.



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4 SHEETS—SHEET 2.

Fig. 2.

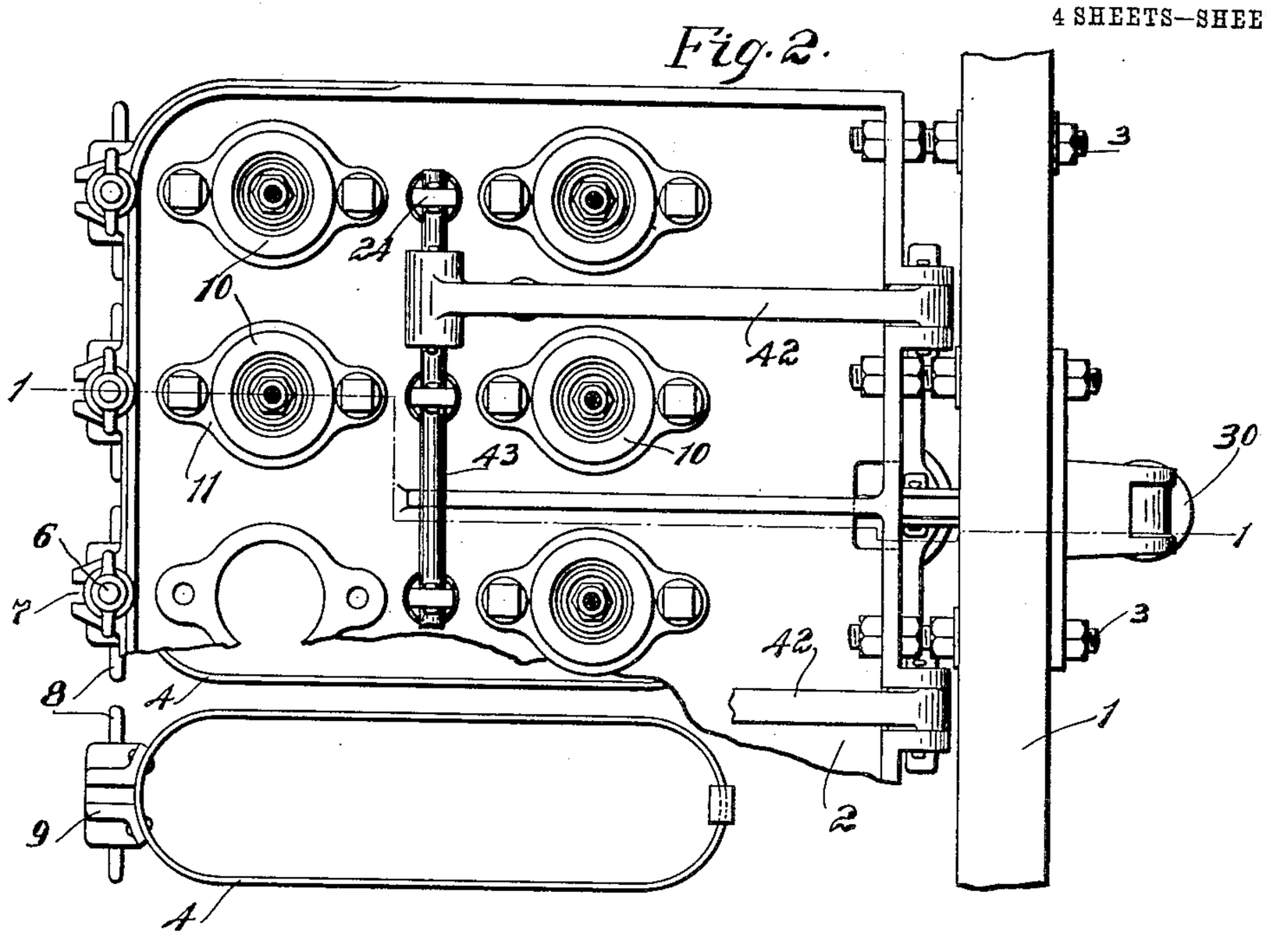
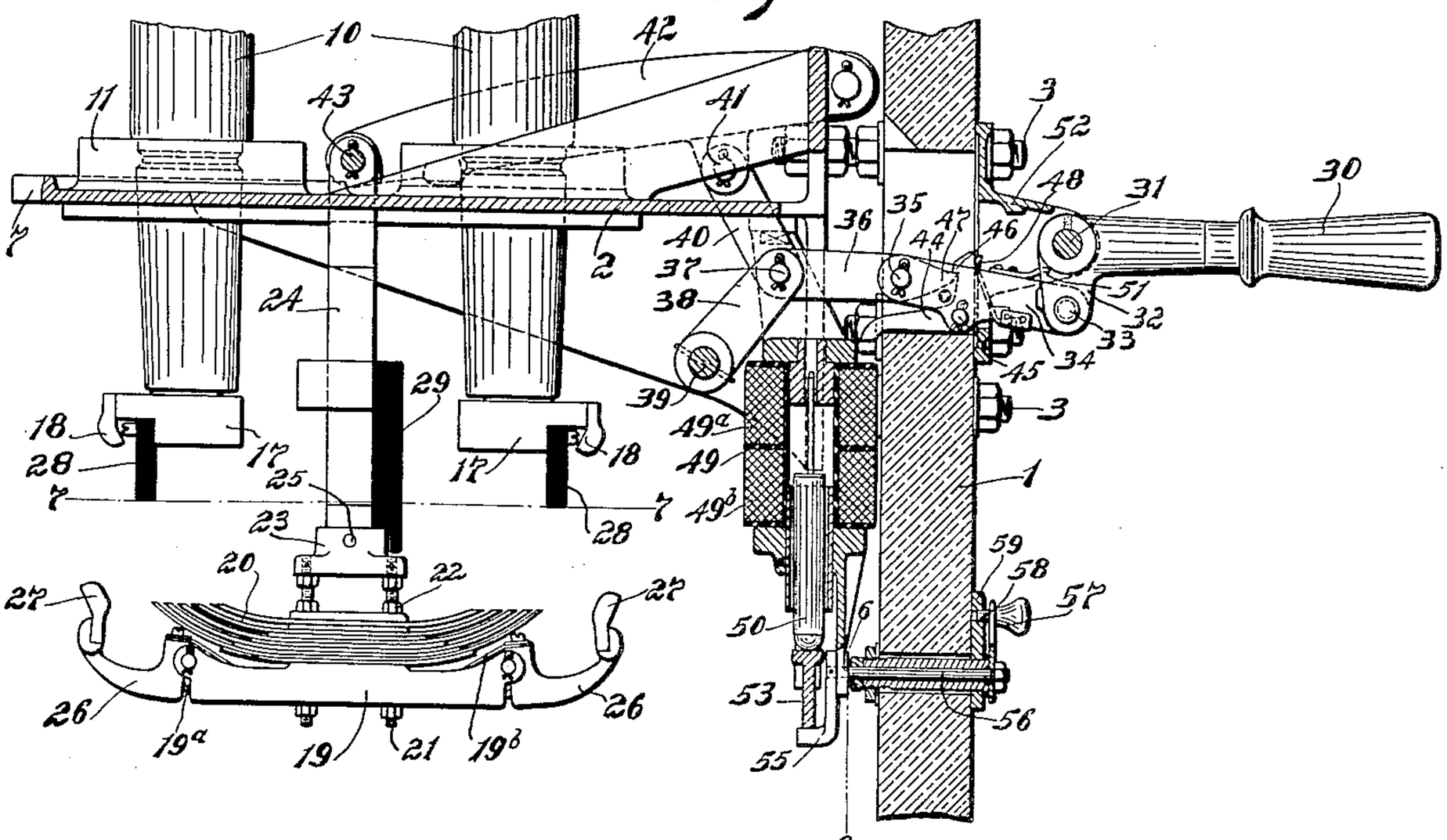


Fig. 3.



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4 SHEETS—SHEET 3.

Fig. 7.

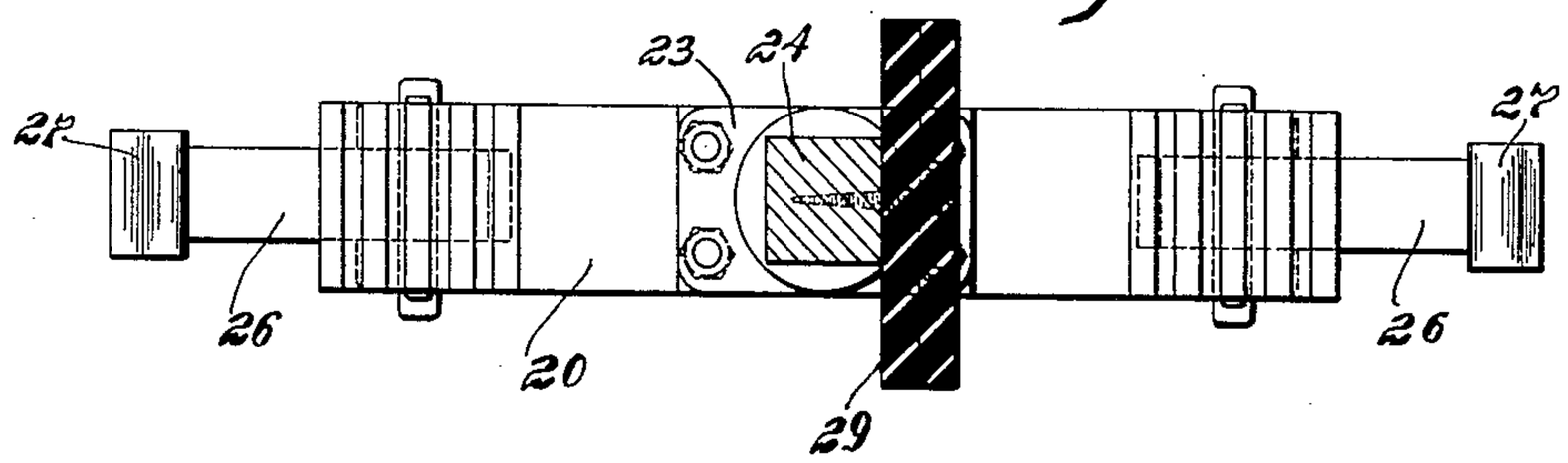


Fig. 4.

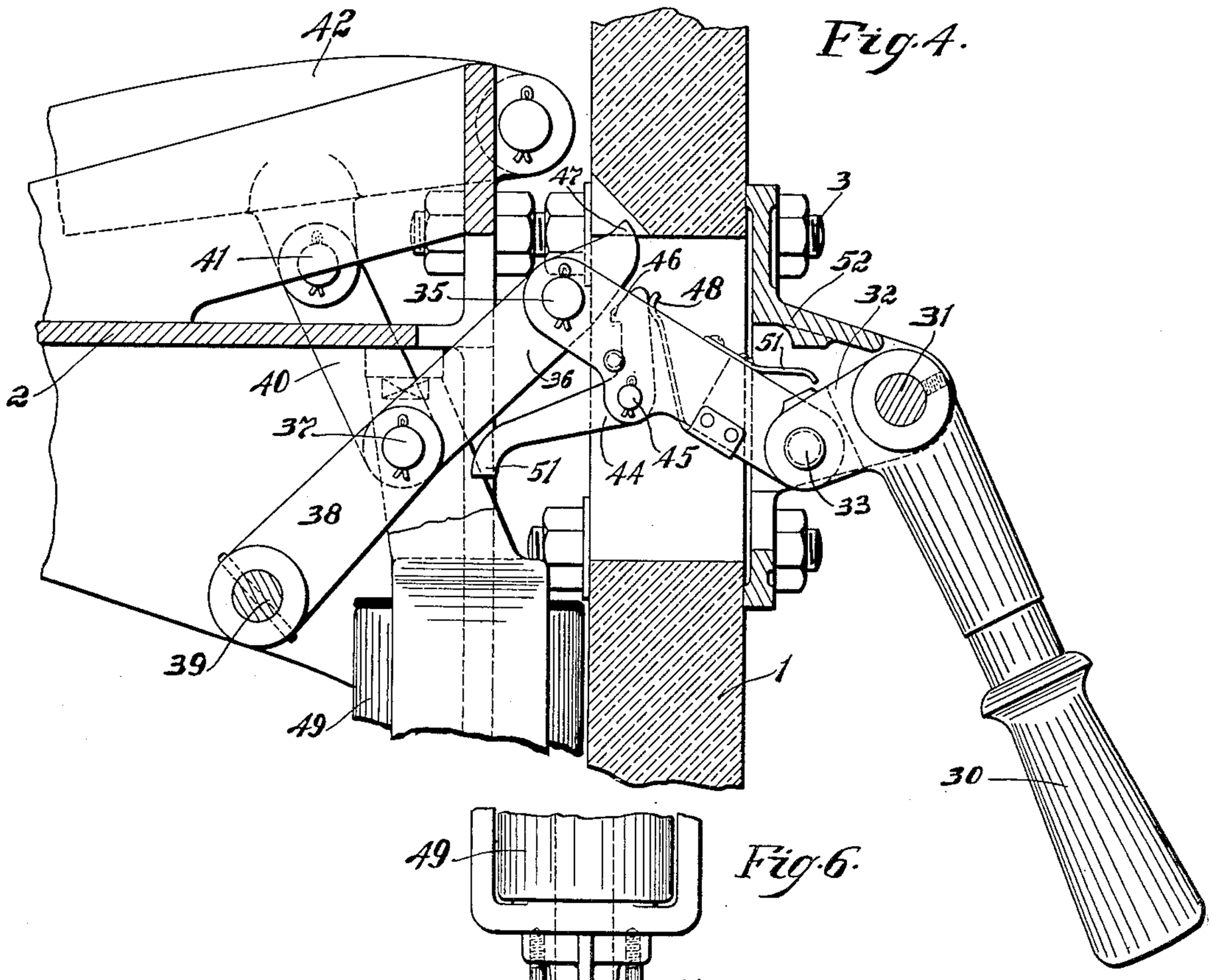
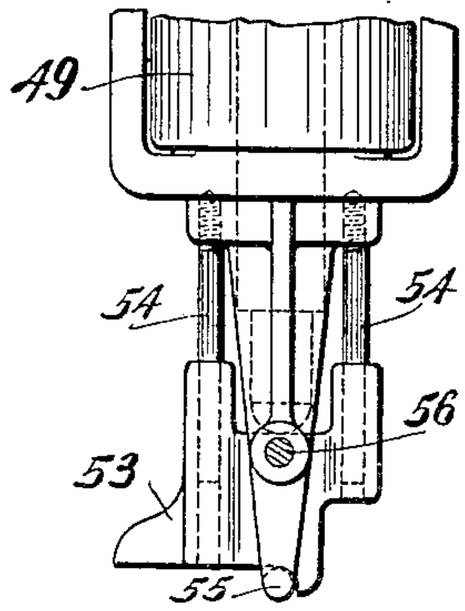


Fig. 6.



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4 SHEETS—SHEET 4.

Fig. 5.

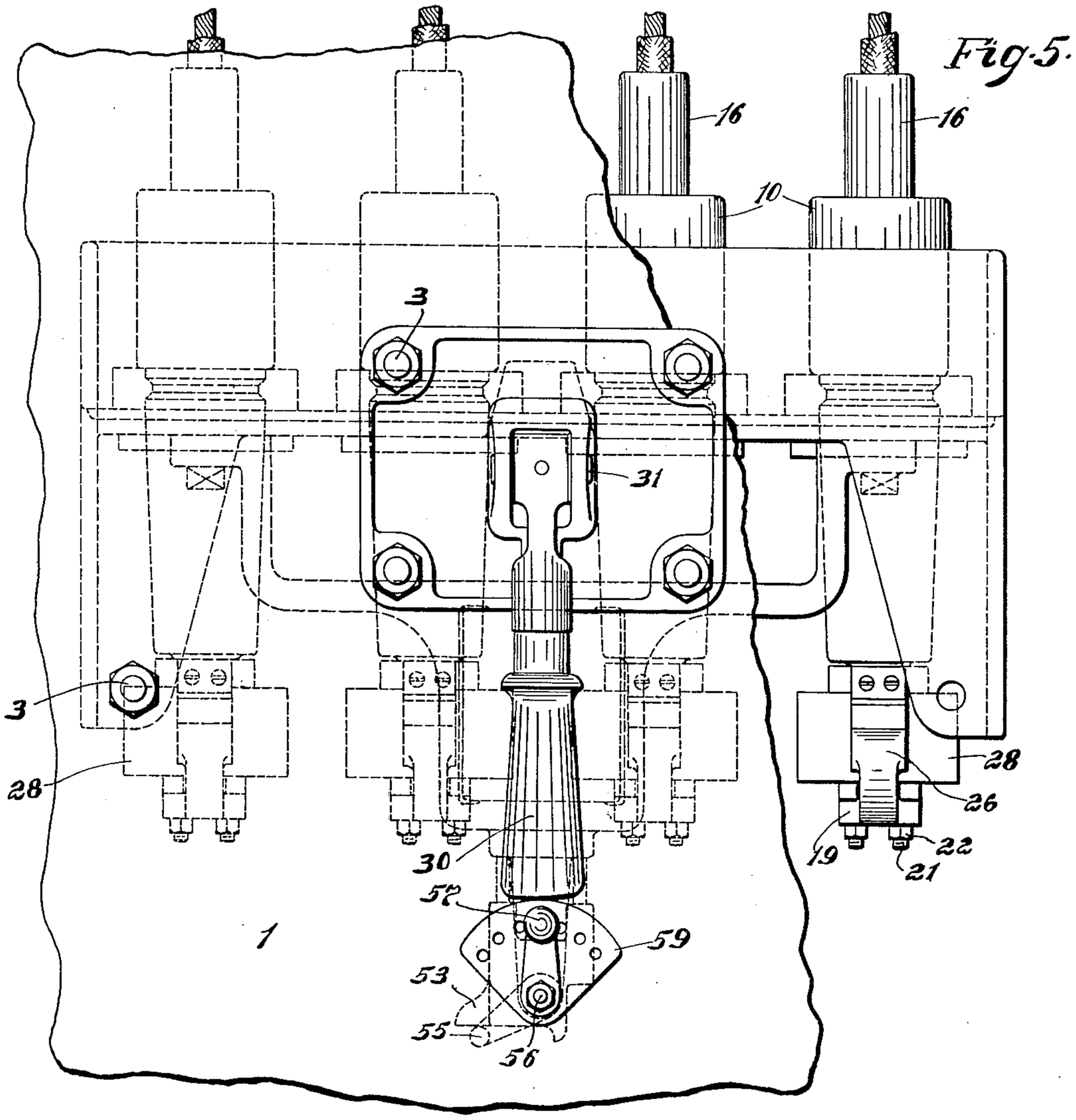
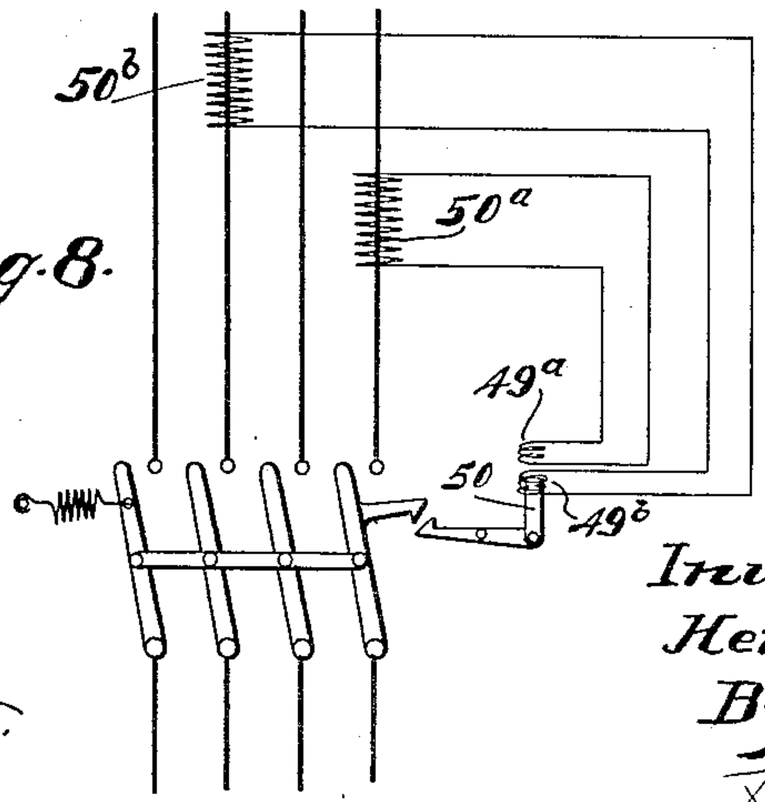


Fig. 8.



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UNITED STATES PATENT OFFICE.

HERBERT W. CHENEY, OF NORWOOD, OHIO, ASSIGNOR TO THE BULLOCK ELECTRIC MANUFACTURING COMPANY, A CORPORATION OF OHIO.

SWITCH CONSTRUCTION.

No. 917,542. Specification of Letters Patent. Patented April 6, 1909.

Application filed August 25, 1905. Serial No. 275,843.

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 Switch Constructions, of which the following is a full, clear, and exact specification.

This invention relates to switches or circuit-breakers, and particularly to oil switches or circuit-breakers of the vertically movable plunger type.

One of the objects of my invention is to provide a switch or circuit-breaker which will be simple in construction, effective in its operation and which can be operated either manually or automatically.

A further object is to provide an operating mechanism which will be simple and effective either for manual or automatic operation.

A further object is to provide a means for preventing sparking between the stationary contacts, and between the auxiliary contacts or arcing tips and the main contacts.

A further object is to provide a means for adjusting the position of the core of the tripping magnet so that the switch or circuit-breaker may be opened at any desired load or amperage.

Still further objects will appear as my device is described in detail.

My invention consists in certain novel details of construction and combination of elements which will be fully described in the following specification and set forth in the appended claims.

For a more complete understanding of my invention, reference is had to the accompanying drawings, forming a part of this application, in which—

Figure 1 is a sectional elevation of my improved switch attached to a switch-board the section being taken along the lines 1—1 or Fig. 2, parts being broken away for the sake of clearness; Fig. 2 is a plan view of the same on a reduced scale, parts being broken away; Fig. 3 is a sectional elevation somewhat similar to Fig. 1, showing the switch in its open position after having been operated manually; Fig. 4 is a detailed sectional elevation of the switch operating mechanism in the position after the switch has been opened automatically; Fig. 5 is a partial front view of the switch-board to the rear of which my switch is connected; this view shows particularly my tripping magnet core-adjusting mechanism; Fig. 6 is an enlarged sectional elevation of the adjustable tripping mechanism, the section being taken along the line 6—6 of Fig. 3; Fig. 7 is a sectional plan of my bridging switch contact along the line 7—7 of Fig. 3; and Fig. 8 is a diagram of the connections for the tripping magnet on a four-pole two-phase switch.

At 1, I have shown a portion of a switch-board panel, to which my switch is attached. A supporting frame 2 has a vertical portion adapted to be attached to the panel by bolts 3 and a horizontal rearwardly extending portion. I have shown a four-pole switch, but I desire it to be understood that my invention is not limited to such a switch. Suspended on the under side of the horizontal portion of the bracket are four oil tanks 4, one for each pole. Each tank is removably supported by means of a hook 5 at one end of the tank and a pivoted bolt 6 and wing-nut at the other end of the tank, the bolt fitting in a slot 7 in the edge of the bracket. For convenience in removing the tanks each of the latter is provided with a swinging handle 8, pivoted in a lug 9 to which likewise the locking bolt 6 is pivoted. Each tank is made oil tight and is lined with suitable insulating material.

Extending down into the tank through the supporting frame are in this case eight porcelain bushings 10 which are cemented or babbitted to removable plates 11 which plates are in turn bolted or screwed to the frame. These bushings are arranged in pairs, one pair extending into each oil tank as is indicated in Fig. 2. Secured in each of the bushings preferably by cement 12 are the long parallel vertical contact-rods 13. Each of the contact rods are threaded at the top and connected to threaded terminals 14 of the main leads by sleeves 15. Fitting over the connections and extending into the bushings are the insulating sleeves 16. These sleeves may be moved at will along the main leads to expose the connections in case it is desired to disconnect the terminals. Connected to the lower end of each contact-rod in any suitable manner is a stationary contact 17 preferably made of copper or brass. Each stationary contact carries an auxiliary contact 18 which is adapted to be engaged by the arcing tip on the bridging contact. Each of the bridging contacts consists of a bundle of laminæ 20,

the distance of the contacting face of each lamina to its point of support being the same as that of the other laminæ, to equalize the pressure of all laminæ against the stationary contacts. The laminæ are held to the base 19 of the bridging contact by bolts 21, and nuts 22, 22. The number of laminæ held between the nuts 22, 22 can be changed at will. The bolts extend upward and engage the cap 23 which in turn is secured to the downwardly extending arm 24 which arm extends upwardly through the cover and connects with the operating mechanism presently to be described. By turning the bolts 21 the position of the bridging contact can be adjusted vertically. Furthermore, if desired, the cap 23 may be secured to the arm 24 by a pin 25, in such a manner as to allow a slight pivotal movement in order that the pressure on the contacts at the right and left of the vertical supporting rod 24 may be equalized. At each end of the base 19 and pivoted thereto is an arm 26 for supporting the arcing tips 27. Each of said arms is yieldingly pressed upward by spring 19^a, so that there will be a slight yielding movement of the arcing tips relative to the base as they engage and leave the stationary contacts 18. In opening the switch the laminæ first leave the main contacts and the current momentarily passes across the auxiliary contacts as is well known. In order that there may be good contact between the arms 26 and base 19, I connect the parts by flexible shunts 19^b. In order that there may be no arcing between the laminæ and auxiliary contact 18 or between the arcing tip 27 and main stationary contacts, when the circuits are broken, I interpose downwardly extending barriers or separators of insulating and arc resisting material 28 between the stationary contacts 17 and 18. These barriers extend down a sufficient distance to protect the contacts as the switch is opened. I also interpose between the main stationary contacts 17, 17 insulating barriers or plates 29, which extend almost the width of the tanks. These barriers are mounted on the vertical supporting arm 24 in such a manner that they will be interposed between the contacts 17 when the arcing tips leave the contacts 18.

I will now describe my improved operating mechanism whereby the switch can be opened automatically or by hand. The operating handle 30 is pivoted at 31 in front of the switch-board and has an arm 32 extending at right angles thereto. The arm 32 is pivoted at 33 to the rearwardly extending arm 34. These two arms constitute a toggle. Pivoted to the arm 34 at 35 is an arm 36 which in turn is pivoted at 37 to an arm 38 which is secured to the long horizontal rod 39. This rod 39 extends nearly the length of the switch bracket and operates two sets of toggles, one arm of one of which is shown at 40. These toggles are connected at 41 to the two lever arms 42, shown in Figs. 1, 2, 3, and 4, which in turn are connected to the horizontal rod 43 to which each vertical switch operating rod 24 is hinged.

If it were only desired to operate the switch by hand, a single connecting arm could be substituted for the hinged arms 34 and 36, the hinged arms being provided for automatic operation, as will appear. In order that the switch may be operated by hand the arms 34 and 36 must normally be locked together. The locking device is simple, consisting of a small bell-crank 44 pivoted on arm 34 at 45. The bell-crank is provided with a hook 46 that engages a nose 47 on an extension of the arm 36. A spring 48 normally holds the hook and nose in engagement. Thus when the operating handle is forced downward, the toggles and locked connecting member will hold the switch firmly closed. The switch can be opened by hand by lifting the handle to the position shown in Fig. 3. It will be seen from Figs. 1 and 3 that the arms 34 and 36 continue locked, both in the open and closed position of the switch, when the latter is operated manually.

In order that the switch may be opened automatically I provide a tripping device which will unlock or "break" the arms 34 and 36 and permit the switch to fly into the open position. My tripping device consists of a magnet coil 49 and core 50 which on overload is adapted to be raised and to strike the rearwardly extending arm 51 of the bell-crank holding latch and release the nose of the arm 36. I have provided a tripping magnet, which consists in this case of two separate coils 49^a and 49^b each preferably connected to a separate transformer 50^a and 50^b in the circuit of each phase as is diagrammatically shown in Fig. 8. Thus if the overload occurs in the circuit of either phase, the core will be raised and the switch thrown. A similar arrangement using two tripping coils may be employed in connection with a three-phase circuit.

In Fig. 4 I have shown the position of the switch operating mechanism after the switch has been automatically opened. It will be noted that the arms 34 and 36 are in their unlocked or "broken" position, the toggles connected to the levers 42 having moved the arms from the closed or alined position as shown in Fig. 1 to the position shown in Fig. 4. The movement of the arms 34, 36 and of the toggles, as just described, would not disturb the position of the operating handle and therefore in order to indicate that the switch has been automatically opened I have provided a spring 51 on the arm 34, which spring is normally free from tension, but when the switch is opened automatically, arm 34 assumes a position shown in Fig. 4, and with the handle 30 in the position shown

in Fig. 4, and with the handle 30 in the position shown in Fig. 1 brings the spring into engagement with the stationary casting 52. Thus when the switch is automatically opened the spring throws the handle outward a slight distance, as shown in Fig. 4. It will be seen that the principal elements of my switch operating mechanism are the toggles and the double arm 34 and 36 connecting the two toggles, the so-called double arm, constituting one of the toggle arms. The principal function of the toggle connected directly to the handle is to hold the switch in the closed position. It will be seen that the centers 31, 33, and 37 of this toggle are almost on a line, when the switch is closed. The principal function of the toggles connected to the lever arm 42 is to assist in opening the switch quickly when the arms 34 and 36 have been unlocked, to provide a long throw of the switch handle and a proper distribution of force along the path which the switch handle traverses, and also to insure increased leverage when engagement between the contact members takes place. When the switch is closed the pivoted centers 33, 35, and 37 of the arms 34 and 36 are almost on a line, so that there is very little strain on the holding latch. Thus a very sensitive trip is provided.

I have provided a novel magnet-core adjusting mechanism by means of which the core can be so adjusted that the switch will be thrown at any desired load. The magnet core rests on a shoe 53 which engages two vertical guide pins 54. A crank 55 connected to the shaft 56 engages the lower face of this shoe and determines its height and consequently the height of the magnet core. The shaft 56 extends through the switch panel and is connected with the crank handle 57 on the front of the switch-board. This handle has a rearwardly extending pin 58 which is adapted to engage any one of a number of holes in the sector plate 59. Thus the handle can be withdrawn from a hole and swung either to the right or left and locked at any desired position. The swinging of the handle to the right or left raises or lowers the crank-arm which engages the shoe. Thus on swinging the handle the shoe is moved vertically on the guide pins and the core is moved to any desired height. In the position shown in Figs. 1 and 6, the core is at its lowest possible position, and in Fig. 5 at its middle or half-way position.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is—

1. In a switch, switch operating mechanism including pluralities of interconnected members comprising a toggle and a series of links and levers, one of said members being composed of two hinged parts, means for holding said hinged parts in locked position when the switch is closed and when opened manually, and means for automatically unlocking said parts for automatic operation.

2. In a switch, switch operating mechanism comprising a toggle, one of the arms of which consists of two normally locked hinged arms, means for holding the hinged arms in locked position when the switch is closed and when opened manually, and means for automatically unlocking the arms.

3. In a switch, switch operating mechanism comprising two sets of toggle arms, one of said toggle arms being in two parts forming a collapsible member, means for holding the parts of said collapsible member in a locked position when the switch is closed and when operated manually, and means for unlocking or "breaking" the parts of said collapsible member whereby the switch may be opened automatically.

4. In a switch, switch operating mechanism comprising a toggle, one of the arms of said toggle having two parts forming a collapsible member, means for holding said parts in locked engagement when the switch is closed and when operated manually, means for automatically unlocking said parts to open the switch, and a second toggle connected to the first named toggle.

5. In a switch, a stationary and movable contact, switch-operating mechanism including two sets of toggles, one of said toggles having connected thereto an operating handle and serving to hold the other toggle in its cramped or distended position, one of the toggle arms consisting of two hinged parts, means for holding said hinged parts in closed or locked position, and means for breaking or unlocking said parts to open the switch automatically.

6. In a switch-operating mechanism, a pair of toggles connected together so that force is transmitted from one to the other, one of said toggles having a collapsible arm, an operating handle connected to one of said toggles, whereby said toggles can be cramped or broken at will, means for holding the parts of said collapsible arm in locked position when the switch is closed and when opened manually, and means for collapsing said arm to break the toggles automatically.

7. In a switch, an operating mechanism comprising an operating handle having one position when the switch is closed, a second position when opened manually, and an intermediate position when opened automatically, means for causing said switch to be opened automatically, and a spring for moving said handle from its normal closed position to the intermediate position to indicate that the switch is open.

8. In a switch operating mechanism, an operating handle having one position when the switch is closed, a second position when opened manually, and an intermediate posi-

tion when opened automatically, means for automatically tripping the mechanism to open the switch, and separate means for throwing said handle from its closed position to the position intermediate its closed and open positions to indicate that the switch has been opened automatically.

9. In a switch, an operating mechanism therefor comprising a toggle and two hinged collapsible arms, means for holding the arms in locked position during manual operation, and means for collapsing said arms for automatic operation.

10. In a switch operating mechanism, two normally locked hinged arms, means for locking said arms during manual operation, said means comprising a bell-crank latch, and means for collapsing said arms to operate the switch automatically.

11. In a switch operating mechanism, comprising a bell-crank and a two-part breakable or collapsible arm, means for locking said parts during manual operation, said means comprising a pivoted latch, a tripping magnet, and a movable core therefor for striking said latch whereby the arm will collapse and the switch will be opened.

12. In a switch, a pair of stationary contacts, a laminated bridging contact, a movable plunger for operating said contact, a member pivotally secured to the lower end of said plunger, means for securing said bridging contact to said pivoted member comprising a pair of spaced threaded bolts which pass through the bridging contact, and means for adjusting the latter on said bolts.

13. In a switch, a pair of stationary contacts, a bridging contact comprising a group of laminæ, a base on which the laminæ are mounted, auxiliary contact members pivotally mounted on the base, a movable plunger for operating said bridging contact, and a member pivotally secured to the lower end of said plunger, said bridging contact being adjustably secured to said pivoted member.

14. In a switch, an operating mechanism comprising an operating handle having one position when the switch is closed, a second position when the switch is opened manually, and a third position intermediate the other positions when the switch is opened automatically, a pair of normally locked hinged links or arms, one of which is connected to said operating handle, means for unlocking said links to cause the switch to open automatically, and additional means for causing the shifting of the handle to the intermediate position to indicate that the switch is open.

15. In a switch, a switch operating mechanism comprising a toggle, an operating handle having one position when the switch is closed, a second position when the switch is opened manually, and a third position when the switch is opened automatically and a pair of normally interlocked arms connecting the toggle and handle, means for unlocking said arms to cause the switch to open automatically, and additional means for shifting the handle to said third position to indicate that the switch is open.

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

HERBERT W. CHENEY.

Witnesses:

SANFORD KLEIN,

FRED J. KINSEY.

Correction in Letters Patent No. 917,542.

It is hereby certified that in Letters Patent No. 917,542, granted April 6, 1909, upon the application of Herbert W. Cheney, of Norwood, Ohio, for an improvement in "Switch Constructions," an error appears in the printed specification requiring correction, as follows: On page 3, lines 1 and 2, the words "in Fig. 4, and with the handle 30 in the position shown" should be stricken out; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 11th day of May, A. D., 1909.

[SEAL.]

E. B. MOORE,

Commissioner of Patents.