E. JOHNSON.

CIRCUIT BREAKER.

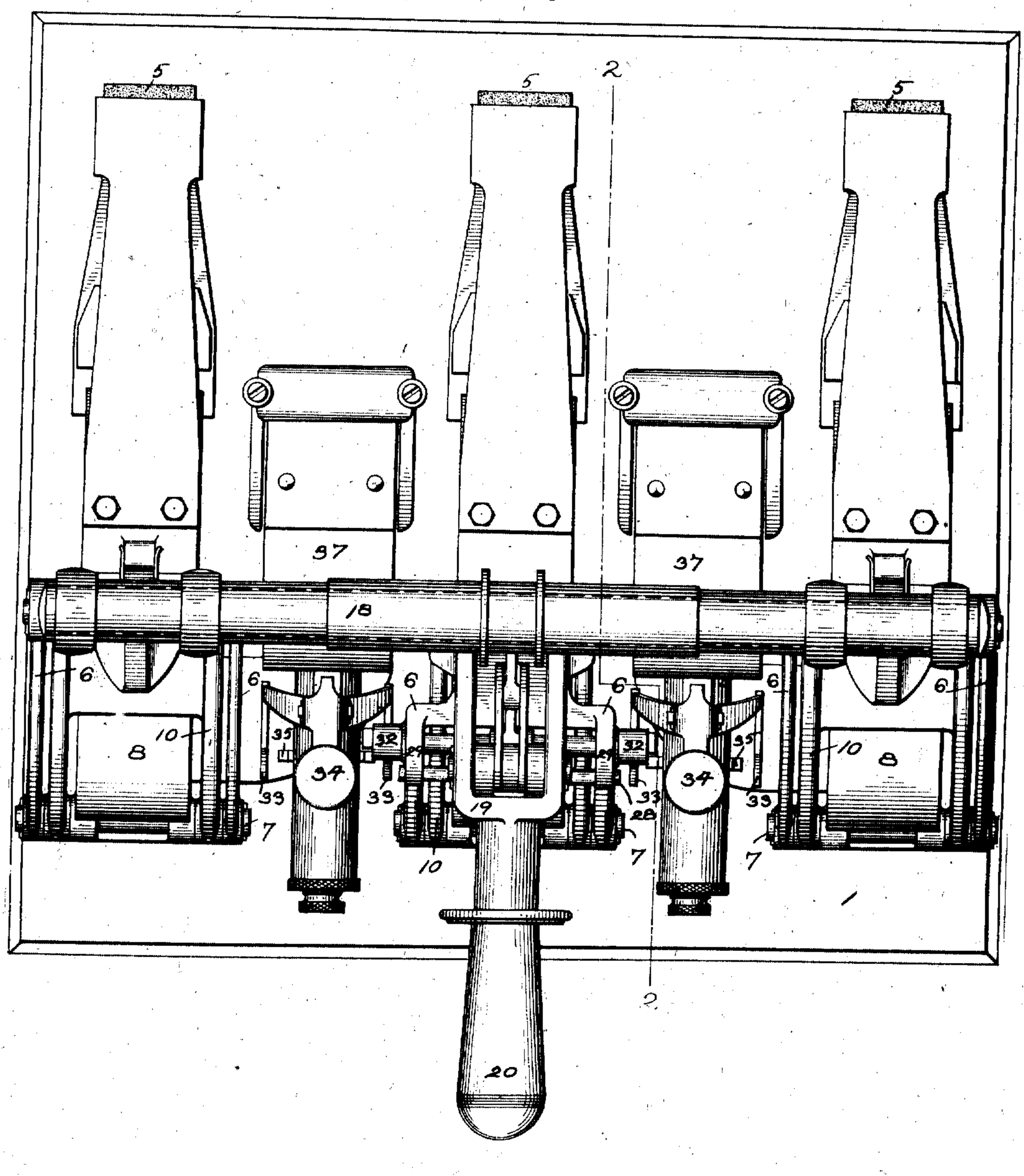
APPLICATION FILED AUG. 21, 1907.

991,511.

Patented May 9, 1911.

3 SHEETS—SHEET 1.

Fig. 1.



WITNESSES

W. Ray Taylor.

J. Ellis Glen

INVENTOR

EDWIN JOHNSON.

by Albert G. Davis

ATT'Y.

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3 SHEETS—SHEET 2.

Fig. 2.

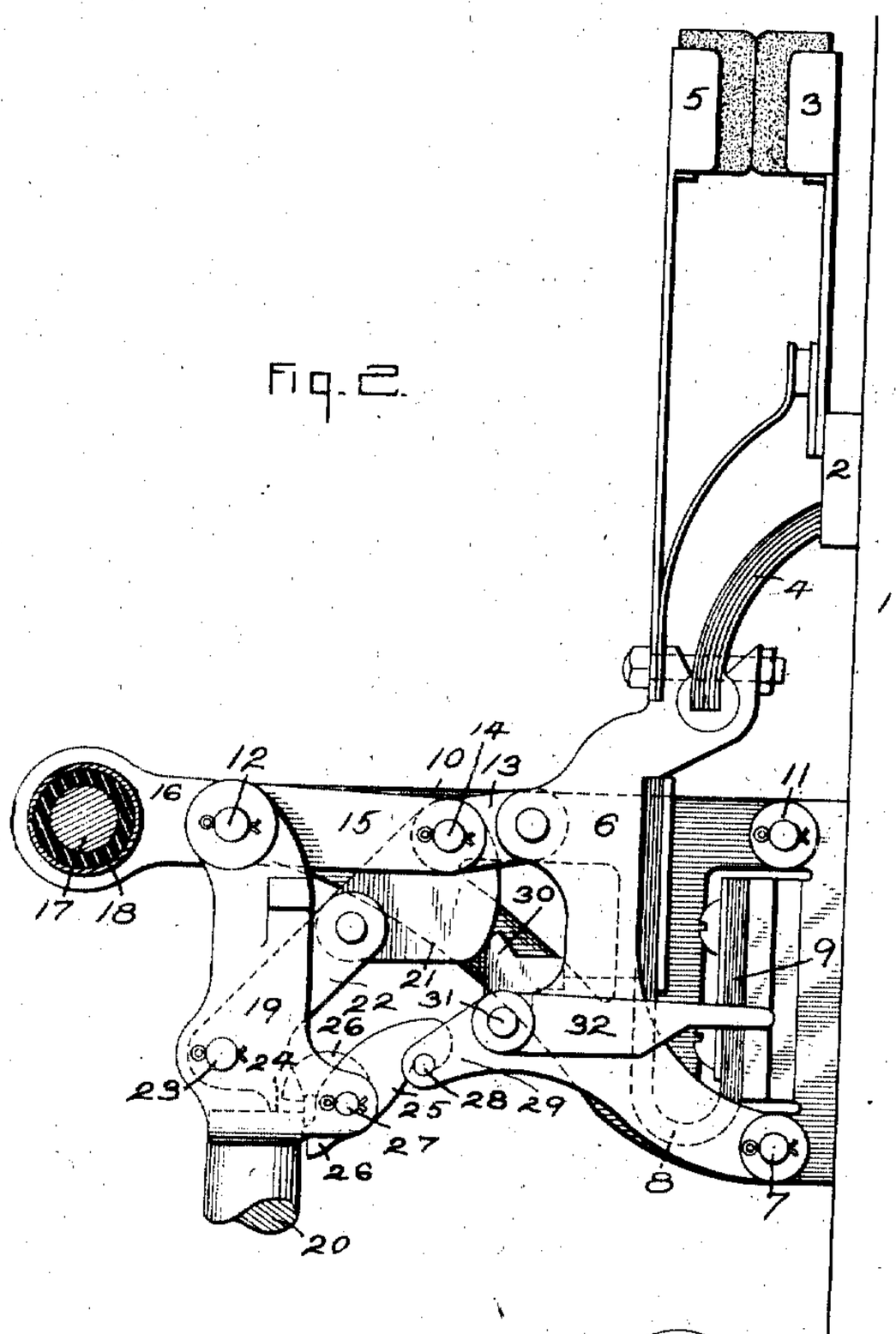
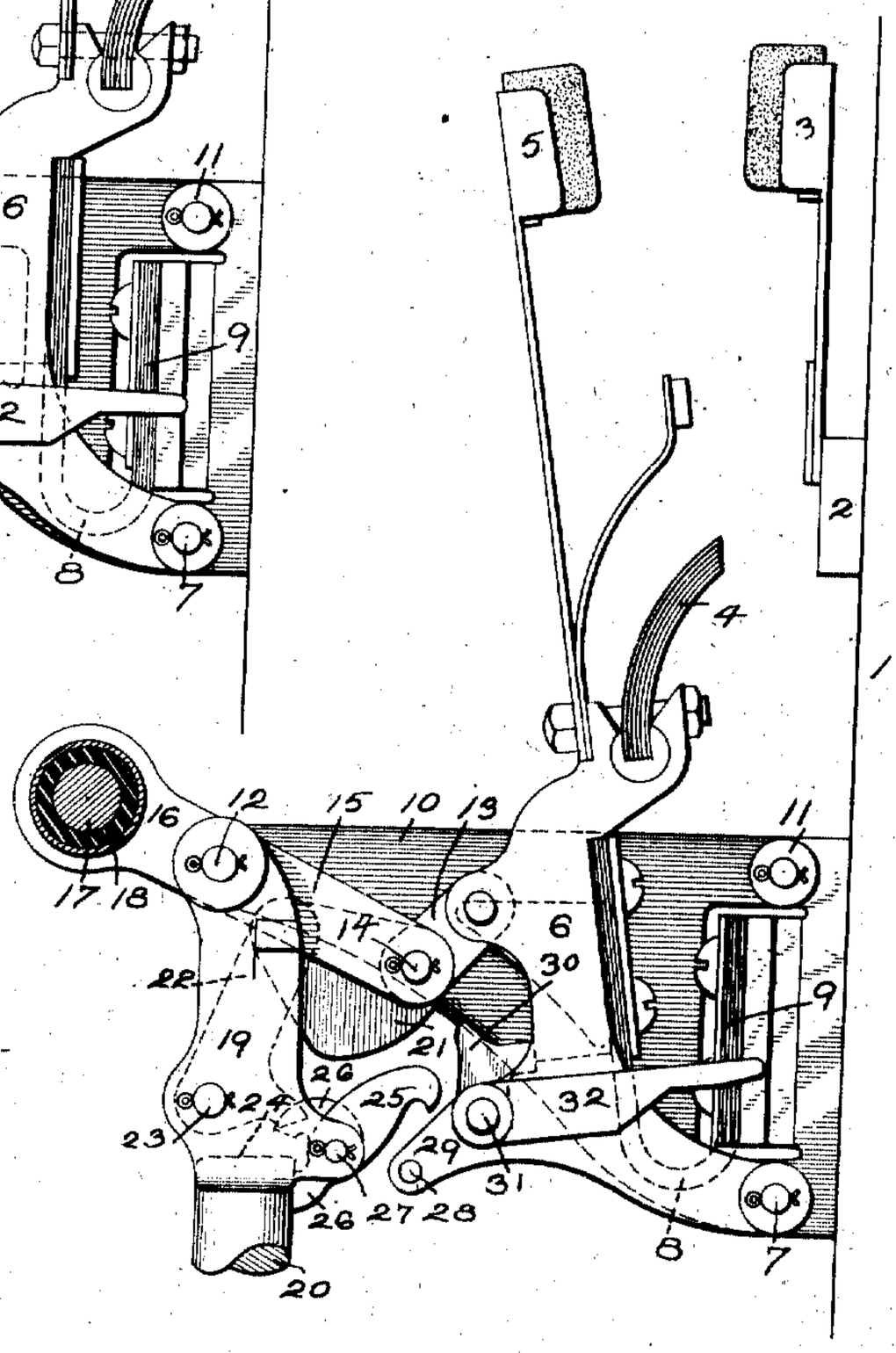


Fig. 3.



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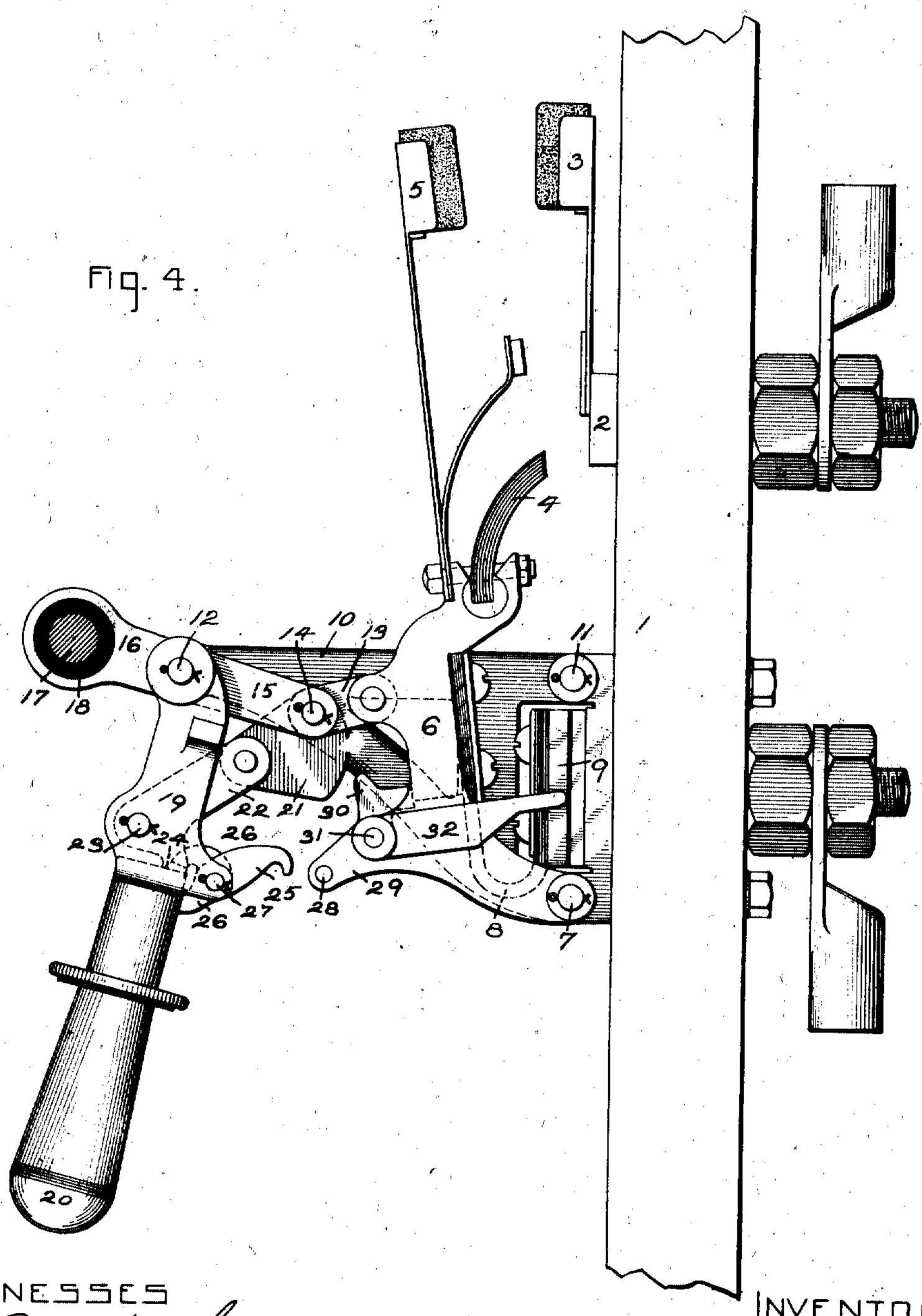
3 SHEETS—SHEET 3.

Fig. 4.



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by Albert G. Davis

ATT'Y.

UNITED STATES PATENT OFFICE.

EDWIN JOHNSON, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

CIRCUIT-BREAKER.

991,511. Specification of Letters Patent. Patented May 9, 1911.

Application filed August 21, 1907. Serial No. 389,480.

To all whom it may concern:

Be it known that I, EDWIN JOHNSON, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Circuit-Breakers, of which the following is a specification.

This invention relates to electric switches and more particularly to automatic switches or circuit breakers comprising a plurality of members interconnected to act simultaneously and operated by a single operating handle from which the switch members trip loose in case of abnormal current upon any part of the controlled circuit, although many features of my invention are applicable to any type of electric switch.

The object of my invention is to provide circuit breakers arranged to trip loose from the handle with an improved operating mechanism by means of which great force can be exerted, so that a circuit breaker having a plurality of movable members can be closed without undue effort on the part of the operator; to provide an improved device for releasing the operating handle from the circuit breaker in case of abnormal current; to strengthen and lighten the means by which the moving elements of the circuit breaker are rigidly connected; to provide an improved latching means released by relative movement of the movable member and the handle; and in general to improve the construction of circuit breakers of this type.

Automatically tripped switches or circuit breakers have heretofore been built in which the operating handle is automatically disconnected from the movable contact in case the operator attempts to close the circuit when conditions are abnormal, but the operating mechanism previously used becomes too bulky and requires too much exertion on the part of the operator if applied to a circuit breaker composed of a plurality of bridging contacts closed simultaneously. The connection between the switch elements by means of which all are operated simultaneously must be an insulator and the size of this connection as heretofore constructed increases very rapidly and becomes very bulky and objectionable in a circuit breaker of even moderate size; the mechanisms for disconnecting the handle are usually some form of latch requiring too much power to operate if the circuit breaker is large while after the handle is disconnected it must be unlatched from some stationary support before it can be manipulated to reset the circuit breaker.

In carrying out my invention I use a force multiplying connection between the operating handle and the switch members occupying a minimum amount of space and arranged to disconnect the operating handle from the switch members by the expenditure of a very slight amount of power, even in large sizes, upon the occurrence of abnormal current in the controlled circuit. I also reduce the size of the rod which rigidly connects the movable members to make them act as one by making the rod in the form of a light and strong steel core surrounded by a sleeve of insulation which prevents current from passing from one movable member to another. I arrange the latch for holding the circuit breaker closed so that the members of the latch are moved out of engagement with each other by the relative movement of the handle and the movable member and as a result the automatic device for opening the circuit breaker needs only to disconnect the handle, whereupon as the circuit breaker opens the latch disengages and the handle is free.

My invention will best be understood in connection with the accompanying drawings which are merely an illustration of one embodiment of my invention and in which—

Figure 1 is a front view of a circuit breaker comprising three switch elements or members: Fig. 2 is a section on the line 2, 2, of Fig. 1 showing the circuit breaker in the closed position: Fig. 3 a section on the same line showing the circuit breaker in the open position; and Fig. 4 a section on the same line showing the circuit breaker as it is being closed.

The circuit breaker shown in the drawings comprises switch elements mounted side by side upon a switchboard 1 of slate or marble or other suitable material. The switch elements may be of any desired form and those shown in the drawings comprise a fixed contact, consisting of a contact block 2 and a shunt contact 3 firmly mounted on the switchboard 1, coöperating with a movable element or contact consisting of a contact brush 4 and shunt contact 5 mounted

upon an arm 6 swinging upon a pivot 7 securely attached to the switchboard 1. The movable contact is connected by means of a flexible strip 8 to a stud 9 passing through the switchboard 1 and connected to one side of the circuit, so that when the switch element is closed the circuit is completed from the terminal 9 through the movable contact to the fixed contact.

Each movable element or contact is mounted on a frame 10 held to the switchboard 1 by means of the pivot 7 and a pin 11. A pivot 12 is also mounted on the frame some distance from the pivot 7. The movable contact is actuated by any suitable force multiplying device which is shown in the drawings as an actuating toggle comprising a link 13 pivoted to the movable contact and pivotally connected by means of a pin 14 to a link 15 mounted upon the pivot 12 and provided with an extension 16 which projects beyond the pivot. When the actuating toggle is straightened the movable contact is brought into engagement with the fixed contact and the circuit is closed, in which position the actuating toggle is slightly underset. The movable contacts are operated simultaneously from a single operating handle because the actuating toggles of all are rigidly connected by a steel rod 17 surrounded by a sleeve 18 of insulation and passing through the extensions 16 of the links 15 of each toggle. The steel rod makes a light and rigid connection between the toggles, while the sleeve of insulation prevents a flow of current between the movable contacts.

The force multiplying mechanism of the circuit breaker may be operated by any suitable operating member which is shown in the drawings in the form of an operating handle consisting of a fork 19 mounted on the pivot 12 and provided with a handle 20. The operating handle is connected to the force multiplying mechanism by means of a normally positive collapsible connection which is shown in the form of a locking toggle consisting of a link 21 mounted on the pivot 14 and connected to links 22 mounted upon a pin 23 carried by the fork 19. Each link 22 is provided with a heel 24 engaging fork 19 to control the position of the locking toggle. The purpose of the locking toggle is to form a connection between the operating handle and the actuating mechanism which is normally positive but which can be very easily collapsed, and in order to secure this result the locking toggle is very slightly overset when extended to form a rigid connection between the operating handle and the actuating toggle.

The circuit breaker is held in closed position by means of a latch 25 provided with heels 26 to regulate the position thereof and mounted upon a pin 27 carried by the operating handle. This latch coöperates with an engaging member or lug comprising a pin 28 mounted in lugs 29 on the arm 6, which swings about the pivot 7 as a center, and since the operating handle carrying the latch 25 swings about the pivot 12 as a center, the latch 25 and the pin 28 can engage only when the circuit breaker is closed, as they describe arcs of circles which are eccentric with relation to each other. When the circuit breaker is closed, therefore, the operating handle is connected to the movable contacts by a normally positive collapsible connection comprising the actuating toggle and the locking toggle and is also connected to the movable contacts by the latching mechanism. The operating handle and the movable element 6 mounted on pivots 12 and 7 extend in opposite directions from said pivots and as long as the locking toggle is rigid those points on the handle and the movable element connected by the toggle must move at the same rate. No other point on the operating handle moves at the same rate as any point on the movable element, and therefore any movement of the handle or element will cause a relative movement between the latch 25 and the pin 28. The hook on the latch 25 normally engages the pin 28 and prevents movement of the handle 20 in a direction to open the circuit breaker, which is locked closed as long as the locking toggle is rigid. If the collapsible connection is broken the movable contact is free to move toward the operating handle and in so moving the pin 28 describes an arc of a circle which carries it out of engagement and away from the hook on the end of the latch 25, whereupon the operating handle is released. The only power, therefore, required to open the circuit breaker is that necessary to break the collapsible connection between the operating handle and the movable contacts, by breaking the locking toggle 21, 22, to permit the underset actuating toggle to break and the movable contact to separate from the fixed contact.

The locking toggle 21, 22 may be broken in any suitable manner, but the mechanism which I prefer for this purpose comprises a trip 30 mounted upon a rock shaft 31 carried by the arm 6 and actuated by arms 32, one at each end of the shaft 31. The ends of these arms are in a position to be engaged by trip fingers 33 carried upon a pivoted trip yoke which may be actuated by hand by pressing upon the buttons 34 or automatically by projections 35 carried upon the movable cores of the overload coils 37. When an abnormal current flows through either overload coil the corresponding core is lifted, and actuates the trip 30, collapsing the connections between the actuating handle and the switch and opening all the circuits or branches simultaneously.

The operation of the device is as follows:

When the breaker is closed the parts are in the position shown in Fig. 2, and firmly locked, since as long as the collapsible connection between the operating handle and the movable contact is rigid the movement of the operating handle about its pivot 12 would give the latch 25 a movement in a different direction and at a different rate of speed than that given the pin 28 as the arm 6 swings about the pivot 7, and the only possible movement of the operating arm is toward the movable contact, which movement is permitted by the shape of the hook on the end of the latch 25. If it is desired to open the breaker, the normally positive connection between the operating handle and the movable contact is collapsed by bringing the trip 30 into engagement with the link 21 of the locking toggle and thereby moving the locking toggle over center. The locking toggle thereupon collapses and permits the actuating toggle to collapse, as shown in Fig. 3. As a result the movable contact is free to move out of engagement with the fixed contact and this movement is not resisted by the latching means, because when the latch 25 remains stationary and the arm 6 swings about its pivot 7 the pin 28 moves away from and out of engagement with the hook on the end of the latch, thereby releasing the operating handle. To close the circuit breaker, the operating handle is drawn into position as shown in Fig. 4 to straighten out the locking toggle, which thereupon becomes slightly overset and forms a rigid connection between the operating handle and the link 15 of the actuating toggle. As the operating handle is pushed to close the circuit breaker as shown in Fig. 2, the actuating toggles of all the movable contacts are straightened, since they are rigidly connected through the rod 17, and the breaker is closed.

My invention may be carried out in many other ways than that shown and described, and I therefore do not desire to be limited to the exact form disclosed, but intend to cover by the appended claims all changes and modifications within the spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is—

1. An electric switch comprising a base, coöperating contacts mounted on said base for relative movement, a support projecting from said base, an operating member movably mounted on said support, a two link actuating toggle with one link pivoted to said support and the other link to one of said contacts to bring said contacts into engagement when straightened, a pin for pivotally connecting said links, a two-link normally positive toggle with one end connected to said member and the other end to said pin whereby said operating member and said actuating toggle are normally rigidly connected, and latching means for said operating member.

2. An electric switch comprising a vertical base, coöperating contacts mounted on said base for relative movement, a horizontal support projecting from said base, an operating member pivoted on said support, a two-link actuating toggle having one link pivoted to said support and the other link to one of said contacts to bring said toggle substantially horizontal when said toggle is straightened, a pin for pivotally connecting said links, a tripping toggle connected to said pin and to said operating member at a point eccentric to the pivot thereof, and a latch coöperating with said operating member to normally hold the switch closed.

3. An electric switch comprising a base, a fixed contact on said base, a coöperating movable contact pivoted to said base to swing in a plane perpendicular to said base, a support projecting at right angles to said base, an operating member pivoted on said support to swing in a plane perpendicular to said base, latching means for said operating member, an actuating toggle having one link pivoted to said support and the other link to said movable contact, a normally rigid tripping toggle connected to said actuating toggle and to said operating member whereby said actuating toggle is straightened and means for collapsing said tripping toggle.

4. An electric switch comprising a base, a fixed contact on said base, a coöperating movable contact pivoted to said base below said fixed contacts, a pivot mounted parallel to said base and in fixed relation thereto, an operating handle mounted on said pivot, latching means for normally restraining said operating handle, an actuating toggle having one link mounted on said pivot and another link connected to said movable contact, a pin for pivotally connecting said links, and a tripping toggle between said handle and said pin whereby said actuating toggle is straightened.

5. In an electric switch, the combination with a support for a fixed contact, and a cooperating movable contact pivoted to said support, of an operating handle pivoted to the support, an actuating toggle having one link pivoted to the support and the other link to the movable contact, a normally positive collapsible connection between the handle and the actuating toggle, a lug on the movable contact, a latch on the handle to engage said lug when the contacts are in engagement, tripping means mounted on said movable contact to collapse said toggle when actuated, and automatic means for actuating said tripping means.

6. In an electric switch, the combination with a movable switch member, of an oper-

ating member eccentrically mounted with relation thereto, a normally positive collapsible connection between said members, means for collapsing said connection, and latching means for connecting said members, said latching means being disengaged by the relative movement of said members due to the collapse of said connection.

7. In an electric switch, the combination with a movable switch member, of an actuating member eccentrically mounted with relation thereto, a collapsible force multiplying connection between said members actuated to close the switch by movement of said members toward each other, latching means operative when the switch is closed to prevent separation of said members, said latching means being unlatched by movement of said members toward each other, and tripping means for collapsing said connection to permit said members to move toward each other.

8. In an electric switch, the combination with a support carrying a fixed contact and two pivots, of a movable contact mounted on one of said pivots to coöperate with said fixed contact, an operating handle mounted on the other pivot, a normally positive collapsible connection between the operating handle and the movable contact, means for collapsing said connection, and means for latching the operating handle to said contact when the contacts are in engagement.

9. In an electric switch, the combination with a support carrying a fixed contact and two pivots, of a movable contact mounted on one of said pivots to coöperate with said fixed contact, an operating handle mounted on the other pivot, a normally positive collapsible connection between the operating handle and the movable contact, means for collapsing said connection, a latch mounted on said handle, and a lug on said movable contact coöperating with said latch to connect the handle and movable contact when the contacts are in engagement.

10. In an electric switch, the combination of a support carrying a fixed contact and a coöperating movable contact pivoted to said support, an operating handle pivoted to said support eccentrically to said movable contact, a normally positive collapsible connection between the operating handle and the movable contact, means for collapsing said connection, and latching means for connecting said handle to said movable contact to prevent movement of the handle away from the movable contact, said latching means being released by movement of said contact toward the handle.

11. In an electric switch, the combination with a frame carrying a fixed contact, of a coöperating movable contact pivoted to said frame, an operating handle pivoted to said frame, a normally positive collapsible connection between said handle and said contact for permitting said contact to move independently of said handle when said connection is collapsed, and means for latching the operating handle to the element.

12. In an electric switch, the combination with a movable switch element, of an operating handle eccentrically mounted with relation to said element, a normally positive collapsible connection between said handle and said element, means for collapsing said connection, and latching means for connecting said handle to said element to prevent movement of the handle and element away from each other, said latching means being unlatched by movement of said handle and element toward each other.

13. In an electric switch, the combination with a pivoted switch element, of a pivoted operating handle for said element, said handle and said element extending in opposite directions from their respective pivots, a normally positive collapsible connection which normally locks the handle to said element, and when collapsed permits said element to move independently of said handle, and latching means for connecting the handle and element to hold the handle and element in predetermined relation to each other.

14. In an electric switch, the combination with a pivoted switch element, of a pivoted operating handle for said element, said handle and said element extending in opposite directions from their respective pivots, a collapsible connection between the handle and said element, trip means on said contact for collapsing said connection, and latching means for connecting the handle and element to hold the handle and element in predetermined relation to each other.

In witness whereof, I have hereunto set my hand this 20th day of August 1907.

EDWIN JOHNSON.

Witnesses:

HELEN ORFORD,

MAY WHITTAKER.