E. H. SMYTHE.

CIRCUIT BREAKER.

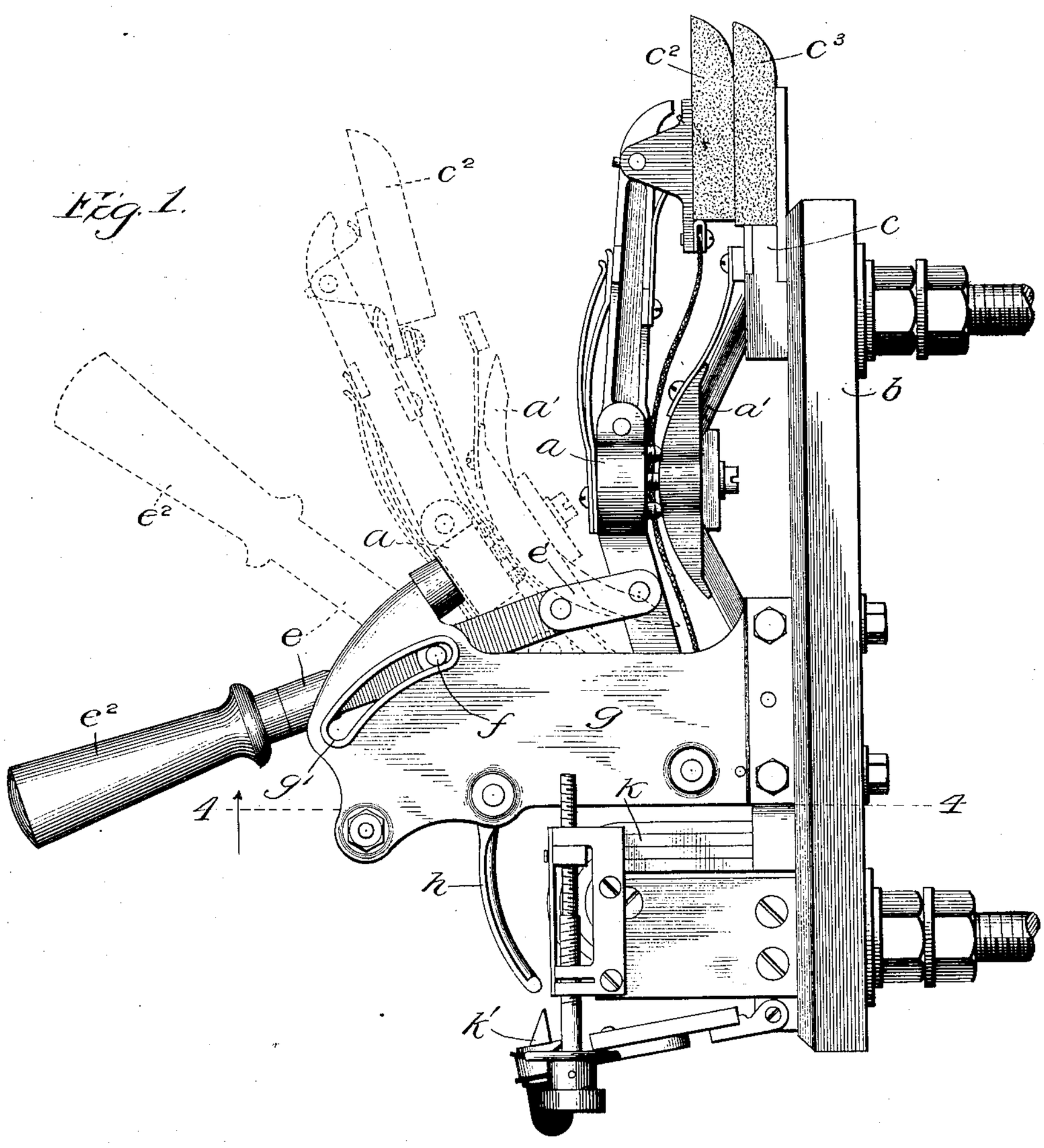
APPLICATION FILED OCT. 21, 1904. RENEWED DEC. 18, 1905.

960,049.

Patented May 31, 1910.

4 SHEETS—SHEET 1.

Fig. 1.



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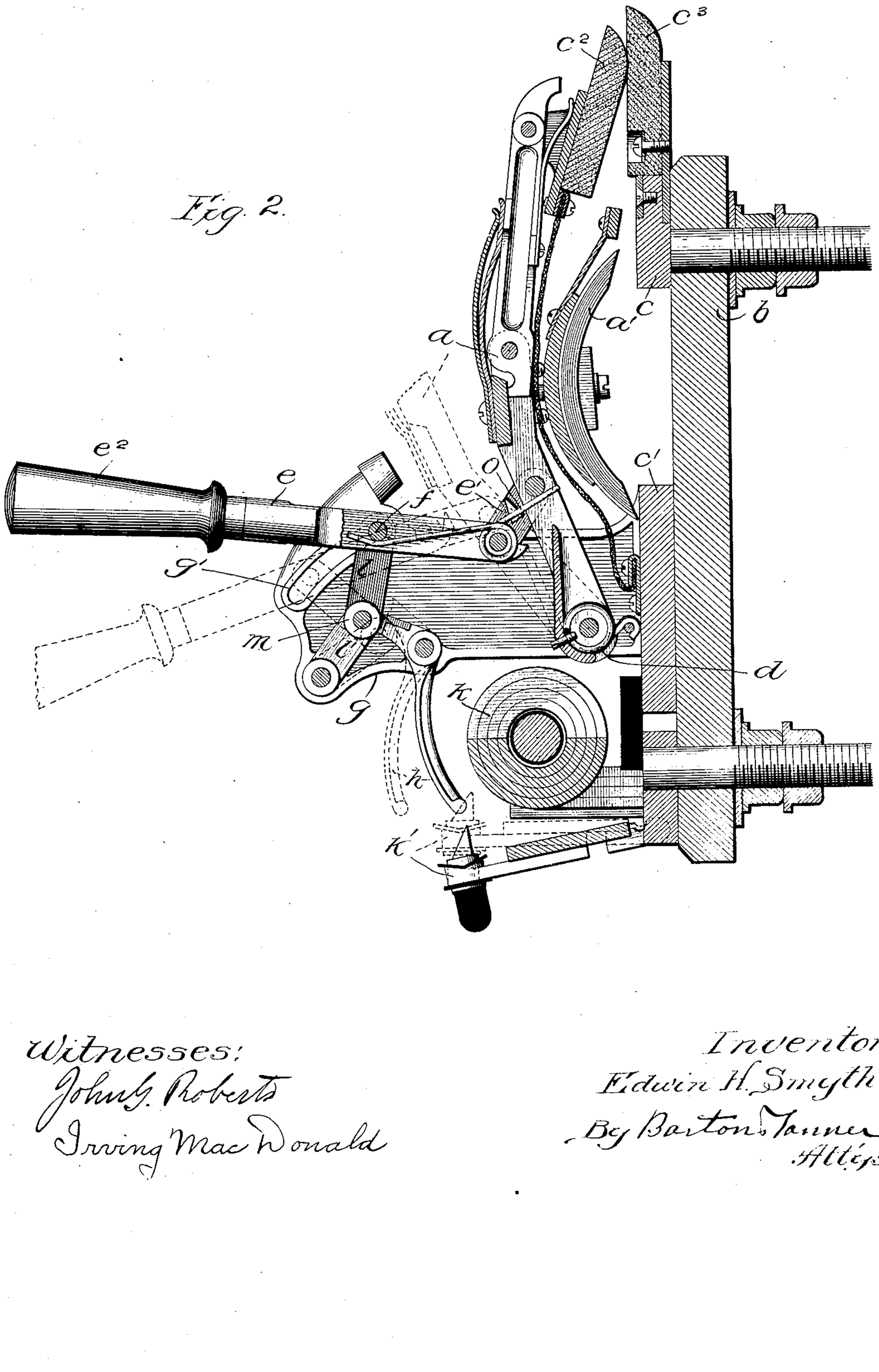
4 SHEETS—SHEET 2.

Fig. 2.



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4 SHEETS—SHEET 3.

Fig. 3.

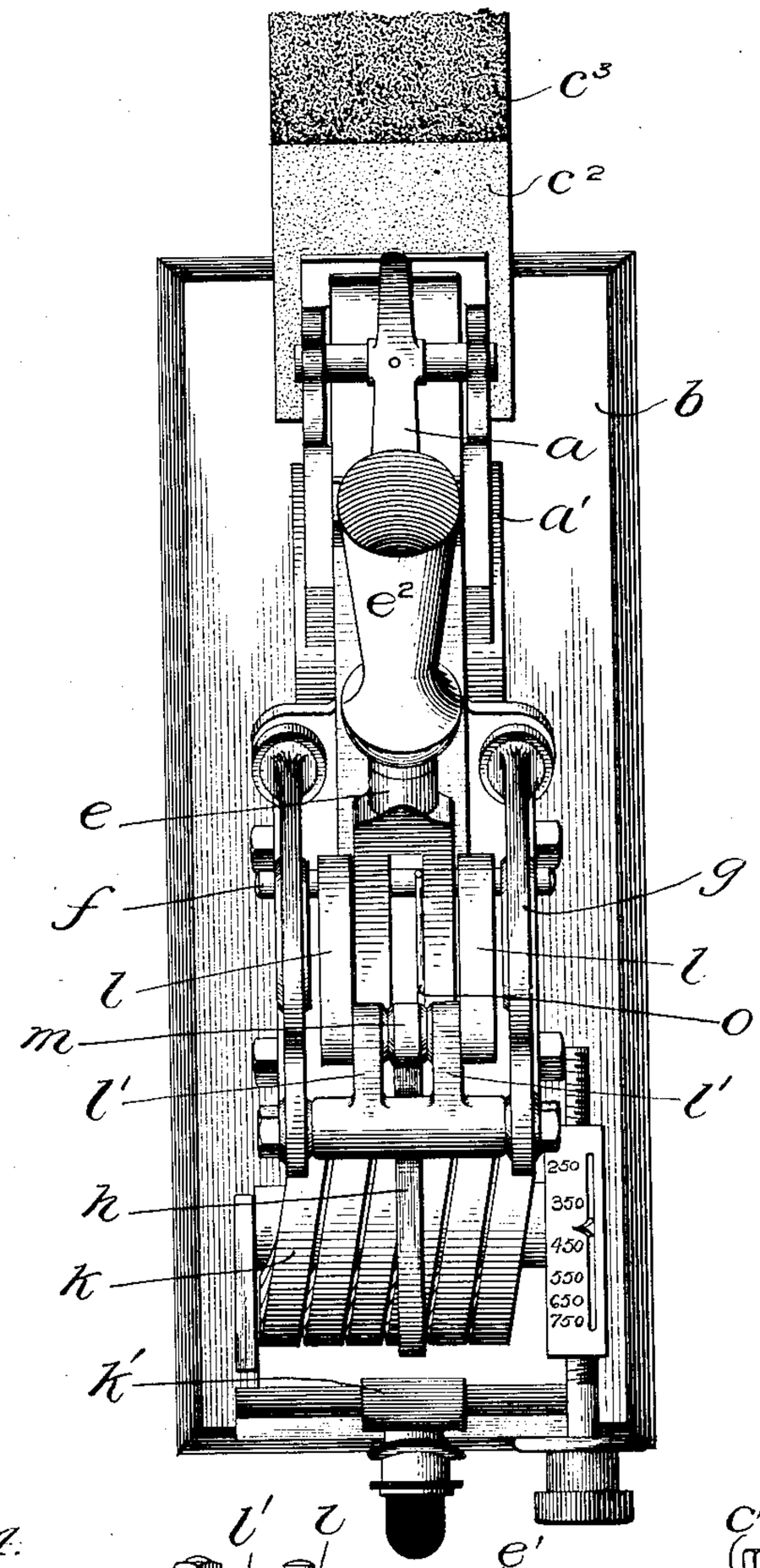
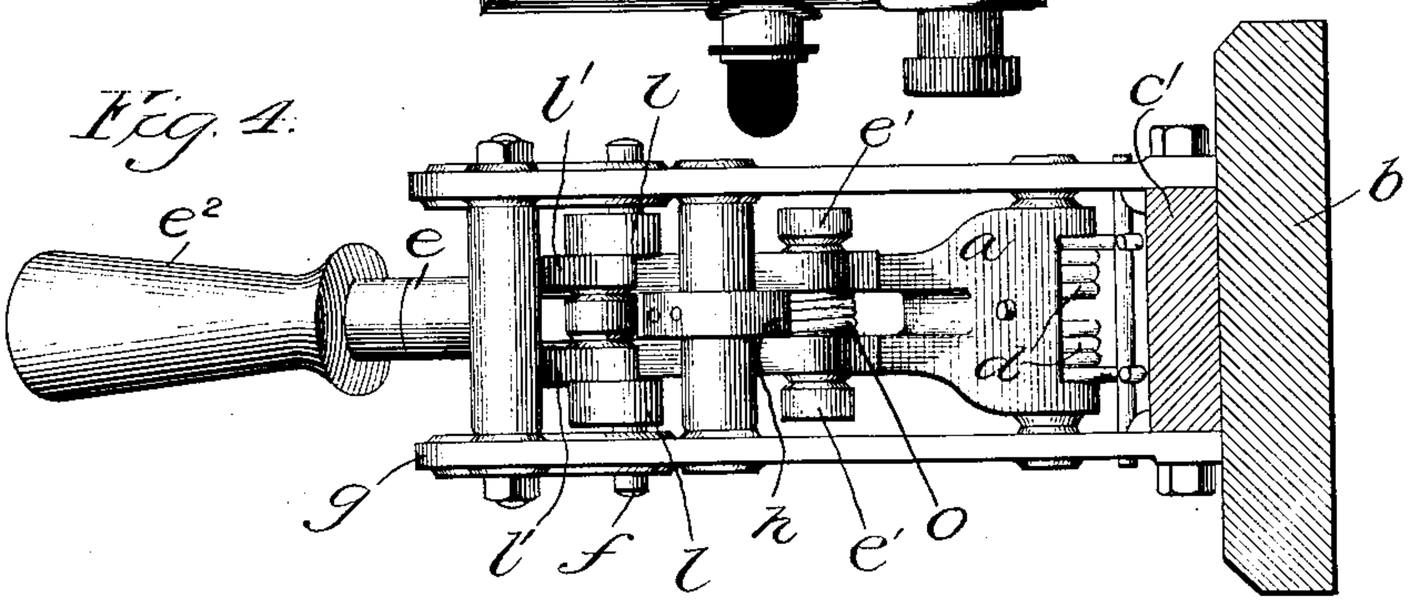


Fig. 4.



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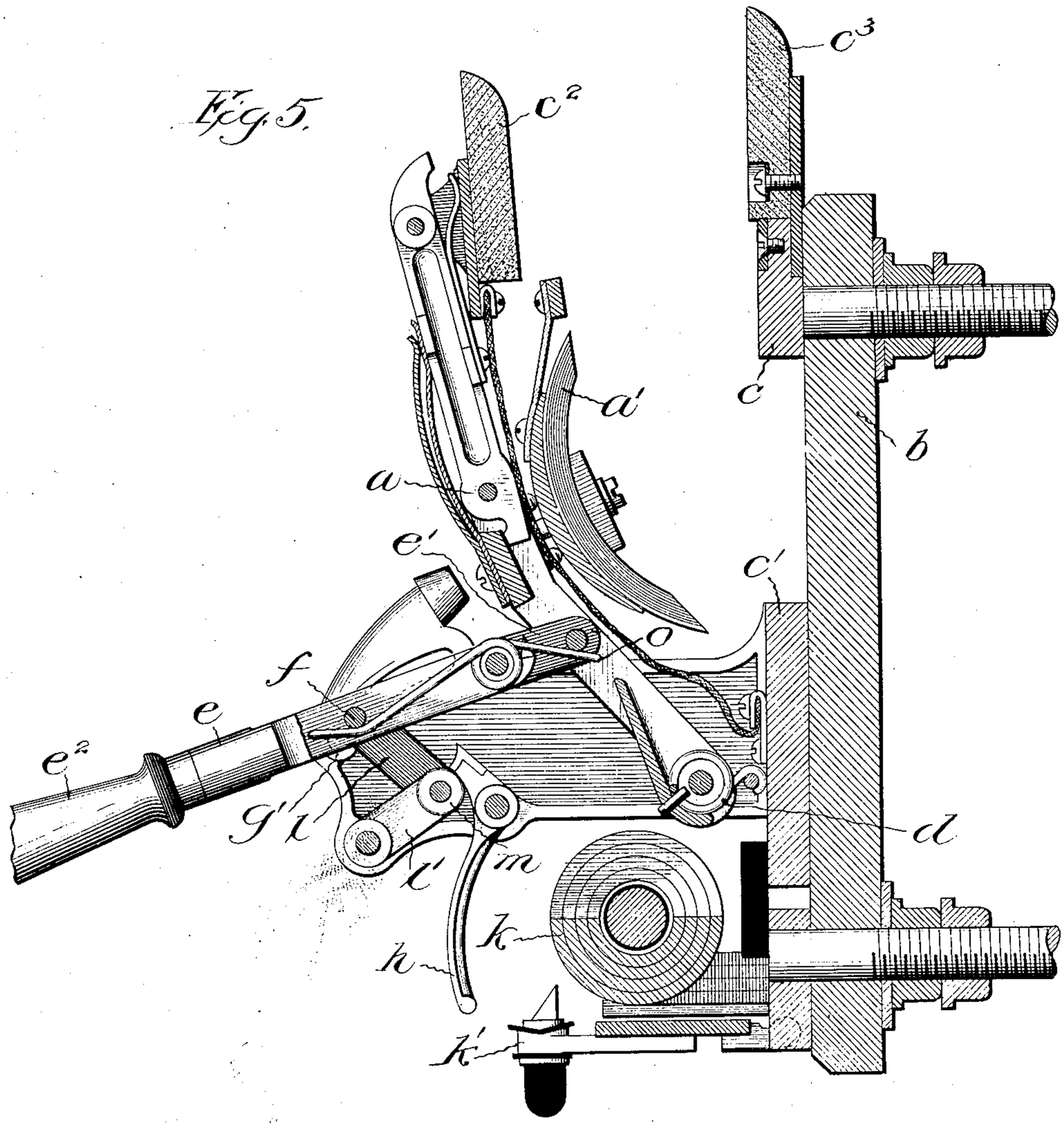
4 SHEETS—SHEET 4.

Fig. 5.



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UNITED STATES PATENT OFFICE.

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CIRCUIT-BREAKER.

960,049. Specification of Letters Patent. Patented May 31, 1910.

Application filed October 21, 1904, Serial No. 229,476. Renewed December 18, 1905. Serial No. 292,159.

To all whom it may concern:

Be it known that I, EDWIN H. SMYTHE, citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Circuit-Breakers, of which the following is a full, clear, concise, and exact description.

My invention relates to an electric circuit breaker, and its object is to provide an improved and simple switch mechanism adapted to be closed manually, and to be released automatically, the manual closure of the switch being also dependent upon the automatic tripping mechanism, so that upon the passage of an abnormal current through the controlling magnet, the switch will be automatically opened, and it will furthermore be made impossible to hold the switch closed as long as the abnormal condition exists.

Generally speaking, my invention contemplates the provision of a manual lever for closing the switch, with a movable fulcrum for said lever controlled by electromagnetic tripping mechanism. Normally the fulcrum of the operating lever is held in such a position that the switch can be closed, but upon the passage of an abnormal current through the controlling magnet the mechanism for holding the fulcrum in operative condition is tripped. The manual lever is thus rendered inoperative to hold the switch closed, and the switch arm will be thrown open even though the lever is being manipulated in an attempt to close the switch. This feature is of considerable advantage to prevent the closing of the switch under improper conditions, as where a short circuit still exists somewhere on the line.

I will describe my invention more particularly by reference to the accompanying drawings, in which—

Figure 1 is a side elevation of my circuit breaker, showing the switch closed, and also indicating in dotted lines the position of the parts when the switch is open; Fig. 2 is a sectional elevation of the circuit breaker in the act of closing, showing also in dotted lines the position of the parts as they would appear if the tripping mechanism were actuated during the attempted closure of the switch; Fig. 3 is a front elevation of the device; Fig. 4 is a sectional plan view on line 4—4 of Fig. 1; and Fig. 5 is a vertical sectional view showing the parts in the position which is indicated in dotted lines in Fig. 2.

The same letters of reference are used to designate the same parts wherever they are shown.

The switch of the circuit breaker may be of the usual type in such devices, comprising a pivoted switch arm a carrying a copper contact brush a' adapted to engage and electrically unite the circuit terminal contacts c c', which are blocks of copper mounted upon the base b. The upper end of the switch arm may also carry a carbon block c^2 which is adapted to engage a corresponding carbon block c^3 carried by the upper terminal c of the switch, the carbon blocks taking the arc when the switch opens, in a manner well understood. A spring d is provided in association with the switch arm which tends to throw the same to its open position.

A toggle adapted for manual operation is connected with the switch arm for closing the same, said toggle consisting of a main lever e having a handle e^2 at its outer end and a link e' connecting the opposite end of said lever e with the switch arm. The fulcrum of the manual toggle is formed by a pin f passing through the same, the ends of said pin being slidably mounted in slots g' g' in the metal supporting frame g which is mounted upon the base b. The normal position of the fulcrum pin f is at the forward end of the slots, as shown in full lines in Fig. 1, the fulcrum pin being normally maintained in this position under the control of a trigger h which is arranged to be tripped by the armature lever k' of the electromagnet k. Said magnet may consist, as usual, of a heavy copper spiral surrounding a suitable core and electrically connected in the circuit of the switch.

The particular means employed for holding the fulcrum pin f of the toggle in its normal position consists of a toggle mechanism l l' connected at one end with the fulcrum pin and at the lower end with the frame-work g, the knee joint of the toggle l l' being provided with a roller m which is adapted to be engaged by the upper end of the trigger h. While the trigger is in its normal position, as shown in Fig. 1, the upper end of said trigger abuts against the roller at

the knee joint of the toggle mechanism *l l'*, whereby said toggle is prevented from closing. This keeps the fulcrum pin *f* in its normal position in the slot as shown in Fig. 1.

The fulcrum of the manual toggle being held in its normal position by means of the trigger, the switch can be closed by pressing down the handle of the lever *e* into the position shown in full lines in Fig. 1. If, while the switch is closed, a short circuit should come upon the line, the armature *k'* of the electromagnet *k* will be drawn up and will trip the trigger *h*. This releases the sliding fulcrum and the switch arm is immediately opened by the main spring *d*.

If it is attempted to close the switch while a short circuit still remains on the line, the moment the contacts engage sufficiently to permit current to flow through the magnet *k*, the armature lever *k'* will trip the trigger *h*, and the pressure of the operator's hand upon the handle of the lever *e*, combined with the action of the springs, will simply cause the fulcrum pin *f* of said lever to slide out in its slots into the position shown in dotted lines in Fig. 2, and the switch to be immediately opened. It is thus rendered impossible for the switch to be held closed for any appreciable time under improper conditions.

The direction of movement of the fulcrum of the manual lever when released is, it will be noticed, in the same direction as that in which the handle moves in closing the switch. Therefore the pressure exerted in the attempt to close the switch will assist rather than oppose the action of the spring which opens it, if the fulcrum is released during this action. In the particular device illustrated, the direction of movement of the fulcrum is of course determined by the direction of the slots in which it slides, these slots extending downward and backward, as shown. An additional spring *o* is provided upon the main toggle, tending to fold the same into the position shown in dotted lines in Fig. 1; and as soon as the fulcrum of the toggle is released, the main lever arm *e* immediately tends to fold up instead of being pushed directly outward, as the switch arm is opened. In other words, as soon as the fulcrum is released, it needs to move only a slight distance through the slots *g' g'* before the spring *o* tends to swing the lever *e* around into such a position that the further opening of the switch arm *a* will merely rotate the lever *e* instead of pushing it lengthwise. This feature is of advantage, since it avoids the liability of persons being struck by the end of the switch handle when the device operates. This action of the spring *o* when the device is tripped has the further important advantage that the sliding fulcrum pin is thereby drawn back to its normal position at the head of the slots, permitting the other toggle *l l'* to reset itself automatically as soon as the trigger resumes its normal position. The principal purpose of the spring *o*, whether it be applied to the mechanism in the manner shown or otherwise, is to yieldingly maintain the toggle *l l'* in its extended or normal position. In the particular device illustrated this spring also coöperates in folding the main toggle.

It will be observed that the two toggle mechanisms *e e'* and *l l'* are so connected with each other and with the switch arm that the release of the switch arm *a* may be effected by the folding of either of the toggles. That is to say, the main toggle may be folded by the handle and the switch thus be released manually; or the auxiliary toggle *l l'* may be tripped by the electromagnetic mechanism to produce an automatic release of the switch, either action being independent of the other. The two toggles are connected in a mechanical series, so to speak, thus forming a support for the switch arm collapsible at two points, its collapse at one point being determined by manual means, while the collapse at the other point may be brought about by the electromagnetic tripping mechanism. The collapse of this support at either point will open the switch.

I claim:

1. In a circuit breaker, the combination with a switch, of a lever for closing the switch, a movable fulcrum for the lever, said lever being inoperative to close the switch when the fulcrum is displaced, and electromagnetic mechanism adapted to control said fulcrum.

2. In a circuit breaker, the combination with a switch, of power multiplying mechanism for closing the switch, a movable support for said mechanism, and electromagnetic mechanism adapted to control said support, said power multiplying mechanism being inoperative to close the switch when said movable support is moved from its normal position.

3. In a circuit breaker, the combination with a switch, of closing means therefor, said means including a toggle through which the force is applied to the switch to close the same, a movable fulcrum for said toggle, and electromagnetic tripping means controlling said fulcrum.

4. In a circuit breaker, the combination with a switch, a part to be moved to close said switch, a movable support for said part adapted to take the thrust thereof in closing the switch, said part being inoperative to close the switch when the movable support is displaced from its normal position, and mechanism controlling the movement of said support.

5. In a circuit breaker, the combination with a switch, of a manual lever for closing the switch and a spring for opening it, a movable fulcrum for said lever, said lever being inoperative to close the switch when the fulcrum is displaced, an electromagnet and tripping mechanism operated by said electromagnet controlling the movement of said fulcrum.

6. In a circuit breaker, the combination with a pivoted switch arm and circuit terminal contacts adapted to be engaged thereby, of a manual toggle connected with said switch arm for closing the same, a fulcrum for the toggle and a mounting for said fulcrum, permitting the same to move in a direction to open the switch and to prevent said toggle from closing said switch, a trigger and means controlled thereby for holding the fulcrum in a normal position in which the toggle is operative to close the switch, an electromagnet responsive to abnormal current in the circuit of said terminal contacts adapted to trip said trigger, and a spring arranged to open the switch when said fulcrum is released; whereby the switch is automatically opened, and the permanent closure thereof prevented, upon the passage of abnormal current through the magnet.

7. In a circuit breaker, the combination with a pivoted switch arm and contacts with which the same is adapted to engage, of a manual toggle for closing said switch arm, a fulcrum pin for said manual toggle, a framework having slots in which said fulcrum pin is adapted to slide, toggle mechanism adapted to hold said fulcrum pin normally in an operative position in said slots, a trigger normally engaging the knee joint of said last mentioned toggle mechanism to prevent the release thereof, and electromagnetic mechanism for tripping said trigger.

8. In a circuit breaker, the combination with a pivoted switch arm and contacts with which the same is adapted to engage, of a manually operated toggle for closing said switch arm, a movable fulcrum for said toggle, whereby the toggle is rendered ineffective to close the switch when its fulcrum is released, an auxiliary toggle connected with said fulcrum, and adapted when extended to hold said fulcrum in a normal operative position, tripping mechanism adapted to release said auxiliary toggle, a spring acting on the main switch arm to open the same, and an auxiliary spring arranged to yieldingly maintain said auxiliary toggle in an extended position.

9. In a circuit breaker, the combination with a switch arm and contacts with which the same is adapted to engage, of a support adapted to maintain the same in a closed position, said support being formed in two collapsible sections, manual means adapted to control the collapse of one section and automatic tripping mechanism controlling the collapse of the other section, and a spring arranged to yieldingly maintain the last mentioned section of said support in its normal position.

10. In a circuit breaker, the combination with a switch, of a manual lever having a handle for closing said switch, a spring arranged to open said switch when released, a fulcrum for said lever, and a mounting therefor permitting the same to move in the direction of the closing movement of the handle, means arranged to normally maintain said fulcrum in a fixed position to permit the closure of the switch by said lever, and automatic tripping mechanism adapted to release said fulcrum to permit the movement thereof, whereby the further movement of said lever is rendered ineffective to close the switch.

11. In a circuit breaker, the combination with a contact terminal, of a movable switch member adapted to coöperate therewith, a closing device adapted to be operated to force said movable switch member into engagement with said contact terminal, a support for said closing device adapted to take the thrust thereof in the closure of the switch, said support being capable of movement to prevent the closure of the switch by said closing device, an electromagnet, and tripping mechanism operated by said magnet adapted to control the movement of said support: whereby the switch is under the control of the tripping magnet during closure.

12. In a circuit breaker, the combination with a switch, of a lever for closing the switch, a movable fulcrum for said lever, and automatic means, responsive to abnormal current in the circuit, for moving said fulcrum into a position in which the lever is inoperative to close said switch.

13. In a switch actuating mechanism, the combination with a movable switch actuating member connected to the switch, of an actuating toggle having one end connected to said switch actuating member to close the switch when straightened, retaining means for normally holding the opposite end of said toggle immovable against the thrust exerted by said toggle as it is straightened to close the switch, means for straightening said actuating toggle, and means for rendering said restraining means inoperative and thereby permitting the opposite end of said actuating toggle to move.

14. In an actuating mechanism for electric switches, the combination with a movable switch actuating member connected to the switch, of an actuating toggle for moving said switch actuating member, means for straightening said actuating toggle, a locking toggle connected to a fixed point to re-

sist when straightened the end thrust of said actuating toggle, and means for breaking said locking toggle.

15. In an actuating mechanism for an electric switch, the combination with a movable member connected to the switch, of a movable abutment, an actuating toggle having one link connected to the movable abutment and the other link to the movable member, and disengageable locking means for holding said abutment in such relation to the movable member that straightening the actuating toggle closes the switch.

16. In an actuating mechanism for electric switches, the combination with a movable switch actuating member, of an actuating toggle connected at one end to said member, a movable abutment for the other end of said toggle, a locking toggle for holding said abutment immovable against the thrust exerted by said actuating toggle as it is straightened to move said member, and electro-responsive means for breaking said locking toggle.

In witness whereof, I hereunto subscribe my name this 1st day of September A. D., 1904.

EDWIN H. SMYTHE.

Witnesses:
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W. S. DUNCAN.