No. 640,062. Patented Dec. 26, 1899.

E. F. WINFIELD.

AUTOMATIC CIRCUIT BREAKER.

(Application filed Nov. 22, 1898.)

(No Model.)

Fig. 1.

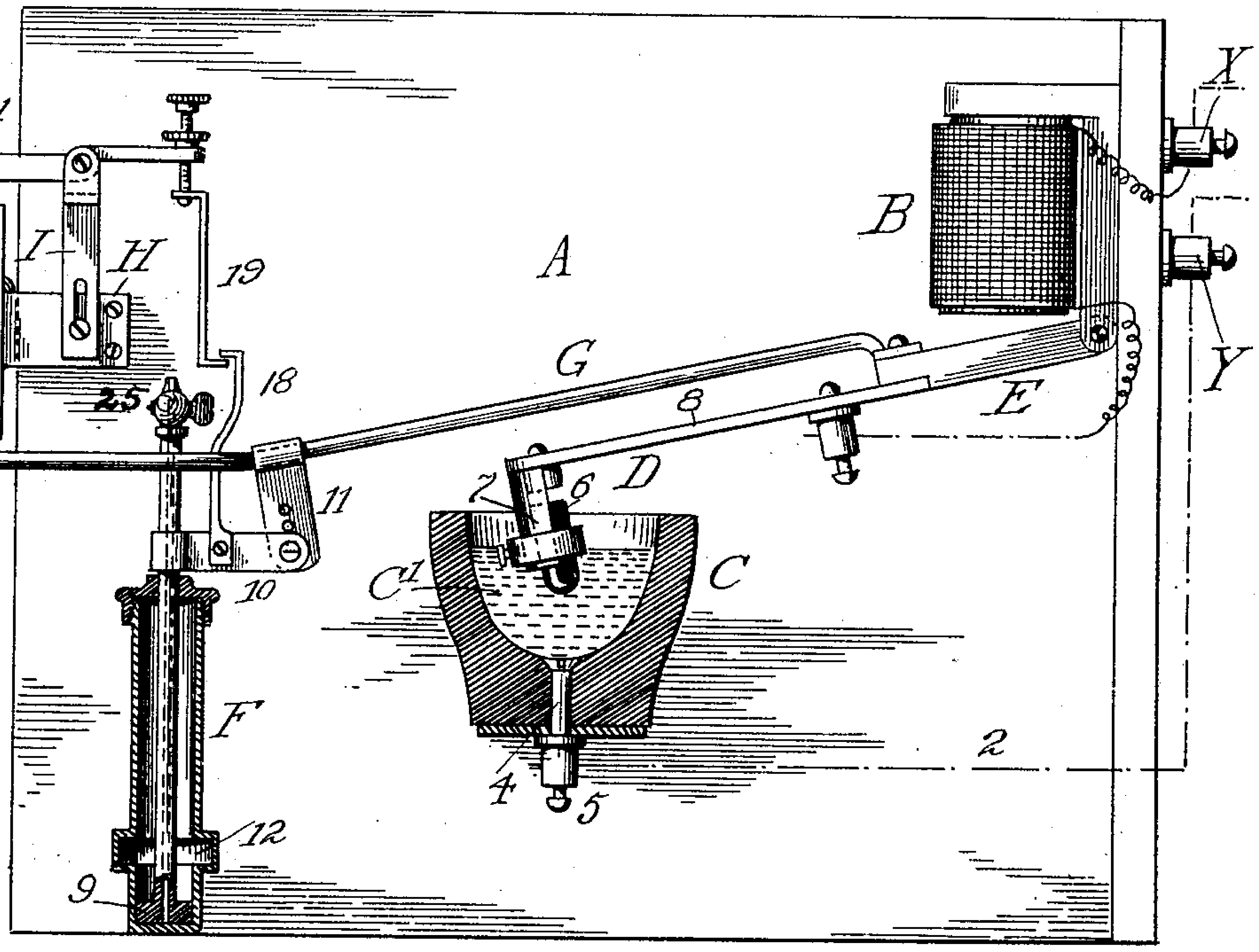


Fig. 2.

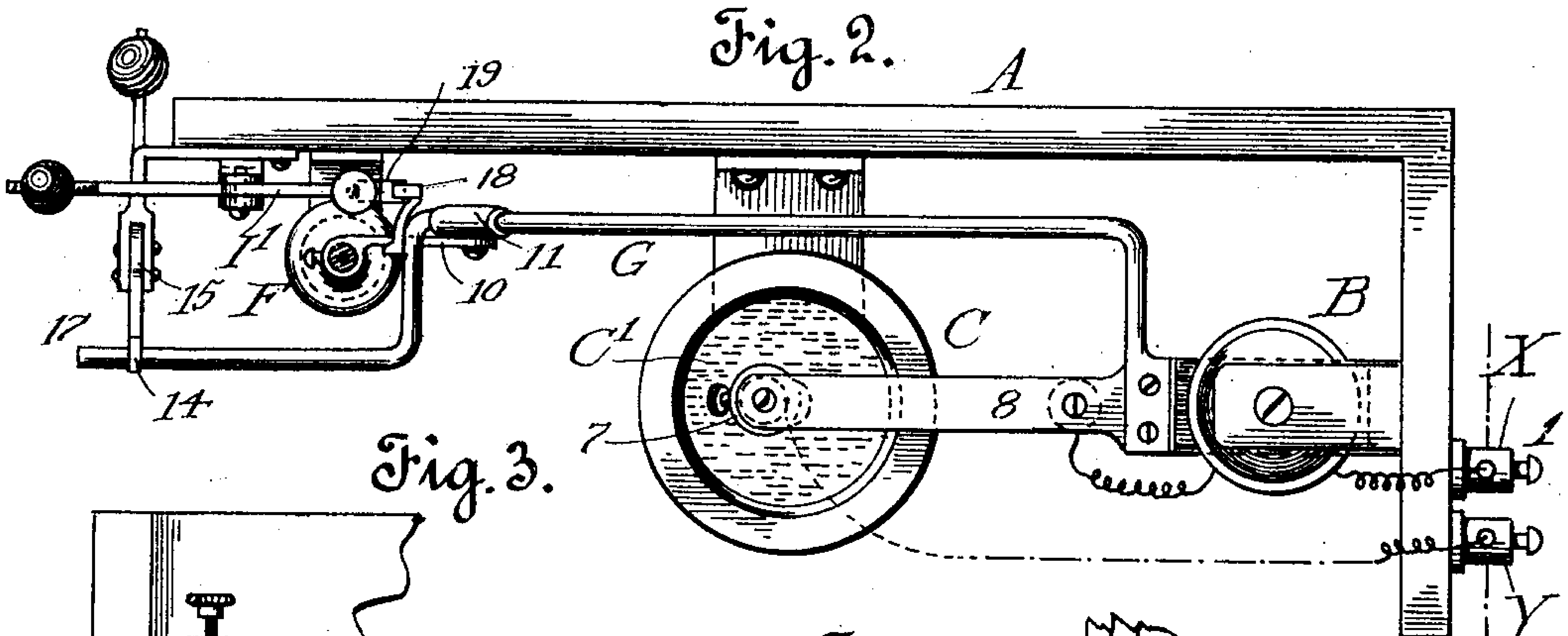


Fig. 3.

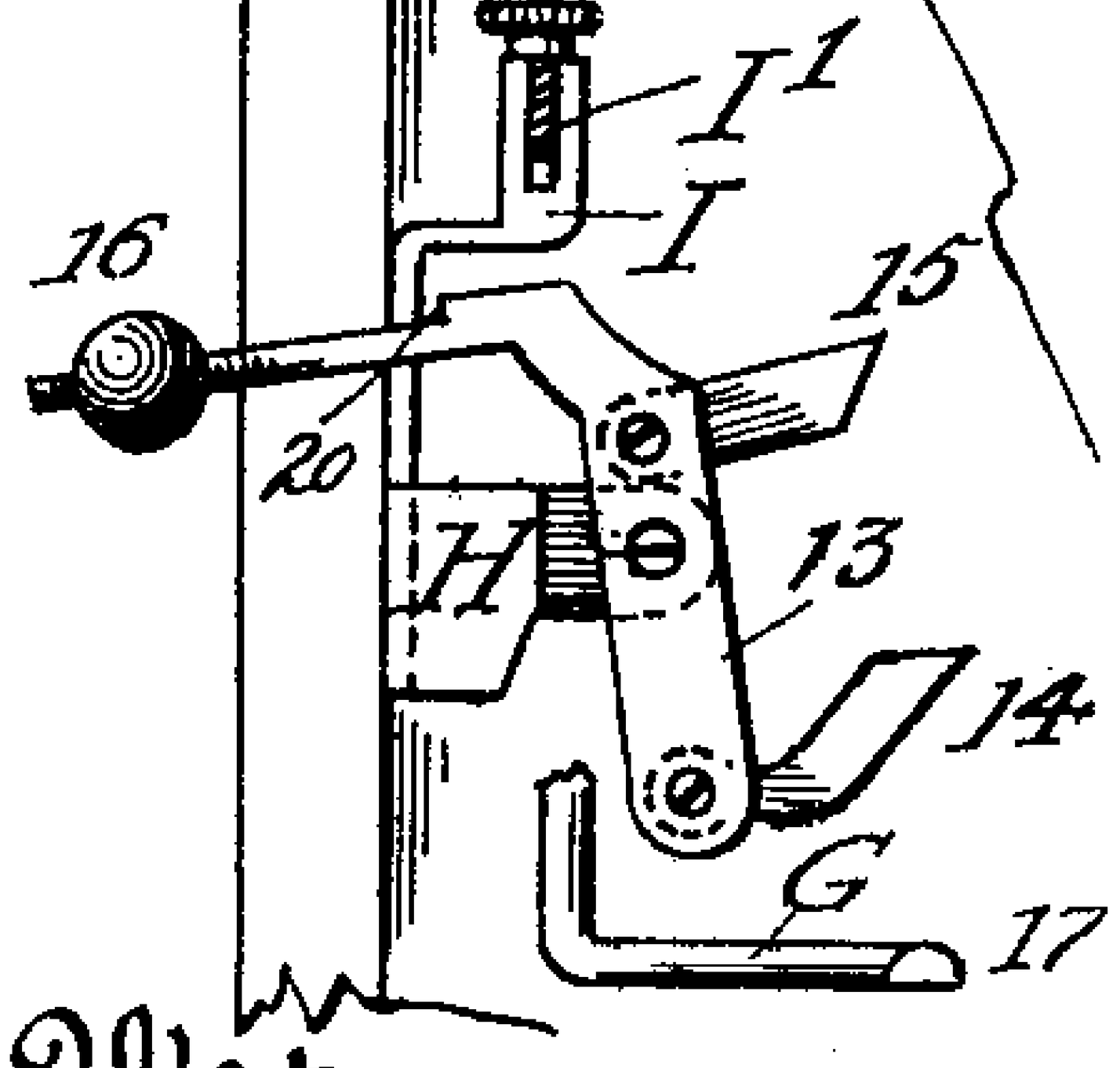


Fig. 4.

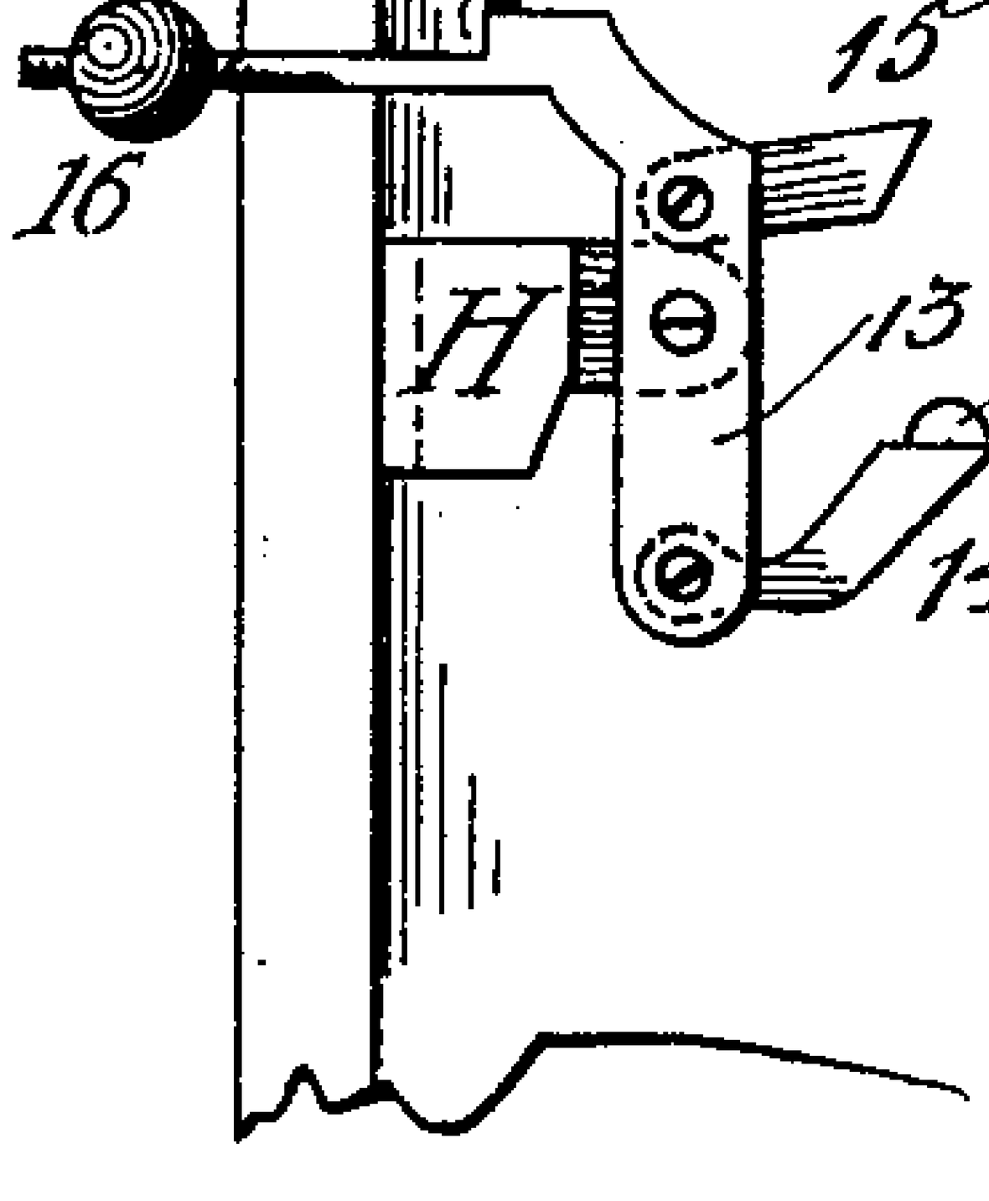
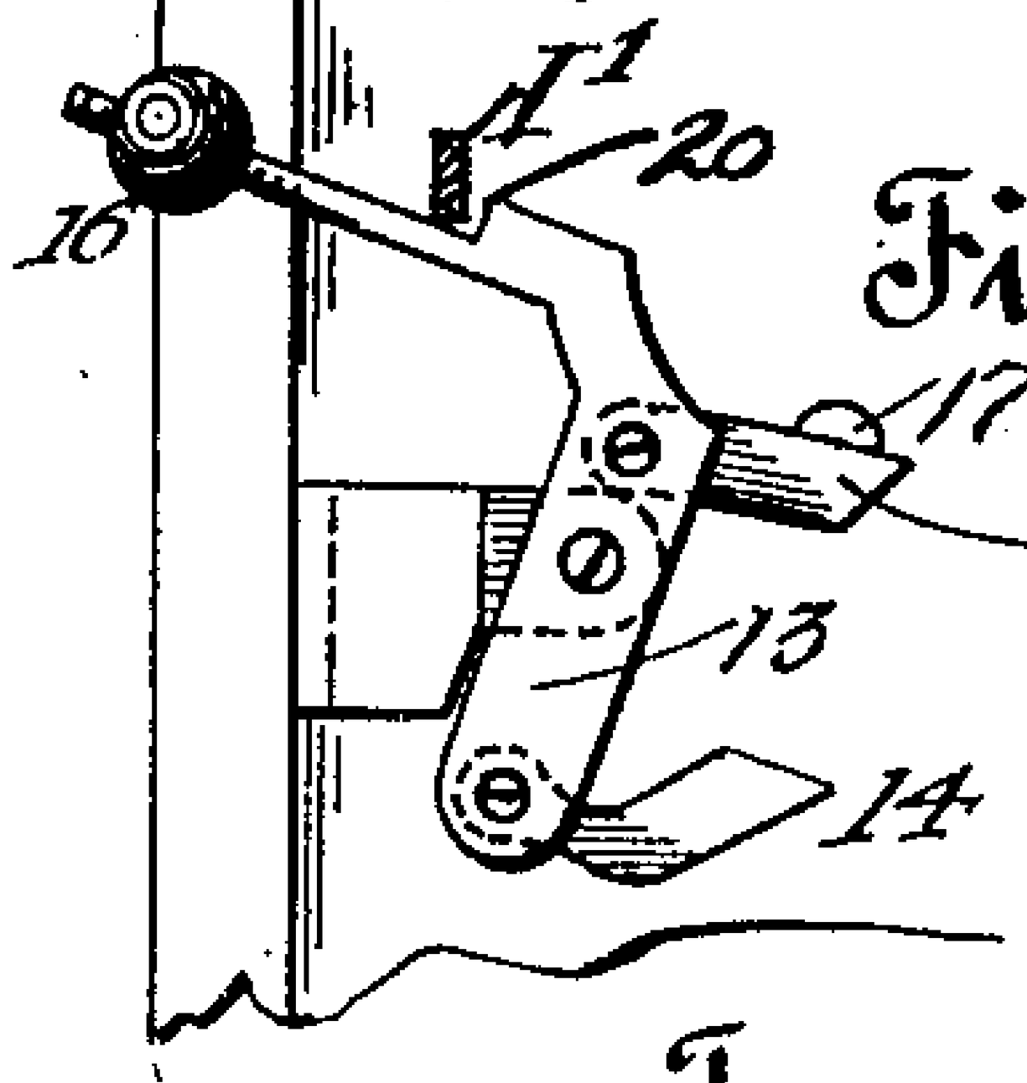


Fig. 5.



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UNITED STATES PATENT OFFICE.

EDWARD F. WINFIELD, OF SAN FRANCISCO, CALIFORNIA.

AUTOMATIC CIRCUIT-BREAKER.

SPECIFICATION forming part of Letters Patent No. 640,062, dated December 26, 1899.

Application filed November 22, 1898. Serial No. 697,208. (No model.)

To all whom it may concern:

Be it known that I, EDWARD F. WINFIELD, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented certain new and useful Improvements in Automatic Circuit-Breakers, of which the following is a specification.

My invention relates to mechanism introduced into electrical circuits for automatically breaking the same upon the occurrence of abnormal conditions in the circuit, such as overloads, grounds, escapes, and crosses.

One object of my invention is to provide an effective substitute for fuse-blocks and circuit-breakers which shall be so constructed as to restore the circuit if the abnormal condition is only temporary, but will keep it open when such condition is permanent. Thus the breaking of the circuit is accomplished without destroying any part of the connections.

A further object is to make the operation more certain and exact than is possible with devices at present in use.

In the accompanying drawings I have illustrated one practical embodiment of my invention, which is fully hereinafter described.

Figure 1 is a front elevation of such an apparatus placed in an electrical circuit in series. In this view certain parts are shown in vertical section. Fig. 2 is a plan view of the same. Fig. 3 is a view of the lock for the main contact of the circuit-breaker in normal position—that is, with the circuit closed. Fig. 4 is a view of the same lock in an intermediate position with the circuit, open but about to be closed, as in the case where a momentary ground, short, or overload has occurred. Fig. 5 is a view of the same parts, but with the main contact locked and the circuit broken, as in the case of a permanent ground, short, or overload which must be located.

In the form in which I have embodied my invention, A represents any suitable base, frame, or bracket adapted to be secured to a wall or in any other convenient position.

X and Y are binding-posts joining the main wire of the circuit in series. The binding-post X is connected to the coil of the solenoid or electromagnet B. The post Y is connected through a wire 2 to the fixed member C of the main contact. The other end of the magnet-coil is connected to the movable member D of the main contact, which forms a part of the armature E. The main contact is in series with the circuit, the course of which is through the solenoid, the wire 2, the main contact, and the post Y. I prefer to use the circuit-breaker in series; but, if desired, it can be located in a shunt with a differential solenoid. The main contact is shown in the drawings as I prefer to construct it. The member C is a cup, which I prefer to make of graphite, and is adapted to contain a body C′ of mercury or other conductor, which is in electrical connection with the main circuit through the screw 4, countersunk in the bottom of the cup and extending through it to the post 5, to which the wire 2 is connected. The movable member of the contact is a button 6, of carbon, secured by a metallic clamp 7 to the contact-arm 8, which in turn is attached to the armature E. The carbon button and clamp plunging into the mercury close the circuit normally, as shown in Fig. 1, and keep it closed until the occurrence of a ground, short, overload, or some other interruption in a part of the circuit controlled by this contact. The effect of the surplusage of current is to energize the magnet sufficiently to attract its armature, withdraw the movable contact from the fixed contact, and break the circuit.

It is desirable to have the contact sharply broken and sharply made, and I therefore provide a mechanical resistance or regulator for the contact-arm which shall secure this result and which also renders the operation of the locking device (yet to be described) certain and sure. For this regulator I prefer to use a dash-pot F, having a hollow plunger 9 and a regulating-valve 25, the plunger being connected by adjustable links 10 and 11 to an arm G, secured to the armature, and hence rising with the movable contact. In the shell of the dash-pot is an expansion-space 12 of greater diameter than the head of the plunger and located in a defined relation to the normal position of the carbon contact. The descent of the plunger and the closing of the circuit are regulated by the valve 25, connected through the hollow plunger to the end or side of said plunger. The relief in the pressure caused by the expansion-space in the dash-pot compels the contact to plunge sharply into

the mercury, and the restoration of pressure below the expansion-space causes it to settle slowly to its normal position, Fig. 1.

In the case of a momentary ground an apparatus operating as just described would be effective to automatically open and close the circuit; but I intend such apparatus to be effective not only in such cases, but to be positively locked with the circuit open in case the ground is of longer duration or of a permanent nature. With this object in view I have devised the construction specially illustrated in Figs. 3, 4, and 5 in connection with Figs. 1 and 2.

Secured to the main support in a convenient place is a bracket H, which carries a pivoted arm 13, having two beveled and pivoted projections 14 and 15. The normal position of this arm is shown in Fig. 3, in which position it is held by its own gravity or by other means, such as an adjustable weight 16. The arm G, connected to the armature, is extended, so that its end 17 is normally beneath and in line with the projection 14, Fig. 2.

An adjustable standard I is mounted upon the bracket H, which carries a pivoted and weighted lever I′, and this lever is adjustably connected, as by the arms 18 and 19, so as to be operated only on the downward movement and to move together downwardly when in contact. A cord or like flexible connection would accomplish the same result. The lower end of the connection, whatever its construction, is secured to one of the moving parts—as shown, to the link 10. Taking the parts in the position of Fig. 1 and imagining an interruption in the circuit, such as a ground or overload, the contacts will be broken, as before explained, and the arm G drawn upwardly. The end 17 of arm G will then slowly descend upon the flat face of projection 14 of the lock, Fig. 4, carrying the lock forward toward the position of Fig. 5, the lever I′ having been caused to engage with a notch 20 in the arm 13. Now if the overload has been momentary and has passed the metal and carbon contact will sink normally into the mercury, causing the connections 18 19 to return the lever I′ to normal position, and the lock will be released and will fall back to the position of Fig. 3; but if the overload is a continuing one the contact is no sooner made than it is broken before the lock is released. In this case the projection 15 being in position to receive it the arm G is caught and held thereby, the position being that of Fig. 5, with the armature, arm G, and contact mechanically locked and the circuit open. Thus the operation of the circuit-breaker is automatic for both kinds of interruption. Any overload, for instance, opens the circuit and sets the lock without effect should it be instantaneous; but should it be continuing the contacts are locked mechanically. The regulator-valve can be set for any time limit that may be desired between the two contacts.

The construction shown can be modified in many ways without departing from the spirit of my invention. For instance, I prefer to use a mercury contact, as shown, but do not desire to be confined to that form. I can also substitute other forms of mechanical resistance for the dash-pot, such as a train of gearing mutilated or deprived of teeth at some proper point, to produce the sharp and sudden make and break at the contacts. I can also simplify the construction by placing the dash-pot within a solenoid, using the plunger as the core of the latter instead of connecting it indirectly through the armature. In short, I do not desire to be limited to the construction shown and described, as I desire to avail myself of all proper modifications and equivalents that are within the spirit of my invention.

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

1. The combination with two contacts opened by an abnormal condition in a circuit, of a device for intercepting the movable contact upon a break, and a lock connected to said device; the said device being moved by the subsequent closing of the contact and setting the lock; whereby, upon a momentary abnormal condition, the circuit is simply broken and restored; but upon a continuing or permanent abnormal condition, the circuit is immediately broken again and the movable contact held by said lock.

2. An automatic circuit-breaker comprising a fixed and a movable contact located so as normally to close an electric circuit, in combination with a locking device in the path of the movable contact, and adapted to intercept it upon a break, without retaining it; such locking device being positively moved by the subsequent closing of the movable contact into a position to intercept and retain said contact after a following break.

3. An automatic circuit-breaker comprising a fixed and a movable contact located in an electric circuit, means for causing said contacts to break upon an overload or like interruption in the circuit, a lock for the movable contact, and a device for setting such lock; whereby upon a prolonged overload such as a continuing ground, the contacts are broken and restored and again broken, such restoration setting the lock in position to retain the movable contact after the following break.

4. In a circuit-breaker operated automatically by an abnormal condition in the circuit, and in combination, a magnet, a movable contact and a fixed contact located in an electric circuit so that such contacts are broken by the attraction of the magnet, and restored by the gravity of the movable contact, in combination with an arm arranged to intercept the movable contact and to be moved by its closing movement, and a lock connected to said arm, and moved by it into position to intercept and retain said contact.

5. In an automatic circuit-breaker and in

combination, a fixed contact and a movable contact located in an electrical circuit so as to be broken by an overload or like interruption, in combination with a regulator connected to the movable contact for resisting its closing movement; such regulator being provided with means for relieving the resistance at the time of making contact, in order to produce a sharp sudden contact.

6. In an automatic circuit-breaker, and in combination, a fixed contact and a movable contact, arranged in an electrical circuit so as to automatically make and break, in combination with a dash-pot having an expansion-space, and a plunger connected to the movable contact, the said space being arranged in a defined relation to the point of contact, so as to relieve the resistance at the contact.

7. In a circuit-breaker, the combination with the movable contact, of a lock for holding said contact open, in case of a permanent abnormal condition in the circuit, a device operated by the said contact for setting such lock, and a dash-pot connected to the movable contact, and having an expansion-space located adjacent to one end; whereby the resistance is relieved at said expansion-space and restored beyond it.

8. In a circuit-breaker, the combination with the movable contact, of a lock for holding said contact open, and a device for setting said lock; a body of mercury forming the second contact, and means connected to the movable contact for releasing said lock; whereby upon a momentary abnormal condition in the circuit, such contacts are broken and restored, the mercury permitting the movable contact to sink and thereby to release said lock.

9. A circuit-breaker comprising contacts located in an electrical circuit, in combination with a lock for the movable contact, means operated by the closing movement of the movable contact after a break for setting such lock in position to intercept and retain the said movable contact after a second break, and a regulator connected to said movable contact.

10. In a circuit-breaker, the combination with the movable contact, of a lock comprising a pivoted arm, having a projection in position to intercept the movable contact after a break, and a second or locking projection; constructed and arranged so that the gravity of the movable contact, in the act of closing, sets the locking projection in position to retain the movable contact after a break following said closing movement.

11. In a circuit-breaker, and in combination with the movable contact, a lock, comprising a pivoted arm having a projection normally in the path of the said contact in its opening movement, a second or locking projection, adapted to be brought into said path by the closing movement; and a lever engaging with said arm to hold the locking projection in said path while the movable contact is making its closing movement.

12. In a circuit-breaker and in combination with the movable contact, a lock comprising a pivoted arm, having a projection normally in the path of the said contact in its opening movement; a second or locking projection, adapted to be brought into said path by the closing movement, a lever engaging with said arm to hold the locking projection in said path until the movable contact has completed its closing movement, and a connection between the movable contact and said lever for disengaging the latter, substantially at the completion of the closing movement.

13. In combination with a magnet, its armature and electrical connections, a movable contact connected to said armature and cooperating with a fixed contact; an arm G connected to said armature, a pivoted arm I having projections 14, 15, a lever I′ adapted to engage with a notch 20 in said arm I and a connection 18, 19 between the contact and said lever, effective in one direction only, and adapted to release said lever from said notch at substantially the end of the closing movement of said contact.

In testimony whereof I have affixed my signature, in presence of two witnesses, this 9th day of November, 1898.

EDWARD F. WINFIELD.

Witnesses:

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