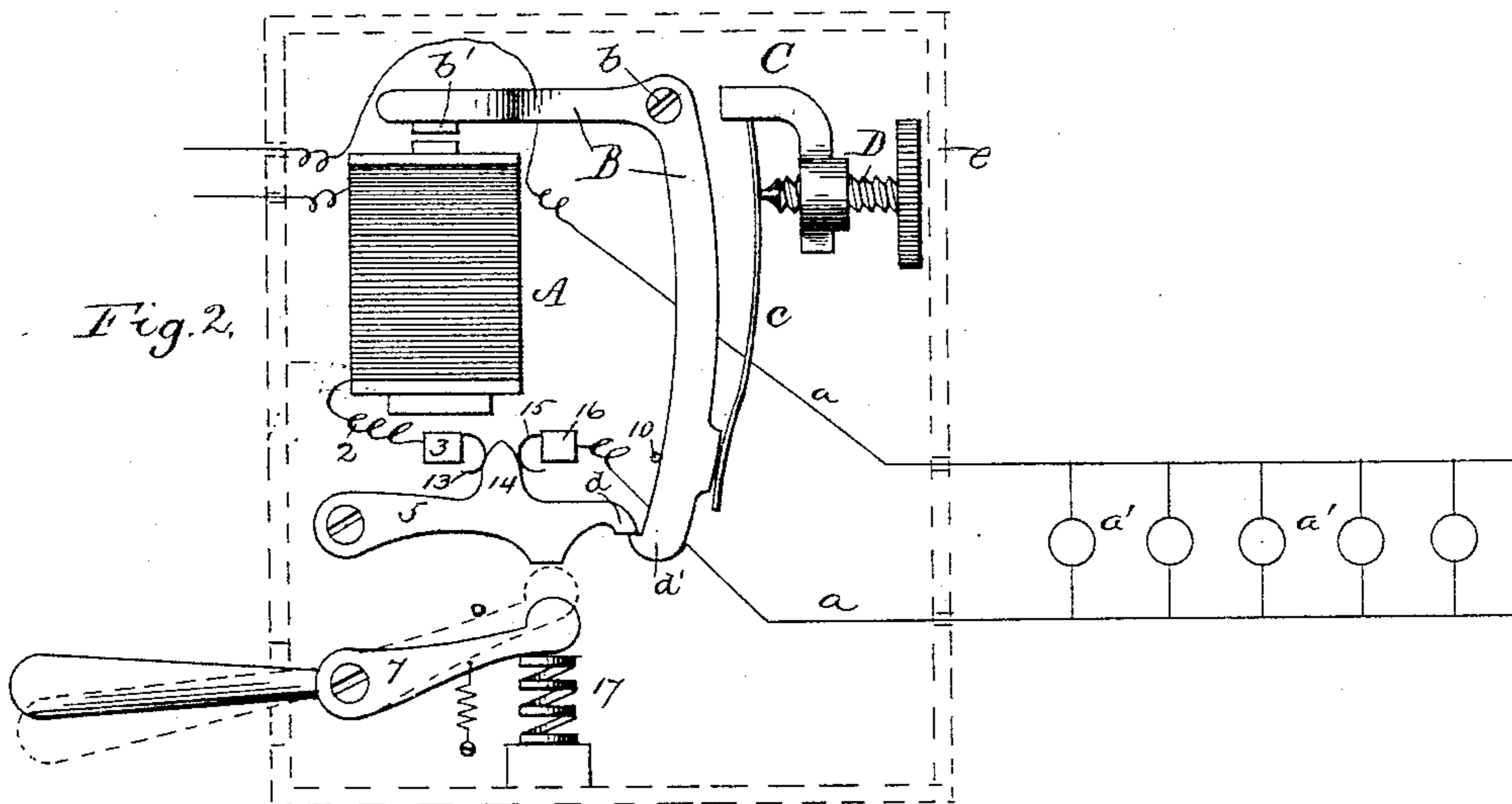
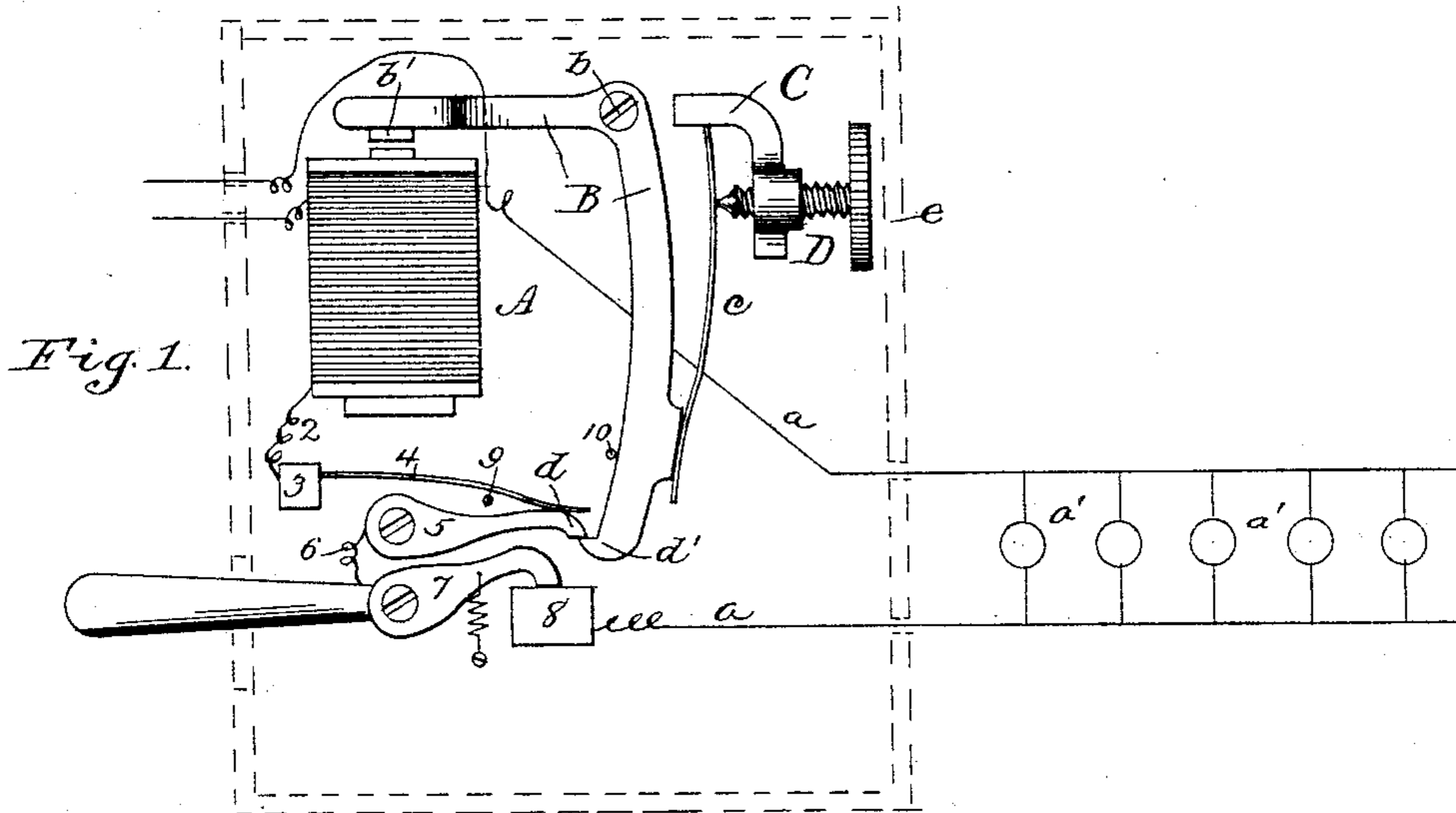


F. MÜLLER & J. G. GREENE.  
CIRCUIT BREAKER FOR INCANDESCENT ELECTRIC LIGHT SYSTEMS.  
No. 449,780. Patented Apr. 7, 1891.



Witnesses:  
*H. Kuchman*  
*J. G. Meyers Jr.*

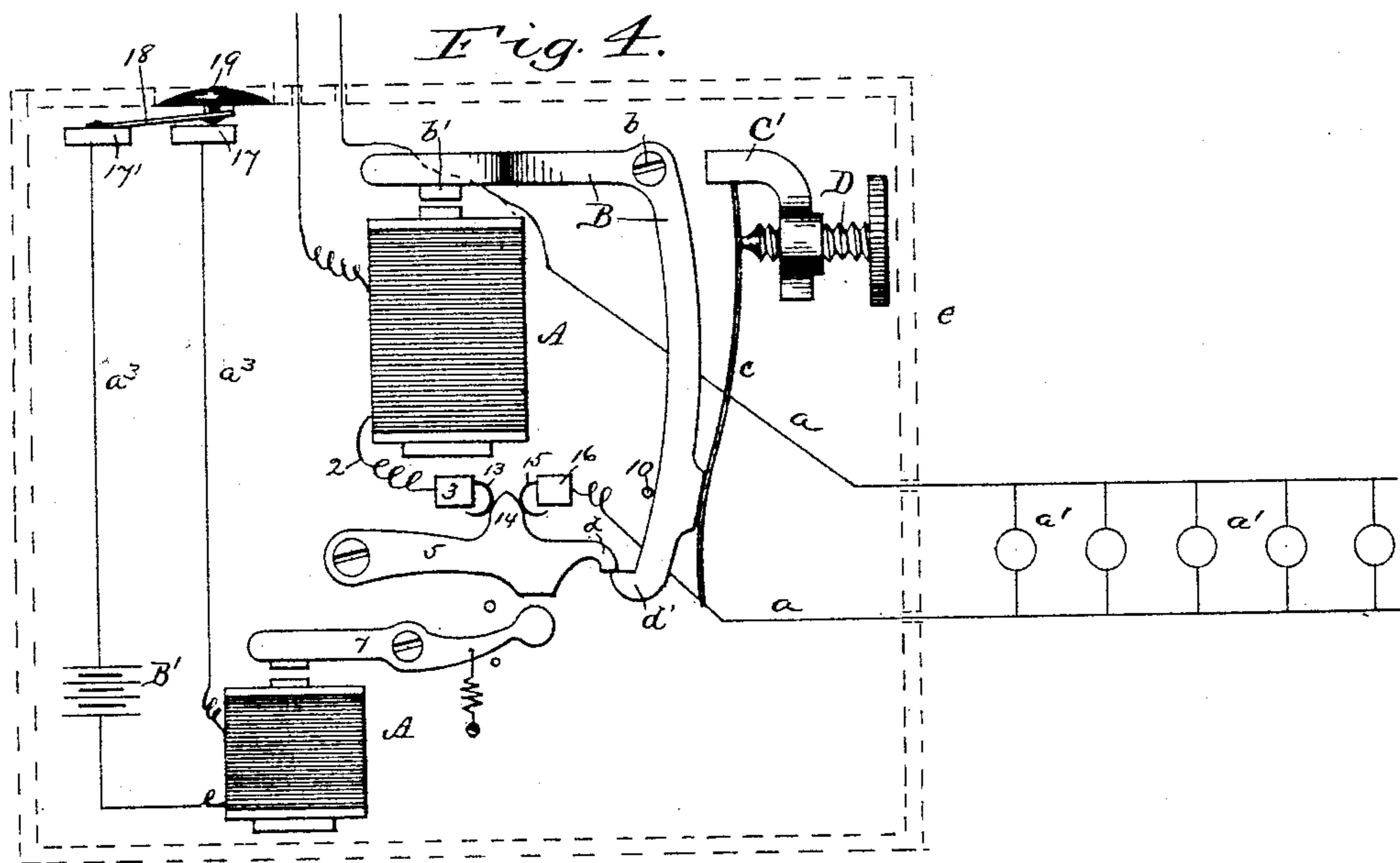
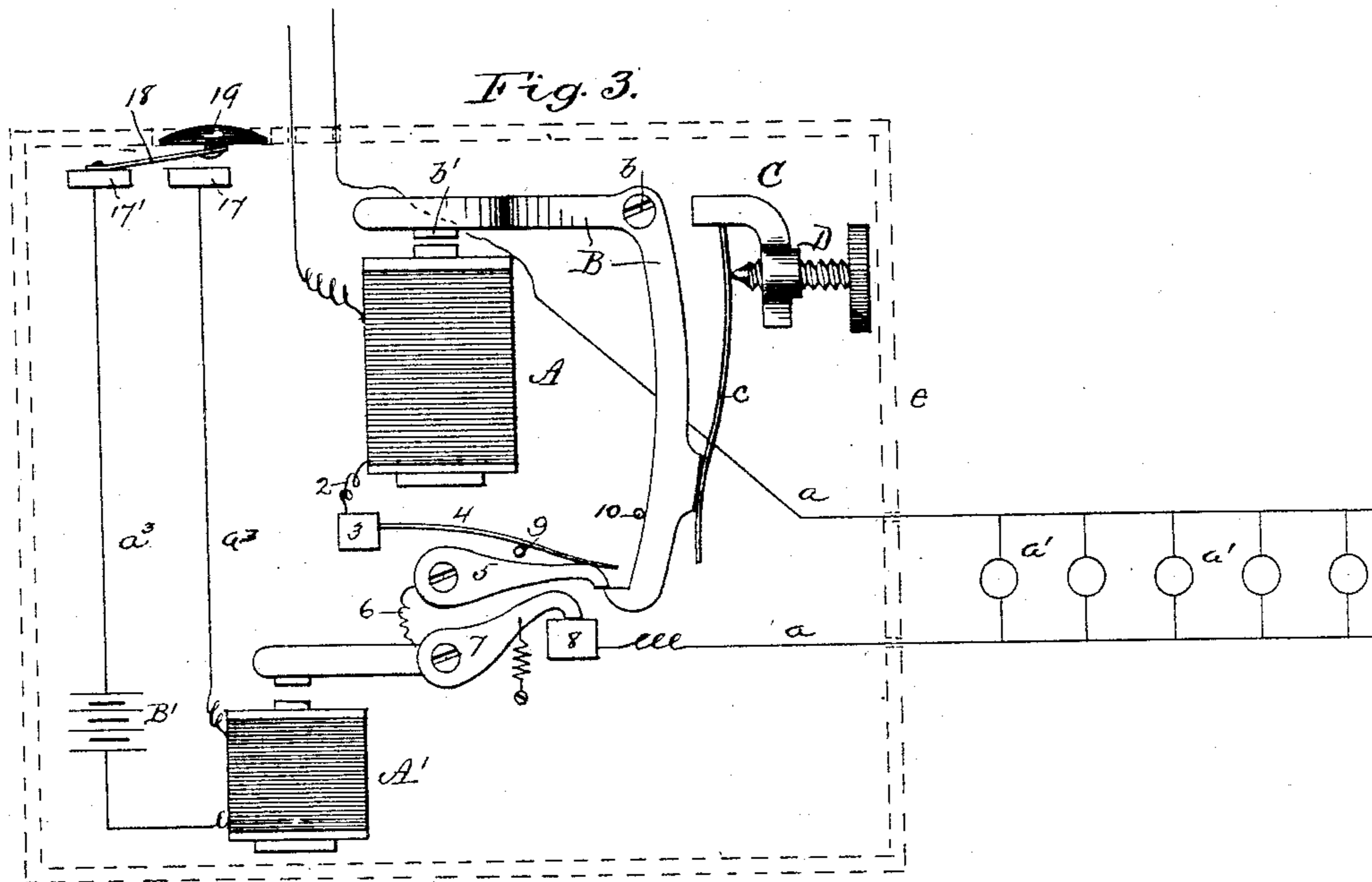
Inventors:  
*Friedrich Müller*  
*and Jas. G. Greene*  
*by Henry K. Lewis*  
*Att'y.*

F. MÜLLER & J. G. GREENE.

CIRCUIT BREAKER FOR INCANDESCENT ELECTRIC LIGHT SYSTEMS.

No. 449,780.

Patented Apr. 7, 1891.



Witnesses:

A. V. Cushman  
J. G. Meyers Jr.

*Inventors:*

Friedrich Müller  
25 Jas G. Brown  
by Henry Calver  
Sty.

# UNITED STATES PATENT OFFICE.

FRIEDERICH MÜLLER AND JAMES G. GREENE, OF ELIZABETH, NEW JERSEY.

CIRCUIT-BREAKER FOR INCANDESCENT-ELECTRIC-LIGHT SYSTEMS.

SPECIFICATION forming part of Letters Patent No. 449,780, dated April 7, 1891.

Application filed July 23, 1890. Serial No. 359,646. (No model.)

*To all whom it may concern:*

Be it known that we, FRIEDERICH MÜLLER and JAMES G. GREENE, citizens of the United States, residing at Elizabeth, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in Circuit-Breakers for Incandescent Electric-Light Systems, of which the following is a specification, reference being had therein to the accompanying drawings.

So far as we are aware it is now the custom with persons using electric incandescent lamps for such persons to pay so much monthly or yearly for each lamp which they may have in their houses, owing to the want of an efficient and reliable meter to measure the amount of electric current used; but, as it is necessary for a proper distribution of light to have a great many more lamps in a house than are ever required at any one time, many more lamps are put in and paid for than the user gets the real benefit of.

Our invention has for its object to provide an automatic circuit-breaking device for an incandescent-electric-light system, said device being of such character that it will allow a predetermined number of lamps to burn without interruption, but will immediately break the circuit and extinguish the lamps if more than the predetermined number of lamps are turned on. It will, however, permit the authorized number of lamps to be immediately relighted by moving a lever or similar manually-operated device after the surplus lamps have been turned off.

To this end our invention comprises the combination, with an electric-light system having a series of incandescent lamps connected in multiple arc, of a circuit-breaking mechanism inclosed in a locked casing or housing and controlled by an electro-magnet in the lamp-circuit and a manually-operated setting or circuit-restoring device. The circuit-breaking mechanism, with the exception of a portion of the manually-operated device, is entirely inclosed in the casing or housing, the interior of which is accessible only to authorized agents of the electric-light company. The controlling or armature lever is pressed upon by a spring the tension of which may be varied by a regulating-screw, so that

the circuit-breaker may be set for any desired number of lamps, all as will be hereinafter more fully set forth.

In the accompanying drawings, Figure 1 illustrates one form of our invention in connection with an electric-light system, the latter being represented diagrammatically. Fig. 2 is a similar view illustrating a slightly different form of our invention. Figs. 3 and 4 illustrate other modifications of our invention.

In the said drawings, A denotes an electro-magnet connected in the electric-light circuit denoted by the conductors *a*, the lamps *a'* being represented as being arranged in multiple arc.

B denotes an armature-lever pivoted at *b* and carrying an armature *b'*, so arranged relative to the poles of the electro-magnet as to be drawn in contact therewith when the current is sufficiently strong for this purpose. The armature *b'* is held away from the poles of the magnet by a spring *c*, attached to a bracket C and pressing against one arm of the bell-crank armature-lever, the stress of said spring being varied by means of a thumb-screw D.

Referring to Fig. 1, the current entering the electro-magnet passes thence through a conductor 2 to block 3, spring 4, tripping-lever 5, and conductor 6 to hand-lever 7, passing through the latter to a block 8, with which one of the conductors *a* is connected. The spring 4 normally presses the end *d* of the lever 5 against the end *d'* of the lever B, and when the parts are arranged as shown in the drawings the lamp-circuit is closed and the lamps lighted. Suppose now the thumb-screw D is so adjusted that the stress of the spring *c* is sufficient to hold the armature-lever in the position shown, or away from the poles of the magnet when ten lamps are in operation. If now the eleventh lamp is turned on, the strength of the magnet will be sufficient to attract the armature *b'*, thus moving the lever B against the stress of the spring *c*. This operation is due to the fact that the resistance of the current in the circuit decreases and the attractive power of the magnet increases with an increased number of lamps in the circuit. This movement

of the lever B causes its lower end  $d'$  to be disengaged from the end  $d$  of the tripping-lever 5, the said tripping-lever thus falling downward out of contact with the spring 4, the latter being prevented from following it fully down by the stop-pin 9, and thus the circuit is broken at the first breaking-point or between the spring 4 and the lever 5. As soon as the circuit is thus broken the magnet instantly loses its power and the lever B will immediately resume the position shown in the drawings, in contact with the stop-pin 10. If now the surplus lamps be turned off, the parts may be restored to their normal positions to close the circuit by pressing down on the outer end of the lever 7, thus lifting the lever 5, and, owing to the fact that the adjacent ends  $d$   $d'$  of the levers 5 and B are chamfered off or rounded on their outer sides, the said lever 5 will press the lower arm of the lever B backward until lever 5 has passed it, when the said lever B will immediately spring into place, as shown in the drawings. The second breaking-point is between the lever 7 and the contact-block 8. As soon as the outer end of the lever 7 has been depressed its inner end will be lifted from the block 8, and although the lever 5 may be restored to its normal position the circuit will not be opened until the lever 7 is again in contact with the said block 8. This feature of having two breaking-points in the circuit-breaking device is preferably employed, in that it prevents tampering with the circuit-breaker. Thus, in the form of our invention shown in Fig. 1, if it were not for the second breaking-point between the lever 7 and the block 8, it might be possible for the user to prevent the circuit from being interrupted when an excess of lamps is turned on by weighting the outer end of the lever 7, so that its inner end would be lifted in contact with the lever 5 and thus prevent the latter lever from moving down out of contact with the spring 4; but if the said lever 7 should be thus weighted it would immediately be lifted from contact with the block 8, and thus break the circuit and prevent the current from passing at all to light the lamps.

Although we prefer, for the reasons just given, to employ a circuit-breaking mechanism having two breaking-points, this feature is not positively essential to the successful operation of our invention, as will be evident by reference to Fig. 2, which shows a circuit-breaking mechanism with but one breaking-point. In this form of our invention the current passes from the electro-magnet through the conductor 2, block 3, spring 13, projection 14 of breaking or tripping lever 5, spring 15, and block 16 to conductor  $a$  and the lamps. The inner end of the manually-operated setting-lever 7 rests on a coil-spring 17. As the projection 14 of the breaking or tripping lever 5 connects the springs 13 and 15, the circuit will be broken between these springs

when the armature-lever B is operated to release this breaking or tripping lever and permit it to fall, as in the form of our invention hereinbefore described. To restore the circuit the outer end of the setting-lever 7 is lifted, compressing the spring 17, and when the said lever is suddenly released its inner end flies up, snapping the lever 5 up to its normal position, where it is held by the armature-lever.

Our automatic circuit-breaker is inclosed in a locked box or housing  $e$ , (denoted by dotted lines,) from which a portion of the circuit restoring or setting lever 7 projects, so that the said lever may be operated by the user of the lamps, to whom the interior of the said locked box or housing is not accessible, this being under the control of employes of the electric-light company only.

Figs. 3 and 4 show forms of our invention corresponding to Figs. 1 and 2, respectively, but with different means for operating the setting-levers 7. In these modified forms of our invention the said levers 7 are entirely inclosed within the locked boxes or housings  $e$  and are operated by electro-magnets  $A'$ , each in a local circuit connected with a battery  $B'$  by conductors  $a^3$ . One of the conductors may be attached to a block 17 and the other connected through block 17' with a spring 18, which latter may be pressed into contact with the said block to close the local circuit by forcing in a push-button 19, which is accessible from the exterior of the box.

Thus it will be understood that the forms of the manually-operated devices by which the tripping-levers 5 may be set to restore the lamp-circuits to relight the lamps may be varied, the essential feature of this part of our invention being that these devices are so arranged as to be accessible to the user of the lamps, to whom the interior of the locked box or housing inclosing the lamp-circuit breaker is not accessible. It will therefore be apparent that by the use of our circuit-breaker properly connected in an incandescent electric-light system a house may be wired for any desired number of lamps, and a circuit-breaker may be so adjusted that any predetermined number of such lamps may be used at any one time; but if a larger number be turned on the circuit will be automatically broken and all of the lamps will be extinguished, and it will be impossible to relight them until the surplus lamps are turned off. Thus the system of lamps may be graded in such a way that a user having a large number of lamps in his house can, by determining how many of such lamps he may desire to use at any one time, arrange to pay for much less number than he may deem necessary or convenient to distribute through his house for convenience in exceptional instances or for occasional use.

We do not wish to be understood as limiting our invention to the specific forms of circuit-breaking devices herein shown, as it will

be obvious that the details of construction of such devices may be varied widely without departing from the spirit of our invention.

Having thus described our invention, we claim and desire to secure by Letters Patent—

1. An electric-lighting system comprising a circuit having a number of incandescent lamps connected in multiple arc, combined with a circuit-breaking mechanism consisting of an electro-magnet connected in the lamp-circuit, an armature-lever controlled by said magnet, a circuit-breaking device controlled by said armature-lever, a box or housing within which the circuit-breaking mechanism is inclosed, and a manual setting device or lever for the said circuit-breaking device, said manual setting device or lever being so arranged as to be accessible to an operator not having access to the interior of the said box or housing.

2. An electric-lighting system comprising a circuit having a number of incandescent lamps connected in multiple arc, combined with a circuit-breaking mechanism consisting of an electro-magnet connected in the lamp-circuit, an armature-lever controlled by said magnet, a spring acting on the said armature-lever, an adjusting-screw for regulating the stress of the said spring, a circuit-breaking device controlled by said armature-lever, a box or housing within which the circuit-breaking mechanism is inclosed, a manual setting device to act on the said circuit-breaking device to restore the circuit, said manual setting device being so arranged as to be accessible to an operator not having access to the interior of the said box or housing.

3. An electric-lighting system comprising a circuit having a number of incandescent lamps connected in multiple arc and a circuit-breaker having two breaking-points, one of which is controlled by an electro-magnet in a lamp-circuit and the other by a manually-operated circuit-restoring device.

4. The combination, with an electric-lighting circuit, of a lamp-regulating device consisting of a circuit-breaker having two breaking-points, one of which is controlled to break the circuit by an electro-magnet in the lamp-circuit and the other of which is controlled by a manually-operated device or hand-lever

by which the parts of the breaker are replaced to restore or open the circuit.

5. The combination, with an electric-light circuit, of a lamp-regulating device consisting of a circuit-breaker having two breaking-points, one of which is controlled to break the circuit by an electro-magnet in the lamp-circuit, and the other of which is controlled by a manual circuit-restoring device, said circuit-breaker being inclosed in a housing entirely protecting the same excepting a portion of the said manual device, which is left exposed.

6. The combination, with an electric-light circuit and a number of electric incandescent lamps arranged in multiple arc therein, of an electro-magnet A connected in the said circuit, an armature-carrying lever B, a spring for normally holding the armature of the said lever away from the poles of the magnet, an adjusting-screw for said spring, a lever 5, which is tripped by the movement of the armature-lever, a circuit-restoring lever 7, electrically connected with said lever 5, a contact-block for said lever 7, and a conductor, as spring 4, electrically connected to said magnet and normally in contact with the said lever 5, but from which conductor the lever 5 is separated when tripped by the movement of the said armature-lever B.

7. The combination, with an electric circuit and a number of incandescent lamps connected therein in multiple arc, of the electro-magnet A, the armature-lever B, carrying the armature *b'*, the spring *c*, for controlling said armature-lever, the regulating-screw D for said spring *c*, the tripping-lever 5, in contact with the armature-lever, the spring 4, normally pressing against said tripping-lever 5 and electrically connected with the said magnet and normally pressing against the lever 5, but from which the said lever may be separated, the circuit-restoring lever 7, electrically connected with the tripping-lever 5, and the contact-blocks in the lamp-circuit.

In testimony whereof we affix our signatures in presence of two witnesses.

FRIEDERICH MÜLLER.  
JAMES G. GREENE.

Witnesses:

JOSEPH F. JAQUITH,  
GEO. R. KULER.