No. 691,809. Patented Jan. 28, 1902.

W. B. POTTER.

ELECTRIC CONTROLLER.

(Application filed July 19, 1900.)

(No Model.)

2 Sheets—Sheet 1.

Fig. 1.

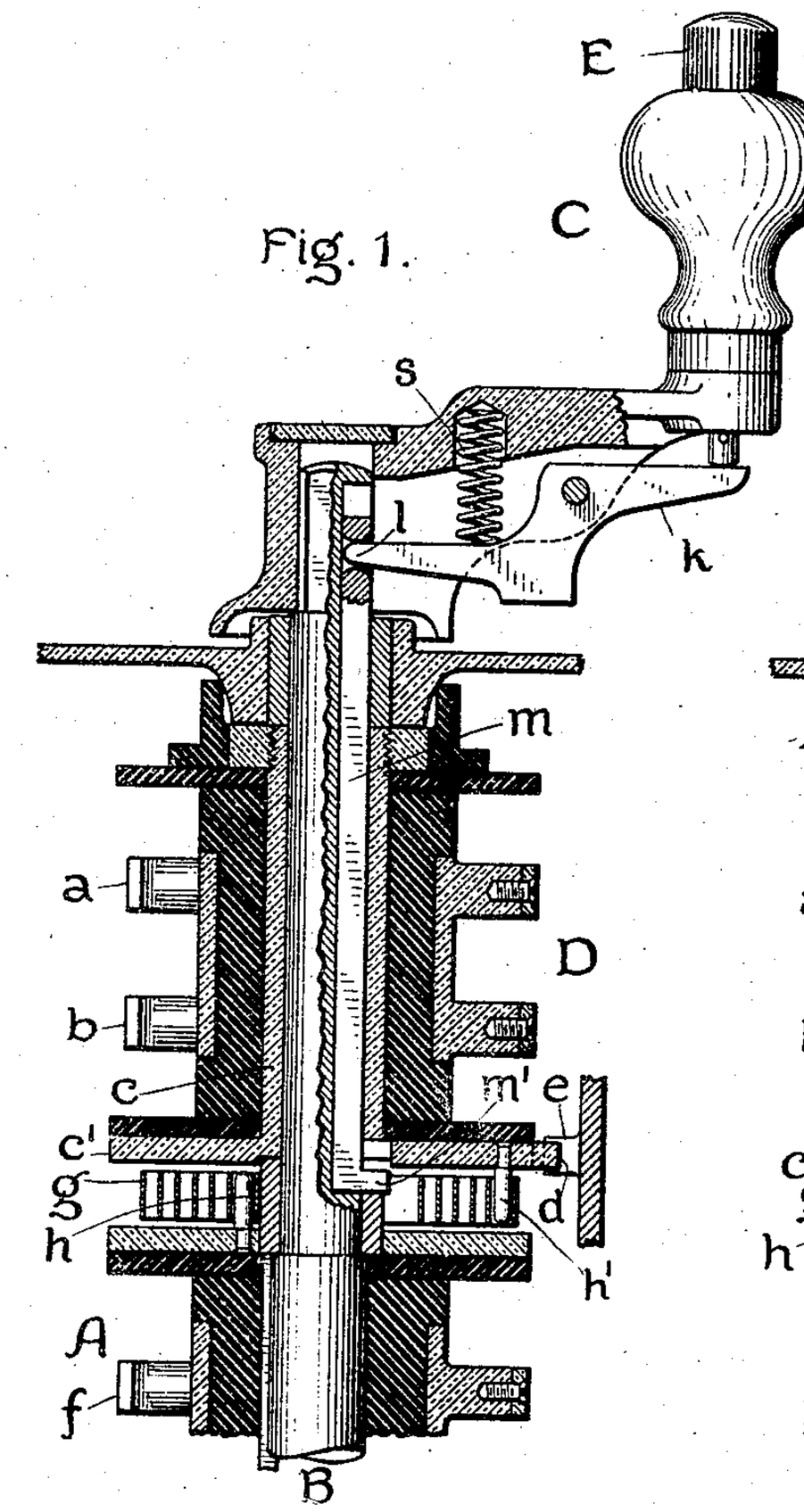


Fig. 2.

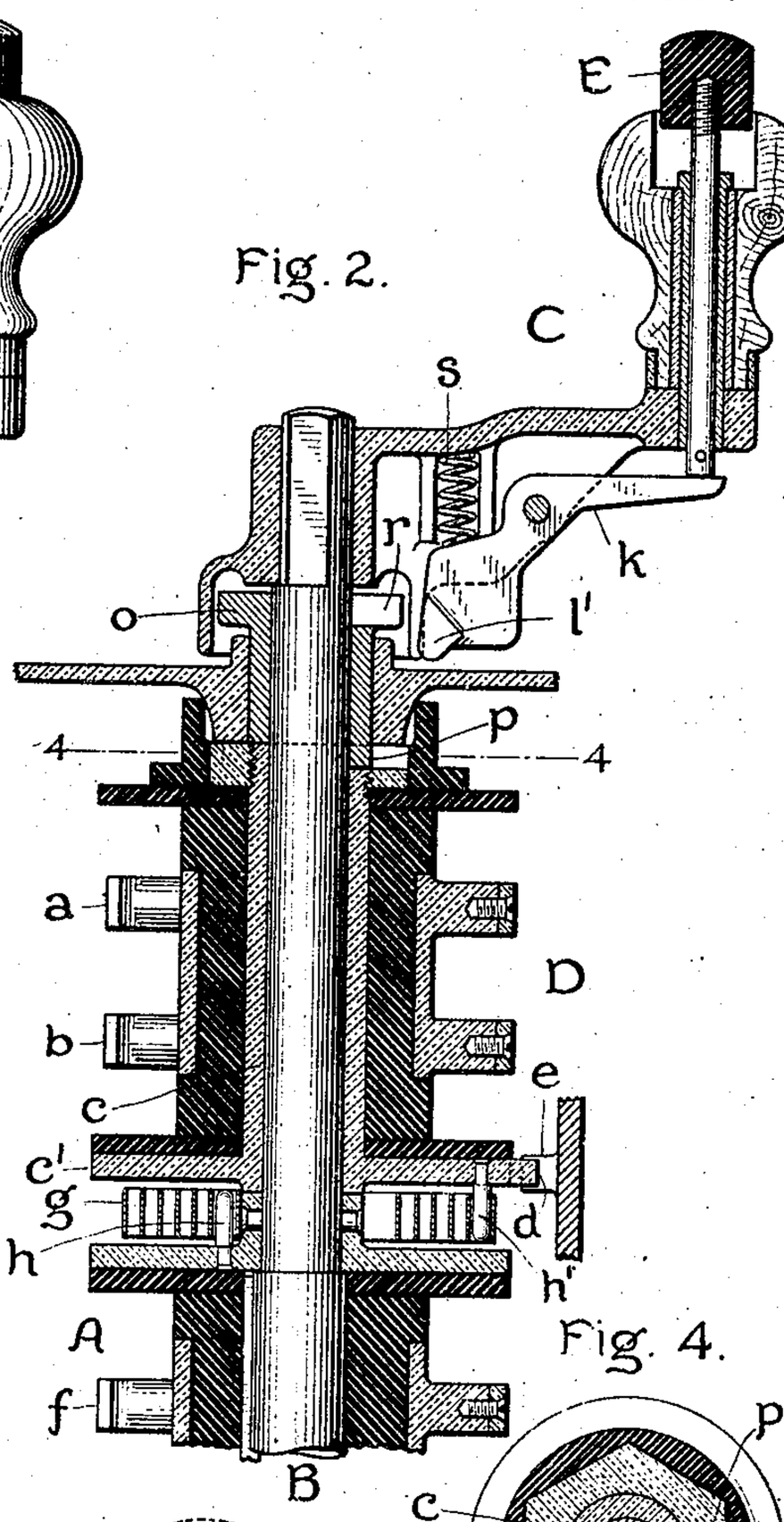


Fig. 4.

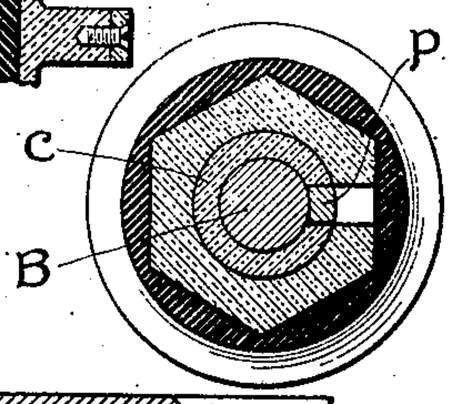
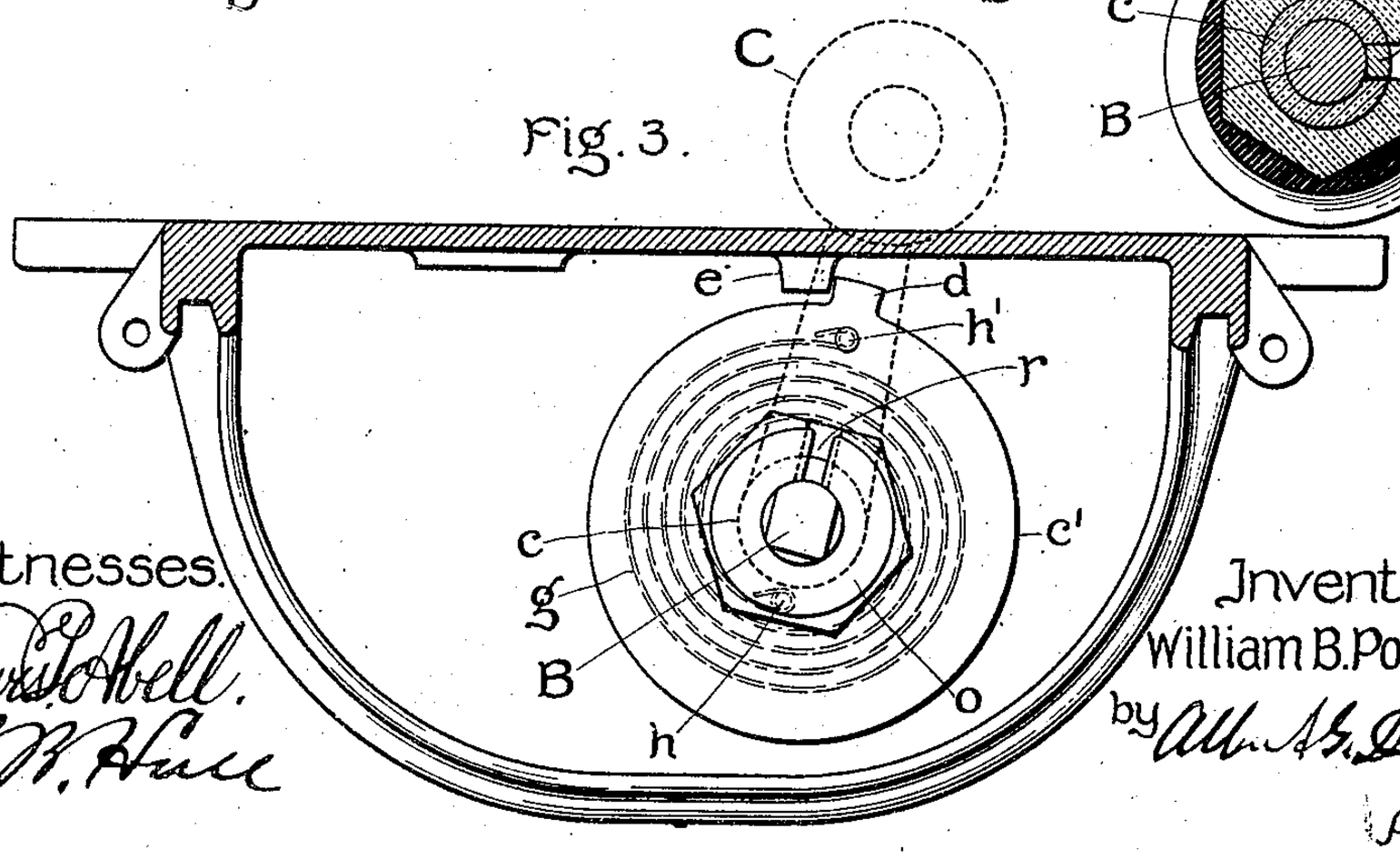


Fig. 3.



Witnesses.

Lewis D. Bell.

B. B. Hull

Inventor:

William B. Potter,

by Allen & Davis

Atty.

No. 691,809. Patented Jan. 28, 1902.

W. B. POTTER.

ELECTRIC CONTROLLER.

(Application filed July 19, 1900.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 6.

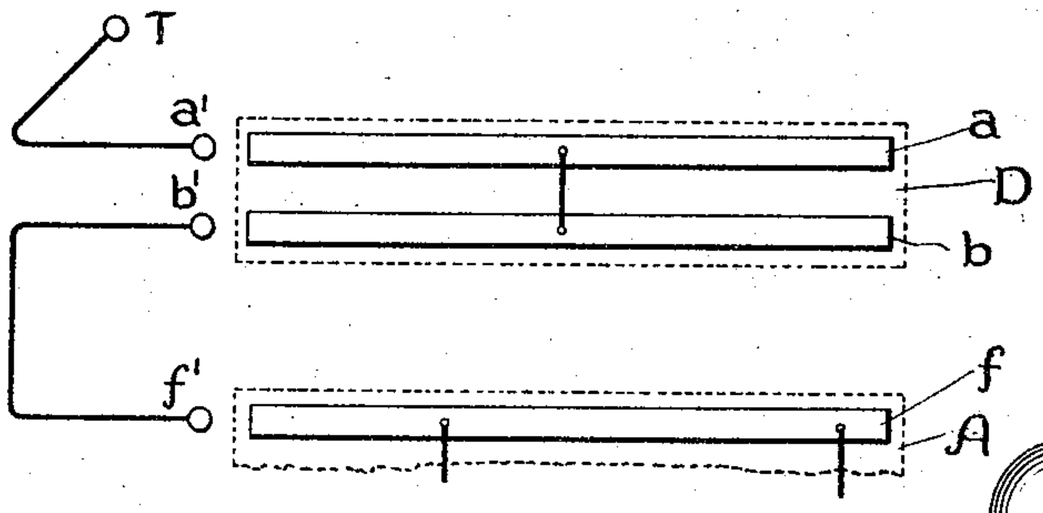
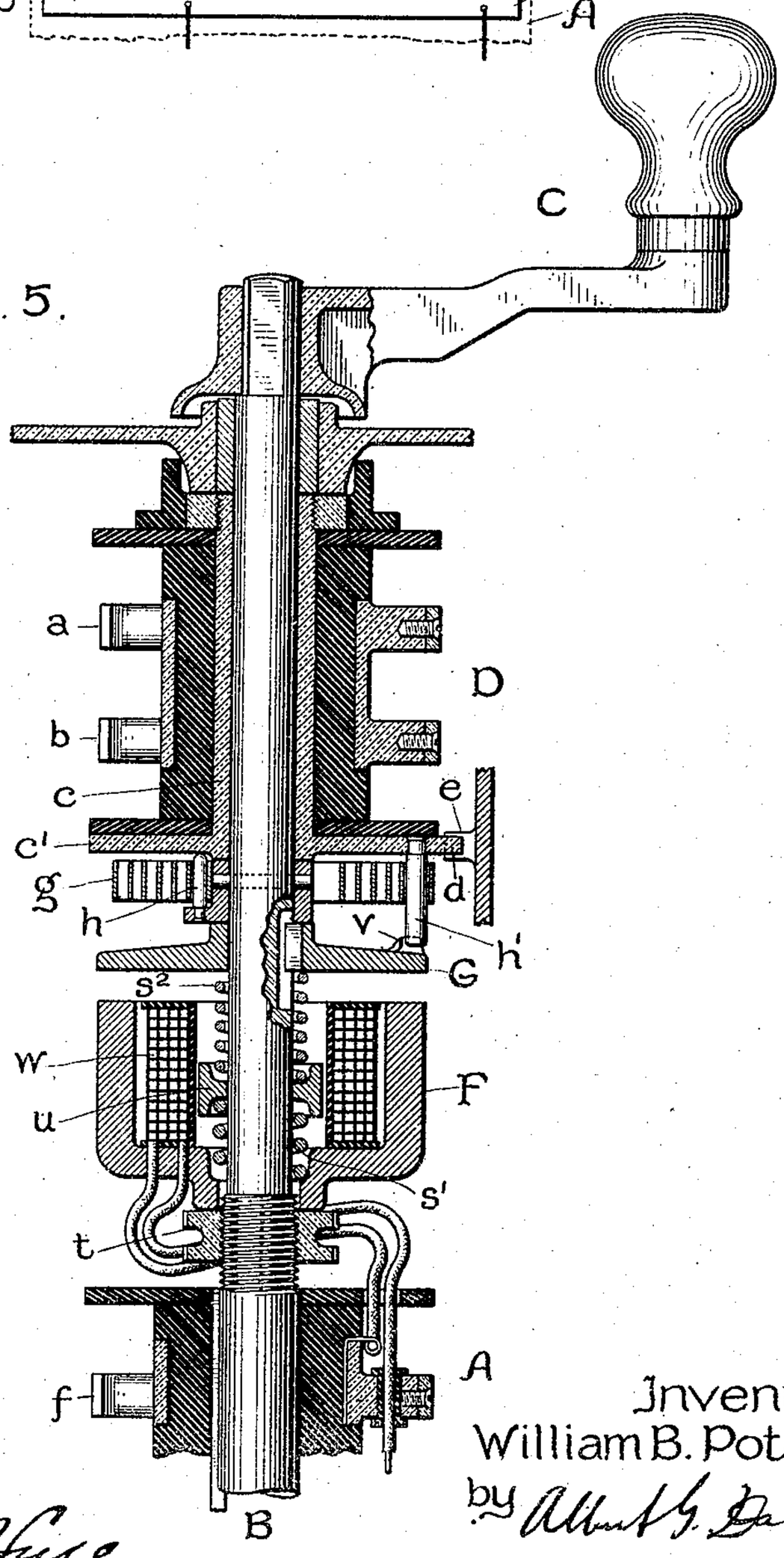


Fig. 5.



Witnesses:
Lewis E. Abell.
Benjamin B. Hicks.

Inventor:
William B. Potter,
by Albert G. Davis
Atty.

UNITED STATES PATENT OFFICE.

WILLIAM B. POTTER, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELECTRIC CONTROLLER.

SPECIFICATION forming part of Letters Patent No. 691,809, dated January 28, 1902.

Application filed July 19, 1900. Serial No. 24,147. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM B. POTTER, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Electric Controllers, (Case No. 1,440,) of which the following is a specification.

My invention relates to means for opening the power-circuit of an electric controller upon the occurrence of predetermined conditions—as, for example, whenever the current flowing through the controller exceeds a predetermined limit or whenever for any reason the operator removes his hand from the controller-handle when it is in one of its operative positions—and constitutes an improvement on the arrangement disclosed in patent to F. E. Case, No. 655,389, dated August 7, 1900.

My invention is especially applicable to electric-railway systems in which it is desirable to keep the current supplied to a car or train within certain limits and in which an injury to the motorman or a temporary disability while running may with the controllers ordinarily employed permit the car or train to run wild with serious results. It is of course equally applicable to the ordinary street-car controller, in which case it will operate to open the power-circuit directly, or to the master-controller of a train system to open the main circuit supplying power for the operation of the separate motor-controllers.

Referring to the accompanying drawings, forming a part of this specification, Figure 1 shows in cross-section one embodiment of my invention. Fig. 2 shows a modified construction. Fig. 3 is a partial plan view of Fig. 2, showing the location of the parts with respect to the controller-casing. Fig. 4 is a section along the line 4 4 in Fig. 2. Fig. 5 shows in cross-section another embodiment of my invention, and Fig. 6 is a diagram showing the circuit connections between the trolley and the auxiliary and main controller-contacts.

Referring first to Fig. 1, A indicates a controller-cylinder of ordinary construction keyed to the shaft B, the lower end of the cylinder and shaft being broken away. Mounted on the upper end of the shaft B is the handle C, by means of which the controller-cylinder is turned. Between the main cylinder and the handle is mounted the auxiliary cylinder D, the contacts of which serve to open the power-circuit (in the particular construction shown in this figure) whe ever the operator removes his hand from the handle C while the main controller-cylinder is in one of its operative positions. The auxiliary cylinder comprises a body of insulating material carrying contact-strips *a* and *b* and is mounted on a sleeve *c*, free to revolve on the controller-shaft B. This sleeve is provided at its lower end with a flange *c'*, and the periphery of the flange is provided with a projection *d*, adapted to engage a lug *e* on the controller-casing. Between the flange *c'* and the upper end of the main controller-cylinder is mounted a spring *g*, fastened at its inner end to a pin *h'* in the upper end of the main cylinder and at its outer end to a pin *h'* in the flange *c'*. This spring is normally under tension, and in the position shown in Fig. 1 operates to maintain the projection *d* in engagement with the lug *e*, and thus to hold the cylinder D in position to open the power-circuit. If with the arrangement thus far described the controller-handle should be turned in right-handed rotation, the main controller-cylinder would be rotated, but the auxiliary cylinder D would remain in the position shown, the spring *g* unwinding by the amount that the main cylinder is moved forward. In order that the cylinder D may be caused to move with the cylinder A, a dog *m*, having a projection *m'* at its lower end, is slidingly mounted in a groove in the controller-shaft. When the controller-handle occupies the position shown in the drawings, the projection *m'* lies directly beneath a slot in the flange *c'*. The dog *m* is operated from a push-button in the controller-handle, the push-button operating when depressed to raise the dog through the instrumentality of a lever *k*, having its end at *l* projecting into a slot in the upper end of the dog. This lever *k* is maintained in the position shown by a spring *s* interposed between the lever and the handle.

Supposing the parts to occupy the position shown in Fig. 1 of the drawings, if the operator places his hand on handle C in such a position as to depress the push-button E the dog *m* will be raised until its lower end *m'* engages the slot in the flange *c'*. If now the handle of the controller is turned, the auxiliary cylinder D will be carried with the main cylinder A and the power-circuit through the controller will be completed. The controller may now be turned into any one of its operative positions, and when so turned will operate the same as any ordinary controller. If, however, after the handle has been turned part way the hand is removed from the handle, the spring *s* will operate to raise the push-button and to depress the dog *m*, thereby disengaging the projection *m'* from the slot in the flange *c'* and permitting the auxiliary cylinder D to be thrown backward by the spring *g* until the projection *d* on the flange *c'* comes into engagement with the lug *e* on the controller-casing, thereby opening the power-circuit at the contacts of the auxiliary cylinder. However the handle C may now be turned the controller will be entirely inoperative and will so remain until the handle C has been brought to the "off" position, when again the lower end of the dog *m* will come into position beneath the slot in the flange *c'*.

From the above description it will be clear that the controller can be operated only when the push-button in the handle is depressed before the handle is moved from its off position, and that if when the controller is in any one of its operative positions the operator removes his hand from the controller-handle the power-circuit will be immediately broken at the cylinder D and cannot be again restored until the controller-handle has been returned to its off position. In constructions heretofore designed for accomplishing this object the spring which operates to open-circuit the controller-contacts has been so arranged that whenever the motorman turns the controller-handle into any one of its operative positions he is compelled not only to overcome the friction of the controller, but also to wind up the spring. In the construction which I have devised the spring is so arranged that it relieves the motorman from any effort to overcome the spring, as the torsional strains are entirely self-contained. So long as the projection on the end of the dog is maintained in engagement with the slot in the flange *c'* the spring, although under tension, is entirely inoperative and always remains in this condition unless the push-button E is released when the controller is in one of its operative positions. In this case the motorman in turning the controller back to its off position winds up the spring.

In Fig. 2 I have shown a modified construction in which in lieu of the dog *m* a sleeve *o* is provided at the upper end of the controller-shaft. This sleeve is provided at its lower end with a projecting portion *p*, which engages a slot in the upper end of the sleeve *c*. The upper end of the sleeve *o* is enlarged and slotted at *r*, and the lever *k* is provided with a projection *l'*, adapted in the off position of the controller to be projected into the slot. The engagement between the sleeve *o* and the sleeve *c* is somewhat more clearly illustrated in Fig. 4, which shows a cross-section through the upper end of the sleeve *c* and the nut, which locks the parts of the cylinder D together. The part *p* shown in this figure is the projection on the lower end of the sleeve *o*.

In Fig. 3 the position of the controller-cylinder in its casing is indicated, the projection on the flange *c'* being shown in engagement with the lug *e* and the spring *g* and the handle of the controller being indicated in dotted lines. This figure shows also the upper end of the sleeve *c* and its surrounding nut and the sleeve *o*. It will be noted that in this which is the off position of the controller the slot *r* lies directly under the middle of the controller-handle in position to be engaged by the projection *l'* on the lever *k*.

The arrangements above described are intended to open the power-circuit of the controller whenever the motorman releases the handle of the controller. In Fig. 5 I have shown a similar arrangement provided with a locking device normally held in operative position by a spring, together with electromagnetically-actuated means for disengaging the locking device and permitting the circuit-breaker to open the controller-circuit whenever the current flowing in the circuit to be controlled exceeds a predetermined amount. In this figure an electromagnet, comprising the members F and G, is interposed between the main and auxiliary-cylinders of the controller. The member F is supported on the shaft by means of an adjusting-nut *t*, the adjustment being for the purpose of regulating the distance between the elements F and G, and thus varying the amount of current required to operate the tripping device. The lower end of the member F is held against the upper surface of the nut *t* by means of a spring *s'* engaging a collar *u*, fixed to the controller-shaft. This member is provided with a winding *w*, connected between the contact-strip *f* and the other contacts of the controller, (not shown,) so that the entire current supplied to the controller passes through it. The member G, which constitutes an armature for the member F, is secured from turning on the controller-shaft by a feather engaging a groove in the said shaft, but is free to move up and down. This armature carries a stop *v*, which engages with a lug on the flange *c'*. As shown in this figure of the drawings, the pin *h'*, to which one end of the spring *g* is fastened, is enlarged to constitute the lug. The armature is maintained in position, so that the stop carried thereby will engage the lug *h'* by means of the spring s^2 interposed be-

tween the lower side of the said armature and the collar u, fixed to the controller-shaft. In operation whenever the controller-handle C is in any one of its operative positions if a current greater than that for which the electromagnet is adjusted flows through the controller the armature G will be drawn into contact with the member F, thereby disengaging the stop v from the lug h'. The auxiliary cylinder D will then be thrown back to its off position where the projection d engages the lug e on the controller-casing, thus opening the controller-circuit at the contacts of the auxiliary cylinder. Further turning of the controller-handle will turn the main controller-cylinder, but will not move the auxiliary cylinder. The controller will therefore remain inoperative until the handle C is turned back to its off position, when the stop on the armature G will slip under and engage the end of the lug h'. After such engagement has taken place the main and auxiliary cylinders will move together until the current again rises to an amount greater than that for which the electromagnet is adjusted, when the same action will take place as before.

In Fig. 6 I have indicated in development the fixed and movable contacts of the auxiliary cylinder D and the first set of contacts on the main cylinder A, together with the circuit connections therefor. From this figure it will be seen that current entering from the trolley T will pass to the fixed contact a' and thence through the movable contacts a and b of the auxiliary cylinder D to the fixed contact b', whence it will flow through the fixed contact f' to the movable contact f, and thence through the fixed and movable contacts of the main cylinder to the circuit to be controlled.

Although I have shown the arrangements for opening the controller-circuit from the controller-handle and for opening the controller-circuit whenever the current exceeds a predetermined limit in separate figures of the drawings, it is evident that if desirable both of these arrangements might be combined in a single structure, and although in the constructions shown in the drawings the contacts constituting the circuit-breaker are carried by the sleeve mounted on the controller-shaft it is evident that in certain of its features my invention is not limited to such construction. The arrangement of the spring connection by means of which the circuit-breaker is operated, so that the torsional strains will be normally self-contained, constitutes one of the principal features of my invention, and though I preferably interpose this spring connection between the controller-shaft and an auxiliary cylinder mounted thereon it is to be understood that the part rotatable on the shaft may, instead of carrying the circuit-breaking contacts, operate in any suitable manner to open a circuit-breaker—as, for example, in the manner shown in the patent to F. E. Case, above referred to.

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

1. In combination in a controller, a rotatable shaft, movable contacts mounted to rotate freely thereon, fixed contacts adapted to engage therewith, means tending to maintain said movable contacts out of engagement with their corresponding fixed contacts, and means for operatively connecting said movable contacts to the controller-shaft.

2. In combination, in a controller, a cylinder mounted on the controller-shaft and provided with contacts adapted to open the power-circuit, means tending to maintain said cylinder in its open-circuit position, means for causing said cylinder to move with the controller-shaft, and means operating under predetermined conditions to release said cylinder.

3. In combination in a controller, a sleeve upon the controller-shaft, a spring connection between said sleeve and said shaft, and means for holding the said sleeve in a definite position on said shaft against the force of the spring.

4. In combination in a controller, a sleeve upon the controller-shaft, a stop limiting the movement of said sleeve, a spring connection between said sleeve and said shaft, means for locking the sleeve to the shaft, and means operating under predetermined conditions for unlocking the sleeve.

5. In combination in a controller, a main cylinder, an auxiliary cylinder, a spring connection between them, means for locking said cylinders together with the spring under tension and means for disengaging said locking means.

6. In combination in a controller, a sleeve on the controller-shaft, a spring connection between said sleeve and said shaft, means for locking said sleeve to the said shaft, and means operating under predetermined conditions for disengaging said locking means.

7. In combination, in a controller, a spring-actuated sleeve mounted on the controller-shaft, and an electromagnetically-actuated device for locking said sleeve to said shaft.

8. In combination, in a controller, a spring-actuated sleeve mounted on the controller-shaft, an electromagnet having an armature adapted to lock said sleeve to said shaft, and means for adjusting said electromagnet to actuate said armature when the current supplied to the winding of said magnet reaches a predetermined limit.

9. In combination in a controller, an auxiliary, cylinder provided with circuit-breaking contacts, mounted on the controller-shaft, means tending to maintain said cylinder to the shaft, and means controlled by the current flowing through said contacts for disengaging said locking means.

10. In combination in a controller, an auxiliary cylinder mounted on the controller-

shaft, a spring connection between said cylinder and said shaft, means for locking said cylinder to said shaft, and means controlled by the current supplied to said controller for disengaging said locking means.

11. In combination in a controller, a spring-actuated sleeve on the controller-shaft, and means for locking said sleeve to said shaft, said locking means being so arranged that it can be operated to lock the sleeve to the shaft only in the off position of the controller.

In witness whereof I have hereunto set my hand this 17th day of July, 1900.

WILLIAM B. POTTER.

Witnesses:

BENJAMIN B. HULL,

MABEL E. JACOBSON.