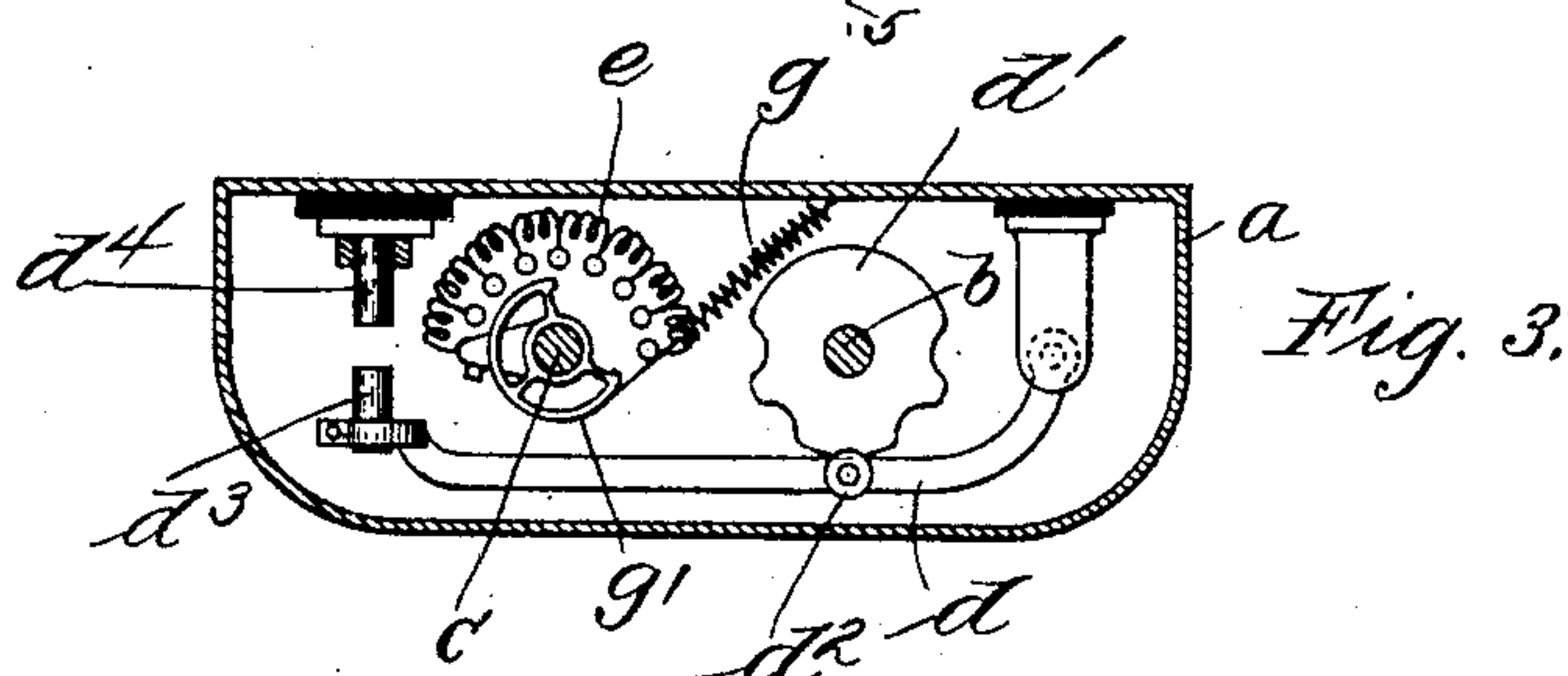
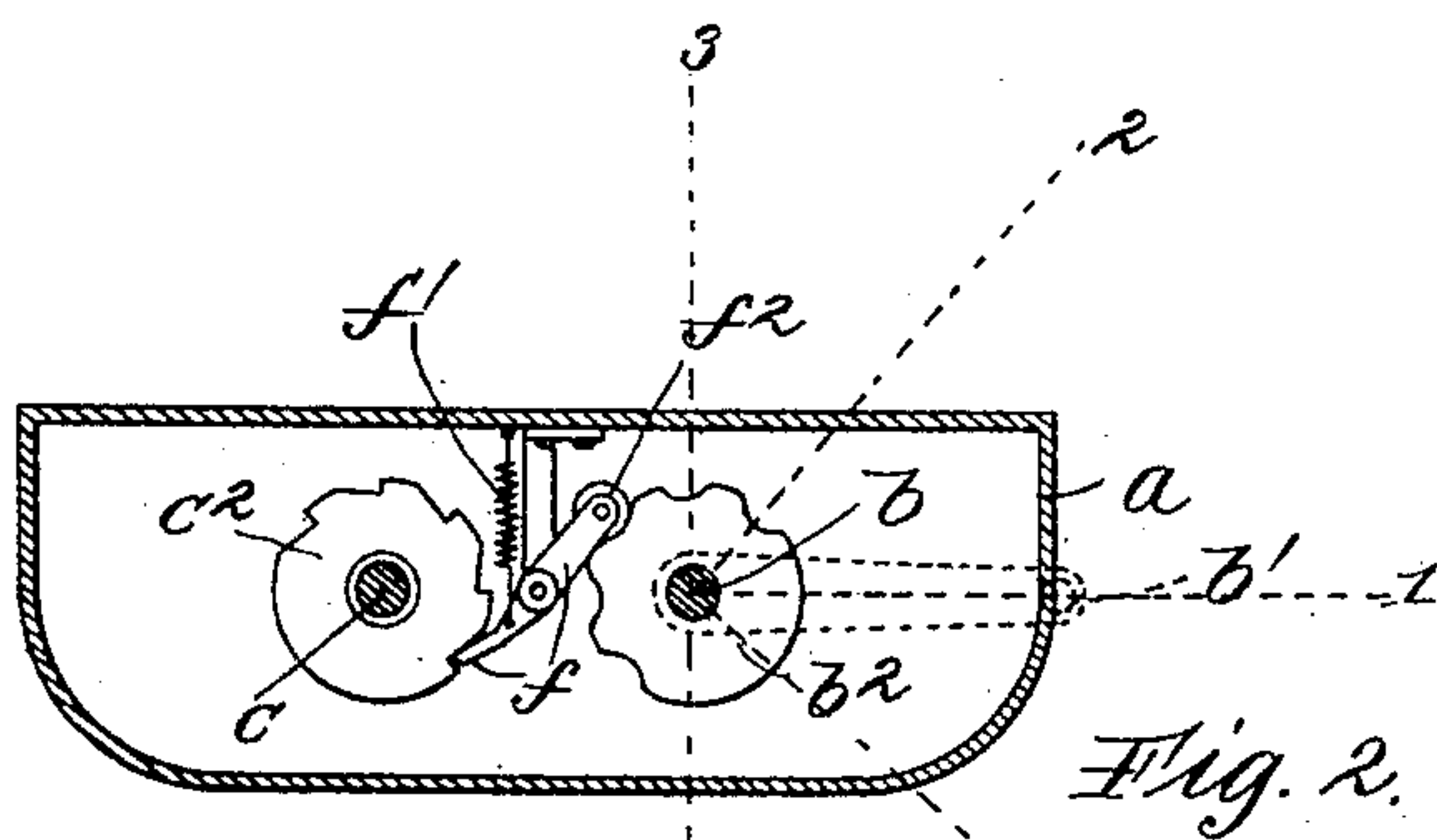
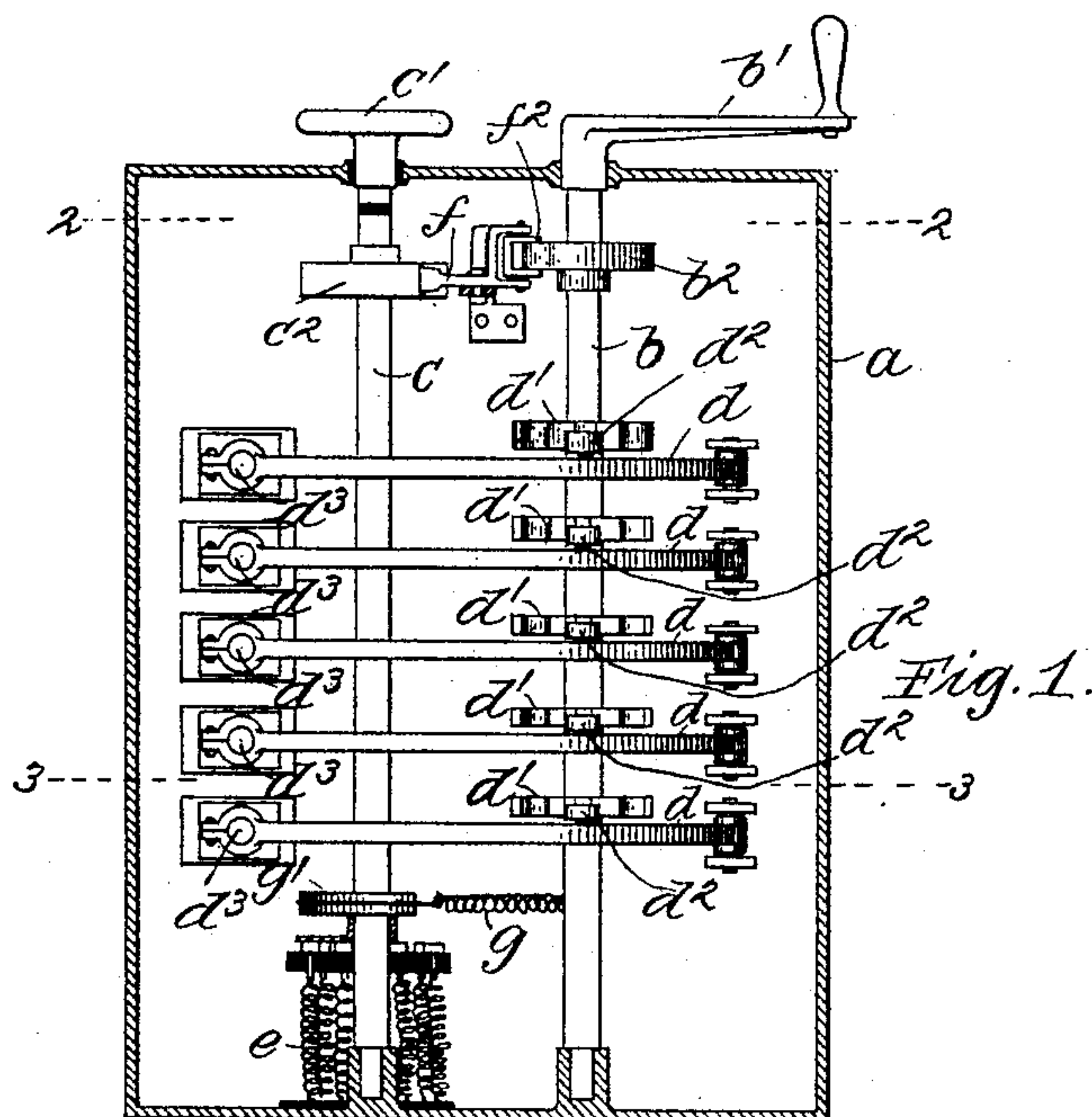


(No Model.)

E. W. G. C. HOFFMANN
CONTROLLER FOR ELECTRIC MOTORS.

No. 598,991.

Patented Feb. 15, 1898.



Witnesses:
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UNITED STATES PATENT OFFICE.

ERNST WILHELM GUSTAV CARL HOFFMANN, OF CHARLOTTENBURG, GERMANY, ASSIGNOR TO THE SIEMENS & HALSKE ELECTRIC COMPANY OF AMERICA, OF CHICAGO, ILLINOIS.

CONTROLLER FOR ELECTRIC MOTORS.

SPECIFICATION forming part of Letters Patent No. 598,991, dated February 15, 1898.

Application filed December 29, 1897. Serial No. 664,387. (No model.) Patented in Germany November 16, 1895, No. 88,586; in Sweden April 14, 1896, No. 8,064; in Switzerland April 14, 1896, No. 11,973; in England April 17, 1896, No. 8,141; in Norway April 18, 1896, No. 5,196; in Belgium April 18, 1896, No. 120,939; in France April 20, 1896, No. 225,687; in Italy June 8, 1896, No. 41,375; in Austria June 24, 1896, No. 46/2,549, and in Denmark January 21, 1897, No. 930.

To all whom it may concern:

Be it known that I, ERNST WILHELM GUSTAV CARL HOFFMANN, a subject of the Emperor of Germany, residing at Charlottenburg, Germany, have invented new and useful Improvements in Controllers for Electric Motors, (Case No. 80,) of which the following is a specification, reference being had to the accompanying drawings, forming a part of the specification, for which Letters Patent have been granted in Germany, No. 88,586, dated November 16, 1895; in France, No. 225,687, dated April 20, 1896; in Belgium, No. 120,939, dated April 18, 1896; in Italy, No. 41,375, dated June 8, 1896; in Switzerland, No. 11,973, dated April 14, 1896; in Austria, No. 46/2,549, dated June 24, 1896; in Norway, No. 5,196, dated April 18, 1896; in Denmark, No. 930, dated January 21, 1897; in Great Britain, No. 8,141, dated April 17, 1896, and in Sweden, No. 8,064, dated April 14, 1896.

My invention relates to improvements in controllers for electric motors, and has for its object the provision of apparatus especially designed for the efficient and partially-automatic control of the motor-circuits of an electrically-propelled car or vehicle in a manner avoiding the arcing frequently attendant upon the control of heavy currents.

When electric motors are switched from series to parallel circuit arrangement with one another, or vice versa, it is necessary either to open the motor-circuit or to short-circuit momentarily one of said motors. In either event violent sparking is liable to occur unless great care is exercised in regulating the rheostat connected with the motor, such sparking obviously being detrimental to these parts. Sparking, however, may be entirely avoided if sufficient resistance is cut into circuit at the time of effecting the circuit changes. The controller of my invention is capable of securing these results, the same being designed automatically to connect the necessary resistance in circuit whenever

the controller is actuated to alter the operative condition of the motor-circuits.

The device of my invention consists in providing, in connection with the switching arm or arms effecting the several circuit-changes in the controller, an automatically-actuated rheostat adapted normally to cut a predetermined amount of resistance in circuit, but which is maintained in its adjusted position during the time that the switching apparatus is inoperative.

My invention will be more readily understood by reference to the accompanying drawings, wherein—

Figure 1 is a vertical sectional view of my improved controller, the same being somewhat diagrammatically shown for the sake of clearness. Fig. 2 is a cross-sectional view on line 2 2 of Fig. 1, illustrating the connection between the switching apparatus and the rheostat; and Fig. 3 is a similar view on line 3 3 of Fig. 1, illustrating one of the switching-arms of the controller.

The same letters of reference are used to designate like parts throughout the several figures of the drawings.

Mounted within the casing *a* are the shafts *b* *c*, respectively connected with the switching-arms *d* of the controller and with the rheostat *e*. The shaft *b* is provided with a crank or handle *b'*, and the shaft *c* is provided with a hand-wheel *c'*, whereby said shafts are adapted, respectively, to be rotated. Upon the upper part of the shafts are respectively provided the recessed disk *b*² and the ratchet-wheel *c*², the teeth of which are engaged by the pivoted catch *f*, which is normally maintained in engagement with said ratchet-wheel by means of the spring *f'*. A roller *f*², provided upon the opposite end of the said catch, is maintained in engagement with the recessed disk *b*², the said disk being adapted to withdraw the catch *f* from engagement with the ratchet-wheel *c*² when the roller is brought in contact with the non-recessed faces of the

disk b^2 . A spring g , acting upon the sector g' , connected with the shaft c , is adapted to rotate said shaft to its first position of adjustment when the ratchet-wheel is thus released
 5 and thereby cut in the full amount of resistance connected in the rheostat. The shaft b also carries five cams or eccentric parts d' , which are adapted to actuate the corresponding switch-arms d , controlling the motor-cir-
 10 cuits through the medium of the engaging roller d^2 , provided upon the said arms.

The switch-arms are provided with contacts d^3 d^4 , each switch-arm thus controlling one of the several circuit changes of the de-
 15 vice. The cams d' are keyed upon the shaft b in different angular positions which correspond to the five operative positions of the said device herein shown and described. When one of the cams is rotated in the po-
 20 sition shown in Fig. 3, the pivoted switch-arm d is moved upward and the contacts d^3 d^4 are separated, thereby opening the corresponding motor-circuit. The five operative positions of the crank or controller handle
 25 may be connected, for example, to effect the following circuit changes: Position 1 maintains the motor-circuits open through the controller, position 2 serves to connect the motors in series, and position 3 to connect
 30 the same in parallel. Moving the crank b' from position 1 in a reverse direction to position 4 will serve to connect the motors in parallel and secure a braking action, while the movement to position 5 will connect said
 35 motors in series and reverse the direction of their rotation.

These several circuit changes above indicated are taken arbitrarily as examples, inasmuch as the switching may be adjusted to the in-
 40 dividual needs of the controlled circuits. Furthermore, any other suitable switching device may be substituted for the several switch-arms d , the same being connected in a well-known manner with the shaft b and
 45 adapted to be actuated thereby. It will be understood, of course, that in each instance, as the position of the crank b' is altered, the full resistance is automatically cut into circuit through the medium of the spring g act-
 50 ing upon the shaft c . Thus the resistance connected in circuit and the several switching movements of the crank are made interdependent, as the release of the shaft c is automatically effected by the disk b^2 each time
 55 the controller-handle is altered in its position. The resistance of the rheostat is accordingly at once cut into circuit, since the spring g is placed under tension whenever the hand-wheel c' is moved to cut resistance out of cir-
 60 cuit. While the crank b' is maintained in any one of its operative positions, it is apparent that the hand-wheel c' may be independently adjusted to cut out any desired amount of resistance from the circuit arrangement at that
 65 time obtaining in the controller.

I have purposely omitted from the drawings for the sake of clearness complete representation of the several rheostat resistance-coils, as well as the indication of circuit ar-
 rangements as adverted to above, since these
 70 are matters well known to those skilled in the art and will be at once supplied by such persons when the specific needs of a circuit are made apparent.

It will be seen that the controller above de-
 75 scribed is capable of numerous modifications without departing from the spirit of my invention, and I do not desire to be understood as limiting myself to the precise apparatus or arrangement of parts herein set forth; but,
 80

Having now explained my invention in connection with its preferred embodiment, I claim as new, and desire to secure by these Letters Patent, the following:

1. The combination in a controller for elec-
 85 trical apparatus, with a controller part b having suitable contact parts connected therewith for effecting the necessary circuit changes, of a rheostat, a part c controlling the resistance of said rheostat connected in
 90 circuit, and means for automatically cutting a predetermined amount of resistance into circuit when the movement of said part is effected, substantially as described.

2. In a circuit-controlling device, the com-
 95 bination with a controller part b , means associated therewith for effecting the several switching arrangements of said controller upon the movement of said part, a rheostat
 100 e associated with said controller, a rheostat part c , the movement of which is adapted to effect the control of the rheostat resistance connected in circuit, and means associated
 105 therewith for effecting the automatic insertion of a predetermined amount of said resistance when part b is moved from one operative position to another, substantially as described.

3. In a circuit-controller for electrical ap-
 110 paratus, the combination with a part b , the actuation of which is adapted to effect an alteration in the switching arrangement of the connected circuits, of a rheostat e , a control-
 115 ling part c associated therewith, means for normally securing the inclusion in circuit of a predetermined amount of resistance, a disk
 120 b^2 , a ratchet-wheel c^2 respectively connected with the said parts b and c , and a catch f in engagement with the said disk and wheel adapted to be actuated upon the movement
 125 of part b to release said ratchet-wheel, whereupon resistance is automatically cut into circuit, substantially as described.

4. In a circuit-controller and rheostat, the combination with a shaft b , the rotation of
 125 which is adapted to effect the movement of a switch part d , thereby effecting the control of a connected circuit, of a rheostat e , a shaft
 130 c , the movement of which controls the resistance of said rheostat connected in circuit, a

disk b^2 , a ratchet c^2 respectively provided upon the said shafts b and c , a catch f in engagement with said ratchet adapted to be actuated by the disk b^2 upon the movement of
5 the shaft b from one operative position to another, and means associated with the said rheostat for automatically cutting a predetermined amount of resistance into circuit

when said ratchet is thus released, substantially as described.

In testimony whereof I affix my signature in the presence of two witnesses.

ERNST WILHELM GUSTAV CARL HOFFMANN.

Witnesses:

HENRY HARPER,

CHARLES H. DAY.