No. 723,119. PATENTED MAR. 17, 1903.

T. VON ZWEIGBERGK.

CONTROLLER.

APPLICATION FILED APR. 23, 1902.

NO MODEL.

Fig. 2,

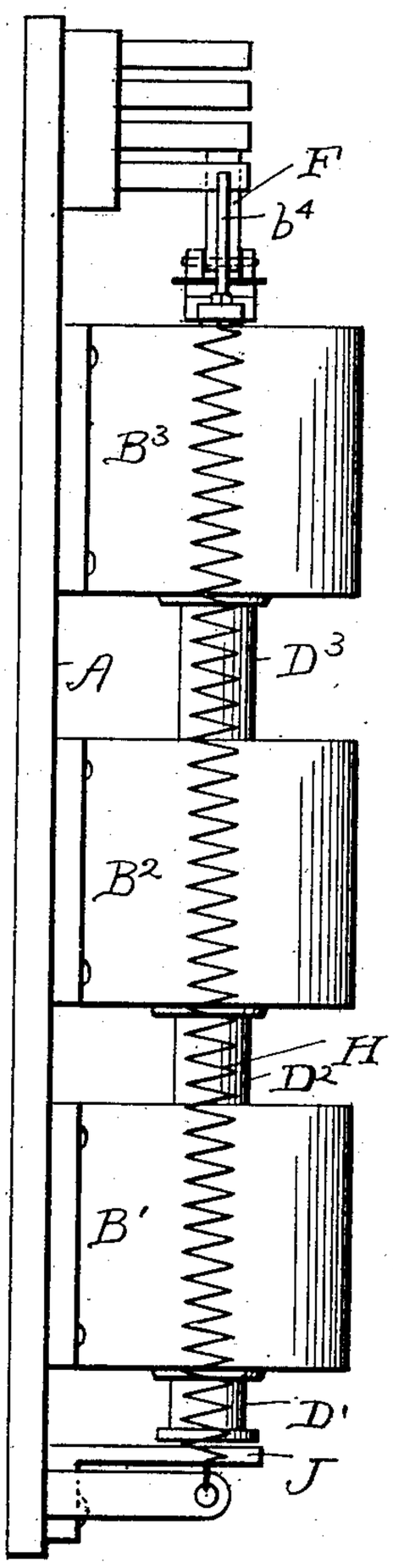


Fig. 1.

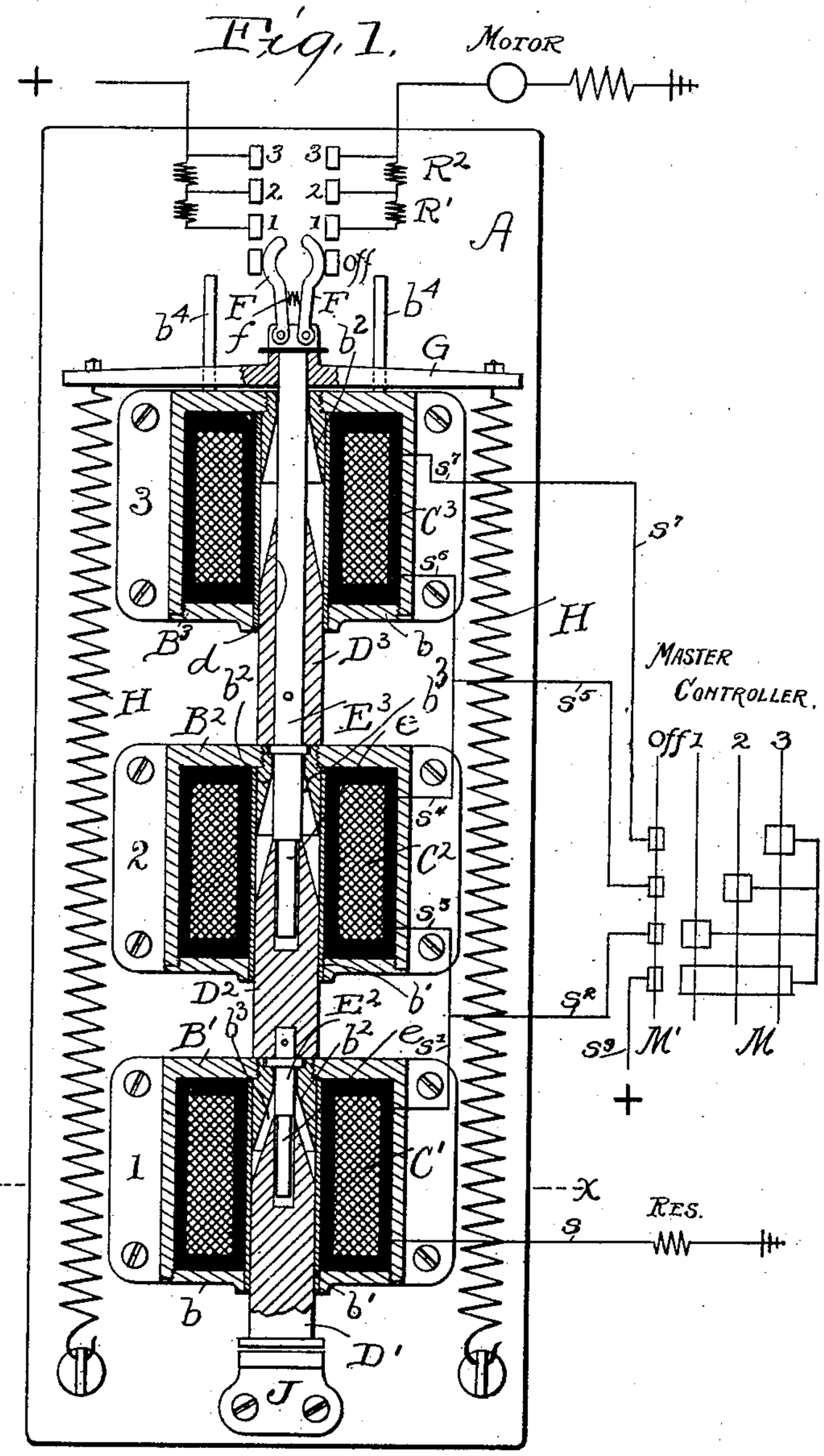
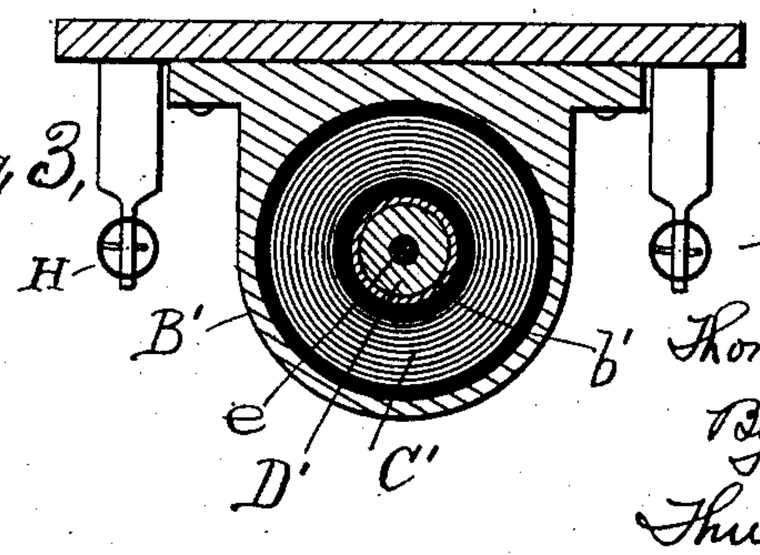


Fig. 3,



Witnesses.
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By his Attorneys,
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UNITED STATES PATENT OFFICE.

THORSTEN VON ZWEIGBERGK, OF PRESTON, ENGLAND.

CONTROLLER.

SPECIFICATION forming part of Letters Patent No. 723,119, dated March 17, 1903.

Application filed April 23, 1902. Serial No. 104,259. (No model.)

To all whom it may concern:

Be it known that I, THORSTEN VON ZWEIGBERGK, a citizen of the United States, residing at Preston, county of Lancaster, England, have invented a certain new and useful Improvement in Controllers, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

The object of this invention is to provide a very simple and efficient controller adapted to be electrically operated from a distant point. The controller is arranged on the multiple-unit plan, being adapted to advance the governing-contacts step by step as a master-controller is operated. The system of governing the motor-contacts by a multiple-unit controller distantly operated by a master-controller is very convenient for many uses, particularly when several motors are to be controlled—as, for example, where several motor-cars are coupled together and it is desired to operate them all from the front car.

The present invention provides a multiple-unit controller in which the movements are caused by solenoids. Such a controller may be very cheaply constructed, while being efficient in operation and not liable to get out of order and needing very little attention.

To this end the invention comprises a series of solenoid mechanisms so connected together that the effect of each is added onto that of the preceding mechanism and suitable contact members relatively actuated by such movement.

The invention may also be summarized as consisting of the combinations of parts to the above end hereinafter described, and pointed out definitely in the claims.

In the drawings, Figure 1 is a central longitudinal section of my controller parallel with its base-plate and showing also the circuits. Fig. 2 is a side elevation of the controller, and Fig. 3 is a transverse section thereof on the line $x\,x$ of Fig. 1.

Referring to the parts by letters, A represents the base of the controller. On this there are rigidly mounted a series of housings, three being shown, (designated B′, B², and B³.) Each of these housings is made of iron and has a cylindrical central cavity, in which lies a solenoid, (designated, respectively, C′, C², and C³,) the solenoid being shown as held in the cavity of the cap *b*, closing the housing. The bore of the solenoid is protected by a brass tube *b*′. Fitting within the brass tube and screwing into the forward end of the housing is the plug b^2, of iron. This much of the construction is the same for each of the units, (numbered 1, 2, and 3.)

Slidable within the tubes *b*′ are the movable magnetic cores D′, D², and D³, respectively. Each of these cores is tapered at its forward end, as at *d*, corresponding to a taper b^3 in the plug b^2. The cores after the first each carry a pin, against which the preceding core may shove, but which is not rigidly connected with that core. Thus there is secured to the rear end of the core D² a pin E², having a reduced portion *e*, adapted to enter a central bore in the forward end of the core D′. Similarly a pin or rod E³ is carried by the core D³ and has a reduced portion *e*, entering a recess in the forward end of the plug D².

It will be observed that the space between the forward end of each of the movable cores and the rear end of the corresponding plugs b^2 increases in the different units in arithmetical progression, the space in the second unit being twice that in the first, the space in the third unit being three times that in the first, and so on. Now it will be seen that if the solenoid C′ is energized the core D′ will be drawn forward the distance between its forward end and the corresponding plug b^2, which will shove forward by that distance all the cores ahead of it. This will close up the spaces in the second unit to what the space in the first unit formerly was, the space in the third unit becoming what the space in the second unit was, and so on. Thereafter if the solenoid C² is energized its core D² is attracted forward, advancing it and the core D³ one step farther, the pin E² drawing out of the core D′ by that much. This movement uses up all the space provided for the core D², but leaves one unit of space still for the core D³. An energization of the solenoid C³ advances the core D³ to take up this space without disturbing the first and second units. Now the last movable core is connected with the contact members. As shown in the drawings, the last core is D³, and its pin E³ continues on through its forward end and through

the corresponding plug b^2 and at its extreme forward end carries the contact members F F. These members are shown as a pair of fingers with a tendency to move apart by a spring *f*, and they are adapted to engage successive stationary contacts, (indicated, respectively, by the numbers 1, 2, and 3.) Secured to the forward end of the rod or pin E^3 is a cross-bar or yoke G, shown as guided by the stationary pins b^4 and connected with two springs H H, secured at their rear ends to the frame A, near its opposite end. A suitable stop J, carried by the frame and adapted to be impinged by the core D', limits the backward movement of this core. The forward side of each housing limits the backward movement of the succeeding cores.

Referring to the diagrammatic portion of Fig. 1, representing the master-controller, the numbered lines indicate the positions of the connected segments M relative to the contact-fingers M' in the usual manner. The solenoid C' has one end grounded through the line *s*. The other end leads by the lines s' s^2 to a contact-finger of the master-controller adapted to be connected at the first operative position with the positive terminal s^9. This contact-finger is also connected with the second solenoid C^2 by the lines s^2 s^3. The return-wire s^4 s^5 from this solenoid leads to the contact-finger, which is in engagement for the second operative position. This latter finger is also connected by the lines s^5 s^6 with the third solenoid C^3, the return-wire s^7 from which leads to the finger for use in the third operative position, and so on. Thus if the master-controller is in the off position the springs H hold the solenoid-controller in the corresponding position. When the master-controller is turned on the first position, the solenoid-controller is correspondingly advanced to cause the contacts F to engage the fingers 1, and so on. The connection from the fingers 1, 2, and 3 of the solenoid-controller may be made as desired. As shown herein, R' and R^2 represent resistance adapted to be cut out by successive movements of the solenoid-controller.

I claim—

1. The combination of a set of solenoid mechanisms, each including two members movable relative to each other, namely, a core and a coil of conductor, one of said members in each set being stationary, the other set of members being movable both collectively and independently, and contact mechanism operated by such movable members, substantially as described.

2. In a controller, the combination of a series of solenoid mechanisms each having an independently-movable member adapted to advance all the corresponding members ahead of it, and a contact device operated by the foremost member, substantially as described.

3. In a controller, the combination of a series of solenoids arranged in alinement, a series of cores therefor, each core being adapted to advance all the cores in front of it, and a contact device operated by the final core, substantially as described.

4. In a controller, in combination, a series of stationary housings, solenoids carried therein in alinement, individual cores for such solenoids, loose connections between each core and the succeeding core, and a contact device operated by the final core, substantially as described.

5. In a controller, the combination of a series of solenoids, a series of cores therefor, each core being arranged to advance all the cores forward thereof, the maximum movement allowed to the cores increasing in the successive cores in arithmetical progression, and a contact device operated by the forward core, substantially as described.

6. In a controller, in combination, a series of solenoids arranged in alinement, a series of cores therefor, there being space for independent movement between the cores increasing in arithmetical progression, pins carried by each core adapted to be engaged by the preceding core without preventing movement independent of the preceding core, a contact device arranged to be operated by the final core, and a spring for retracting such core, substantially as described.

7. In a controller, the combination of a series of solenoids in alinement, a series of cores therefor, magnetic plugs in the forward end of the solenoid-bores, pins carried by the cores and projecting through said plugs into proximity to the forward end of the preceding core, and a contact device operated by the final core, substantially as described.

8. In a controller, the combination of a series of solenoids, a series of cores therefor, magnetic plugs in the forward end of the solenoid-bores, pins carried by the cores and projecting through said plugs and adapted to bear against the preceding core, the opposing faces of said plug and cores being complementarily tapered, the maximum space between the tapers increasing in the successive cores, and a contact device operated by the final core, substantially as described.

9. In a controller, the combination of a series of housings in alinement, solenoids carried therein, plugs carried by the housings, cores slidable within the solenoids, and pins loosely connecting each core with the core in advance thereof, the maximum movement allowed to the cores successively increasing, and a contact device operated by the final core, substantially as described.

10. In a controller, the combination of a series of housings in alinement, solenoids carried therein, cores slidable within the solenoids, each core being adapted to shove forward the core in advance thereof, the maximum movement allowed to the cores successively increasing, a contact device operated by the final core, and a spring tending to retract the final core, substantially as described.

11. In a controller, in combination, a series

of housings in alinement, a series of solenoids carried therein, plugs carried by the forward side of the housings and occupying the forward portion of the bore of the solenoid and tapered on their rear ends, magnetic cores for said solenoids tapered complementarily on their forward ends, the distance between the tapers of the core and the plug increasing in successive units, and pins carried by each core and adapted to bear against the forward end of the preceding core but not interfering with the advancement of the pin from the preceding core, and a contact device actuated by the final core, substantially as described.

12. In a controller, a series of housings in alinement and having cavities, solenoids occupying said cavities, a non-magnetic sleeve within said solenoid, magnetic cores loosely slidable within said sleeves, a magnetic plug connected to the housing and occupying the forward portion of the bore of the solenoid, a pin carried by a core and slidable through the preceding plug and loosely engaged by the preceding core, and a contact device governed by the final core, substantially as described.

13. In a controller, in combination, a series of housings arranged in alinement and having cavities therein, a solenoid occupying each cavity, plugs of magnetic material carried by the housings and extending into the solenoid-bores and carrying an internal taper therein, a core slidable within the solenoid being correspondingly externally tapered, pins carried by the rear end of each core and loosely occupying recesses in the forward ends of the preceding cores, and a contact device actuated by the final core, substantially as described.

14. In a controller, in combination, a series of cores slidable within the solenoids, pins carried by the rear end of each core and loosely engaging the forward end of the preceding core, a contact device actuated by the final core, a cross-bar rigid with the final core, and a pair of springs secured to said bar and tending to draw the same rearward, substantially as described.

15. In a controller, the combination of a frame-plate, a series of housings secured thereto in alinement, solenoids within the housings, a series of cores within said solenoids, each core being adapted to shove forward all the cores in front of it, a contact device actuated by the final core, a cross-bar rigid with the final core, a pair of springs leading from said cross-bar to stationary points at the rear of the controller, and stop limiting the backward movement of the cores, substantially as described.

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

THORSTEN VON ZWEIGBERGK.

Witnesses:
CHR. BARNHOLDT,
CHAS. H. LACEY.