No. 704,336. Patented July 8, 1902.

J. D. IHLDER.

REVERSING SWITCH MOTOR.

(Application filed Apr. 4, 1899.)

(No Model.) 2 Sheets—Sheet I.

Fig. 2.

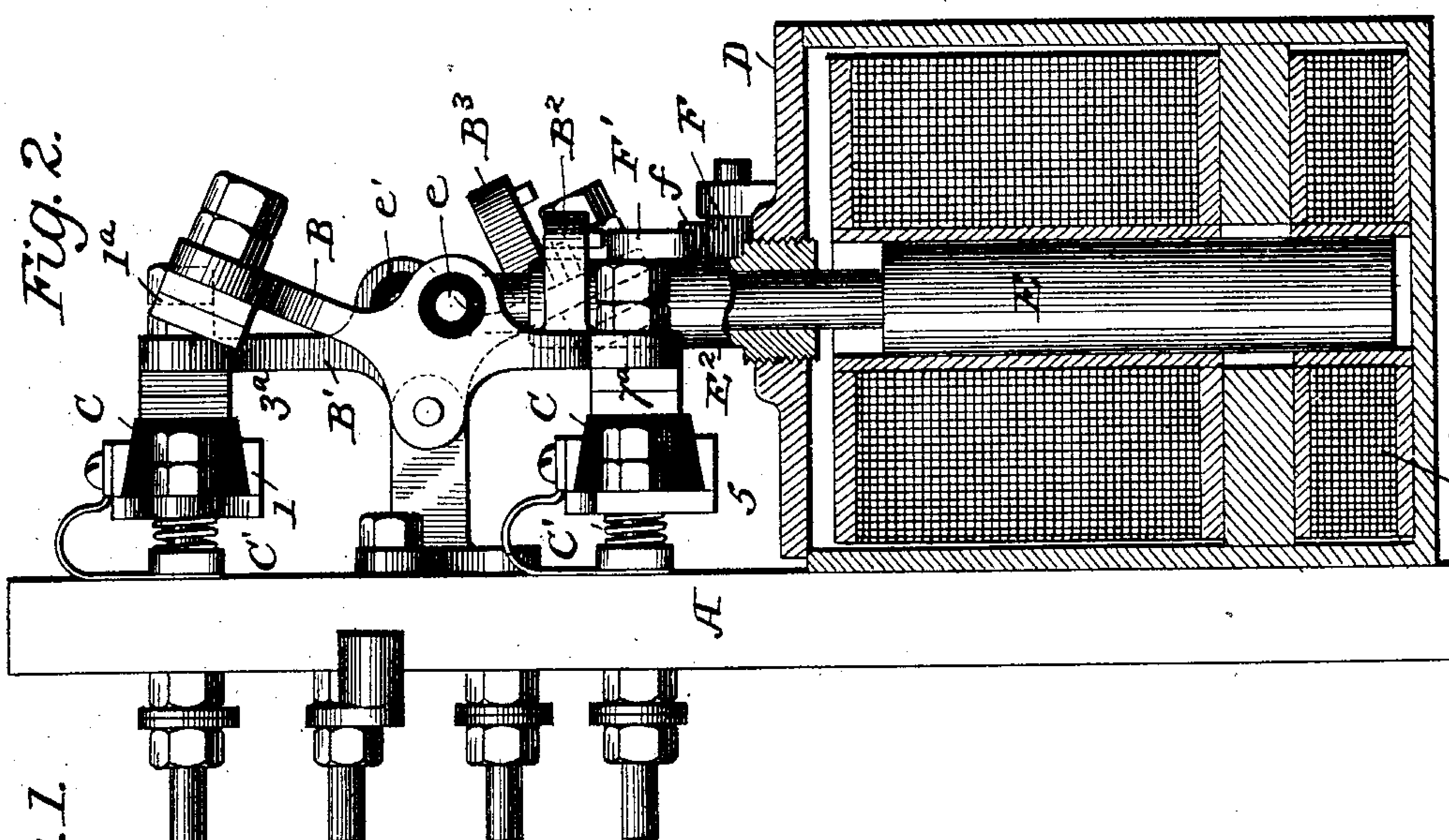
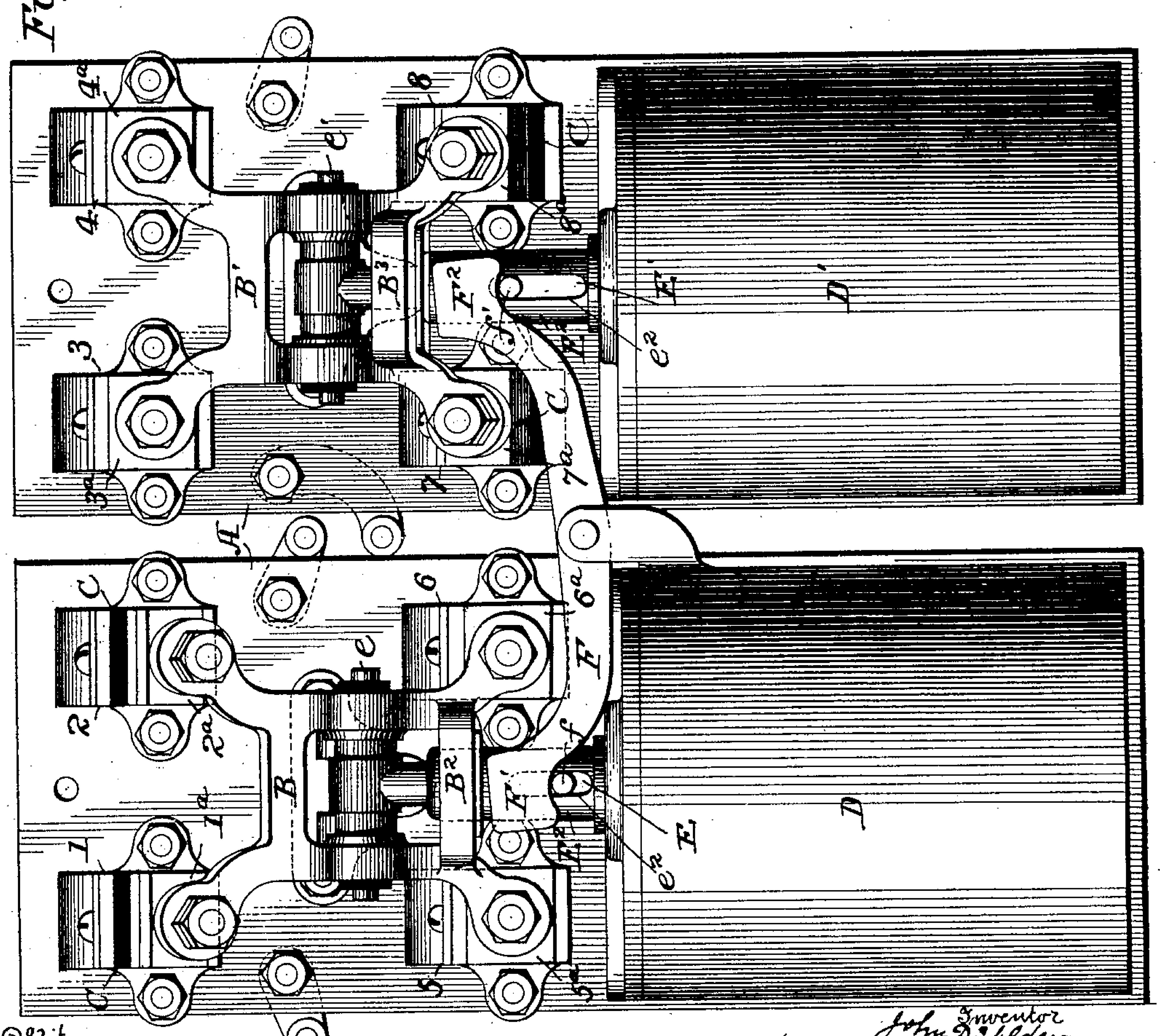


Fig. 1.



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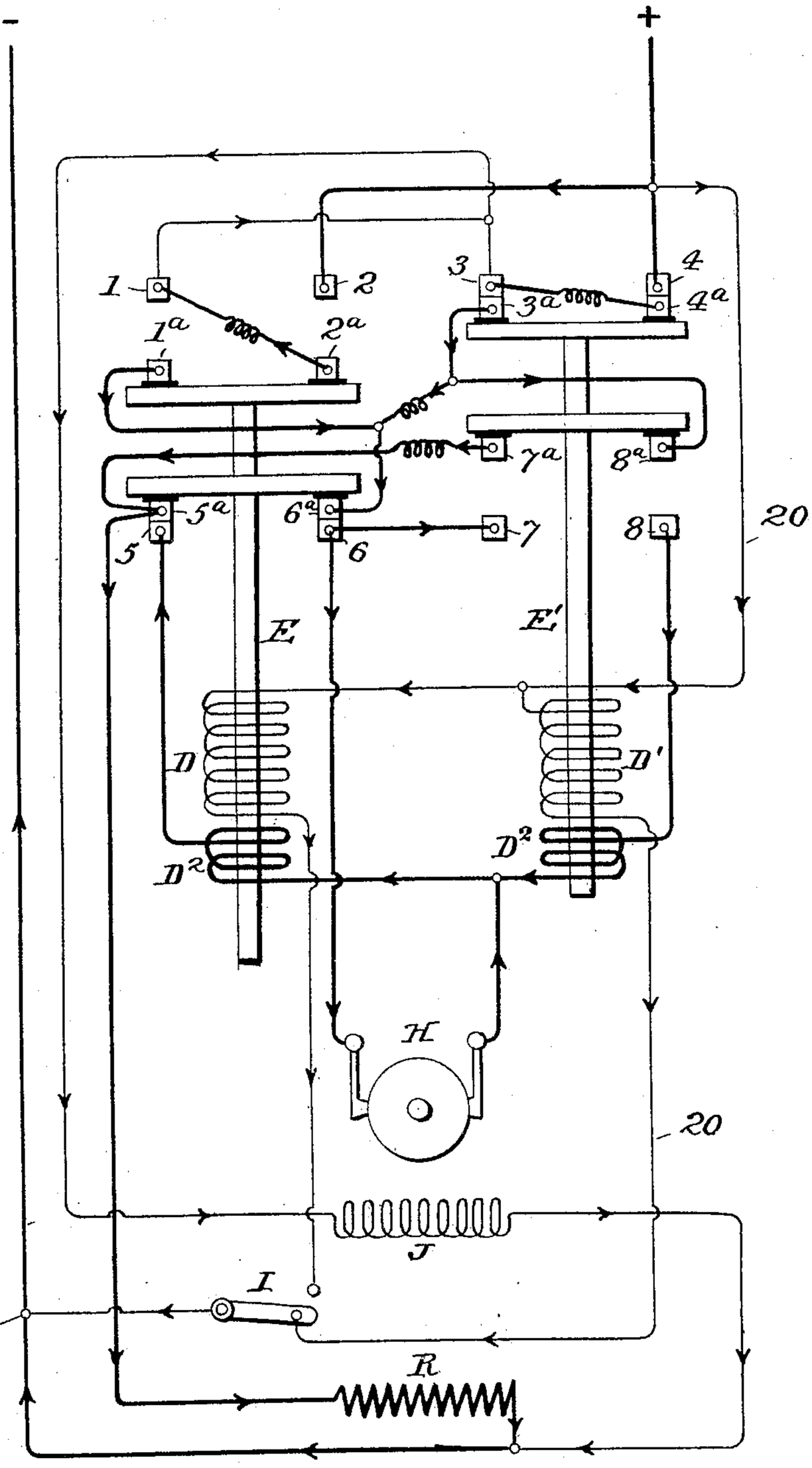

Fig. 3.

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UNITED STATES PATENT OFFICE.

JOHN D. IHLDER, OF YONKERS, NEW YORK, ASSIGNOR TO OTIS ELEVATOR COMPANY, OF ORANGE, NEW JERSEY, A CORPORATION OF NEW JERSEY.

REVERSING-SWITCH MOTOR.

SPECIFICATION forming part of Letters Patent No. 704,336, dated July 8, 1902.

Application filed April 4, 1899. Serial No. 711,711. (No model.)

To all whom it may concern:

Be it known that I, JOHN D. IHLDER, a citizen of the United States, residing at Yonkers, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Reversing-Switch Motors, of which the following a specification.

My invention relates to reversing-switches for electric circuits, and has for its object to provide a safety reversing-switch by means of which the order in which the circuits are opened or closed is automatically controlled; and to these ends my invention consists in a switch embodying the general features of construction, arrangement, and operation of parts substantially as hereinafter more particularly set forth.

Referring to the accompanying drawings, wherein one embodiment of the switch is illustrated, Figure 1 is a front elevation of the switch. Fig. 2 is a side view, partly in section; and Fig. 3 is a diagrammatic representation of the switch and circuits and connections therefor.

In the use of electric reversing-switches it is often desirable and even necessary that certain circuits should be opened and closed in a certain definite relation to each other in order to avoid injury to the apparatus and danger in using the circuits, and this is especially so in connection with the control of electric motors—such, for instance, as are used in connection with electric elevators—which require reversals of the motor and in connection with devices for controlling the operations of motors, for instance, similar to those shown in my pending application, Serial No. 713,593, filed April 19, 1899.

The main object of my present invention is to provide a simple, cheap, and effective reversing-switch which shall be a safety reversing-switch in that the movements of the switch-arms are interdependent upon one another, so that they will have to operate to make and break the circuits in a certain prearranged order, and, further, to provide such a switch with a safety arm or device which is operated by the switch-arms and in turn controls the movements of the switch-arms.

My invention may be embodied in many and various forms of switches having different arrangements of contacts for controlling circuits for different purposes, and in the accompanying drawings I have illustrated one typical form or embodiment of the invention which will be sufficient to disclose the general principles thereof and enable those skilled in the art to apply and adapt the invention for the special purpose desired.

Referring to the drawings, upon a suitable base A are mounted a series of terminals or contact-pieces 1 2 3 4 5 6 7 8, which are connected with suitable conductors, as indicated. These contact-pieces may be differently constructed in details; but as the switch is intended more particularly for use in connection with circuits carrying relatively heavy currents it is preferable to make these contact-pieces of carbon, and I have shown each of these contacts as provided with a block of carbon C. Furthermore, in order that good electric contact may be obtained it is preferable to mount these contacts so that they will yield to a greater or less extent when the circuits are closed therethrough, and in the present instance I have shown each of these contacts as controlled by springs C′, so that they will have the necessary amount of resiliency. Arranged to coöperate with the terminals or contacts are corresponding terminals 1^a 2^a 3^a 4^a 5^a 6^a 7^a 8^a, and these in the present instance are mounted on the hinged switch-arms or contact-plates B B′. In the present embodiment each of these switch-arms carries four contacts; but of course the number of contacts carried by the arms is immaterial and depends upon the particular arrangement of the circuits. The contacts or terminals carried on the switch-arms may be provided with carbon contacts or metallic contacts or any other similar material, as deemed best under the peculiar circumstances of the case, and they are shown in the present instance as being metallic and having means for attaching the terminals of the circuits to the switch-arms. Each of the switch-arms, as B, is so pivoted and mounted with relation to the contacts on the base-plate in the present instance that two sets of contacts, as 1 1^a and 2 2^a, can be si-

multaneously closed and at the same time the opposite set 5 5^a and 6 6^a will be opened, and vice versa, and the switch-arm B′ is similarly arranged with relation to its sets of contacts.

Some means for operating the switch-arms B B′ must be provided, and these may vary according to circumstance; but I preferably operate them by means of the electromagnets D D′, connected in the circuits controlled by the switch-arms. I have shown these magnets in the form of solenoids, with cores E E′ connected to the switch-arms by pins *e e′*, which are preferably insulated from the arms. With such an arrangement when the magnet is not excited the weight of the core, together with the weight of the switch-arm, will normally hold contacts 5 5^a and 6 6^a closed and contacts 1 1^a and 2 2^a open, as shown in connection with the switch-arm B; but when the magnet is excited the core will be moved so as to close the contacts 1 1^a and 2 2^a and open contacts 5 5^a and 6 6^a and hold them open as long as the current through the magnet-core is sufficient to sustain the parts in this relation. As before stated, when the magnets are deënergized the cores will fall, operating the switch by gravity; but sometimes it is desirable to make this action more positive, and in that case the magnets may be provided with a coil D^2, so arranged that if the circuit is closed through the coil it will exert an influence on the core to positively pull it down, and thereby operate the switch-arm. This latter coil is properly connected in the circuits to be controlled in a way that is well understood by electricians.

So far described, it will be seen that there are two switch-arms arranged to control their respective circuits, and in the present instance it is assumed that it is necessary that the contacts 5 5^a and 6 6^a shall not be closed simultaneously with the contacts 7 7^a and 8 8^a or that contacts 1 1^a and 2 2^a should not be closed simultaneously with contacts 3 3^a and 4 4^a, and I therefore provide a safety device which will prevent such an operation of the two switch-arms and will insure that when one of said sets of contacts is closed the other set will remain open and cannot be closed until the first set is opened. Various means for accomplishing this may be used; but I have shown an exceedingly simple construction comprising a safety device or arm F, which in the present instance is conveniently pivoted on a projection from one of the magnets, which in this instance are shown in the form known as "cup-magnets;" but of course this pivotal support may be otherwise arranged, and this safety-arm is provided with extensions F′ and F^2, arranged in position to be operated by the cores of the magnets controlling the switch-arms, and in the present instance the cores E E′ are shown as extending through the casings E^2, having slots e^2, through which pins *f f′*, connected to the extended cores, extend and project adjacent to the extensions of the safety-arm F. From this arrangement it will be seen that as either one of the cores—as E′, for instance—moves upward under the influence of the magnet the safety-arm F is tilted, its extension F^2 being moved by the pin *f′* and the other extension F′ being correspondingly depressed, and if perchance the core E is raised at this time it is forced downward by the upward movement of the core E′, and it will further be seen that neither one of the cores can rise without forcibly lowering the other. Assuming the parts in the position shown in Fig. 1, as before stated, it will be seen that the switch-arm B cannot move to close the open contacts without first moving the switch-arm B′ to break the contacts 3 3^a and 4 4^a; but it might happen that the core E′ would fall or be drawn downward while the core E is in its lowermost position and the contacts 7 7^a and 8 8^a be closed simultaneously with the contacts 5 5^a and 6 6^a. Some means must be provided to prevent this, and in the present instance I have shown the switch-arms as provided with a stop in the form of a yoke B^2 B^3, although any other sort of stop may be used. This yoke is so arranged that when the parts are in the position shown, with the extension F^2 up, the contacts 7 7^a and 8 8^a cannot be closed, as the yoke will impinge upon the extension F^2 before contact is made. While this yoke is a convenient stop-piece in connection with the particular-shaped switch-arm shown, it is evident that similar mechanical devices or constructions may be used to accomplish the same purpose.

From this description the general principles of my invention will be understood, and if perchance the lower sets of contacts 5 5^a 6 6^a and 7 7^a 8 8^a control, for instance, the armature-circuit of an electric motor it will be seen that by my arrangement only one of these sets of contacts can be closed at a time and the closed set cannot be broken until or simultaneously with the closing of the other set and a short circuit of the armature is prevented. So, too, the same effect will be produced in connection with the upper sets of contacts—that is, one set only can be closed at a time, and relatively when the upper set of contacts of one of the switch-arms is closed the lower set of contacts of the other switch-arm is closed, and vice versa. From this it will be seen that in this particular arrangement the switch-arms control the movements of the safety device, and the safety device in turn controls the movements of the switch-arms, requiring them to operate in a regular sequence or relation to each other.

It will be seen that with the condition shown in Fig. 1 the switch-arm B′ can move so as to break the circuits at the points 3 and 4 without in any way affecting the movements of the other switch-arm. So, also, if this arm were in a position so that its yoke B^3 rested on the end F^2 of the safety-lever it could be moved to close contacts 3 and 4 without affecting the other switch-arm, so that the arms may be said to be operated by independent devices

under certain conditions. The safety device, however, is so arranged that the arms must operate under certain conditions in a certain predetermined order or succession, as hereinbefore fully set forth.

Referring to Fig. 3, the switch is shown diagrammatically with suitable circuits and connections therefor, the safety device connecting the cores E E′ not being shown in this view for the sake of simplicity. As before, E and E′ represent the cores of magnets D and D′, and 1^a 2^a 3^a 4^a 5^a 6^a 7^a 8^a represent the contacts of the switch. A suitable electric motor H is shown connected in circuit with a shunt field-winding J and a resistance R, although any suitable device might be shown here through which it is desired to reverse the current. The heavy lines represent the armature-circuits, while the light lines represent the controlling-circuits of the switch and the field-circuit of the motor. As hereinbefore described, the contacts 3 3^a, 4 4^a, 5 5^a, and 6 6^a are adapted to be closed at the same time, while the remaining upper and lower contacts of the switch are open, and in the positions of the cores E E′ shown it is assumed that magnet D′ is energized, attracting the core E′ upward and closing contacts 3 3^a 4 4^a, at which time the magnet D^2 of core E is also energized and pulls the core E downward, thereby making close contact at 5 5^a and 6 6^a, the weight of the core E and its connected parts assisting in making good contact at these points. A suitable switch I is shown—in this instance a three-point switch—controlling the circuits of the magnets D D′, and assuming that the switch is in the position shown a circuit will be completed from the positive main (represented by a + sign) by wire 20 to one or the other of the magnets D D′—in this instance to magnet D′—and from thence still by wire 20 to and through switch I to the negative main at 21. As hereinbefore stated, the switch is only represented diagrammatically; but it is understood that the safety device described in connection with Figs. 1 and 2 prevents the simultaneous closure of all of the lower contacts or all of the upper contacts represented in Fig. 3. The magnet D′ having been energized, the core E′ is raised and the core E remains down, and the armature-circuit is completed through the armature of the motor H in one direction, as follows: from the positive main to contact 4^a, through contacts 3 3^a to contacts 6^a 6, from thence to and through the armature of the motor H, through magnet D^2, around core E, through contacts 5 5^a, to and through the armature resistance R, and to the negative main. At the same time the circuit of the field-winding J is completed from contact 3 to and through the field-winding to the negative main. Should the switch I be operated to complete the circuit of magnet D instead of magnet D′, core E′ would remain, closing its lower contacts, while the core E would be pulled upward and the circuit of the motor-armature would be reversed.

What I claim is—

1. In a switch, the combination with a plurality of electrically-operated switch-arms, of a safety device controlled by the movement of one switch-arm and controlling the movements of another switch-arm, whereby the switch-arms are operated in a predetermined order or succession, substantially as described.

2. In a switch, the combination with a plurality of electrically-operated switch-arms, of a safety-arm controlled by the movement of one switch-arm and controlling the movements of another switch-arm, whereby the switch-arms are operated in a predetermined order or succession, substantially as described.

3. In a switch, the combination with a plurality of switch-arms, of independent electrical devices for moving the arms, and a safety device connected to be operated by the moving device of one of the switch-arms and to control the movements of another switch-arm, whereby the switch-arms are operated in a predetermined order or succession, substantially as described.

4. In a switch, the combination with a plurality of switch-arms, of independent devices for moving the arms, and a rocking safety device controlled by the independent moving device of one switch-arm and controlling the movements of another switch-arm, whereby the switch-arms are operated in a predetermined order or succession, substantially as described.

5. In a switch, the combination with a plurality of switch-arms, of independent devices for operating the arms, magnets to move said independent devices, and a safety device connected to be moved by the magnet of one switch-arm and controlling the movements of another switch-arm, whereby the switch-arms are operated in a predetermined order or succession, substantially as described.

6. In a switch, the combination with the pivoted switch-arms, of magnets the cores of which are connected to move the switch-arms, a pivoted safety device, and connections between the cores and the pivoted safety device for moving the latter, substantially as described.

7. In a switch, the combination with the pivoted switch-arms, of magnets for moving the switch-arms, magnet-core extensions connected to the switch-arms and carrying pins, a pivoted safety-arm having extensions engaging the pins, and stops on the switch-arms engaging the extensions, substantially as described.

8. In a switch, the combination with a plurality of switch-arms, each arm carrying a contact at each end, of independent devices for moving the arms, and a safety device controlled by the movement of one switch-

arm and controlling the movements of another switch-arm, whereby the switch-arms are operated in a predetermined order or succession substantially as described.

9. In a switch, the combination with the stationary spring-supported contacts, of pivoted switch-arms carrying contacts coöperating therewith, electromagnets for operating the switch-arms, cores connected to the arms, a pivoted safety-arm, pins connected to the cores for operating the safety-arm, and stops on the switch-arms coöperating with the safety-arm, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN D. IHLDER.

Witnesses:
JAMES S. FITCH,
ARTHUR ROWLAND.