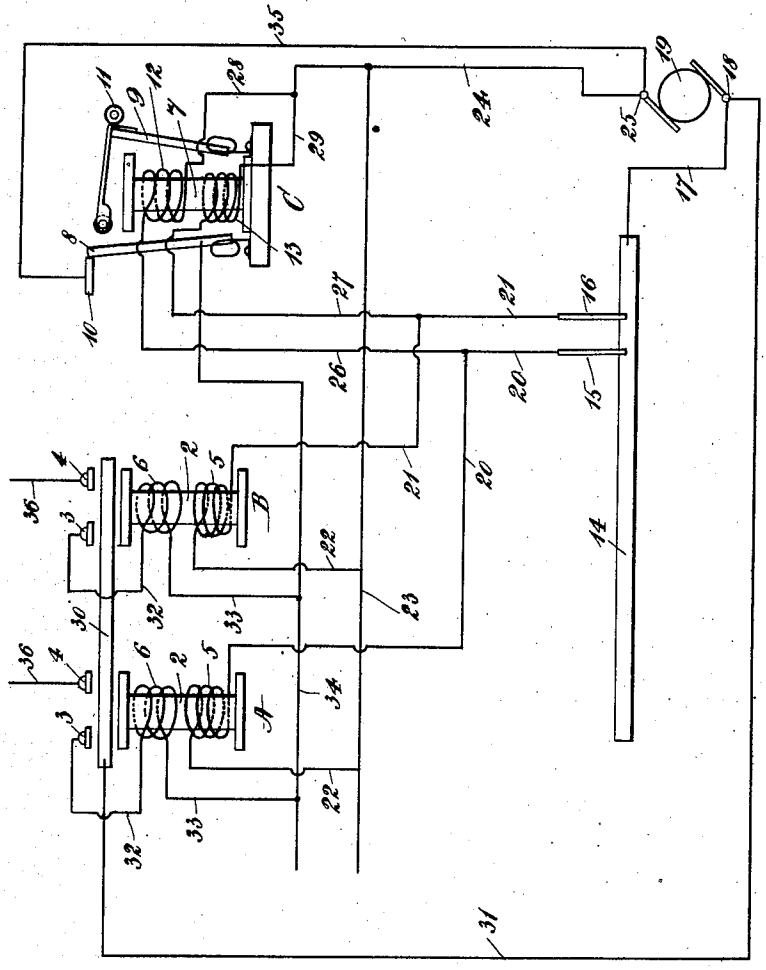
W. C. REED.

CIRCUIT CONTROLLING APPARATUS.

APPLICATION FILED NOV. 23, 1916.

1,290,658. Patented Jan. 7, 1919.



INVENTOR=

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CIRCUIT-CONTROLLING APPARATUS.

1,290,658. Specification of Letters Patent. Patented Jan. 7, 1919.

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To all whom it may concern:

Be it known that I, WALTER C. REED, a citizen of the United States, residing at Dalton, in the county of Berkshire and State of Massachusetts, have invented certain new and useful Improvements in Circuit-Controlling Apparatus, of which the following is a specification.

The object of this invention is to provide a circuit-controlling apparatus by means of which any desired number of secondary electric circuits may be completely controlled, that is to say, opened or closed either one at a time or more than one at a time and left open or closed as long as may be required, by momentarily closing one or more of an equal number of primary circuits.

Such an apparatus is particularly useful for operating the expression appliances which are commonly employed in electrically-operated piano players and pipe organs controlled by perforated music sheets and the operation of which has heretofore required the music sheet to be provided with a number of series of special slots for putting the expression appliances "on", one series for each appliance, and also with one or more additional series of special slots for taking the various appliances "off." When such expression appliances are operated by a circuit controller embodying my invention, the putting on of one or more of the appliances results also in automatically taking off the others, so that it is possible to completely control all the appliances by providing the music with one series of special slots for each appliance, without additional take-off slots.

My apparatus may be readily adapted to control any desired number of secondary circuits, but as the invention will be sufficiently explained by describing the apparatus as designed for controlling two such circuits only I have illustrated such an apparatus in the accompanying drawing, in which the figure is a diagrammatic view showing the parts employed and their operating circuits.

The apparatus shown in the drawing comprises two circuit closers A and B of identical construction, one for each circuit to be controlled, and a circuit opener C. Each of the circuit closers, as preferably constructed, includes a double-wound magnet 2 having two armatures 3 and 4 which are simultaneously attracted by the magnet when energized and automatically move away from the magnet when the latter is deënergized. The two coils 5 and 6 with which each magnet 2 is wound are supplied with current as explained below and are herein referred to as the exciting coil and the retaining coil respectively. The circuit opener C, as preferably constructed, includes a multiple-wound magnet 7 supported in upright position on a suitable base and having two armatures 8 and 9 which are mounted on spring wires secured at their lower ends to the base and are simultaneously attracted by a pole piece at the top of the magnet when energized. The armature 9 has a greater magnetic mass than the armature 8 and is therefore attracted with greater force, and at its upper end it carries a striker which extends laterally toward the upper end of the armature 8 and is normally separated from the latter by a distance slightly less than the distance between the attracting pole of the magnet and the armature 9. Said armatures are normally held away from the attracting pole of the magnet, by spring action, with the upper end of the armature 8 in contact with a metallic contact piece 10 and the upper end of the armature 9 resting against a fixed stop 11. The coils with which the magnet 7 is wound are equal in number to the circuit closers above described, the two coils employed in the present case being indicated at 12 and 13.

14 indicates a metallic contact bar and 15 and 16 indicate a pair of circuit-controlling fingers which are movable into and out of contact with the bar 14 and may be assumed to be controlled by a perforated music sheet (not shown). The contact bar 14 is connected by a circuit wire 17 to one pole 18 of a suitable source of electric current, such as a generator 19, and from the fingers 15 and 16 wires 20 and 21 lead to the exciting coils 5 of the circuit closers A and B respectively, the circuits through said coils being completed by way of wires 22 and common return circuit wires 23 and 24 leading to the other pole 25 of the generator. Branch circuit wires 26 and 27 lead respectively from the circuit wires 20 and 21 to the coils 12 and 13 of the magnet 7, the return circuit for these coils being provided by wires 28 and 29 connected to the return wire 24.

Another metallic contact bar 30 is located in position to make contact with the several

armatures 3 and 4 when attracted, and is connected by a circuit wire 31 to the pole 18 of the generator, so that it has the same polarity as the contact bar 14 and is adapted to supply current to the armatures 3 and 4 when in contact therewith. Each of the armatures 3 is connected by a circuit wire 32 to the coil 6 of the corresponding circuit closer, and from these coils the return circuit extends through wires 33 to a common return wire 34 which leads to the armature 8 of the circuit opener C. When the latter armature is in contact with the contact piece 10 the return circuit from the coils 6 is completed by way of a wire 35 connecting said contact piece with the pole 25 of the generator.

Each of the armatures 4 when in contact with the bar 30 transmits current to a corresponding expression appliance through an operating circuit which is represented in part by the wire 36. No specific expression appliances are illustrated, as their construction is not material to the present invention, but it is to be assumed that each expression appliance is put on whenever the corresponding armature 4 makes contact with the bar 30 and goes off whenever such contact is broken.

As thus constructed the operation is as follows: Whenever either of the fingers 15 and 16 is permitted to make contact with the bar 14, current is transmitted through the exciting coil 5 of the corresponding magnet 2 and also through one of the coils of the magnet 7, which results in simultaneously attracting both armatures of the circuit closer and both armatures of the circuit opener. Consequently the return circuit through both of the retaining coils 6 is opened by the movement of the armature 8 away from the contact piece 10 but is immediately closed again by the action of the armature 9, the striker on which engages and overpowers the armature 8 and moves it into contact with the piece 10, where it is held so long as the magnet 7 remains energized, the slot which permits the closing of the primary circuit through the finger 15 or 16 being made long enough to provide for the restoration of the contact of the parts 8 and 10 as above described. While this contact is being broken and restored the armatures 3 and 4 of the energized circuit closer are drawn into contact with the bar 30, with the result that the secondary or operating circuit through the corresponding wire 36 is closed by the armature 4 and the expression appliance operated thereby is put on. At the same time the armature 3 closes the circuit through the retaining coil 6 at the contact bar 30, and since this circuit is also closed by the armature 8 before the exciting coil 5 is deënergized the retaining coil remains energized after the finger 15 or 16 has been moved out of contact with the bar 14, so that the magnet 2 of the corresponding circuit closer continues to remain energized and to hold both of the armatures 3 and 4 in contact with the bar 30, thereby keeping the corresponding expression appliance on. The momentary breaking of the return circuit of the coils 6 by the armature 8, however, results in deënergizing the magnet 2 of the other circuit closer, and since the exciting coil 5 of this magnet is not supplied with current both of its armatures 3 and 4 move away from the bar 30, if they were previously in contact therewith, and the corresponding expression appliance is thereby taken off by the opening of the circuit through the wire 36. In other words, the closing of either primary circuit through its contact finger 15 or 16 results in closing the corresponding secondary circuit and thereby putting on the expression appliance operated thereby, and also results in simultaneously taking off the other expression appliance. When both primary circuits are closed at the same time, both expression appliances go on and remain on until one or the other of the primary circuits is again closed, whereupon the corresponding expression appliance remains on and the other goes off.

All of the expression appliances will obviously go off automatically when the current is cut off from the playing apparatus, and if it is desired to take off all the expression appliances while the apparatus is playing this may be done by opening the return circuit of the retaining coils 6 in any suitable manner, or by providing the music sheet with a slot adapted to operate either of the fingers 15 and 16 and cut so short that it will terminate before the circuit which is broken by the attraction of the armature 8 is closed again by the action of the armature 9, since in such case the current sent through either of the exciting coils 5 will be broken while the return current through the corresponding retaining coil is also open. When the apparatus is used for operating the stops of a pipe organ, however, it will not be necessary to open at the same time all the circuits represented by the wires 36, since the organ will not play unless one or more of the stops are on.

The circuit opening and closing devices employed in the apparatus may be constructed in various ways without departing from my invention, so long as they are adapted to operate as above explained. The devices indicated at A and B are not individually claimed herein, as they form the subject matter of my Patent No. 1,243,221, granted October 16, 1917, in which their construction is described in detail. Also the device indicated at C is not individually claimed herein, as it forms the subject matter of my copending application Serial No. 127,571, filed October 25, 1916.

I claim:

1. A circuit-controlling apparatus comprising a plurality of primary circuits provided with means for opening and closing them independently of one another and each including an electro-magnet having an exciting coil and a retaining coil, means operated by each magnet when energized for closing the circuit through its retaining coil and also closing a secondary circuit, and means operative with the closing of any one of the primary circuits for momentarily opening the circuit through all the retaining coils.

2. A circuit-controlling apparatus comprising a plurality of circuit closers each including an electro-magnet provided with an exciting coil and a retaining coil, the exciting coils being severally included in primary circuits having means for independently opening and closing them and the secondary coils being included in circuits having a common portion, means operated by each magnet when energized for closing the circuit through its retaining coil and also closing a secondary circuit, and a circuit opener including an electro-magnet wound with a plurality of coils, each connected in circuit with the exciting coil of one of the circuit-closer magnets, and provided with means for momentarily opening the common portion of the retaining-coil circuit.

3. A circuit-controlling apparatus comprising a plurality of circuit closers each including an electro-magnet provided with an exciting coil and a retaining coil and having an armature arranged to close a normally-open secondary circuit and another armature arranged to close the circuit through the retaining coil when the magnet is energized by the exciting coil, means for momentarily closing the circuits through the exciting coils of said circuit closers independently of one another, a circuit opener including an electro-magnet wound with a plurality of coils each connected in circuit with the exciting coil of one of the circuit-closer magnets, the circuit-opener magnet being provided with two armatures of which one is subject to a greater attractive force than the other, means operated by the attraction of the latter armature for opening the circuit through the retaining coils of all the circuit closers, and means operated by the other armature for moving the less-powerful armature into position to close the last-mentioned circuit.

Signed at Boston, Mass., this seventeenth day of November, 1916.

WALTER C. REED.