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R. E. BATES.

CONTROL SYSTEM FOR ELECTRIC MOTORS.

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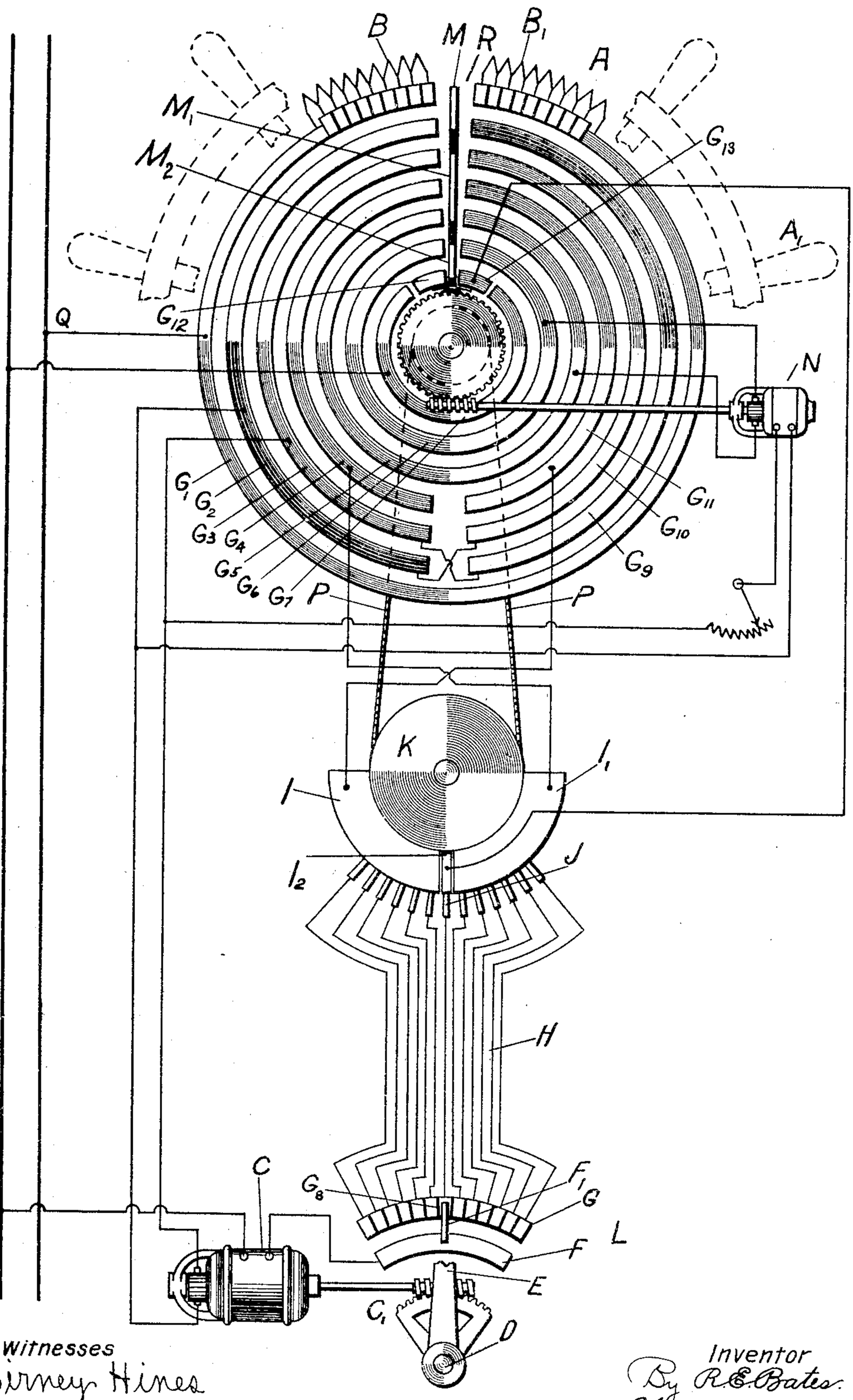

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CONTROL SYSTEM FOR ELECTRIC MOTORS.

No. 803,209. Specification of Letters Patent. Patented Oct. 31, 1905.

Application filed February 1, 1905. Serial No. 243,730.

To all whom it may concern:

Be it known that I, RALPH E. BATES, a citizen of the United States, and a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Control Systems for Electric Motors, (Case No. 1,375,) of which the following is a specification.

My invention relates to control systems for electric motors, and particularly to control systems for electric motors that are employed for operating the steering-gears of ships and similar mechanisms.

The object of my invention is to provide a system of control by means of which the amount and direction of movement of devices operated by motors may be accurately predetermined and governed.

The single figure of the accompanying drawing illustrates a system embodying my invention.

An electric motor C is connected by gearing C′ or otherwise to a shaft D, that may be the rudder-post of the steering-gear of a ship or the shaft or movable part of any other mechanism the movement of which is to be controlled. The circuit of the motor C is governed, primarily, by a master-controller A, that comprises two sets of relatively movable contact members, here shown as annularly-curved segments G′, G^2, G^3, G^4, G^5, G^6, G^7, G^8, G^9, G^{10}, G^{11}, G^{12}, and G^{13} and as brushes M, M′, and M^2, respectively. Movement of the conducting-segments G′ G^2, &c., may be effected by a pilot-wheel A′ or by any other suitable manually or automatically operated means, and movement of the brushes M, M′, and M^2, which are adapted to engage said segments, may be effected by means of a motor N, that is geared or otherwise suitably connected to the arm R that carries the said brushes.

A second controlling device K is connected by any suitable means, such as a belt P, with controller A, so as to operate simultaneously therewith, and comprises conducting-sectors I and I′, a smaller conducting-segment I^2, which is located between the sectors I and I′, and a plurality of contact-terminals J, that are adapted to engage the said conducting-sectors and segment. The conducting-segment I^2 is insulated from the sectors I and I′ and is of such width that it may engage only one of the contact-terminals J at any one time.

Contact-terminals J are connected, by means of conductors H, to the respective contact-terminals G of a third controller L, the arm E of which is operatively connected to the controlled member D and carries a brush F′, that is adapted to engage the contact-terminals G and connect them with a conducting-sector F, which is connected to one terminal of the field-magnet winding of the motor C, the other terminal of said winding being connected to distributing-conductor Q^2.

When the system is in the condition shown in the drawing, none of the electrical circuits are complete, and consequently the motor and its connected devices remain at rest, the devices being shown in mid-position. If, however, the pilot-wheel A′ is moved in a clockwise direction, the brushes M, M′, and M^2 are brought into engagement with the corresponding conducting-segments G′ to G^6 and G^{12}, and controller K is also moved an amount corresponding to the amount of movement of the controller A. A circuit is then established from distributing-conductor Q, through conducting-segment G′, resistance B, brush M, conducting-segment G^2, the armature of the motor C, conducting-segment G^3, brush M′, conducting-sector I, the central contact-terminal J, contact-terminal G^8, brush F′, conducting-segment F, and the field-magnet winding of motor C, to distributing-conductor Q^2. The motor C then rotates the rudder-post D in a contra-clockwise direction, thereby moving the brush F′ over contact-terminals G. When brush F′ is brought into engagement with the contact-terminal G, that is connected to the terminal J, which engages the conducting-segment I^2, the circuit of the motor C is interrupted and a circuit is then established from distributing-conductor Q, through resistance B, brush M, conducting-segment G^2, the field-magnet winding of motor N, conducting-segment G^3, brush M′, conducting-segment G^5, the armature-winding of motor N, conducting-segment G^6, brush M^2, conducting-segment G^{13}, conducting-segment I^2, one of the contact-terminals J, one of the contact-terminals G, brush F′, conducting-segment F, and the field-magnet winding of motor C, to conductor Q^2. The motor N is thus set in operation and causes

the arm R, that carries the brushes M, M′, and M^2, to move in a direction that will ultimately cause the said brushes to become disengaged from their corresponding conducting-segments. This following-up motion of the arm that carries the brushes M, M′, and M^2 is provided for the purpose of avoiding any delay that would otherwise occur between successive operations of the controller. The tendency of this arrangement is to always maintain the controller in its "off" position.

If the controller A is moved such a degree that the brush M is moved beyond all of the contact-terminals that are connected with the resistance B, the brush M^2 is then brought into engagement with conducting-segment G^7 and a circuit is then immediately established through the motor N, since the conducting-segment G^7 is connected directly to the distributing-conductor Q^2. As a result the motor N is immediately set into operation, and the following-up motion of the arm R, that carries the brushes M, M′, and M^2, continues until the brush M^2 no longer engages conducting-segment G^7. The remainder of the following-up motion is dependent upon the rotation of the rudder-post D, that carries the brush F′.

It will be understood without specific description that movement of the pilot-wheel A′ contra-clockwise will bring the resistance B′ and the segments G′, G^9, G^{10}, G^{11}, G^5, G^6, and G^{13} into service and that the directions of motion of the motors C and N will be the reverse of those just described. In other respects the operation of the system will be the same.

While I have shown the controller A as being of a specific type, it will be readily seen that it may assume any other form and dimensions than those here shown, and I desire it to be understood that the details of construction and arrangement may be further varied within wide limits without departing from the scope of my invention.

I claim as my invention—

1. The combination with a source of electrical energy, a motor, and a controlled member, of a controller for said motor having two sets of movable conducting-segments that are adapted to engage each other, a second controller operated simultaneously with the first, comprising a plurality of terminal pieces, conducting-segments adapted to engage a plurality of said terminal pieces, and another conducting-segment adapted to engage a single terminal piece, a third controller that comprises terminal pieces that are connected respectively to the aforesaid terminal pieces, and means operated by the said controlled member for making circuit connections to said terminals, and a motor for operating one set of the conducting-segments of the first controller.

2. The combination with a source of electrical energy, a motor, and a controlled member, of a controller comprising two sets of relatively movable conducting-segments that are adapted to engage each other, a second controller that is operated by the movement of one set of the movable conducting-segments of the first controller, comprising a plurality of contact-terminals, conducting-segments that may engage a plurality of said terminals, and a conducting-segment that may engage only one of said terminals at a time, a third controller comprising a plurality of contact-terminals that are respectively connected to the contact-terminals of the second controller, and means operated by the said controlled member for making circuit connections to said contact-terminals, and means for moving one set of conducting-segments of the first controller out of engagement with the other set when circuit connection is made with a contact-terminal of the third controller that corresponds to the contact-terminal of the second controller which is in engagement with the smallest conducting-segment thereof.

3. The combination with an electrical-supply circuit, a motor, and a governed member, of a controller comprising one or more manually-operative conducting-segments and one or more automatically-operative conducting-segments, a second controller that is moved by and in proportion to the extent of movement of the manually-operative conducting-segments, and a third controller that is operated by the governed member and in proportion to the extent of movement of the second controller.

4. The combination with an electrical-supply circuit, a motor, and a governed member, of a controller comprising one or more manually-operative conducting-segments and one or more automatically-operative conducting-segments, a second controller that is moved by and in proportion to the extent of movement of the manually-operative conducting-segments, a third controller that is operated by the governed member and in proportion to the extent of movement of the second controller, and means for causing operation of the automatically-operative conducting-segments when the third controller has been moved in proportion to the extent of movement of the second controller.

5. The combination with an electrical-supply circuit, a motor, and a governed member, of a controller comprising one or more manually-operative conducting-segments and one or more automatically-operative conducting-segments, a second controller that is moved by and in proportion to the extent of movement of the manually-operative conducting-segments, a third controller that is operated by the governed member and in proportion to the extent of movement of the second controller, means for causing operation of the automatically-operative conducting-segments when the third controller has been moved in

proportion to the extent of movement of the second controller, and means for causing similar operation of the automatically-operative conducting-segments when the manually-operative conducting-segments have been moved more than a predetermined amount.

6. The combination with an electrical-supply circuit, a motor and a governed member, of a controller comprising one or more manually-operative conducting-segments, one or more other conducting-segments adapted to engage therewith, a second motor for effecting movement thereof, a second controller that is moved by and in proportion to the extent of movement of the manually-operative conducting-segments, and a third controller that is operated by the governed member and in proportion to the extent of movement of the second controller.

7. The combination with an electrical-supply circuit, a motor and a governed member, of a controller comprising one or more manually-operative conducting-segments, one or more other conducting-segments adapted to engage therewith, a second motor for effecting movement thereof, a second controller that is moved by and in proportion to the extent of movement of the manually-operative conducting-segments, a third controller that is operated by the governed member and in proportion to the extent of movement of the second controller, and means for causing operation of the second motor and the corresponding conducting-segments when the third controller has been moved in proportion to the extent of movement of the second controller.

8. The combination with an electrical-supply circuit, a motor and a governed member, of a controller comprising one or more manually-operative conducting-segments, one or more other conducting-segments adapted to engage therewith, a second motor for effecting movement thereof, a second controller that is moved by and in proportion to the extent of movement of the manually-operative conducting-segments, a third controller that is operated by the governed member and in proportion to the extent of movement of the second controller, means for causing operation of the second motor and the corresponding conducting-segments when the third controller has been moved in proportion to the extent of movement of the second controller, and means for effecting similar operation of the said motor when the manually-operative conducting-segments have been moved more than a predetermined amount.

In testimony whereof I have hereunto subscribed my name this 28th day of January, 1905.

RALPH E. BATES.

Witnesses:
OTTO S. SCHAIRER,
BIRNEY HINES.