J. T. JANETTE.

MOTOR CONTROLLER.

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1,018,765. Patented Feb. 27, 1912.

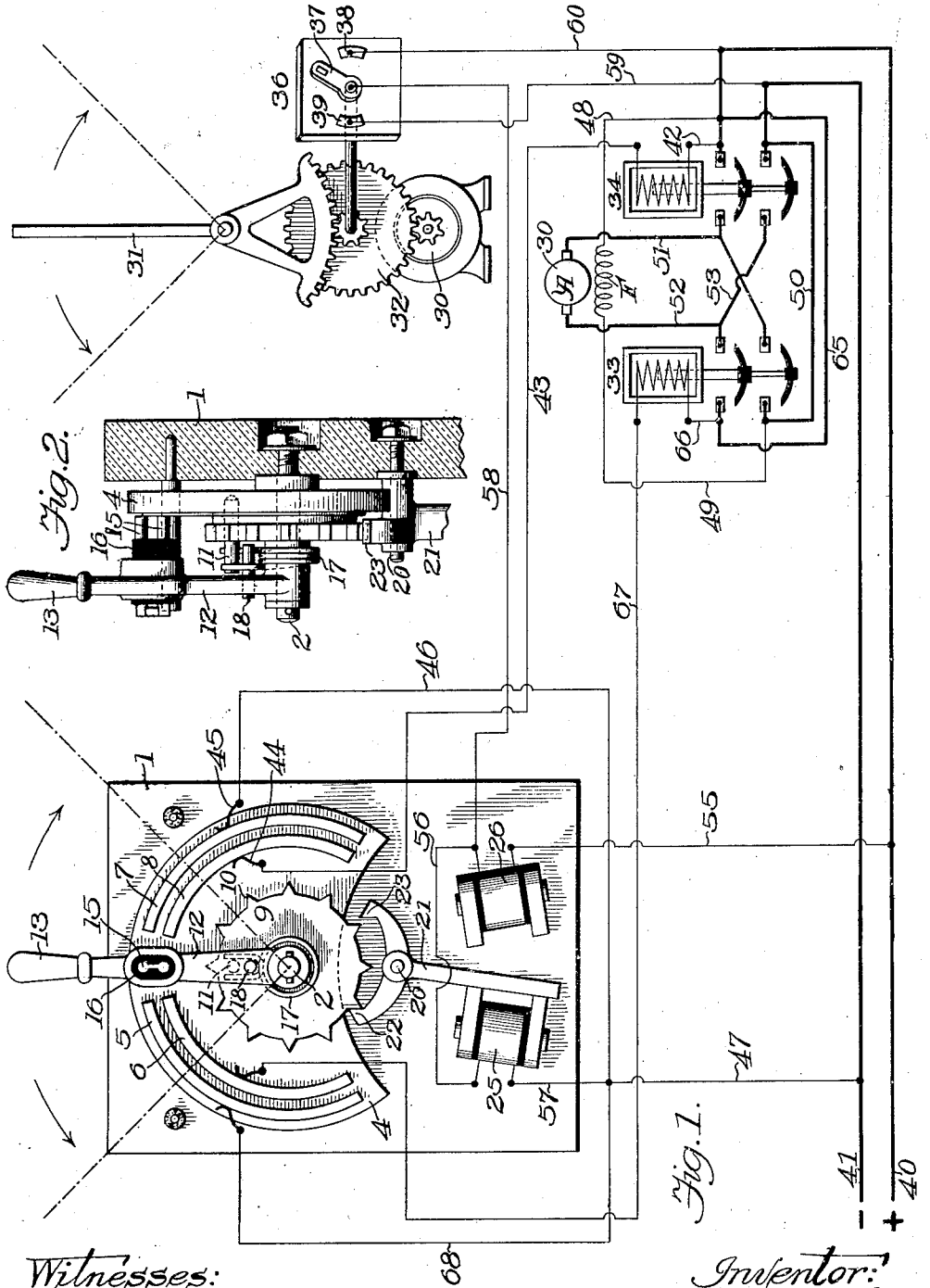

Fig. 2.

Fig. 1.

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MOTOR-CONTROLLER.

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To all whom it may concern:

Be it known that I, JOHN T. JANETTE, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Motor-Controllers, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to improvements in controllers for electric motors.

It is the object of my invention to provide a simple and efficient device which may be set to cause the motor to operate for any predetermined number of revolutions and then automatically bring the motor to rest. Such a device is particularly appropriate for controlling the steering apparatus of a ship. It should be understood, however, that my invention is not limited in its application, but, on the contrary, may be used in various different relations.

For the purpose of more fully disclosing the characteristic features of my invention, I shall describe the embodiment thereof illustrated in the accompanying drawing. It should, of course, be understood that my invention is not limited to the particular construction illustrated, but is susceptible of various modifications.

In the accompanying drawing, Figure 1 is a front elevation of the device. This figure also shows diagrammatically one circuit arrangement for the device. Fig. 2 is a side elevation of a portion of the device illustrated in Fig. 1, the supporting panel being shown in section.

The several parts of the device illustrated are mounted on a supporting panel 1 which, in practice, may be formed of any suitable insulating material. Secured to the panel 1 and projecting forwardly therefrom is a spindle or stud 2. Loosely mounted on the stud 2 is a substantially circular member 4, preferably formed of suitable insulating material. The insulating member 4 carries contact segments 5, 6, 7 and 8 secured thereto in any suitable manner. These segments are preferably curved substantially concentric with the member 4 and arranged in pairs. The lower portion of the member 4 is preferably cut away for the purpose hereinafter set forth. Also loosely mounted on the spindle 2 in front of the member 4 is a disk 9, provided, on its outer periphery, with ratchet teeth 10. For the purpose hereinafter set forth, I desire to have the ratchet disk 9 and the member 4 move in unison, and I, therefore, preferably secure the same together. As illustrated, the disk 9 and the member 4 are locked together by means of a pin 11 which passes through a portion of each. The pin 11 is arranged to project forwardly from the disk 9 for the purpose hereinafter set forth. The stud 2 also pivotally supports an arm 12, provided with a suitable operating handle 13. The arm 12 carries a contact brush 15 which is maintained out of contact therewith by means of an insulating bushing 16.

In practice, the contact brush 15 may be of any preferred type and connected to the arm 12 in any preferred manner. The arm 12 is adapted to be moved in either direction to cause the brush 15 to sweep over and electrically connect either pair of contact segments carried by the member 4. In practice, I desire to have the arm 12 normally maintained in such a position that the brush 15 will lie between and out of contact with the two pairs of contact segments carried by the member 4. For accomplishing this result, and for a further purpose to be hereinafter set forth, I arrange on the stud 2 or the hub of the arm 12 a coil spring 17, the ends of which are adapted to bear against opposite sides of the pin 11 carried by the disk 9 and a pin 18 carried by the arm 12. This arrangement of the spring 17 obviously tends to maintain the arm 12 and the member 4 in such a relation that the contacts thereof will be out of engagement. Further, the spring 17 will tend to cause the member 4 to follow in the same direction as the arm 12 whenever the latter is moved in either direction. Pivotally mounted on a stud 20, arranged directly beneath the stud 2, is a double arm pawl 21, carrying at the end of its arms lugs 22 and 23 adapted to be alternately thrown into engagement with the ratchet teeth of the disk 9 as the pawl is rocked upon its pivot. The pawl 21 is arranged to form the armature of electromagnets 25 and 26, which, when alternately energized and deënergized, will rock said pawl upon its pivot. In other words, the pawl and ratchet wheel form an escapement

mechanism for controlling the operation of the contact member 4. The purpose of cutting away the lower portion of the member 4 is to enable the stud 20 to be placed nearer to the stud 2, thereby permitting the use of a smaller ratchet disk than would otherwise be required.

I shall now describe the mechanical operation of the device. If the arm 12 be moved to the right from the position illustrated in Fig. 1, it will be seen that the contact brush 15 will be moved into engagement with the contact segments 7 and 8 carried by the member 4, and that the spring 17 will be so tensioned as to cause the ratchet disk 9 and the member 4 to turn about the spindle 2 in the same direction as the arm 12. Such movement of the ratchet disk and the member 4, however, is prevented by means of the pawl 21, the projection 22 of which is in engagement with one tooth of the ratchet disk 9. However, if the pawl 21 be rocked on its pivot, the ratchet disk 9 and the member 4 will be permitted to move step by step in the same direction as the arm 12. If the pawl 21 be rocked a sufficient number of times, the ratchet disk 9 and the member 4 will eventually move into such a position that the contact segments 7 and 8 will move out of engagement with the brush 15 of the arm 12. When the ratchet disk has moved to this point, the tension on the spring 17 will be relieved, thereby causing the member 4 and the arm 12 to remain in the same relative position as illustrated in Fig. 1. Movement of the arm 12 to the left from any position would cause the brush 15 to engage and bridge contact segments 5 and 6 and would so tension the spring 17 as to tend to revolve the ratchet disk and the member 4 in the opposite direction to that previously described and in the same direction as the arm 12. Thus by rocking the pawl as before set forth, the member 4 would be permitted to follow the arm 12 until the contact segments, carried thereby, disengaged the contact brush 15.

As illustrated in Fig. 1, the device described is adapted to control the operation of an electric motor 30 arranged to operate a ship rudder 31. In practice, the motor may be operatively connected to the rudder 31 in any preferred manner, but, for the purpose of illustration, I have shown the motor as connected to the rudder by suitable gearing 32. The motor 30 is diagrammatically illustrated as provided with an armature A and a shunt field winding F. It should, of course, be understood that the particular form of motor is immaterial to my invention. Also, for the purpose of illustration, I have shown a pair of switches 33 and 34 for controlling the continuity of the motor circuit and the direction of operation thereof, it, of course, being understood that any preferred means may be employed for this purpose. Each of the switches 33 and 34 is provided with a suitable operating winding, the circuits of which, as will be hereinafter explained, are controlled by the contact arm 12 and the contact member 4. For controlling the electromagnets 25 and 26 of the escapement mechanism, I have shown a commutator 36 which, in practice, may be of any preferred type. As illustrated, the commutator 36 merely comprises a revoluble switch member 37 adapted to alternately engage and disengage contacts 38 and 39. In practice, the switch member 37 may be operated directly from the motor or from the driven mechanism, but, in the present instance, it is operated by the gearing connecting the motor to the driven mechanism.

I shall now describe the operation of the system of control illustrated, at the same time setting forth the circuit connections therefor. With the switches 33 and 34 in the position illustrated, no current will flow to the motor from the main lines 40 and 41. To close the motor circuit, it is necessary to move the arm 12 to cause the brush 15, carried thereby, to engage one pair of the contact segments carried by the member 4. The direction in which the arm 12 is moved will determine which of the switches 33 or 34 will be operated, thus determining the direction of operation of the motor. For instance, if the arm 12 be moved to the right, the contact brush 15, carried thereby, will be moved into engagement with contact segments 7 and 8 of the member 4. This results in closing a circuit from main line 40 by conductor 42, through the operating winding of the switch 34, by conductor 43 and brush 44 to contact segment 8, thence through brush 15 to contact segment 7 and brush 45, by conductors 46 and 47 to the opposite side of the main line. This results in the energization of the switch 34 which thereupon closes, thereby closing the motor circuit. The field winding of the motor is permanently connected across the main lines and its circuit may be traced from main line 40 by conductor 48 through said winding, by conductors 49 and 50 to main line 41. Upon closure of the switch 34 the circuit of the motor armature may be traced from main line 40 through the upper contact of switch 34, by conductor 51, through the motor armature, by conductors 52 and 53, through the lower contact of the switch 34 and thence to the main line 41. The motor is thus set in operation, thereby setting in operation the gearing 32 which imparts movement to the rudder 31 and also to the switch 37 of the commutator 36.

The direction in which the rudder will move, of course, will depend upon the direction of operation of the motor. For the

purpose of illustration, we will assume that when the motor is operated in the directions set forth, the rudder will be moved to the right. This causes the commutator switch 37 to move to the left. The commutator, when operated, is arranged to alternately short-circuit the magnets 25 and 26 of the escapement mechanism, which magnets are permanently connected across the main lines. The circuit for said magnets may be traced from main line 40 by conductor 55, through the magnet 26, by conductor 56, through the magnet 25 and by conductors 57 and 47 to main line 41. With the pawl 21 in the position illustrated, when the arm 12 is moved to the right, said pawl will hold the contact member 4 stationary against the tension of the spring 17. However, as the commutator switch moves to the left, it first engages contact 39, thereby establishing a low resistance shunt around the magnet 25, which may be traced from one terminal of magnet 26 by conductor 58 through the commutator switch 37 and contact 39 by conductor 59 to main line 41. Thereupon the magnet 25 is deënergized, thus permitting the magnet 26 to attract the pawl 21 without opposition. This rocks the pawl upon its pivot, thereby disengaging the projection 22 from the teeth of the ratchet disk and throwing the projection 23 into the path thereof. This, however, permits the member 4 to move one step under the tension of the spring 17. Of course, as soon as the commutator switch leaves contact 39, the magnet 25 will again be energized, but will not have sufficient power to withdraw the pawl from the magnet 26 until said magnet 26 is short-circuited. Continued movement of the commutator switch 37 will cause the same to engage contact 38, thereby establishing a short-circuit around the magnet 26, which may be traced from main line 40 by conductor 60, through the commutator switch, by conductors 58 and 56, through the magnet 25 and conductors 57 and 47 to main line 41. This results in the deënergization of the magnet 26, whereupon the pawl will be again drawn into the position illustrated, by the magnet 25, thereby allowing the contact member 4 to be moved another step under the tension of the spring 17. This operation will be repeated until the contact member 4 moves a sufficient distance to cause the contact segments 7 and 8, carried thereby, to disengage the brush 15 carried by the arm 12. When this occurs, the circuit of the switch 34 will be opened, thereby causing said switch to open the motor circuit. This, of course, stops the motor, the rudder and the commutator switch.

From the foregoing it will be seen that by varying the speed ratio between the commutator switch 37 and the motor, I am enabled to insure any predetermined number of revolutions of the motor during one step of the contact member 4. For example, let it be assumed that the speed ratio between the motor and the commutator switch 37 is five to one. Hence, during one complete revolution of the commutator switch, the motor will make five revolutions. It has already been explained that during one revolution of the commutator switch, the contact member 4 of the controlling device moves two steps. Consequently, the motor would make two and one-half revolutions during each step of the contact member 4. Consequently, by varying the number of steps necessary for the contact member 4 to make before disengaging the contacts of the arm 12, I am enabled to cause the motor to operate for any predetermined number of revolutions and then automatically bring the same to rest. The number of steps in the operation of the member 4 necessary prior to stopping the motor may thus be regulated by means of the arm 12. For instance, if the arm 12, when moved to the right, is placed in the dot and dash position shown, then the motor would be maintained in operation until it had moved the rudder 31 to the right hand dot and dash position thereof. On the other hand, if the arm 12 be moved just half of this distance, the motor would be automatically stopped as soon as the rudder had reached a position midway between the position illustrated and the dot and dash position. It is therefore, obvious that by moving the arm 12 into different positions, I am enabled to bring the rudder into practically any desired position. Of course, in practice, I would provide means for maintaining the arm 12 in different positions so that the same could be released as soon as it had been set, but I have deemed it unnecessary to show such means in the drawing. Movement of the arm 12 in the opposite direction results in the energization of the switch 33. The circuit of this switch may be traced from main line 40 by conductors 65 and 66, through the winding of switch 33, by conductor 67 to contact segment 6, by brush 15 of the arm 12, to contact segment 5, and thence by conductors 68 and 47 to main line 40. This energizes the switch 33 which completes the motor circuit, but reverses the direction of flow of current through the motor armature. Thus the motor is started in the opposite direction to that previously set forth. The motor then operates the rudder and commutator in the opposite direction until the contact member 4 has been moved in the manner previously set forth to disengage the contact arm 12, whereupon the motor circuit is opened. The operation of the escapement mechanism during this operation of the motor is the same as previously set forth. It will now be apparent that the direction of operation of the arm 12 deter-

mines the direction of operation of the motor and rudder while the position in which said arm is set determines the range of operation of the motor and rudder.

I claim—

1. In a controlling device, in combination, two coöperating contact members, one being movable at will and the other tending to automatically operate upon operation of the former, and means restricting the operation of said automatic member to a step by step movement, the controlling part of said means being stationarily mounted.

2. In a controlling device in combination, two coöperating contact members, one being movable at will, means for moving the other member automatically, and automatic means restricting the operation of said automatically operated member to a step by step movement, said means including stationarily mounted actuating means.

3. In a controlling device in combination, two coöperating contact members, one being movable at will, means for automatically moving the other member, speed restricting means for said automatically operated member, and stationarily mounted electro responsive means controlling said speed restricting means.

4. In a controlling device, in combination, two coöperating contact members, one being movable at will and the other tending to automatically operate upon movement of the former, and a ratchet and pawl escapement device for restricting the operation of said automatic member.

5. In a controlling device, in combination, two coöperating contact members, one being movable at will and the other tending to automatically operate upon movement of the former, coöperating parts for restricting the operation of said automatic member to a step by step movement, and stationarily mounted electro responsive means for operating one of said coöperating parts.

6. In a controlling device, in combination, two coöperating contact members, one being movable at will, and the other tending to automatically operate upon operation of the former, and two coöperating parts one movable with said automatic member, and the other being mounted on a stationary support, the latter of said coöperating parts being movable to govern the speed of said automatic member.

7. In a controlling device, in combination, two coöperating contact members, one being movable at will and the other tending to operate automatically upon operation of the former, a movable controlling member mounted upon a stationary part of the device and adapted to coöperate with means movable with said automatic member to restrict operation of said automatic member to a step by step movement.

8. In a controlling device, in combination, two coöperating contact members, one being movable at will and the other tending to operate automatically upon operation of the former, a movable controlling member mounted upon a stationary part of the device and adapted to coöperate with means movable with said automatic member to restrict operation of said automatic member to a step by step movement, and electro responsive means for actuating said controlling member.

9. In a controller for electric motors, in combination, two coöperating contact members, one being movable at will and the other tending to operate automatically upon movement of the former, and means controlled by stationary electro responsive means for restricting the operation of said automatic member to cause the same to move in synchronism with the motor.

10. In a controller for electric motors, in combination, two coöperating contact members, one being movable at will and the other tending to automatically operate upon movement of the former, an escapement mechanism for restricting the operation of said automatic member to a step by step movement, and stationarily mounted and automatically controlled electro responsive means for controlling said escapement mechanism to insure movement of said automatic member in synchronism with the motor.

11. In a controller for electric motors, in combination, two coöperating contact members, one being movable at will and the other tending to automatically operate upon movement of the former, a ratchet and pawl mechanism for restricting the operation of said automatic member to a step by step movement, and automatic means operating said pawl to insure movement of said automatic member in synchronism with the motor.

12. In a controlling device, in combination, two coöperating contact members, one being movable at will in opposite directions and the other tending to automatically operate upon operation of the former and in a corresponding direction, and a ratchet and pawl device for restricting the operation of said automatic member to a step by step movement regardless of the direction in which it moves.

13. In a controlling device for electric motors, in combination, two coöperating contact members, one movable at will in opposite directions and the other tending to automatically operate upon movement of the former and in a corresponding direction, and an escapement mechanism for restricting the operation of said automatic member to a step by step movement in both directions, said escapement mechanism having stationarily mounted electro responsive

controlling means for insuring operation of said automatic member in synchronism with the motor.

14. In a controller for electric motors, in combination, a contact member movable at will, a coöperating contact member arranged to move automatically upon movement of said first mentioned member, an escapement wheel movable in unison with said automatically operated member, a pawl coöperating with said escapement wheel, and means for operating said pawl to retard said automatically operated member to cause the same to move in synchronism with the motor.

15. In a controller for electric motors, in combination, a contact member movable at will, a coöperating contact member arranged to move automatically upon movement of said first mentioned member, an escapement wheel movable in unison with said automatically operated member, a pawl coöperating with said escapement wheel to check the operation of said automatic member, electromagnets for operating said pawl to permit said automatic member to move in synchronism with the motor, and automatic means controlling said electromagnets.

16. In a controller for electric motors, in combination, two coöperating contact members, one of said members being movable at will and the other of said members being automatically movable, an escapement mechanism for retarding the operation of said automatic member, electromagnets for operating said escapement mechanism, both of said magnets being normally energized, and means movable in synchronism with the motor to alternately short circuit said magnets.

17. In a controller for electric motors, in combination, a switch member and a coöperating contact member revoluble about a common axis, two sets of contacts carried by said contact member, said switch member being movable at will in opposite directions to engage said sets of contacts, a spring tending to move said contact member in the same direction as said switch member to disengage its contacts from said switch member, an escapement wheel and pawl for retarding the operation of said contact member, electromagnets for operating said pawl, and means movable in synchronism with the motor for controlling said magnets.

In witness whereof, I have hereunto subscribed my name in the presence of two witnesses.

JOHN T. JANETTE.

Witnesses:
FRANK H. HUBBARD,
J. W. FITZGERALD.