F. T. TAYLOR.

CONTROLLER FOR ELECTRIC MOTORS.

APPLICATION FILED JULY 10, 1909.

990,464.

Patented Apr. 25, 1911.

2 SHEETS—SHEET 1.

Fig. 1.

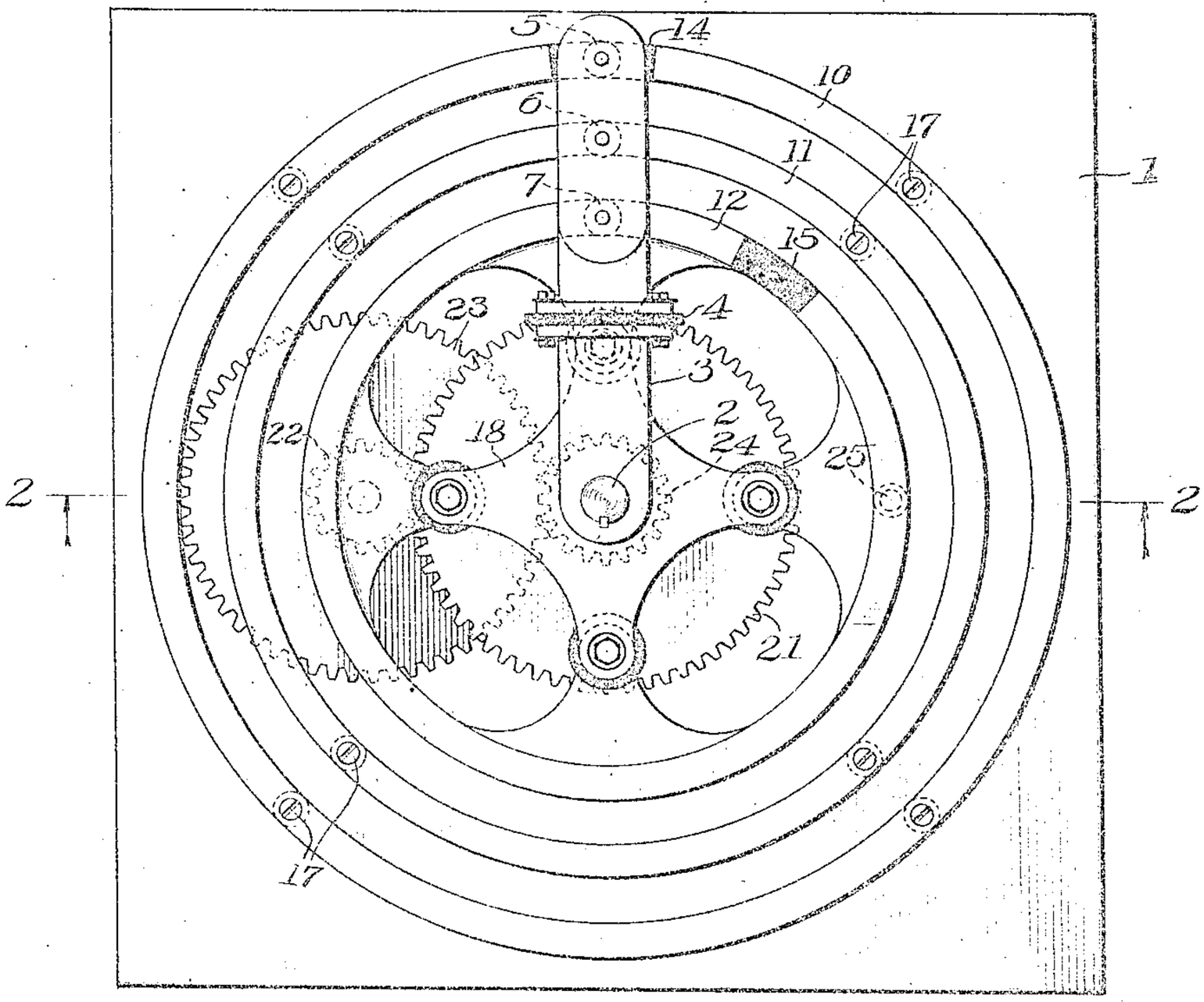
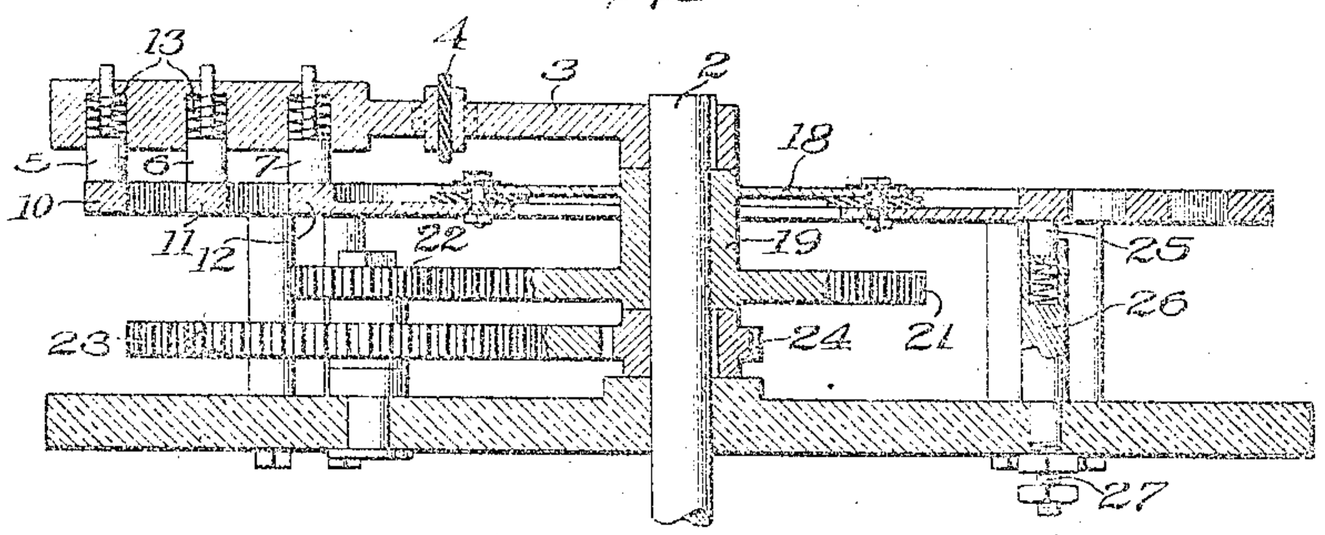


Fig. 2.



Witnesses:
Robt. N. Wilkie
George Hayes

Inventor:
Floyd T. Taylor
By: Edwin A. Stetson, Jr.
Attorney

F. T. TAYLOR.

CONTROLLER FOR ELECTRIC MOTORS.

APPLICATION FILED JULY 10, 1909.

990,464.

Patented Apr. 25, 1911.

2 SHEETS—SHEET 2.

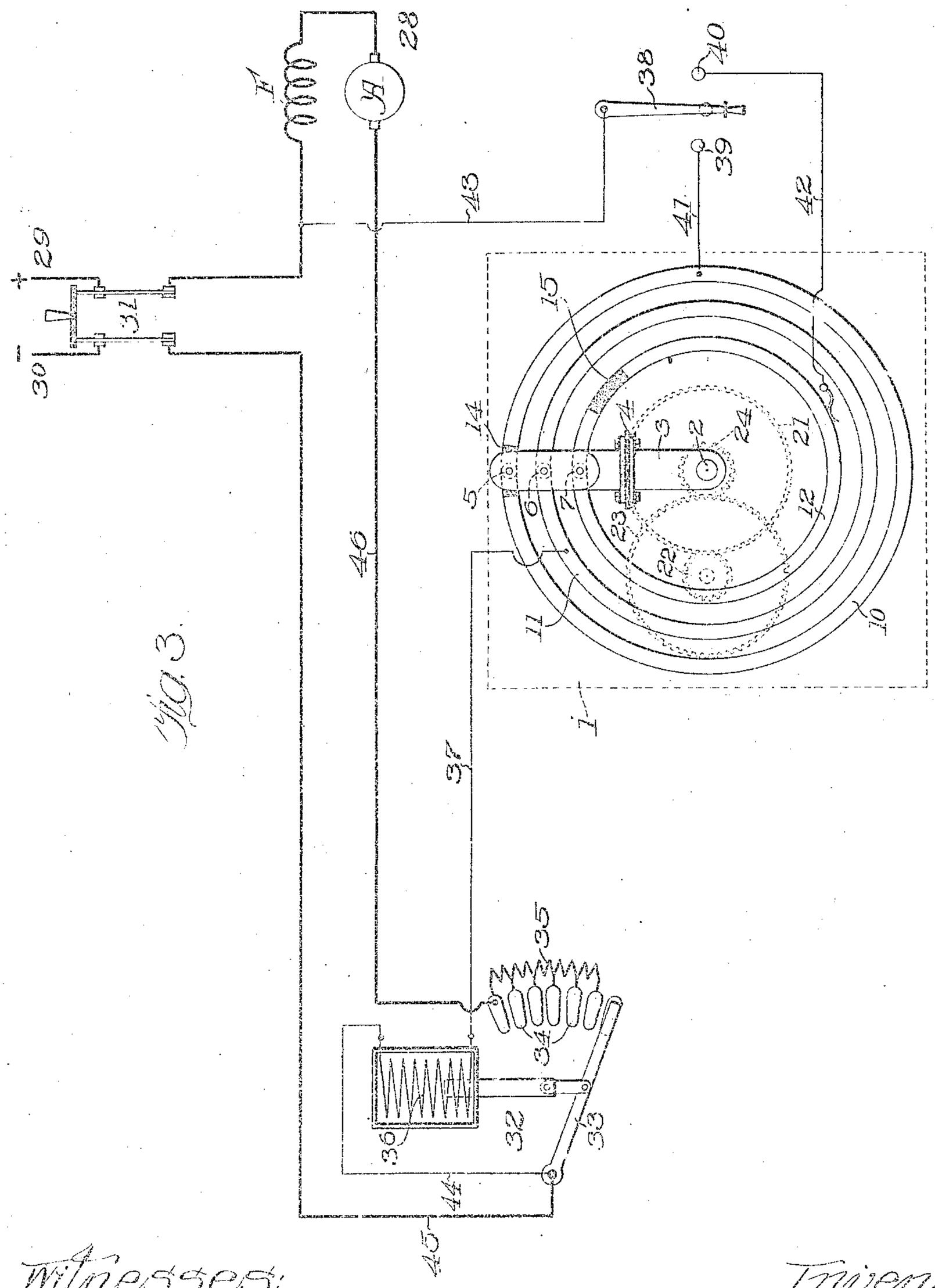


Fig. 3.

Witnesses:
Chester A. Snell
George Hayes

Inventor:
Floyd T. Taylor.
By: Edwin B. Stimpson Jr.
Attorney

UNITED STATES PATENT OFFICE.

FLOYD T. TAYLOR, OF NEW YORK, N. Y., ASSIGNOR TO THE CUTLER-HAMMER MFG. CO., OF MILWAUKEE, WISCONSIN, A CORPORATION OF WISCONSIN.

CONTROLLER FOR ELECTRIC MOTORS.

990,464. Specification of Letters Patent. **Patented Apr. 25, 1911.**

Application filed July 10, 1909. Serial No. 506,942.

To all whom it may concern:

Be it known that I, FLOYD T. TAYLOR, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented new and useful Improvements in Controllers for Electric Motors, 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 means necessitating the operation of an electric motor in stages and automatically varying the range of operation of the motor during successive stages.

My invention is particularly applicable to the control of furnace tops and other motor operated machinery where it is desired to operate the driven mechanism for different predetermined distances in a predetermined order and to insure the stopping of the driven mechanism each time it has been operated the desired distance.

Of course my invention is not limited to any particular application.

For the purpose of more fully disclosing my invention, I shall describe the device illustrated in the accompanying drawing.

Of course, my invention is not limited to the exact construction of the device illustrated as various changes may be made therein without departing from the scope of my invention.

In the accompanying drawing, Figure 1 is a front elevation of the device; Fig. 2 is a sectional view taken on line 2—2 Fig. 1 with the contact member of the device in a different position from that illustrated in Fig. 1; and Fig. 3 diagrammatically illustrates one circuit arrangement for the device.

The several parts of the device may be conveniently mounted upon a suitable insulating base 1. Revolubly mounted in the base 1 is a shaft or spindle 2 to which is keyed, or otherwise rigidly secured, a contact member 3. The member 3 is preferably formed in two parts, the parts being secured together with suitable insulating material 4 interposed between the same. The purpose of this arrangement is to insulate the outer end of the member 3 from the shaft 2. The member 3 in the present instance is provided with three contact brushes 5, 6 and 7, which, in practice, may be of any preferred type. As illustrated, each of these brushes comprises a cylindrical contact portion fitting into a cylindrical recess in the arm 3 and provided with a stem which passes through said arm and forms a guide. The brushes 5, 6 and 7 are arranged to engage contact rings 10, 11 and 12 respectively, and are preferably yieldingly held against said rings by means of suitable springs 13. The rings 10 and 12 are provided with insulated portions 14 and 15 respectively, while the ring 11 is continuous. The rings 10 and 11 are preferably stationary and secured to the insulating base 1 by any suitable means, such as screws 17. The ring 12, however, is arranged to revolve. This ring is secured to a suitable spider 18 having a hub 19 loosely fitting onto the shaft 2. It is essential that the ring 15 be insulated from the shaft 2, and I have, therefore, shown the ring 12 insulated from the arms of the spider at the points of connection therewith. In practice, I prefer to drive the ring 12 from the shaft 2, but at a reduced speed. Of course, various means might be employed in practice for accomplishing this result. As illustrated, the hub 19 of the spider 18 has formed thereon a gear wheel 21, which meshes with a pinion 22. The pinion 22 is arranged to revolve with a gear wheel 23, arranged to mesh with a pinion 24 keyed, or otherwise rigidly connected to the shaft 2.

As illustrated, the gearing just described is so proportioned that the ring 12 will be driven at a considerably slower speed than the shaft 2 and the contact member 3, which is keyed to said shaft. Of course, in practice, the gearing may be modified to give any preferred speed ratio of the contact member 3 and the ring 12. In practice, the ring 12 may be operated in a reverse direction from the contact member, but, as illustrated, it is arranged to operate in the same direction as said member. The ring 12 may be connected in circuit in any preferred manner. As illustrated, I have shown a brush 25 adapted to engage the rear face of said ring, said brush being yieldingly mounted in a suitable supporting member 26, having a binding post 27. In practice, the shaft 2

may be operatively connected to the motor which it is desired to control, or, it may be connected to a moving part of the driven mechanism.

I shall now describe the circuit arrangement shown in Fig. 3. In this arrangement, I have shown the device above described as applied to the control of a motor 28 having an armature A and a series field winding F. Of course, my invention is applicable to other types of motors than the plain series motor illustrated. The motor 28 is supplied with current from main lines 29 and 30 through a double pole switch 31. For controlling the continuity of the motor circuit, I have shown an electromagnetically operated device 32, comprising a pivoted member 33 tending to normally stand in a position to open the motor circuit and adapted to be moved over a series of contacts 34 to first close the motor circuit and then gradually remove a starting resistance 35 from the motor circuit. Of course, in practice, any preferred means may be employed for controlling the motor circuit. The device 32 is provided with a suitable operating winding 36, one terminal of which is connected directly to one of the main lines, while its opposite terminal is connected by a conductor 37 to the ring 11 of the controlling device. For initially controlling the operating winding 36, I have provided a suitable switch 38, which, in practice, may be of any preferred type. As illustrated, the switch 38 comprises a manually operated member adapted to be moved from a central position into engagement with contact button 39 or contact button 40. Contact button 39 is connected by conductor 41 to ring 10 of the controlling device, while contact button 40 is connected by conductor 42 to the revoluble ring 12.

I shall now describe the operation of the controller, assuming the member 3 of the controlling device to be in the position illustrated, in which position the contact brush 5, carried thereby, engages the insulated portion 14 of ring 10. In this position of the member 3, in order to energize the device 32 to start the motor, it is necessary to move the controlling switch 38 into engagement with contact button 40. This closes a circuit from main line 29 by conductor 43 through the controlling switch 38 by conductor 42 to ring 12, and through said ring to brush 7, thence through the member 3 to brush 6 and ring 11, and thence by conductor 37 through the operating winding 36 and by conductors 44 and 45 to main line 30. The winding 36 thereupon responds, raising the arm 33 of the starting device. As soon as the arm 33 engages the first of the contacts 34, circuit is closed from main line 29 through the series field winding F and armature A of the motor by conductor 46, through the starting resistance 35, and the arm 33 by conductor 45 to the negative side of the line. This, of course, starts the motor with all of the resistance in circuit. The device 32, however, operates automatically to gradually remove the starting resistance 35 from circuit, thus bringing the motor up to normal speed. Assuming, now, that the shaft 2 of the controlling device is connected either to the motor or to the driven mechanism, it will be seen that as soon as the motor is started, the member 3 and the contact ring 12 will be set in operation. When once started in the manner set forth, the motor will continue to operate until the brush 7 of the controlling member 3 passes onto the insulated portion 15 of the contact ring 12, thereby deënergizing the starting device. The contact ring 12, however, is arranged to operate in the same direction as the member 3, and it is, therefore, necessary for the member 3 to operate a considerable distance before overtaking and engaging the insulated portion 15. The length of time consumed in this operation depends entirely upon the speed ratio of the member 3 and the ring 12. For the purpose of illustration, we will assume that the member 3 will not overtake the insulated portion of the ring 12 until said member has moved 120 degrees. Consequently, if the member 3 is arranged to operate at the same relative speed as the driven mechanism, the driven mechanism will operate 120 degrees before the motor is brought to rest. When the member 3 has reached the insulated portion of the ring 12, thereby opening the circuit of the operating winding of the starting device 32, the brush 5 thereof will be in engagement with contact ring 10. The motor may then be again started by moving the controlling switch 38 into engagement with contact button 39. This closes a circuit through the switch 38 by conductor 41 to contact ring 10, and brush 5 through the member 3 to brush 6 and ring 11, and thence through the operating winding 36 of the starting device in the manner already set forth. The device 32 will thereupon respond again starting the motor and bringing the same up to speed. This, of course, sets the member 3 and the ring 12 again in operation. The motor circuit will then be maintained closed until the member 3 again moves into engagement with the insulated portion 14 of the ring 10. This, however, will require 240 degrees rotation of the member 3, thereby causing the driven mechanism to be operated 240 degrees before the motor is again stopped.

While the arm 3 is returning to initial position, the ring 12 is moved farther away from the insulated portion of ring 10 and, consequently, when the motor is again started by throwing the controlling switch into

engagement with the contact button 40, the member 3 will have to rotate probably more than 360 degrees in order to overtake the insulated portion of the ring 12 to again stop the motor.

From the foregoing it will readily be seen that the range of operation of the motor during successive stages may thus be automatically varied almost indefinitely. Of course, in time the cycle of operation would be repeated, but numerous variations in the range of operation of the motor would necessarily be obtained. As before stated, the speed ratio of the member 3 and the ring 12 may be adjusted to give practically any desired variations in the range of operation of the motor during successive stages. It will also be understood that the speed ratio of the member 3 and the motor or driven mechanism may be adjusted as desired. Further, either or both of the contact rings might be provided with more insulated portions and the number of contact rings varied if desired.

I claim:

1. In a controller for electric motors, in combination, a contact member and a contact arranged to be engaged and disengaged thereby, said member, upon disengaging said contact, being adapted to stop the motor, and said member and said contact being movable automatically at relatively different speeds to vary the range of operation of the motor during successive operating periods thereof.

2. In a controller for electric motors, in combination, electroresponsive means for controlling the motor circuit, and an automatically operated switch having a contact member and a contact therefor, said member, upon disengaging said contact, being adapted to cause the deënergization of said means to stop the motor, and said member and said contact being movable at relatively different speeds for varying the range of operation of the motor during successive operating periods thereof.

3. In a controller for electric motors, in combination, a contact member, and a plurality of contacts arranged to be engaged thereby, said member being adapted to alternately disengage said contacts to stop the motor, and said member and one of said contacts being arranged to be automatically operated at relatively different speeds to vary the range of operation of the motor during successive operating periods thereof.

4. In a controller for electric motors, in combination, means for starting the motor, and an automatically operated switch having a contact member and a plurality of contacts arranged to be engaged thereby, said member being adapted to alternately disengage said contacts to stop the motor, and to always remain in engagement with one of said contacts to enable said means to be operated to cause the motor to operate in stages, said member and one of said contacts being movable at relatively different speeds to vary the range of operation of the motor during successive stages of operation thereof.

5. In a controller for electric motors, in combination, a contact member and a plurality of contacts arranged to be engaged thereby, said member and one of said contacts being arranged to be automatically operated at relatively different speeds, said contact member being arranged to alternately disengage said contacts to stop the motor, said movable contact being adapted to necessitate said contact member being moved varying distances to stop the motor, thereby varying the range of operation of the motor during successive operating periods.

6. In a controller for electric motors, in combination, electroresponsive means for controlling the motor circuit, and an automatically operated switch having a contact member and a plurality of contacts arranged to be engaged thereby, said contact member being arranged to alternately disengage said contacts to deënergize said means to stop the motor, thereby necessitating operation of the motor in stages, said movable contact being adapted to necessitate said member being moved varying distances to stop the motor, thereby varying the range of operation of the motor during successive stages.

7. In a controller for electric motors, in combination, electroresponsive means for controlling the motor circuit, an automatically operated switch having a contact member and a plurality of contacts arranged to be engaged thereby, said contact member being arranged to alternately disengage said contacts to deënergize said means to stop the motor, thereby necessitating operation of the motor in stages, said movable contact being adapted to necessitate said member being moved varying distances to stop the motor, thereby varying the range of operation of the motor during successive stages, and means for causing the energization of said first mentioned means when said member is in engagement with either of said contacts.

8. In a controller for electric motors, in combination, electroresponsive means for controlling the motor circuit, said means having a plurality of energizing circuits, a movable contact member common to said circuits, contacts arranged to be engaged by said member to include the same in either of said circuits, said contact member being movable to alternately disengage said contacts to alternately open said control circuits to cause said means to stop the motor, and one of said contacts being movable at a relatively different speed from said member to necessitate said member being moved varying distances to open said circuits,

thereby varying the range of operation of the motor during successive operating periods thereof.

9. In a controller for electric motors, in combination, electroresponsive means for controlling the motor circuit, said means having parallel energizing circuits, a single controlling switch arranged to close either of said energizing circuits, an automatically operated switch member common to said parallel circuits, and contacts arranged to be engaged by said switch member to include the same in either circuit, said member being always in engagement with one of said contacts and arranged to alternately disengage said contacts to alternately open said circuits to cause said means to stop the motor, one of said contacts being automatically movable at a relatively different speed from said member to necessitate said member being moved varying distances prior to stopping the motor, thereby varying the range of operation of the motor during successive operating periods.

10. In an electric switch, in combination, a contact member and a contact therefor, said member and said contact being arranged to be moved at relatively different speeds, said contact member moving longitudinally of said contact.

11. In an electric switch, in combination, a contact member and a plurality of contacts arranged to be engaged thereby, said contact member and one of said contacts being movable at relatively different speeds, another of said contacts remaining stationary.

12. In an electric switch, in combination, a contact member, and a plurality of contacts arranged to be engaged thereby, said contact member being movable to alternately disengage said contacts, and one of said contacts being movable at a relatively different speed from said contact member to necessitate said member being moved varying distances prior to disengaging said contacts.

13. In an electric switch, in combination, a movable contact member, a plurality of contacts arranged to be engaged thereby to connect said member in different circuits, said member being arranged to alternately disengage said contacts to alternately interrupt said circuits, and one of said contacts being arranged to move at a relatively different speed from said member to necessitate said member being moved varying distances prior to disengaging said contacts.

14. In an electric switch, in combination, a pivoted contact member, and a pair of curved contact strips arranged to be engaged thereby, said member being movable to alternately disengage said contact strips, and one of said contact strips being movable at a relatively different speed from said member to necessitate said member being moved varying distances in order to disengage said strips.

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

FLOYD T. TAYLOR.

Witnesses:
LAURA E. SMITH,
M. GOLDSTEIN.