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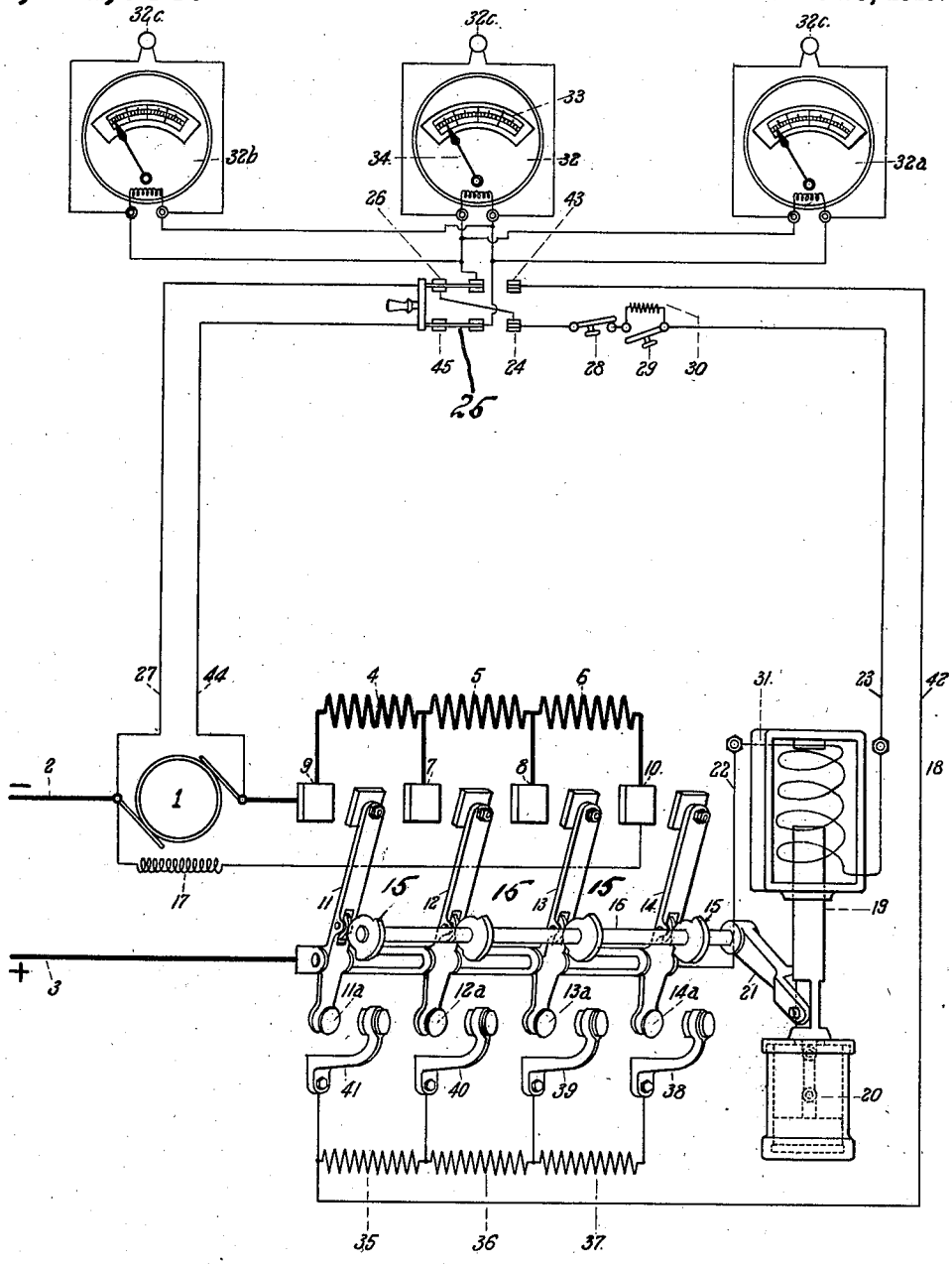
F. W. SMITH.

MOTOR CONTROLLER AND INDICATOR.

APPLICATION FILED OCT. 24, 1913.

1,144,388.

Patented June 29, 1915.



WITNESSES

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MOTOR CONTROLLER AND INDICATOR.

1,144,388. Specification of Letters Patent. Patented June 29, 1915.

Application filed October 24, 1913. Serial No. 797,014.

To all whom it may concern:

Be it known that I, FRANK W. SMITH, a citizen of the United States, and resident of the town of Westfield, county of Union, and State of New Jersey, have invented certain new and useful Improvements in Motor Controllers and Indicators, of which the following is a specification.

It is one of the objects of this invention to provide an apparatus by means of which a motor may be controlled from a distant point and in which the resistance in the motor circuit may be varied step by step, a suitable indicating means being provided by means of which it may be readily determined on which resistance step the motor is operating.

Another important object of the invention is to provide means whereby the speed of the motor when operating on any one of the resistance steps, or when operating without resistance in the motor circuit, may be determined.

Another object of the invention is to provide an indicator having a series of resistance steps or units in its circuit, means being provided to progressively vary said resistance steps or units to thereby vary the indication.

Another object of the invention is to provide means whereby a resistance unit in the motor circuit and a corresponding resistance unit in the indicator circuit will be simultaneously cut out, or cut in, whereby the indication will vary in accordance with the variation of resistance in the motor circuit.

Another object of the invention is to provide means whereby a resistance unit in the motor circuit and a corresponding resistance unit in the indicator circuit will be simultaneously cut out or cut in whereby the indication will vary in accordance with the variation of resistance in the motor circuit, combined with means whereby the counter-electromotive force may be utilized to give a speed indication.

There are other important objects and advantages of the invention which will appear hereinafter.

In the drawing, the figure is a diagrammatic view of the apparatus applied to a motor.

Referring to the various parts by numerals, 1 designates a motor to which current is supplied through the main wires 2 and 3. In circuit with the motor armature is a series of resistance units 4, 5 and 6 between which are arranged contacts 7 and 8; contacts 9 and 10 being placed at the ends of said series of resistance units. A series of contact levers 11, 12, 13 and 14 are electrically connected to the electrical supply wire 3, said levers carrying contacts which are adapted to engage the contacts 7, 8, 9 and 10 of the armature circuit to thereby complete the motor circuit. Suitable means, such as a series of cams 15 mounted on shaft 16, are provided for successively operating the contact levers to close the motor circuit. The cams 15 are so disposed on their shaft that lever 14 will be the first one operated so that the motor circuit will be completed through the contact 10 and through the entire resistance. Upon the further movement of the shaft 16 the contact lever 13 will be moved to complete the motor circuit through contact 8, thereby cutting one resistance unit 6 out of the motor circuit. A further rotation of the shaft 16 will complete the motor circuit through the lever 12 and contact 7, thereby cutting out resistance unit 5; and a still further rotation of the cam shaft 16 will operate lever 11 and complete the motor circuit through the contact 9, thereby cutting out all of the resistance in the motor circuit and supplying the full strength of current to the motor. The motor field 17 is connected to contact 10.

Any suitable means for rotating the cam shaft 16, or for otherwise operating the contact levers may be provided. As shown in the drawing this means consists of a solenoid 18 provided with a core 19 operating at its lower end in a dash pot 20, said dash pot serving to retard the movement of the core in both directions. Connected to the core of the solenoid is a crank arm 21, said arm being secured to the cam shaft 16 so that as the solenoid core reciprocates the cam shaft will be rocked. The solenoid circuit is completed through the wires 22 and 23 to contact 24 of switch 25, and thence to contact 26 of said switch and through wire 27. In the solenoid circuit is arranged

a normally closed circuit breaking device 28 and a normally open circuit breaking device 29, this latter device being arranged to short-circuit a resistance 30. The solenoid is provided with a suitable magnetic shell 31 for a purpose which will hereinafter appear.

When the solenoid circuit is closed through the device 29 resistance 30 is short-circuited and the solenoid coil is energized to lift the core 19. As said core is lifted the cams 15 are rotated and the contact carried by the lever 14 is first thrown into engagement with the contact block 10, thereby completing the motor circuit. If it be desired to hold the motor in the first speed with the entire resistance in the armature circuit the circuit breaker 29 is released, thereby placing the resistance 30 in the solenoid circuit. This resistance is sufficient to neutralize the pull on the solenoid core so that said core will be held stationary in its coil, the magnetism of the magnetic shell assisting in holding said core in the desired position. When it is desired to cut out another resistance unit from the motor circuit the resistance in the solenoid circuit is again cut out by means of the device 29. This will cause a further movement of the solenoid core and a further rotation of the shaft 16, said further rotation causing the operation of the second lever 13 to bring its contact into engagement with the contact 8, thereby cutting out the first resistance unit. If the circuit breaker 29 be now again returned to its normal open position the solenoid core will again be held against movement in its coil. This operation may be repeated throughout the entire series of contact levers and resistance units until the motor is operating at its high speed and all resistance removed from the motor circuit. It will, of course, be understood that any suitable form of means may be provided for bringing about this gradual reduction of resistance in the motor circuit and I do not wish to be limited in this respect to the apparatus shown and described as that apparatus is merely used by way of illustration. The normally closed device 28 is operated to open the solenoid circuit whenever it is desired to drop the solenoid core and thereby progressively insert resistance in the motor circuit. It is manifest that by closing the motor circuit through the device 28 the solenoid core may be held at any position desired, and that, therefore, the resistance units may be inserted in the motor circuit in a step-by-step manner, and in the reverse order in which they were cut out.

In order to indicate at any desired point the step on which the motor is operating so that the operator may know the number of resistance units in the motor circuit and the number of said units that have been short-circuited I provide an indicator 32 having a dial 33 and an index finger 34. In circuit with this indicator is a series of resistance units 35, 36, 37, each of said units being provided with a contact arm as at 38, 39 and 40, an additional contact arm 41 being provided in order to cut all of the said resistance units out of the indicator circuit. The contact levers 11, 12, 13 and 14 are provided with supplemental contacts 11^a, 12^a, 13^a and 14^a which are adapted to engage the contacts 38, 39, 40 and 41, and at the same time that the contact blocks 7 to 10 inclusive are engaged by the contacts on the other ends of said levers. The dial 33 is divided into four portions or divisions, each of said divisions corresponding to the steps in the motor circuit and to the number of changes in resistance in the indicator circuit. When the motor circuit is completed by means of the lever 14 the indicator circuit is closed by the contacts 14^a and 38, through the resistances 35, 36 and 37. The current passing through said resistance and through the indicator circuit will be only sufficient to move the index hand to the first division on the dial 33. When the motor circuit is completed through the lever 13 contacts 13^a and 39 are brought together, thereby cutting out the resistance unit 37. This will increase the current flowing through the indicator and will move the index or pointer to the second division on the dial 33, thereby showing to the observer that the second set of resistance has been dropped from the motor circuit. This operation may be repeated throughout the entire series of resistance units so that the indicator will show at all times on what step of resistance the motor is operating.

The indicator circuit is completed through the wire 42 to the post 43 of the switch 25. By placing the switch arms in engagement with the posts 24 and 43 the indicator will be in circuit with the resistance units 35, 36 and 37 and will then indicate the resistance step on which the motor is operating and also the number of resistance units in the indicator circuit.

It is manifest that by means of the circuit opening device 28 the resistance units may be progressively inserted in the motor circuit and the corresponding resistance units progressively inserted in the indicator circuit, the indicator showing at all times the number of resistance units in the indicator circuit and the resistance step on which the motor is operating.

It is manifest that an indicator having a series of resistance units in its circuit combined with means for progressively cutting out said resistance units from said circuit or progressively inserting them therein may be used for a great many purposes, and I desire it understood that I do not wish to be

specifically limited to the use of this device for the purpose of indicating the resistance step on which a motor is operating.

It is frequently desired to know the speed of a motor operating at a distance and under varying loads and with more or less resistance in the motor circuit. It is particularly desirable at times to know the speed of a motor operating upon certain resistance steps or units. In order to accomplish this the indicator 32 is connected by means of wires 27 and 44 with the main circuit wires on each side of the motor armature. When it is desired to test the speed of the motor the switch 25 is thrown into engagement with contacts 45 and 26 so that the counter electromotive force generated by the motor will give a speed indication on the indicator 32. It is manifest, therefore, that in order to learn the speed of the motor on any resistance step or with any certain number of resistance units in circuit with the motor it is simply necessary to throw the switch 25 to the contacts 26 and 45. The index finger will then be moved over the dial under the influence of the counter electromotive force and said dial will be so marked that the number of revolutions per minute will be indicated by the index finger.

It is obvious that a plurality of indicators may be arranged in parallel, as shown in the drawing, in order to secure the various indications at a plurality of points separated a suitable distance from each other. The various indicators may be located as desired so that precisely the same indication will be given at a number of separated points. The indicators 32^a and 32^b will be precisely like the indicator 32 in construction and will give precisely the same indication and said indicators 32^a and 32^b may be placed on different floors of a building, or in different buildings if desired. It is also manifest that if desired electric lamps may be used in connection with each indicator, said lamps being connected either in parallel or in series, as desired, with the indicators. As shown in the drawing the lamps 32^c are connected in parallel with the indicators. The object of this is to show by means of the light that the indicator is operating, that is to say that the current is passing to the indicator. The advantage of the light as a means for showing that the indicator is operating will be obvious.

What I claim is:

1. A motor, a series of resistance units in the motor circuit, an electrically operated indicator, a series of resistance units in the indicator circuit equal in number to the resistance units in the motor circuit, and means for changing the resistance units in the motor circuit and in the indicator circuit.

2. A motor, a series of resistance units in the motor circuit, an electrically operated indicator, a single circuit for said indicator, means for varying the resistance units in the motor circuit and a means operated through the motor-circuit-controlling means to indicate on what resistance step the motor is operating.

3. A motor, a series of resistance units in the motor circuit, a plurality of indicators in a single electric circuit, means for varying the resistance units in the motor circuit and means operated through the motor-circuit-controlling means to simultaneously operate all of the indicators to show on what resistance step the motor is operating.

4. A motor, a series of resistance units in the motor circuit, an electrically operated indicator, means for cutting the resistance units from the motor circuit, means operated through the motor-circuit-controlling means to indicate on what resistance step the motor is operating and means for connecting the motor to the indicator whereby the counter electromotive force will operate said indicator, and a suitable dial or index with speed indications marked thereon.

5. A motor, a series of resistance units in the motor circuit, an electrically operated indicator, a series of resistance units in the indicator circuit equal in number to the resistance units in the motor circuit and means for cutting the resistance step by step from the motor circuit, said means simultaneously cutting out the corresponding resistance units from the indicator circuit.

6. A motor, a series of resistance units in the motor circuit, an electrically operated indicator, a series of resistance units in the indicator circuit equal in number to the resistance units in the motor circuit, means for cutting the resistance step by step from the motor circuit, said means simultaneously cutting out the corresponding resistance units from the indicator circuit, and means for connecting the motor to the indicator whereby the counter-electro-motive force will operate said indicator and indicate the speed of the motor on any resistance step.

7. A motor, a series of resistance units in the motor circuit, an electrically operated indicator, a series of resistance units in the indicator circuit equal in number to the resistance units in the motor circuit, means for cutting the resistance step by step from the motor circuit, said means simultaneously cutting out the corresponding resistance units from the indicator circuit, means for connecting the motor to the indicator whereby the counter-electro-motive force will operate said indicator and indicate the speed of the motor on any resistance step, and means for showing that the indicator is operating.

8. A motor, a series of resistance units in the motor circuit, an electrically operated indicator, a series of resistance units in the indicator circuit, means for cutting the re-

sistance step by step from the motor circuit, said means simultaneously cutting out resistance units from the indicator circuit, means for connecting the motor to the indicator whereby the counter-electro-motive force will operate said indicator and indicate the speed of the motor on any resistance step, and means for showing that an electric current is passing through the indicator.

9. A motor, a series of resistance units in the motor circuit, a series of electrically operated indicators, a series of resistance units in the indicator circuit equal in number to the resistance units in the motor circuit, means for cutting the resistance step by step from the motor circuit, said means simultaneously cutting out the corresponding resistance from the indicator circuit, means for connecting the motor to the indicators whereby the counter-electro-motive force will operate said indicators to indicate the speed of the motor on any resistance step, and a lamp connected to each of the indicators to indicate when current is passing through the indicators.

10. A motor, a series of resistance units in the motor circuit, an electrically operated indicator, a series of resistance units in the indicator circuit equal in number to the resistance units in the motor circuit and means for correspondingly varying the number of resistance units in the motor circuit and in the indicator circuit.

11. A motor, a series of resistance units in the motor circuit, a motor-circuit-controlling means for varying the number of resistance units in the motor circuit, means operated through the motor-circuit-controlling means to indicate on what resistance step or unit the motor is operating, and means for connecting the motor to the indicator, whereby the counter-electro-motive force will operate said indicator and give a speed indication.

12. A motor, a series of resistance units in the motor circuit, a motor-circuit-controlling means for varying the number of resistance units in the motor circuit, means operated through the motor-circuit-controlling means to indicate on what resistance step or unit the motor is operating, means for connecting the motor to the indicator, whereby the counter-electro-motive force will operate said indicator and give a speed indication, and electrically operated means for showing that current is passing through the indicator.

13. A motor, a series of resistance units in the motor circuit, an electrically operated indicator, a series of resistance units in the indicator circuit and means for cutting the resistance step by step from the motor circuit, said means simultaneously cutting out the corresponding resistance units from the indicator circuit.

14. A motor, a motor controlling means, an electrically operated indicator, a circuit therefor, means operated by the motor controlling means for completing the indicator circuit to show the resistance in the motor circuit, and means for connecting the motor to the indicator, whereby the electromotive force will operate said indicator and thereby give a motor speed indication.

15. A motor, an indicator, means whereby said indicator will be operated to show the resistance in the motor circuit, and means whereby said indicator may be connected to the motor to give a speed indication for any resistance in the motor circuit.

16. A motor, resistance in the motor circuit, an electrically operated indicator, resistance in the indicator circuit, and means for simultaneously changing the resistance in the motor circuit and in the indicator circuit, whereby the indicator will show the amount of resistance in the motor circuit.

17. A motor, resistance in the motor circuit, an electrically operated indicator, resistance in the indicator circuit, means for simultaneuosly changing the resistance in the motor circuit and in the indicator circuit, whereby the indicator will show the amount of resistance in the motor circuit, and means for connecting the motor to the indicator to give a motor speed indication for any resistance in the motor circuit.

18. A motor, resistance in the motor circuit, means for varying said resistance step by step, variable means for indicating what step of resistance the motor is operating on, and means for indicating by means of the counter electromotive force the speed of the motor for any resistance in the motor circuit.

19. A motor, resistance in the motor circuit, means for varying said resistance step by step, and variable means independent of the resistance in the motor circuit for indicating the step of resistance the motor is operating on.

20. A motor, resistance in the motor circuit, means for varying the said resistance step by step, and means independent of the resistance in the motor circuit for indicating the resistance step on which the motor is operating.

21. A motor, resistance in the motor circuit, means for varying the said resistance step by step, and means independent of the resistance in the motor circuit for automatically indicating on what resistance step the motor is operating.

22. A motor, resistance in the motor circuit, means for varying the said resistance step by step, means independent of the resistance in the motor circuit for indicating on what resistance step the motor is operating, and means for indicating the speed of the motor on any resistance step.

23. A motor, resistance in the motor cir-

cuit, means for varying the said resistance step by step, means independent of the resistance in the motor circuit for indicating on what resistance step the motor is operating, and means for indicating the speed of the motor on any resistance step by voltage developed by the motor.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

FRANK W. SMITH.

Witnesses:
LILLIAN MCGUIRE,
F. R. MILLER.