A. J. HORTON.

MOTOR CONTROLLER.

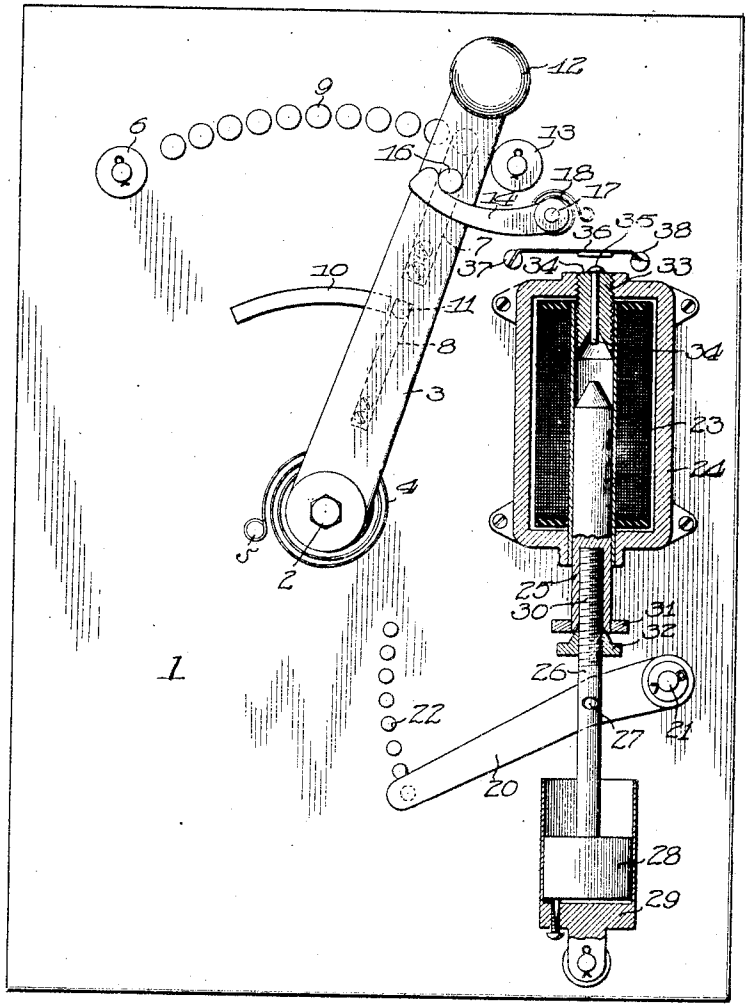
APPLICATION FILED JULY 6, 1908.

1,108,907.

Patented Sept. 1, 1914.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses:

Robert N. Weir

Frank H. Hubbard

Inventor:

Albert J. Horton

By: Edwin B. Hopkins

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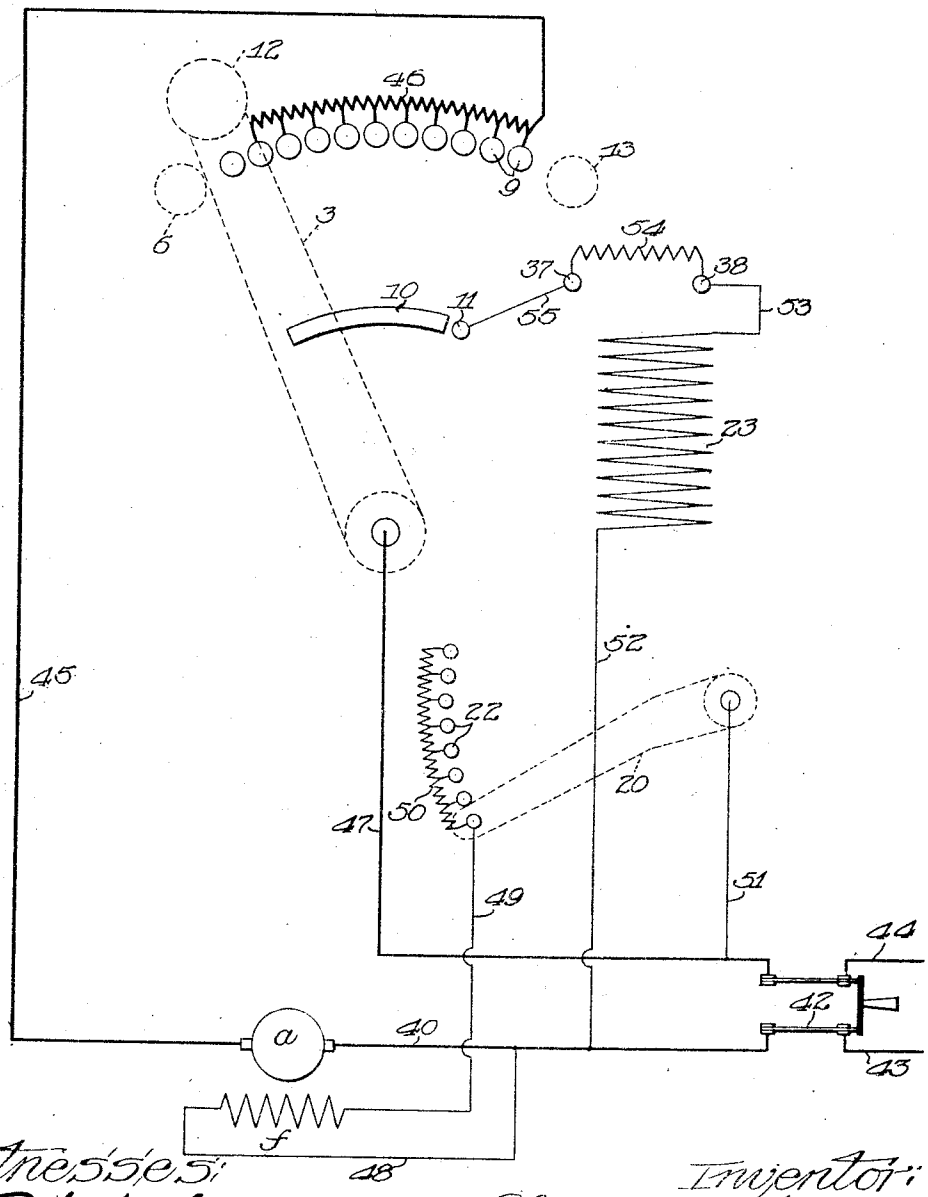
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2 SHEETS—SHEET 2.

Fig. 2.



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UNITED STATES PATENT OFFICE.

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MOTOR-CONTROLLER.

1,108,907. Specification of Letters Patent. Patented Sept. 1, 1914.

Application filed July 6, 1908. Serial No. 442,173.

To all whom it may concern:

Be it known that I, ALBERT J. HORTON, a citizen of the United States, residing at White Plains, in the county of Westchester and State of New York, 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 speed controllers and has for its object to provide an automatically operated controller which is capable of being adjusted to bring the motor up to any predetermined maximum speed.

My present invention relates to one of the several modifications or embodiments of which the generic invention set forth in my prior application filed May 4, 1908, Serial No. 430,829, is susceptible.

According to the preferred form of my present invention, I provide an adjustable connection between the movable element of the controlling device and the plunger of the operating winding.

For the purpose of more fully disclosing my invention I have shown, in the accompanying drawings, the preferred form thereof embodied in a combined starting and speed controlling device. It should be understood that various modifications may be made in the form of device illustrated, and that the same may be used in other relations.

The views in the drawings are as follows:

Figure 1 is a front elevation of the device, parts of a speed controller being shown in section. Fig. 2 diagrammatically illustrates one circuit arrangement for the device.

The various parts of the controller are preferably mounted on a supporting panel 1. An arm 3, fulcrumed on a pin 2, protruding from the panel, is provided with brushes 7 and 8. The brush 7 is adapted to be moved over a series of contacts 9, while the brush 8 is adapted to engage either contact segment 10 or contact 11, according to the position of the arm. A coil spring 4, connected at one end to the arm 3 and at its other end to a pin 5, carried by the panel 1, tends to move said arm to the left against a stop 6. The arm 3 is provided with an operating handle 12. A stop 13 is provided to limit the movement of the arm 3 to the right. A hook 14 is adapted to engage a pin 16, carried by the arm 3, to maintain said arm in its final position. The hook 14 is fulcrumed on a pin 17, carried by the panel 1, and is provided with a coil spring 18 which tends to move the same upwardly. The upward movement of the hook 14 is limited by the stop 13. The hook 14 is so formed that as the arm 3 reaches its final position the pin 16 will ride over the end thereof to automatically lock said arm. As will be hereinafter explained, the arm 3 is adapted to be operated to control a starting resistance.

I shall now describe the speed controller which embodies my invention in one form: This device comprises a switch or arm 20, fulcrumed on a pin 21, and adapted to sweep over a series of contacts 22. The arm 20 is provided with an operating solenoid 23, mounted in a frame 24 secured to the panel 1. The solenoid 23 is provided with a plunger 25 which carries a tail rod 26. The arm 20 carries a pin 27 which fits in a transverse slot in the tail rod 26. The lower end of the tail rod is connected to the piston 28 of a dash-pot 29. The dash-pot may be of any desired type. The lower end of the plunger 25 is preferably made hollow and internally screw-threaded to receive the screw-threaded portion 30 of the tail rod 26. At its lower end the plunger 25 is provided with a knurled collar 31 by means of which it may be turned on the tail rod to raise or lower the same in the winding 23. The purpose of this adjustment will be hereinafter explained. For preventing the plunger 25 from turning on the tail rod after adjustment, I provide a lock nut 32. The solenoid 23 is provided with a stationary core or plug 33 which is preferably screwed into the frame 24. The lower end of the plug 33 is recessed to receive the conical end of the plunger 25. Extending through the plug 33 and projecting into the recess in the end thereof, is a pin 34 provided with a head 35 which bears upon the end of the plug. Mounted directly above the solenoid in the path of the pin 34 is a switch 36. The switch 36 preferably comprises a strip of spring metal secured at one end to a pin 37 carried by the panel 1, and adapted at its other end to engage a contact 38. With this arrangement it will be seen that the plug 33 forms a stop for the plunger 25 and that as the plunger 25 reaches the limit of its upward movement it will raise the pin 34

and cause the same to open the switch 36. As shown in the drawing, the plunger 25 is adjusted to its lowermost position on the tail rod 26 and therefore the upper end of said plunger is at the greatest distance from the plug 33 allowed by the adjustment. With this adjustment the full upward movement of the plug 25 will raise the arm 20 into engagement with the uppermost of the series of contacts 22. As will be hereinafter explained, the contacts 22 are connected to a field regulating resistance, so that as the arm 20 moves upwardly it will gradually insert the resistance in circuit with the shunt field winding of the motor, thereby gradually increasing the speed of the motor.

I shall now describe the circuit arrangement for this device: One terminal of the motor armature *a* is connected by conductor 40, through switch 42, to main line 43. The other terminal of the armature is connected by conductor 45 to the last of the series of contacts 9. All except the first of the series of contacts are connected to an armature resistance 46. The arm 3 is connected by conductor 47 through the switch 42 to main line 44. One terminal of the shunt field winding *f* of the motor is connected by conductor 48 to conductor 40, while the other terminal of said winding is connected by conductor 49 to the lowermost of the series of contacts 22. The contacts 22 are connected to a field resistance 50. The arm 20 is connected by conductor 51 to conductor 47. One terminal of the solenoid 23 is connected by conductor 52 to conductor 40, while the other terminal thereof is connected by conductor 53 to contact 38. Contact 38 is connected by a resistance 54 to pin 37, which is connected by conductor 55 to contact 11. The first of the series of contacts 9 and the contact segment 10 are both dead.

I shall now describe the operation of the device: Assuming that the main line switch 42 is closed and the arm 3 is in its "off" position, as shown in dotted lines, Fig. 2, the armature circuit will be open while the field circuit is closed. The field circuit may be traced from main line 44, through switch 42 by conductors 47 and 51, through the arm 20 to the first of the series of contacts 22, thence by conductor 49 through the field winding *f*, by conductor 48 to conductor 40, thence through the switch 42 to main line 43. It will thus be seen that the shunt field winding is of full strength. If now arm 3 be moved onto the second of the series of contacts 9, circuit will be closed through the motor armature. This circuit may be traced from main line 44, through switch 42, by conductor 47, through the arm 3, through the resistance 46 by conductor 45, through the motor armature, and thence by conductor 40 through the switch 42 to the main line 43. The motor is thus started with all of the starting resistance in circuit. If now the arm 3 be moved to the right it will gradually remove the resistance 46 from circuit and when moved to its extreme right-hand position will bring the motor up to normal speed. When the arm 3 reaches its final position the hook 14 will engage the pin 16 and lock said arm. Inasmuch as the spring 4 tends to move the arm 3 to its "off" position it will be seen that said arm must be moved to its final position before being released, as otherwise the same would return to the starting position and open the armature circuit. When the arm 3 reaches its final position the brush 8 is moved onto contact 11, which results in the closure of the circuit of solenoid winding 23. This circuit may be traced, as already described, to arm 3, thence to contact 11, by conductor 55, across switch 36 to contact 38, by conductor 53, through the solenoid and by conductors 52 and 40 to the main line 43. The solenoid will then respond and raise its plunger 25. The upward movement of the plunger 25 causes the arm 20 to move over the contacts 22 and inserts the resistance 22 in circuit with the shunt field winding *f*. This causes the motor speed to gradually increase until the plunger 25 is stopped by the stationary plug 33. As already set forth, the parts are shown to be so adjusted that when the winding 23 is energized, the arm 20 will be moved over all of the contacts 22, and, therefore, when the plunger 25 is stopped by the plug 33 the motor will be caused to operate at the maximum speed provided by the field resistance. When the plunger 25 reaches its final position, it raises the pin 34 which in turn opens the switch 36, thereby inserting the resistance 54 in circuit with the solenoid winding. The insertion of the resistance 54 prevents the solenoid winding from becoming overheated.

The purpose of the adjustment between the plunger 25 and the tail rod 26 will now be apparent, for, if the plunger is raised on the tail rod the same will be raised in the winding 23, thereby decreasing the distance between the end of the plunger and the stationary plug 33. If the distance between the plunger and the plug is decreased it is obvious that the range of movement of the plunger is decreased, and, therefore, the range of movement of the arm 20 is decreased. Suppose, for instance, the plunger 25 to be so adjusted on the tail rod that the distance between the end of the plunger and the plug is just half the distance shown in the drawing, then, when the magnet 23 is energized, the plunger would be permitted to travel only half of the distance, and, consequently, the arm 20 would only move over half of the contacts 22. Thus the maximum speed at which the motor would be caused

scribed. It will thus be seen that this adjustment provides means whereby the controller may be set to automatically bring the motor up to any predetermined maximum speed.

While I have shown the arm 20 as controlling a field resistance, it is obvious that the same may control an armature resistance, or both a field resistance and an armature resistance.

Having thus described my invention what I claim as new and desire to secure by Letters Patent, is:

1. In a speed controller for electric motors, in combination, a controlling element, an automatically operated member for actuating said controlling element and an adjustable connection between said member and said element for varying the range of movement of said element to cause the motor to operate at different predetermined speeds.

2. In a speed controller for electric motors, in combination, a controlling element, an electromagnetically operated member for actuating said element and an adjustable connection between said member and said element for varying the range of movement of said element to cause the motor to operate at different predetermined speeds.

3. In a speed controller for electric motors, in combination, a controlling element, an electromagnetic winding, a movable plunger within said winding and connected to said element, and a stationary plug within said winding for limiting the movement of said plunger, said plunger being adjustable relative to said plug for varying the range of movement of said controlling element to cause the motor to operate at different predetermined speeds.

4. In a speed controller for electric motors, in combination, a controlling element, an electromagnetic winding, a plunger mounted within said winding, a stationary plug within said winding for limiting the movement of said plunger and an adjustable connection between said plunger and said controlling element whereby said plunger may be adjusted to vary the range of movement of said controlling element to cause the motor to operate at different predetermined speeds.

5. In a speed controller for electric motors, in combination, a controlling element, movable over a series of contacts, an electromagnetic winding, a plunger within said winding, the end of said plunger being hollow and internally screw-threaded, a tail rod connected to said controlling element and having a screw-threaded portion fitting within the internally screw-threaded portion of said plunger, and a lock-nut for preventing movement of said plunger relative to said tail rod, the screw threaded connection affording means whereby said element may be brought to rest in engagement with different contacts upon the energization of said winding.

6. In a speed controller for electric motors, in combination, a controlling element, an electromagnetic winding, a plunger mounted within said winding and connected to said element, a stationary plug within said winding for limiting the movement of said plunger, said plunger being adjustable relative to said plug for varying the range of movement of said controlling element, and means for reducing the flow of current through said winding when said element has reached the limit of its movement.

7. In a speed controller for electric motors, in combination, a controlling element, an electromagnetic winding, a plunger mounted within said winding and connected to said element, a stationary plug within said winding for limiting the movement of said plunger, said plunger being adjustable relative to said plug for varying the range of movement of said controlling element, a resistance connected in circuit with said winding, a switch tending to short-circuit said resistance, and a pin movably mounted within said plug, and adapted to be actuated by said plunger, upon reaching its final position, to open said switch.

8. In a speed controller for electric motors, in combination, a controlling element, an electromagnetic winding, a plunger within said winding, the end of said plunger being hollow and internally screw-threaded, a tail rod connected to said controlling element and having a screw-threaded portion fitting within the internally screw-threaded portion of said plunger, a lock-nut for preventing movement of said plunger relative to said tail rod, and means for reducing the flow of current through said winding when said controlling element has reached the limit of its movement.

9. In an automatic speed controller for electric motors, in combination, a speed controlling member, a solenoid for operating the same and means for varying the limit of movement of said member and insuring the sealing of the plunger of said solenoid with the stationary core of the solenoid without adjusting the core.

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

ALBERT J. HORTON.

Witnesses:
WILLIAM L. CULLY,
CHARLES B. BAKER.