No. 771,958. PATENTED OCT. 11, 1904.

M. M. WOOD & H. GEISENHÖNER.

CONTROLLER.

APPLICATION FILED APR. 4, 1904.

NO MODEL.

Fig. 1.

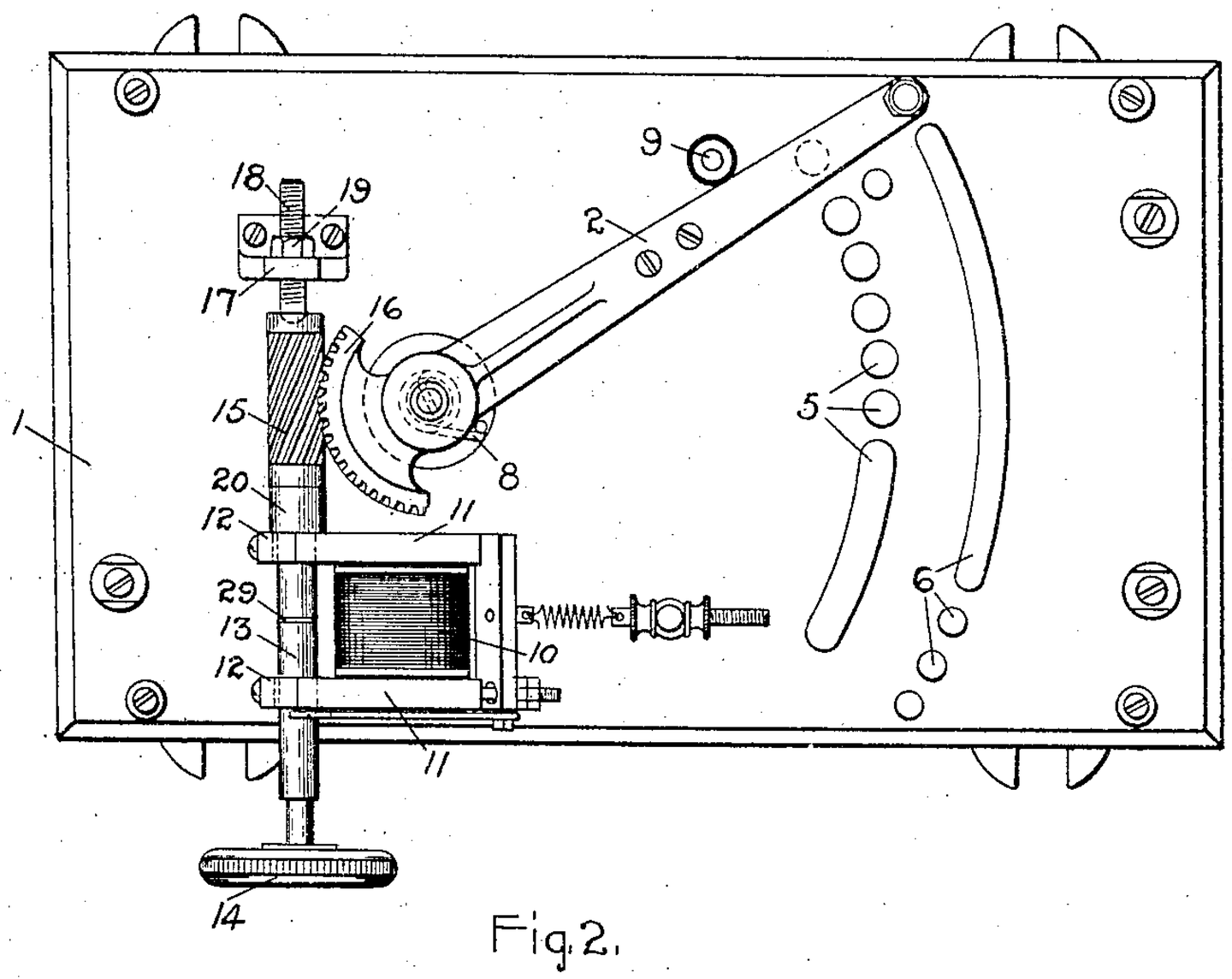
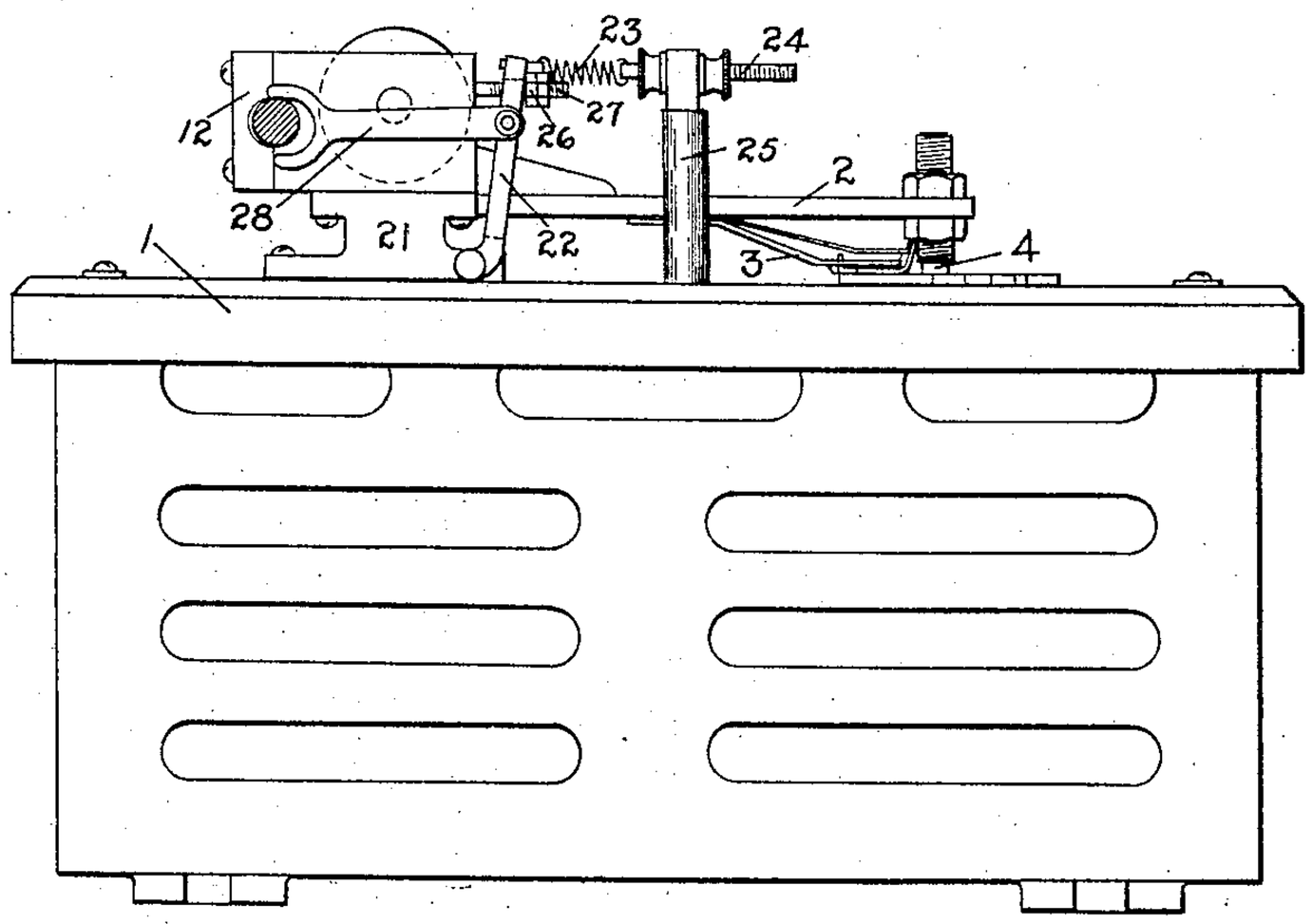


Fig. 2.



WITNESSES:

Robt. C. Chapman,

Helen A. Ford

INVENTORS

Montraville M. Wood:

Henry Geisenhöner,

by Albert G. Davis Att'y.

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No. 771,958. Patented October 11, 1904.

UNITED STATES PATENT OFFICE.

MONTRAVILLE M. WOOD AND HENRY GEISENHÖNER, OF SCHENECTADY, NEW YORK, ASSIGNORS TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

CONTROLLER.

SPECIFICATION forming part of Letters Patent No. 771,958, dated October 11, 1904.

Application filed April 4, 1904. Serial No. 201,508. (No model.)

To all whom it may concern:

Be it known that we, MONTRAVILLE M. WOOD and HENRY GEISENHÖNER, citizens of the United States, residing at Schenectady, in the county of Schenectady and State of New York, have invented certain new and useful Improvements in Controllers, of which the following is a specification.

This invention relates to controllers for electric motors, and particularly to that class of controllers known as "speed-regulating" rheostats by which resistance is cut into and out of the circuit of either or both the field and armature of an electric motor to vary its speed.

It has been common heretofore to provide rheostats with a switch-arm which is normally biased toward an off position and an electromagnetic device for holding the switch-arm in the position of maximum travel while the circuit conditions are normal and to release the arm when the circuit is overloaded or when the voltage of the circuit falls off or dies out. When a rheostat is used to regulate the speed of an electric motor, the switch-arm is often left for considerable periods at intermediate points in its range of movement. It is therefore highly desirable that the devices for holding the switch-arm during normal operation and releasing it when the circuit is overloaded or when the voltage across the lines decreases should be operative when the arm is in any of its positions of adjustment. We have therefore provided a regulating-rheostat having a pivoted switch-arm normally held in an off position by a spring and an electromagnetic device for retaining the arm against the tension of the spring in any position to which it is adjusted and to release it when the current flowing in the circuit rises abnormally or when for any reason the voltage falls off to a dangerous extent. We accomplish this with a single electromagnet which by drawing a rotatable shaft geared to the switch-arm up into jaws or bearings formed in its pole-pieces locks the switch-arm against movement, and we provide the electromagnet with a normally retracted armature which when attracted closes a path of low reluctance for the magnetic flux and shunts the flux away from its normal path, thereby releasing the shaft which holds the switch-arm and allowing the latter to be returned to the off position.

The features of novelty which we believe to be characteristic of our invention will be definitely indicated in the claims appended hereto.

The details of construction and the mode of operation of our improved speed-regulating rheostat will be better understood by reference to the following description, taken in connection with the accompanying drawings, which show the preferred embodiment of our invention, and in which—

Figure 1 is a top plan view of the rheostat, and Fig. 2 a side elevation of the same.

Referring to the drawings, 1 indicates a base, of soapstone or other insulating material, on which is pivotally mounted a switch-arm 2, carrying suitable spring-pressed contacts 3 and 4.

Mounted on the base 1 are two rows of contact studs and segments 5 and 6, with which the contacts 3 and 4 coöperate to cut resistance into or out of the circuits of the motor field and armature, respectively, as the switch-arm is moved over them. The studs and segments 5 and 6 are connected to resistance contained within a box to which the base 1 is secured, the sides of which are perforated, as shown, to better radiate the heat. A spring 8 is coiled about the post on which the switch-arm 2 is pivotally mounted and has one end secured in an opening in the post and the other braced against a member secured to the switch-arm, so that when the arm is released the spring returns it to the open-circuit position or position in which the maximum resistance is cut into the armature-circuit, in which position it abuts against a stud 9, mounted on the base 1.

Mounted on suitable supports 21 of non-magnetic material secured on base 1 is an electromagnet 10, having pole-pieces 11 11,

which are extended on one side of the magnet and have secured to their ends the non-magnetic pieces 12 12. In the pole-pieces 11 11 and the non-magnetic pieces 12 12 are jaws or openings forming bearings for a shaft 13, which is of iron or other magnetic material. These openings are elliptical, as shown in Fig. 2, so as to permit a slight lateral movement of the shaft 13 therein. Shaft 13 extends through these openings and on one end carries a hand-wheel 14 and on the other a worm 15, meshing with the segmental gear 16, carried by the switch-arm 2 on the opposite side of its pivot, and preferably formed integral therewith.

Mounted on base 1 is a standard 17, having a threaded opening therein in which is a screw 18, the end of which is rounded off and extends into a hemispherical depression in the end of shaft 13. Screw 18 is adjustable in the standard 17 and when in the desired position can be locked by a nut 19. On the other side of the gear 15 on shaft 13 is a brass collar 20, which abuts against the pole-pieces 11 and, with the pivot 18, prevents longitudinal movement of shaft 13, but permits a slight lateral movement thereof in the openings in pole-pieces 11 11.

Pivotally mounted on the supports 21 of the electromagnet 10 is an armature 22, normally held retracted by a coiled spring 23, one end of which is attached to the armature and the other end to the adjustable screw 24, carried by post 25, mounted on the base 1. The movement of the armature 22 is limited by the nuts 26, adjustable on a threaded rod 27, secured to one of the pole-pieces 11 and extending through an opening in the armature 22. Pivotally connected to the armature is a lever 28, of brass or other non-magnetic material, the end of which is bifurcated to form two arms, which extend on either side of the shaft 13, as shown in Fig. 2. Lever 28 is of such length that when the armature 22 is drawn up against the pole-pieces 11 the lever forces shaft 13 out of frictional engagement with the sides of the openings in the pole-pieces. Armature 22 when attracted closes a path for the magnetic flux in addition to the path through the shaft 13, and a thin section 29, of copper or other non-magnetic material, is inserted in shaft 13 between the pole-pieces, so as to make this path for the flux of greater reluctance than the path through armature 22 when the latter is attracted.

The coils of the magnet 10 may be connected in any suitable relation to respond to predetermined underload and overload conditions in the work-circuit. When it is desired to start the motor, the arm 2 is moved over the contacts 5 and 6, either by a handle thereon or by the hand-wheel 14, through the gears 15 and 16. In moving thus over the contacts resistance is cut out of the armature-circuit and into the field-circuit until the motor is brought up to the desired speed. When the motor-circuits are closed, current passes through the coils of the electromagnet 10, and the magnet being energized draws the shaft 13 toward it in its bearings in the pole-pieces, so that whenever the operator releases hand-wheel 14 shaft 13 will be prevented from turning by being held in firm frictional engagement with the sides of the openings in the pole-pieces. If the voltage falls or if the circuit is opened, the hold of the magnet on the shaft weakens, and when it is overcome by the tension of the spring 8 acting through the gears 15 and 16 the spring moves the switch-arm to the off position. In case the circuit is overloaded the current in the coils of magnet 10 is increased, and the magnetization is increased in direct proportion thereto until armature 22 is drawn up against the tension of spring 23, thus closing a path for the magnetic flux which is of less reluctance than the path through the pole-pieces 11 and the shaft 13 on account of the section 29, of non-magnetic material, which forms part of the latter path. The flux is therefore shunted from the shaft 13, and in addition to this the rod 27 pushes the shaft 13 laterally in its bearings away from magnet 10 just as armature 22 is drawn into contact with pole-pieces 11, so that shaft 13 is out of frictional engagement with the pole-pieces, and the spring 8 again moves the armature to the off position.

We do not wish to be understood as limited in any way to the construction illustrated and described herein, as many modifications can be made therein without departing from the spirit of our invention, and all such modifications we aim to cover in the claims appended hereto.

What we claim as new, and desire to secure by Letters Patent of the United States, is—

1. A controller for electric motors comprising a variable resistance, a switch-arm biased toward an off position coöperating therewith, and a single electromagnet having a single winding and arranged to hold the arm in any position to which it is moved when the circuit conditions are normal and to release the arm in case of either an overload or underload.

2. A controller for electric motors comprising a switch-arm movable to cut resistance into and out of the motor-circuit, means for moving the arm in one direction, an electromagnetic holding device for holding the arm in any position to which it is moved, and means actuated when the circuit conditions are abnormal for short-circuiting the flux of said electromagnetic holding device.

3. A controller for electric motors comprising contacts connected to resistances, a switch-arm coöperating therewith, a spring for mov-

ing the arm in one direction, an electromagnetic device for locking the arm in any position to which it is moved when the circuit conditions are normal, and means for short-circuiting the flux of the electromagnetic device when the circuit is overloaded.

4. A controller for electric motors comprising a variable resistance, a switch-arm biased toward an off position coöperating therewith, an electromagnet, means coöperating therewith for holding the arm in any position to which it is moved, and a normally retracted armature for said magnet attracted when an abnormal current is flowing in the circuit and arranged to free the arm.

5. A controller for electric motors comprising contacts connected to resistances, a switch-arm biased toward an off position coöperating therewith, an electromagnet, means cooperating therewith for holding the arm in any position to which it is moved, and a normally retracted armature for said magnet attracted when an abnormal current is flowing in the circuit and arranged to shunt the flux of the magnet from said holding means.

6. A controller for electric motors comprising a switch-arm movable to cut resistance into and out of the motor-circuit, a magnet, and a rotatable member governing the switch-arm, said member forming part of the magnetic circuit.

7. A controller for electric motors comprising a switch-arm movable to cut resistance into or out of the motor-circuit, a magnet, pole-pieces therefor having jaws formed therein, and a member rotatable in said jaws by the movement of said switch-arm.

8. A controller for electric motors comprising contacts connected to resistances, a switch-arm coöperating therewith, means for moving the arm in one direction, a magnet, pole-pieces therefor, and a member mounted in coöperative relation to the pole-pieces and rotated by the movement of the switch-arm.

9. A controller for electric motors comprising contacts connected to resistances, a switch-arm coöperating therewith, a spring for moving the arm in one direction, a magnet, pole-pieces therefor, a member mounted in proximity to the pole-pieces and arranged to be drawn into engagement therewith, and gearing between the switch-arm and said member by which movement of the former rotates the latter.

10. A controller for electric motors comprising a pivoted switch-arm, contacts connected to resistances coöperating therewith, means for moving the arm in one direction, a magnet, a rotatable member forming part of its magnetic circuit, a worm-gear on said member, and a gear meshing therewith carried by the switch-arm.

11. A controller for electric motors comprising a pivoted switch-arm, contacts connected to resistances coöperating therewith, a shaft geared to the switch-arm, and an electromagnetic device for locking said shaft against movement.

12. A controller for electric motors comprising a pivoted switch-arm, contacts connected to resistances coöperating therewith, a shaft geared to the switch-arm, an electromagnetic device for locking said shaft against movement, and means for short-circuiting the flux of said electromagnetic device.

13. A controller for electric motors comprising a pivoted switch-arm, contacts connected to resistances coöperating therewith, a shaft geared to the switch-arm, an electromagnet for locking said shaft against movement, and a normally retracted armature therefor arranged to short-circuit the flux of said electromagnet when attracted.

14. A controller for electric motors comprising a switch-arm movable to cut resistance into and out of the motor-circuit, a magnet, pole-pieces therefor having jaws therein, a member rotatable in said jaws by the movement of said switch-arm, and means for reducing the magnetic flux through its pole-pieces.

15. A controller for electric motors comprising a switch-arm movable to cut resistance into and out of the motor-circuit, a magnet, pole-pieces therefor having jaws formed therein, a member rotatable in said jaws by the movement of the switch-arm, an armature for the magnet, and means whereby the armature when attracted moves said member in said jaws.

16. A controller for electric motors comprising a switch-arm movable to cut resistance into and out of the motor-circuit, a magnet, pole-pieces therefor having jaws formed therein, a member rotatable in said jaws by the movement of said switch-arm, and means for moving said member in said jaws when the motor-circuit is overloaded.

17. A controller for electric motors comprising a switch-arm movable to cut resistance into and out of the motor-circuit, means for moving the arm in one direction, a magnet, pole-pieces therefor, a member mounted in proximity to the pole-pieces and arranged to be drawn into engagement therewith, means for rotating said member when the switch-arm is moved, an armature for the magnet, and means for easing the engagement of the member with the pole-pieces when the armature is attracted.

18. A controller for electric motors comprising a switch-arm movable to cut resistance into and out of the motor-circuit, a magnetizable shaft geared to the switch-arm, an electromagnetic lock for the shaft, and means operated when the circuit conditions are abnormal for closing a path of low reluctance relatively to the shaft for the flux of said electromagnetic device.

19. A controller for electric motors compris-

ing a switch-arm movable to cut resistance into and out of the motor-circuit, a magnetizable shaft geared to the switch-arm, an electromagnetic lock for the shaft, a high-reluctance section in the shaft, and means operated when the circuit conditions are abnormal for closing a path of low reluctance relatively to the shaft for the flux of the electromagnetic device.

In witness whereof we have hereunto set our hands this 2d day of April, 1904.

MONTRAVILLE M. WOOD.
HENRY GEISENHÖNER.

Witnesses:
BENJAMIN B. HULL,
HELEN ORFORD.