No. 744,665. PATENTED NOV. 17, 1903.

T. VON ZWEIGBERGK.

CONTROLLER.

APPLICATION FILED APR. 7, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1

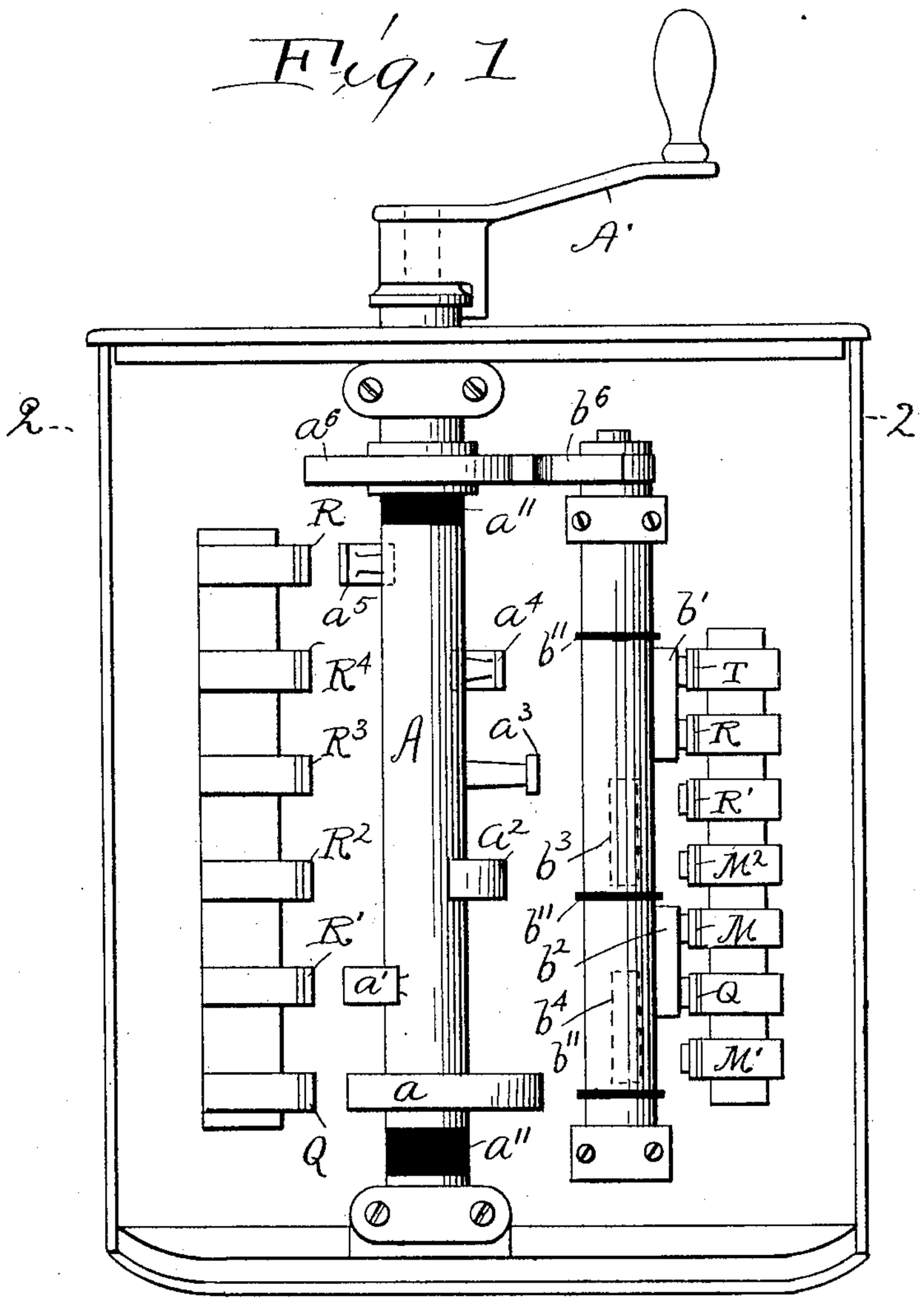
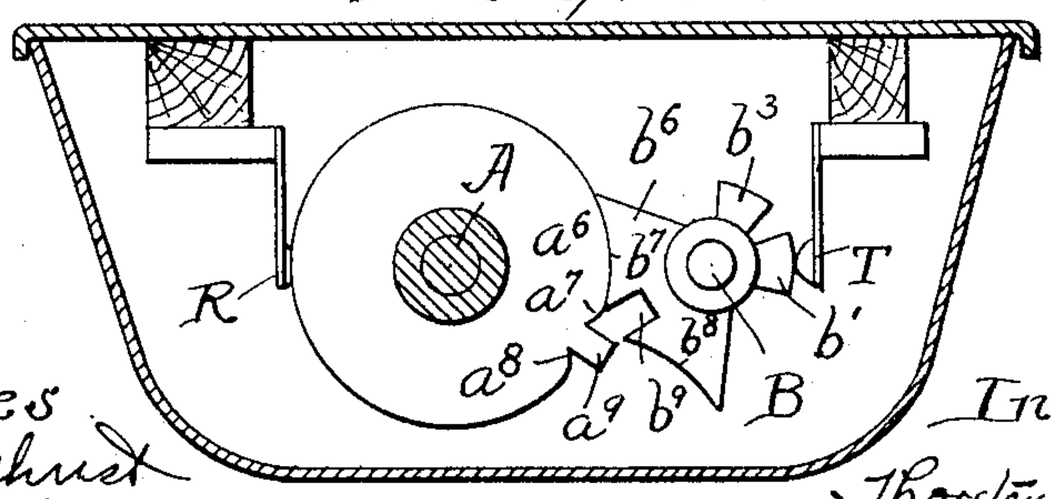


Fig. 2.



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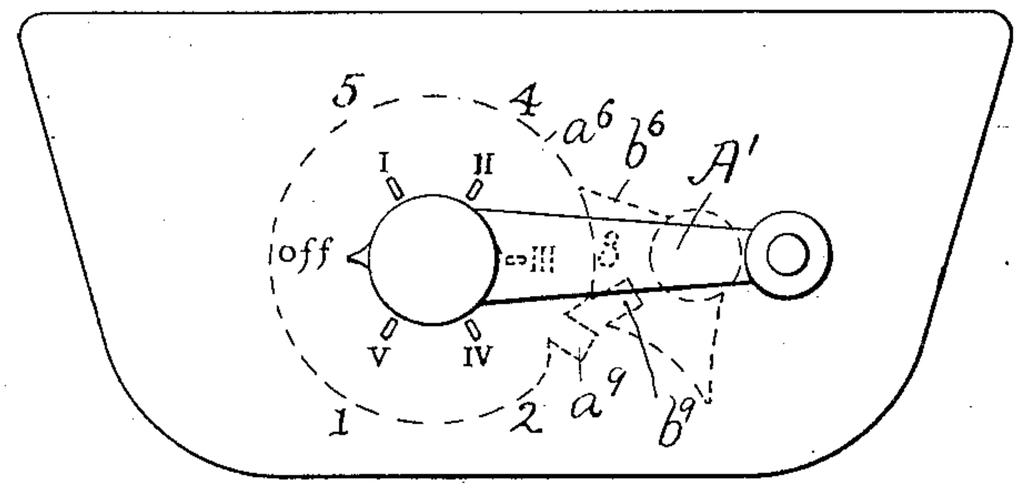
NO MODEL. 2 SHEETS—SHEET 2.

Fig. 3.



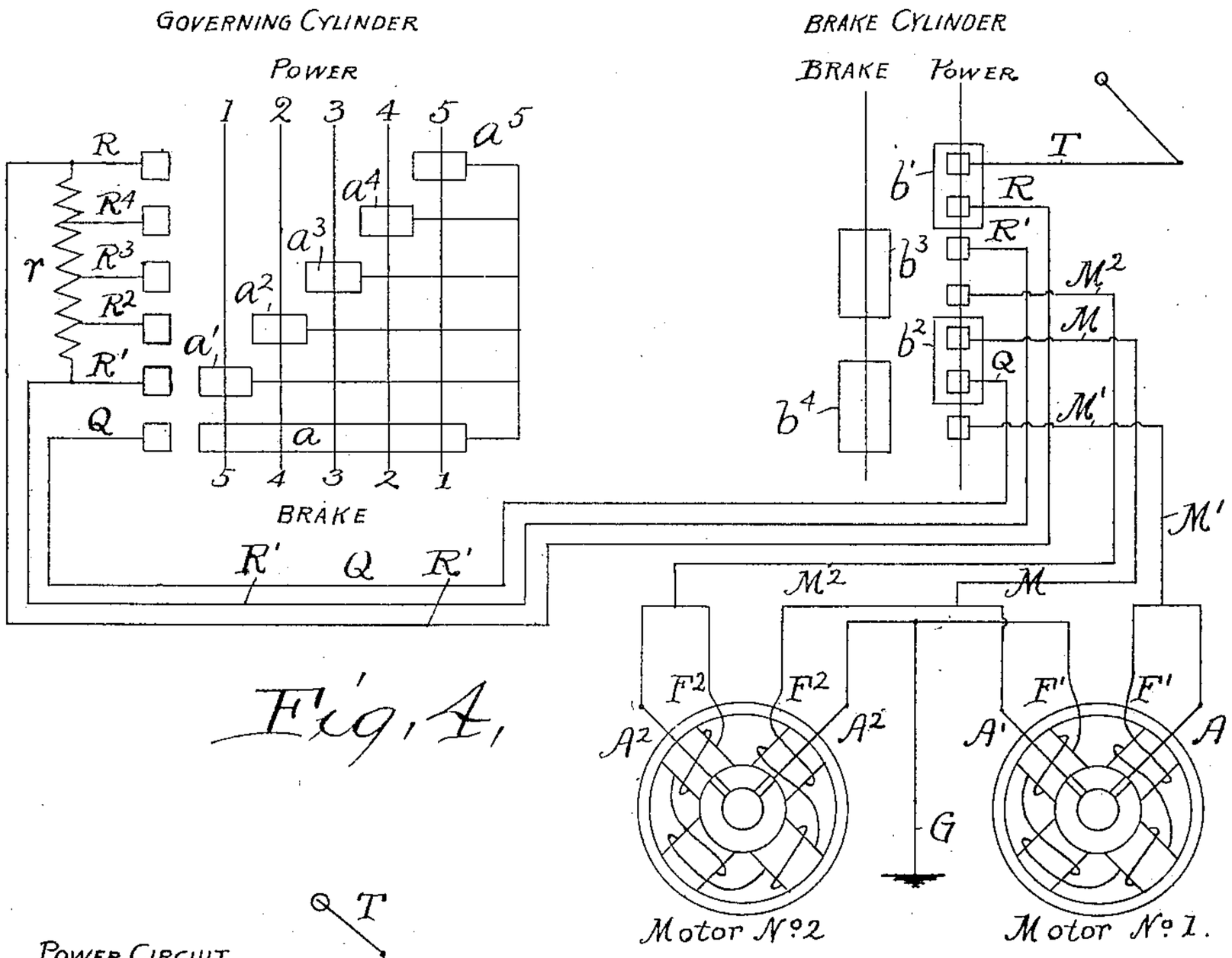


Fig. 4.

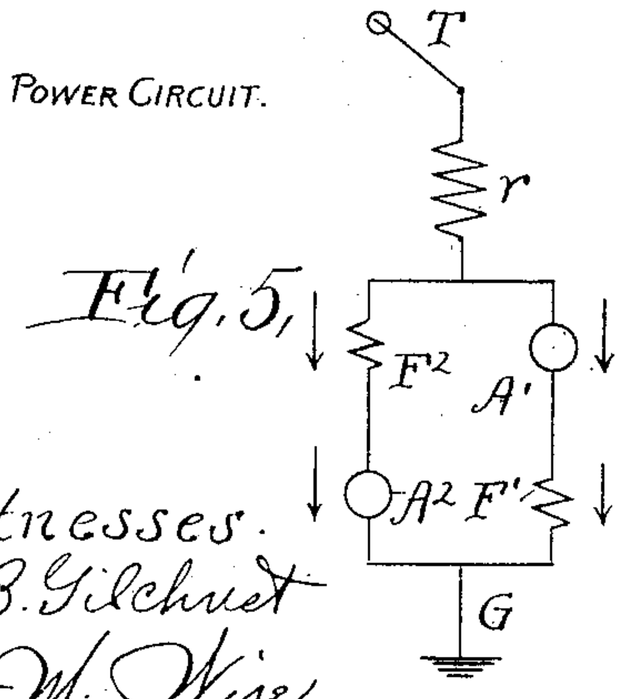


Fig. 5.

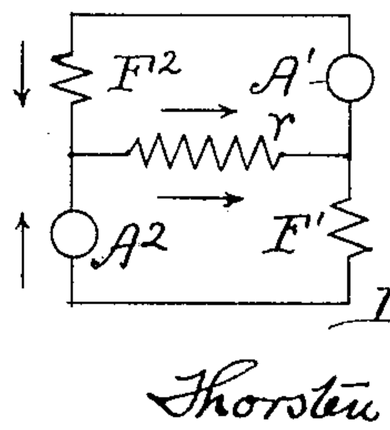


Fig. 6.

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No. 744,665. Patented November 17, 1903.

UNITED STATES PATENT OFFICE.

THORSTEN VON ZWEIGBERGK, OF PRESTON, ENGLAND.

CONTROLLER.

SPECIFICATION forming part of Letters Patent No. 744,665, dated November 17, 1903.

Application filed April 7, 1902. Serial No. 101,664. (No model.)

To all whom it may concern:

Be it known that I, THORSTEN VON ZWEIGBERGK, a citizen of the United States, residing at Preston, in the county of Lancaster, England, have invented a certain new and useful Improvement in Controllers, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

The object of this invention is to provide a combined governing and braking controller which shall occupy a minimum space and be of great simplicity of construction and operation. To accomplish this, I provide in the controller a governing-switch adapted to cut in or out resistance and a brake-switch adapted to be thrown by a movement of the governing-lever backward from the off position to make such connections that the further backward movement of such lever will apply the brake on the same notches as were used for power-circuit, but in reversed rotation. Thus the same contacts on the governing-switch and the same resistance which were in action at the last position in running are in action for the first position in braking, the next to the last running position being the second braking position, and so on, the last braking position being the first running position, the same resistance which was gradually cut out in running being thus gradually cut in in braking. The contacts are so arranged that in running the motors are connected in parallel and in braking the armature of the first motor is closed with the field of the second and the armature of the second with the field of the first. In such closed circuits the resistance is common to each circuit, being a shunt across the lines connecting the fields and armatures of each motor, wherefore this resistance regulates the braking action of both motors. No equalizer, however, is required on account of any difference in the motors, for the coupling of the field of each motor with the armature of the other mutually equalizes them. The armatures and fields of the two motors are permanently connected together in one local series circuit. This circuit is grounded and for running is connected at the opposite point with the power, the motors being thus on a derived or parallel circuit. In the braking positions the power is disconnected and a bridge is established across the local circuit to close the armature of one motor on the field of the other. This arrangement does not disturb any of the motor-leads and requires simply three lines leading from the local motor-circuit to the controller—namely, one line for the power and two lines which when connected together constitute the bridge. This makes a very simple and cheap installation and is one of the features of this invention.

The drawings clearly illustrate the invention, Figure 1 being a side elevation of a controller embodying it; Fig. 2, a horizontal section of the same on the line 2 2 of Fig. 1, and Fig. 3 a top plan. Fig. 4 is a diagram showing the development of the two controller-cylinders and the circuits; and Figs. 5 and 6 are diagrams showing the connection of the circuits in action for power and braking, respectively.

Referring to the drawings, A represents the governing controller-barrel, carrying contact-segments and rotatable by the operating-lever A′. The segments are all electrically connected together, being insulated from the shaft and controller-frame, as by the bushings a''. As hereinafter explained, the segment a is in engagement for all operative positions and the segments a', a^2, a^3, a^4, and a^5 for running positions 1 to 5, respectively.

B represents the barrel of the braking-switch, carrying segments b' b^2 b^3 b^4, the segments b' and b^3 being insulated from the segments b^2 and b^4 and all from the controller-frame, as indicated by the washers b''. As hereinafter explained, the segments b' b^2 are in action for power and b^3 b^4 for braking.

On the upper end of the brake-switch B is the wing b^6, which coöperates with the disk a^6 on the governing-barrel A. This wing b^6 has a pair of concave surfaces b^7 and b^8, between which is a notch b^9. The disk a^6 has a projection a^9, on opposite sides of which the circular edge of the disk is cut out in the notches a^7 and a^8. The position of the parts shown in the drawings is the off position, when, as will be seen from Fig. 2, the concave surface b^7 of the wing b^6 engages the circular edge of the disk a^6. The braking-switch is thereby held with its plates b' b^2 engaging the

corresponding contact-fingers, as shown. As the governing-switch is turned in the right-hand direction to bring contacts a' a^2 a^3 a^4 a^5 successively into engagement with their contact-fingers the braking-switch remains stationary, being locked by the periphery of the disk a^6.

When it is desired to apply the brake, the handle A′ is turned backward—that is, in the direction of a left-hand rotation—from the off position, which causes the projection a^9 to engage the notch b^9, thereby swinging the brake-switch on its axis, bringing the concave surface b^8 against the periphery of the disk a^6 and bringing the contact-segments b^3 b^4 into engagement with the corresponding contact-fingers, thus changing the contacts to establish braking-circuits. Thereafter the movement of the governing-switch brings the segments a^5 a^4 a^3 a^2 a' consecutively into engagement with their corresponding contact-fingers in the reverse order from the power governing.

I will now describe the circuits. The contact-fingers, wherever shown, are given the same designation as the lines leading to them.

In the diagrams, r represents the governing resistance. The lines leading from opposite ends thereof are designated, respectively, R and R′, and the lines leading to intermediate portions of the resistance are designated R^2 R^3 R^4.

Q represents a line and corresponding contact-fingers connecting the governing-switch with the brake-switch.

T represents the line from the trolley or other source of current.

M M′ M^2 represent the lines from the brake-switch to the motors and branching as follows: M through the armature and field of motor No. 1 and through the field and armature of motor No. 2, respectively, M′ branching through the armature and field of the first motor, and M^2 through the armature and field of the second motor.

G represents a line branching from the field of the first motor and the armature to the second motor to the ground.

A′ F′ A^2 F^2 represent the armatures and field of the two motors, respectively, or the lines leading to these parts.

The five positions of the governing-switch are indicated by the numbered lines in the diagram Fig. 4. The corresponding positions of the controller-barrel are indicated by the same numbering on Fig. 3 and the positions of the pointer on the operating-lever by corresponding Roman numerals.

In the first power position the circuit leads from the trolley T through the segment b' to the line R, through the resistance r, to the line R′, to the plate a', to the plate a, to the line Q, to the segment b^2, to the line M, and from thence branching through the armature and field of motor No. 1 and the field and armature of motor No. 2, respectively, to the line G and the ground. The successive positions of the governing-cylinder simply cut out resistance, the circuit passing from the line R to the plates a^2 to a^5, successively, via the lines R^2 R^3 R^4, and finally directly. These circuits are illustrated in condensed form in Fig. 5, which shows the running positions, the motors being oppositely in parallel. Now when the lever A is turned from the off position backward into the brake positions the segments b^3 b^4 are brought into action with the corresponding contact-fingers through the action of the disk a^6 and the wing b^6, and this operates to disconnect the trolley and the ground and place the resistance in a shunt between the motors. In the circuits for the first brake position (which corresponds to the fifth running position) the lines T R M are out of service. Starting from the contact-plate b^3, the circuit passes via the line R′, through the resistance r, to the plate a^5, to the plate a, to the line Q, to the line M′, thence branching, one line passing through the armature of motor No. 1, the field of motor No. 2, and the other line passing through the field of motor No. 1 and the armature of motor No. 2, and the lines meshing at the line M^2, which connects with the contact-plate b^3, our starting-point. There are thus established circuits, as shown in Fig. 6, wherein the armature of motor No. 1 is closed on the field of motor No. 2, and the armature of motor No. 2 is closed on the field of motor No. 1, by reason of the resistance being shunted across them. These closed circuits provide braking action, and no equalizer is necessary, the motors being mutually equalized, and no reversal of any motor-lead being required. The successive movements of the lever in applying the brake simply cut in the resistance without varying the circuits.

It is to be particularly noticed that any difference in the operation of the two motors is immaterial in my braking system, because the field of one motor is coupled with the armature of the other, so that each of the two closed braking-circuits modifies the other through the shunt until they are equal.

Having described my invention, I claim—

1. The combination of a pair of series-wound motors connected together in series independently of the controller, the fields and armatures being thus on a closed local circuit, and a controller adapted to convert said local circuit into a derived circuit from the source of current, or form a bridge across it for braking action.

2. A pair of motors having their armatures and fields connected in one local series circuit which is independent of the controller and is grounded, combined with a controller adapted to connect a power-line to said local circuit whereby it becomes a derived portion of the power-circuit, or disconnect said power-line and establish a bridge across the local circuit to close the field of each motor on the armature of the other.

3. A pair of motors having their armatures

and fields permanently connected together in one local series circuit, combined with a controller arranged to establish a bridge across said circuit to close the field of each motor on the armature of the other.

4. A pair of motors, having their armatures and fields permanently connected together in one local series circuit, combined with a controller adapted to disconnect the power and to establish a bridge across said local circuit to close the field of each motor on the armature of the other without disconnecting any of the motor-leads.

5. The combination of a pair of motors, having their armatures and fields permanently connected together in one local series circuit, said circuit being grounded, a controller, three lines leading from it to said local circuit, one line being adapted to convey power to the local circuit, and the other two lines being adapted to form a bridge across said circuit to close the field of each motor on the armature of the other.

6. In a controlling system, in combination, a pair of motors, a controller and connections suitably arranged, the controller being adapted to establish a shunt with resistance in it across the two motors, closing the armature of each motor on the field of the other motor through said shunt, said controller having successive positions adapted to leave the circuits as thus established but successively vary the resistance in the shunt.

7. The combination of a governing-switch adapted to connect motors in parallel and successively cut out resistance, and a braking-switch adapted to change the connections to disconnect the power and establish a shunt across the motors, the armature of each motor being closed on the field of the other, said governing-switch thereafter operating to vary the resistance in said shunt.

8. A governing-switch comprising a switch-body and an operative handle connected therewith to move the switch-body in one direction or the other from the off position when the handle is correspondingly moved, a braking-switch adapted to establish proper connections for power and braking, and a connection between the braking-switch and the governing-switch whereby the latter is operated when the governing-switch passes through the off position.

9. A governing-switch, having a plurality of positions, adapted to cut in or out resistance according to the direction of movement, an operating-handle rigidly connected with said switch, combined with a braking-switch normally idle but connected to be operated when the operating-handle passes through the off position and to change the connections so that the same positions of the operating-handle may control the power or the brake according to the direction of movement.

10. The combination with a pair of motors, having their armatures and fields connected in one local series circuit, of a governing-switch adapted to cut in or out resistance according to the direction of its movement, and a braking-switch adapted to be operated by the governing-switch when it passes through the off position, to disconnect the power and form a bridge across said local circuit.

11. A pair of series-wound motors connected together in series, the fields and armatures being thus on a closed local circuit, combined with a controller having a governing-switch adapted to cut in or out resistance and a braking-switch thrown by the governing-switch when it passes through the off position and adapted according to the direction of movement either to convert said local circuit into a derived circuit from the source of current or to disconnect the line from the source of current and establish a bridge across said local circuit to close the field of each motor on the armature of the other.

12. The combination of a governing-switch adapted to connect motors in parallel, a braking-switch adapted to disconnect the power and establish a shunt across the motors, the armature of each motor being closed on the field of the other, and mechanism whereby the movement of the governing-switch backward from the off position moves the braking-switch.

13. In a controller, the combination of a governing-switch comprising an operating-handle, and a switch-body having a plurality of positions adapted to successively cut out resistance in one direction of movement, and cut in resistance in the opposite direction, a braking-switch adapted to be automatically shifted when the governing-switch body is moved backward from its off position whereby the same positions of the governing-switch body may connect in the power or the brake according to the direction of movement which brought said body into such position.

14. A controller adapted for use with two motors and having a governing-switch adapted to be moved in either direction from its off position, the movements in one direction successively cutting out resistance and the movements in the opposite direction establishing some of the same contacts and successively cutting in resistance, and a braking-switch adapted to be thrown by the movement of the governing-switch backward from the off position to place such resistance in a shunt across the two motors to close the field of each motor on the armature of the other.

15. In a controller, a braking-switch having two positions one of which couples the motors in parallel and connects the same in a power-circuit having resistance in it, and the other of which disconnects the power and establishes a shunt with the resistance in it across the two motors closing the field of each motor on the armature of the other, combined with a governing-switch adapted to vary the resistance.

16. In a controller, a braking-switch having two positions one of which couples the

motors in parallel and connects the same in a power-circuit having resistance in it, and the other of which disconnects the power and establishes a shunt with the resistance in it across the two motors closing the field of each motor on the armature of the other, combined with a governing-switch adapted to move in one direction from its off position and cut out resistance and in the opposite direction from its off position and cut in resistance, and cutting mechanism between said two switches whereby the moving of the governing-switch from the cutting-out positions to the cutting-in positions shifts the braking-switch from the power to the braking position.

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

THORSTEN VON ZWEIGBERGK.

Witnesses:
JOHN MAUNLEIUS,
E. S. GARDNER.