(No Model.)

2 Sheets—Sheet 1.

G. GIBBS, W. S. JOHNSON & H. WINKENWERDER.

CONTROLLING MECHANISM FOR ELECTRIC MOTORS.

No. 605,953. Patented June 21, 1898.

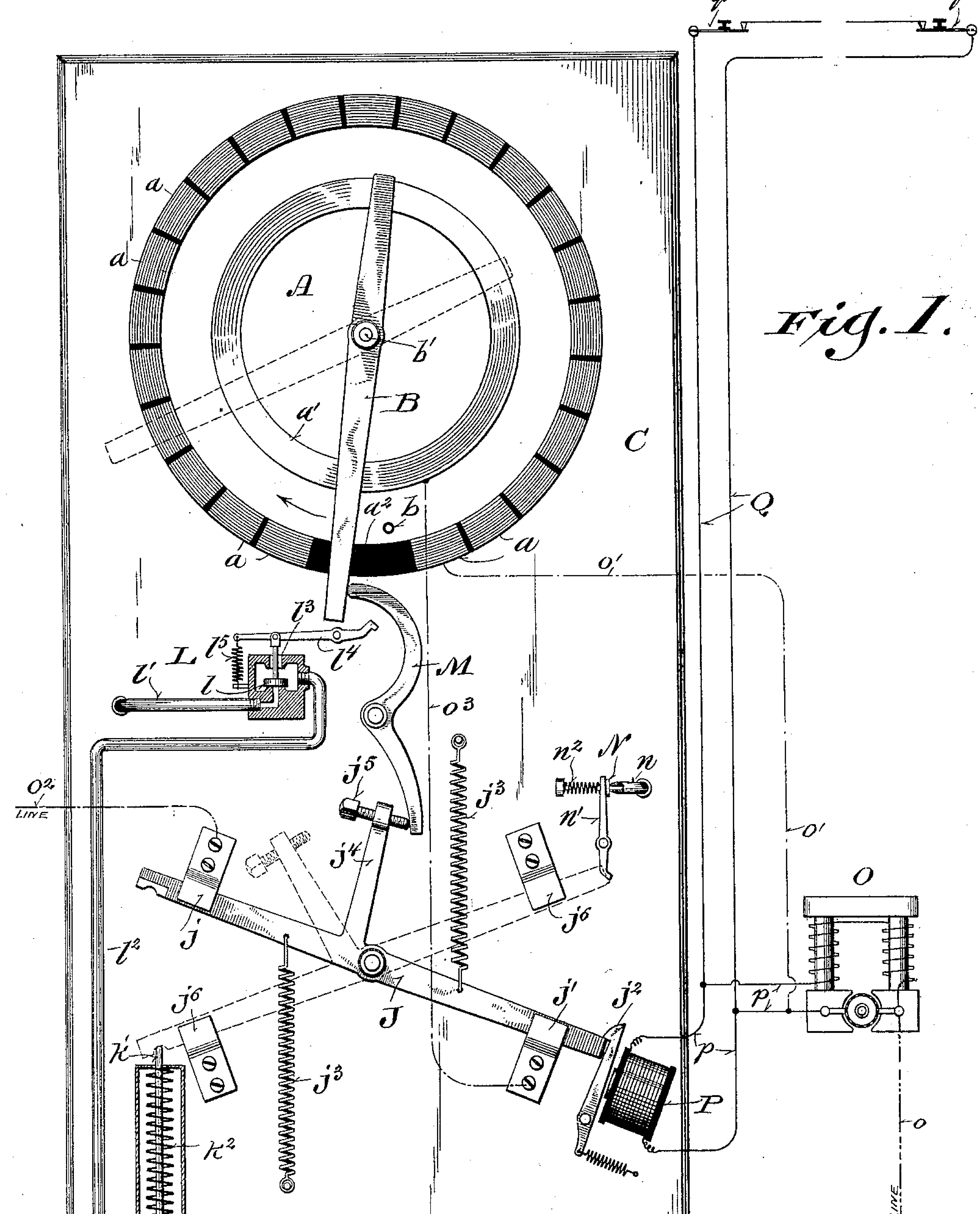

Fig. 1.

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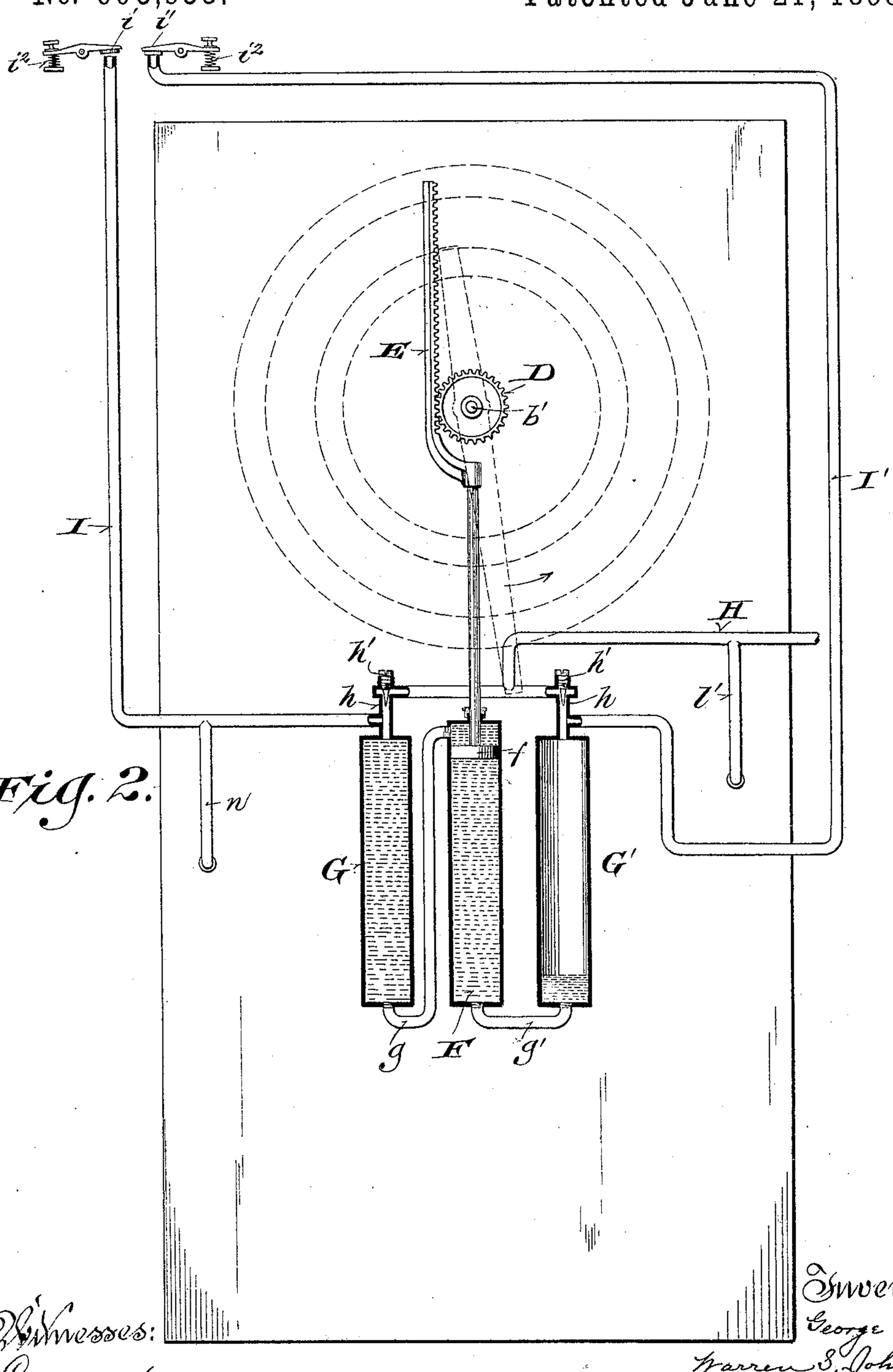

Fig. 2.

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UNITED STATES PATENT OFFICE.

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CONTROLLING MECHANISM FOR ELECTRIC MOTORS.

SPECIFICATION forming part of Letters Patent No. 605,953, dated June 21, 1898.

Application filed May 10, 1897. Serial No. 635,822. (No model.)

To all whom it may concern:

Be it known that we, GEORGE GIBBS, WARREN S. JOHNSON, and HENRY WINKENWERDER, of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Controlling Mechanism for Electric Motors; and we do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

The main objects of our invention are to provide for promptly stopping electric motors in cases of emergency and thus prevent accidents or injuries that might otherwise occur, to automatically shift the rheostat-arm into position and restore the circuit to condition for gradually starting the motor with resistance in the circuit, and to vary the resistance in the circuit, and consequently the speed of the motor, at any convenient point or points distant from the rheostat and motor.

It consists in the means hereinafter particularly described, and pointed out in the claims, for breaking the circuit, for automatically restoring it to condition for starting the motor with resistance in circuit, and for varying the resistance in the circuit and the consequent speed of the motor at a distance from the rheostat and motor.

In the accompanying drawings like letters designate the same parts in both figures.

Figure 1 is a front elevation of a device embodying our invention, the electric circuits being shown in diagram and certain parts of the apparatus in section; and Fig. 2 is a reverse view of the device, the motor for operating the rheostat-arm being shown in vertical section.

Our improvements are designed to be employed in connection with a rheostat or starting-box of the usual or any suitable construction, comprising resistance and a movable arm or part arranged to bring more or less of the resistance into circuit with the armature of the motor.

The device, as herein shown and described, is designed, primarily, for use in connection with printing-presses and other machines or apparatus in the operation of which it is desirable to control the motor from one or more convenient points at a distance from the motor or rheostat and in case of emergency to promptly stop the motor—as, for instance, when the paper is torn or severed in running a cylinder printing-press.

Referring to the accompanying drawings, A designates a rheostat of the usual construction, comprising a circular series of insulated contacts a a, which are connected with each other by suitable resistance, (not shown,) a ring a', concentric with the contacts a, and an arm B, pivoted at the center of said ring and adapted to electrically connect the same with any one of the contacts a and to bring more or less of the resistance into circuit. The several parts of the rheostat are mounted upon a suitable base C.

A stop b is provided to arrest the movement of the arm B in either direction in full "on" or "off" position. In "off" or starting position said arm rests over or upon an insulating space or block a^2, thus breaking the circuit at that point. The spindle b', by which the arm B is pivoted to the base, is provided on the opposite side of the base, as shown in Fig. 2, with a pinion D, which is engaged by a rack E, attached to the rod of the piston f of a fluid-motor cylinder F, preferably arranged in a vertical position, as shown, behind the rheostat A. Two chambers or reservoirs G G' are connected at their lower ends with opposite ends of the cylinder F by pipes g g', respectively.

H is a supply-pipe leading from a source of compressed air or other suitable fluid pressure and connected with the upper ends of the reservoirs G G' by branches h h, provided with needle-valves h' h' for restricting the passages therein. Waste or exhaust pipes I I' lead from the upper ends of said reservoirs to any convenient point for controlling the motor and are provided with valves i i', which may be conveniently mounted upon levers and are held normally closed by springs i^2.

J designates a switch-arm which may be conveniently pivoted to the base C, as shown in Fig. 1. It is held normally in engagement

with the two contacts j j' by a spring-actuated latch or detent j^2, pivoted to the base C. Springs j^3 j^3 tend constantly to open said switch or pull it out of engagement with said contacts.

K designates the cylinder of a fluid-motor for closing the switch J. It is mounted upon the base B below the end of the switch-arm J opposite the detent j^2, and it is provided with a piston k, the rod k' of which is arranged when forced upwardly to engage with the switch-arm J and force it into engagement with the contacts j j', in which position it is automatically caught by the detent j^2. A spring k^2, bearing at its upper end against the upper end of the cylinder K and at its lower end upon the piston k, serves to return the latter to the lower end of the cylinder after it has been forced upwardly by fluid-pressure.

L is a supply and waste valve mounted upon the base C, adjacent to the starting-point a^2 of the rheostat-arm B. It has a supply-port controlled by the valve proper, l, and connected by a branch pipe l' with the fluid-pressure-supply pipe H. The valve-chamber is connected by a service-pipe l^2 with the lower end of the cylinder K, and it has a waste-port l^3 around the valve-stem. A lever l^4, pivoted to the base C, is connected with the valve-stem and has an inclined projection in the path of the rheostat-arm B. A spring l^5 holds the valve l normally in position to close the supply-port and open the waste-port. The switch-arm J is formed with an upwardly-projecting arm j^4, which is provided with a transverse set-screw j^5, arranged to engage when the switch is closed the lower end of a lever M, pivoted to the base C and adapted to be forced at its upper end into engagement with the rheostat-arm B and move the same forward out of contact with the lever l^4 when the switch J is closed, as shown in Fig. 1.

N is a valve normally closing the discharge-orifice of a branch pipe n, leading out of the waste-pipe I. It is mounted upon one end of a lever n', which is pivoted to the base C, and projects at its opposite end into the path of that end of switch-lever J which is engaged by the detent j^2. A spring n^2 holds said valve normally closed.

O designates an electric motor with which the controlling device is connected. One terminal of the armature is connected with the main-circuit conductor o, while the other terminal is connected by a conductor o' with the last contact a of the rheostat. The contact j of the emergency-switch J is connected with the other conductor o^2 of the main circuit, and the contact j' is connected by a conductor o^3 with the contact-ring a' of the rheostat.

P is a switch-releasing magnet having a coil or winding of high resistance in a shunt p with the field of the motor. It is attached to the base C, with its core in proximity with the detent j^2, which is drawn out of engagement with the switch J when said magnet is energized. The magnet is normally short-circuited through a loop Q, including one or more circuit-breakers, such as q, located at the most convenient point or points for stoping the motor.

The movement of the switch-lever J in opening is arrested at the proper point by a suitable stop or stops j^6, attached to the base C.

Our improved device operates as follows: To start the motor, the valve i' is opened by pressing on the opposite end of the lever to which it is attached, and the air contained in reservoir G' is permitted to escape therefrom through the pipe I' faster than it can enter said reservoir through the restricted passage in the branch h of the supply-pipe. The unbalanced air-pressure on the liquid contained in reservoir G forces liquid therefrom through the pipe g into the upper end of the cylinder F above the piston f, the liquid below said piston being forced through the pipe g' into reservoir G'. This causes the piston f to descend gradually and through the medium of the rack E and pinion D to turn the arm B in the direction indicated by arrows on the drawings. When the arm B engages the first contact a, the armature-circuit is closed through conductor o^2, contact j, switch J, contact j', conductor o^3, contact-ring a', arm B, and all the resistance of the rheostat-conductor o', through the motor-armature to line o. As the arm advances over the several contacts a in succession the resistance is gradually cut out until the motor attains the desired speed. When this occurs, the valve i' is released, being closed by the spring i^2, and thereupon the further movement of the arm B is arrested, the pressure in the two reservoirs G G' and in the opposite ends of the cylinder F, connected therewith, being equalized by the compressed air entering the reservoir G' from the supply-pipe H. The liquid medium with which the cylinder F is filled being practically inelastic holds the arm B quiescent when the pressure in the reservoirs G and G' is equalized and prevents a wavering and indeterminate movement of said arm, which would occur if compressed air or other elastic fluid pressure medium acted directly upon the piston f.

To stop the motor or reduce its speed under ordinary conditions, the valve i is opened, which produces a reverse movement of the arm B in the manner above explained.

In cases of emergency, or whenever it is desirable to stop the motor instantly—as, for instance, when the paper breaks in a printing-press—the attendant presses the circuit-breaker q, which is located within easy reach, thereby breaking the short circuit Q and compelling the current to pass through the winding of magnet P, which is thus energized and caused to draw the detent j^2 out of engagement with the switch-lever J. The springs j^3 acting upon said lever instantly throw it out of engagement with the contacts j j' against the stops j^6, thereby breaking the circuit.

When this occurs, the switch-lever J by engagement with the lever n' opens the valve N, allowing compressed air to escape from reservoir G. The piston f thereupon rises gradually, turning the arm B back to its starting-point against the stop b, thus breaking the circuit at a^2. When the arm B approaches the stop b, it engages the lever l^4 and shifts the valve l, opening the supply-port and closing the waste-port l^3. Compressed air then passes from the supply-pipe H through the branch pipe l' and pipe l^2 into the lower end of cylinder K, moving the piston k upward, and by the engagement of its rod k' with the switch-lever J turning said lever back into normal position in engagement with the contacts j and j', thereby closing the circuit. The detent j^2 springs over the end of said lever and holds it in engagement with said contacts. When said switch is closed, as above explained, the screw j^5, which is properly adjusted for the purpose, engaging the lower end of lever M, forces its upper end against the arm B and advances said arm a short distance out of contact with the lever l^4. The valve l being thus released is returned by spring l^5 to normal position, closing the supply-port and opening the waste-port l^3. Compressed air contained in cylinder K below the piston k thereupon escapes through the pipe l^2, and the spring k^2 forces said piston back to normal position in the lower end of said cylinder in readiness for further action, as explained.

When the switch J is closed, the valve N being released is closed by the spring n^2, preventing further escape of air. As this occurs immediately after the arm B reaches its starting-point, the liquid contained in reservoir G is prevented from escaping therefrom.

Obviously a single spring may be employed in place of the two springs j^3, and in place of waste-valves i i' one or more valves may be employed to control the fluid-pressure-supply connections of the motor, which actuates the rheostat-arm.

In short, various changes in the details of the apparatus may be made within the spirit and intended scope of our invention.

We claim—

1. In controlling mechanism for electric motors the combination with a rheostat comprising a movable contact-arm of a switch in circuit with the armature of the motor, means tending to open said switch, a detent for holding said switch closed, a releasing-magnet having a winding of high resistance in a shunt of the motor-circuit, a circuit-breaker through which said magnet is normally short-circuited, and means for automatically returning said rheostat-arm to starting position whenever the switch is opened, substantially as and for the purposes set forth.

2. In controlling mechanism for electric motors the combination with a rheostat comprising a series of contacts and connected resistances and a movable contact-arm, of an emergency-switch, means tending to open said switch, a detent for holding the switch normally closed, means for disengaging said detent and releasing said switch, and means for automatically shifting the rheostat-arm into starting position when said switch is opened and for closing the switch when the rheostat-arm is returned, substantially as and for the purposes set forth.

3. In mechanism for controlling electric motors, the combination with a rheostat comprising resistance and a movable arm for bringing more or less of said resistance into circuit, of a fluid-motor for operating the rheostat-arm consisting of a chamber, a movable part in said chamber connected with the rheostat-arm, an air-supply connection with the motor, a liquid medium between said supply connection and the movable part of the motor and valve mechanism for controlling the operation of the fluid-motor, substantially as and for the purposes set forth.

4. In mechanism for controlling electric motors, the combination with a rheostat comprising resistance and a movable arm for bringing more or less of said resistance into circuit, of a fluid-motor for operating the rheostat-arm consisting of a cylinder provided with a piston which is connected with said arm, two reservoirs connected with opposite ends of said cylinder, and each having an air-supply and waste connection, and valve mechanism controlling an air connection of each reservoir, substantially as and for the purposes set forth.

5. In mechanism for controlling electric motors, the combination with a rheostat comprising resistance and a movable arm for bringing more or less of said resistance into circuit, of a fluid-motor consisting of a cylinder containing a liquid and provided with a piston which is connected with said arm, and two chambers or reservoirs connected with opposite ends of said cylinder, and each having a restricted air-supply connection and a waste connection of larger area provided with a valve, substantially as and for the purposes set forth.

6. In mechanism for controlling electric motors, the combination with a rheostat comprising resistance and a movable arm for bringing more or less of said resistance into circuit, a fluid-motor for operating said arm, a valve in a fluid connection of said motor, a switch in the motor-circuit having a tendency to open and arranged when opened to shift said valve and cause the fluid-motor to return the rheostat-arm to starting position, and a detent holding said switch normally closed, substantially as and for the purposes set forth.

7. In mechanism for controlling electric motors, the combination with a rheostat comprising resistance and a movable arm for bringing more or less of such resistance into the motor-circuit, of a fluid-motor for operating said arm, an emergency-switch in the motor-circuit having a tendency to open, and arranged when opened to start said fluid-motor

and to return the rheostat-arm into starting position, a detent holding said switch normally closed, a fluid-motor for closing said switch, and a valve controlling the operation of the switch-closing motor arranged to be operated by the return of the rheostat-arm to its starting-point, substantially as and for the purposes set forth.

8. In mechanism for controlling electric motors, the combination with a rheostat comprising resistance and a movable arm for bringing more or less of said resistance into the motor-circuit, a fluid-motor for operating said arm, a switch in the motor-circuit having a tendency to open and arranged when opened to start said fluid-motor and cause it to return the rheostat-arm to starting position, a detent for holding said switch normally closed, a fluid-motor for closing said switch, a supply and waste valve mechanism in the fluid connection of said motor arranged to be operated by the return of the rheostat-arm into starting position to open the supply and close the waste port, and a lever operated by the closing of said switch to advance the rheostat-arm and permit said valve mechanism to resume its normal position, closing the supply and opening the waste port, substantially as and for the purposes set forth.

9. In mechanism for controlling electric motors, the combination with a rheostat comprising resistance and a movable arm for bringing more or less of said resistance into circuit, a fluid-motor for operating said arm, a valve in a fluid connection of said motor, a switch in the motor-circuit arranged when opened to shift said valve and cause the fluid-motor to return the rheostat-arm to starting position, substantially as and for the purposes set forth.

10. In mechanism for controlling electric motors, the combination with a rheostat comprising resistance and a movable arm for bringing more or less of such resistance into the motor-circuit, of a fluid-motor for operating said arm, an emergency-switch in the motor-circuit arranged when opened to start said fluid-motor and to return the rheostat-arm into starting position, a fluid-motor for closing said switch and a valve controlling the operation of the switch-closing motor, arranged to be operated by the return of the rheostat-arm to its starting-point, substantially as and for the purposes set forth.

In testimony that we claim the foregoing as our own we affix our signatures in presence of two witnesses.

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WARREN S. JOHNSON.
HENRY WINKENWERDER.

Witnesses:
CHAS. L. GOSS,
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