(No Model.) 3 Sheets—Sheet 1.

F. E. HERDMAN.

AUTOMATIC WORKING RHEOSTAT FOR STARTING ELECTRIC MOTORS.

No. 541,543. Patented June 25, 1895.

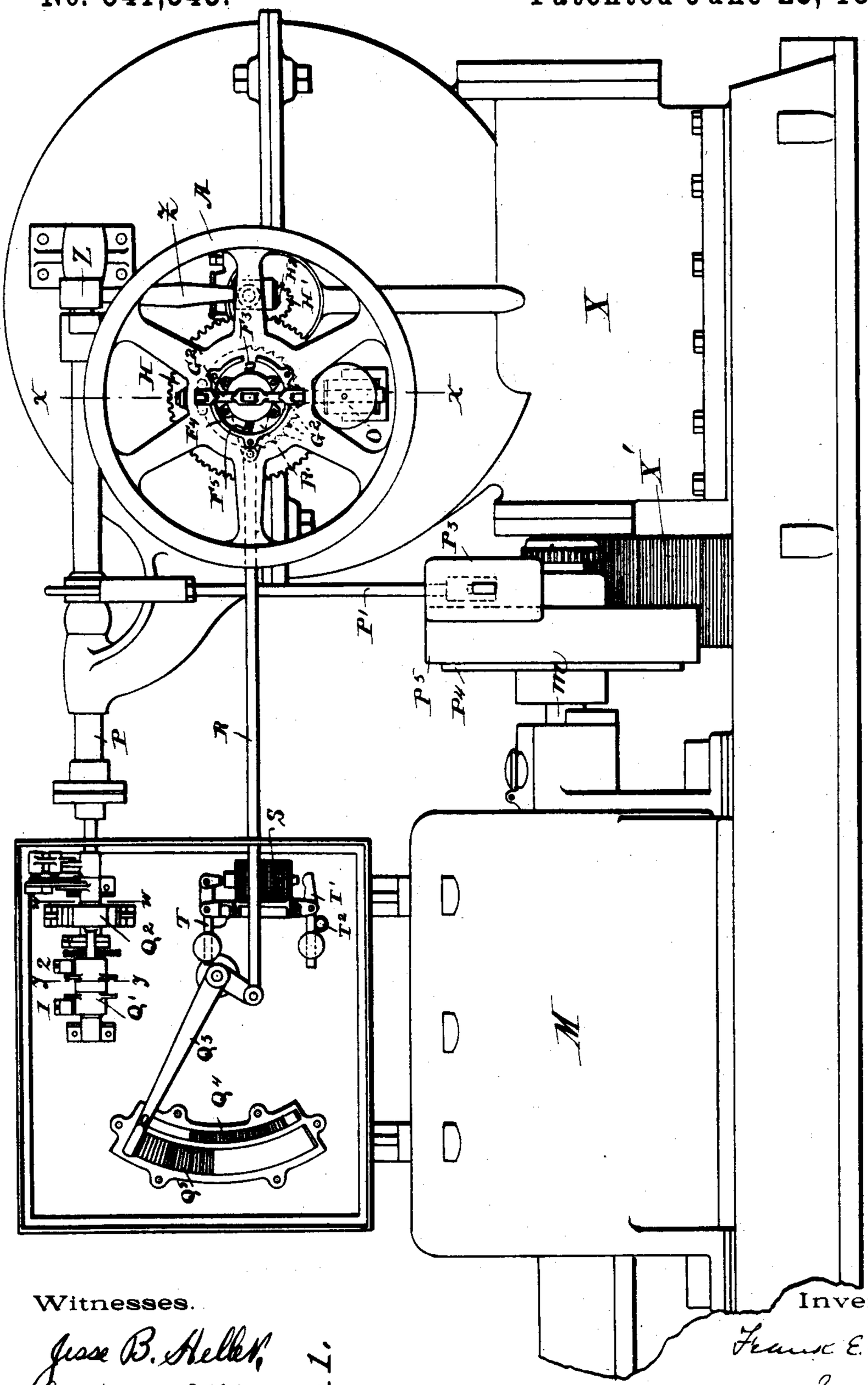

Fig. 1.

Witnesses.

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(No Model.) 3 Sheets—Sheet 2.

F. E. HERDMAN.

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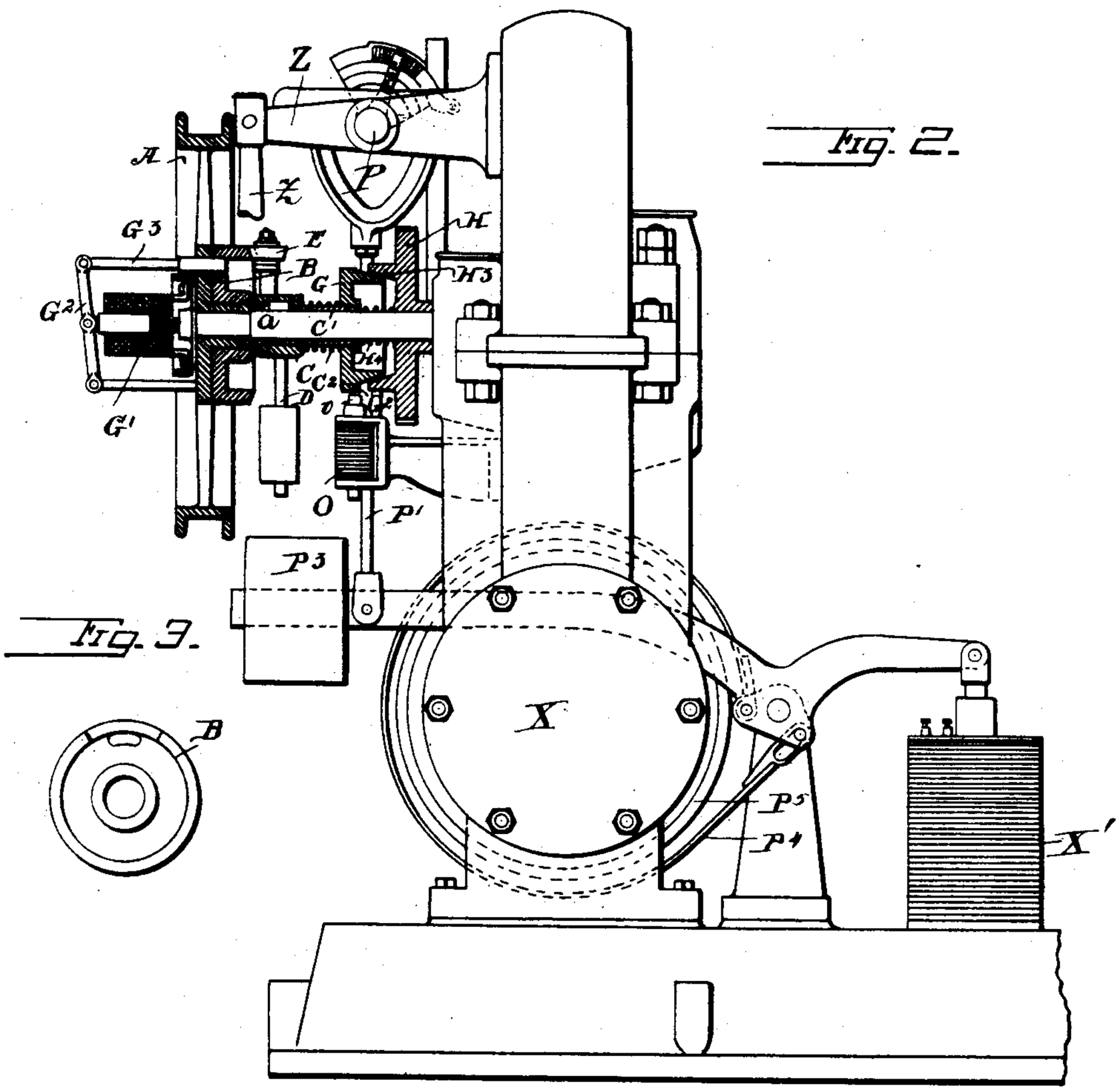
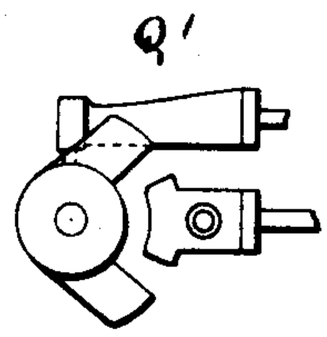


Fig. 2.

Fig. 3.

Fig. 4.



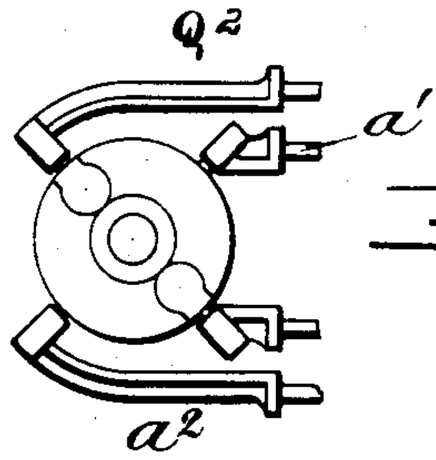


Fig. 5.

Witnesses.

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(No Model.) 3 Sheets—Sheet 3.

F. E. HERDMAN.

AUTOMATIC WORKING RHEOSTAT FOR STARTING ELECTRIC MOTORS.

No. 541,543. Patented June 25, 1895.

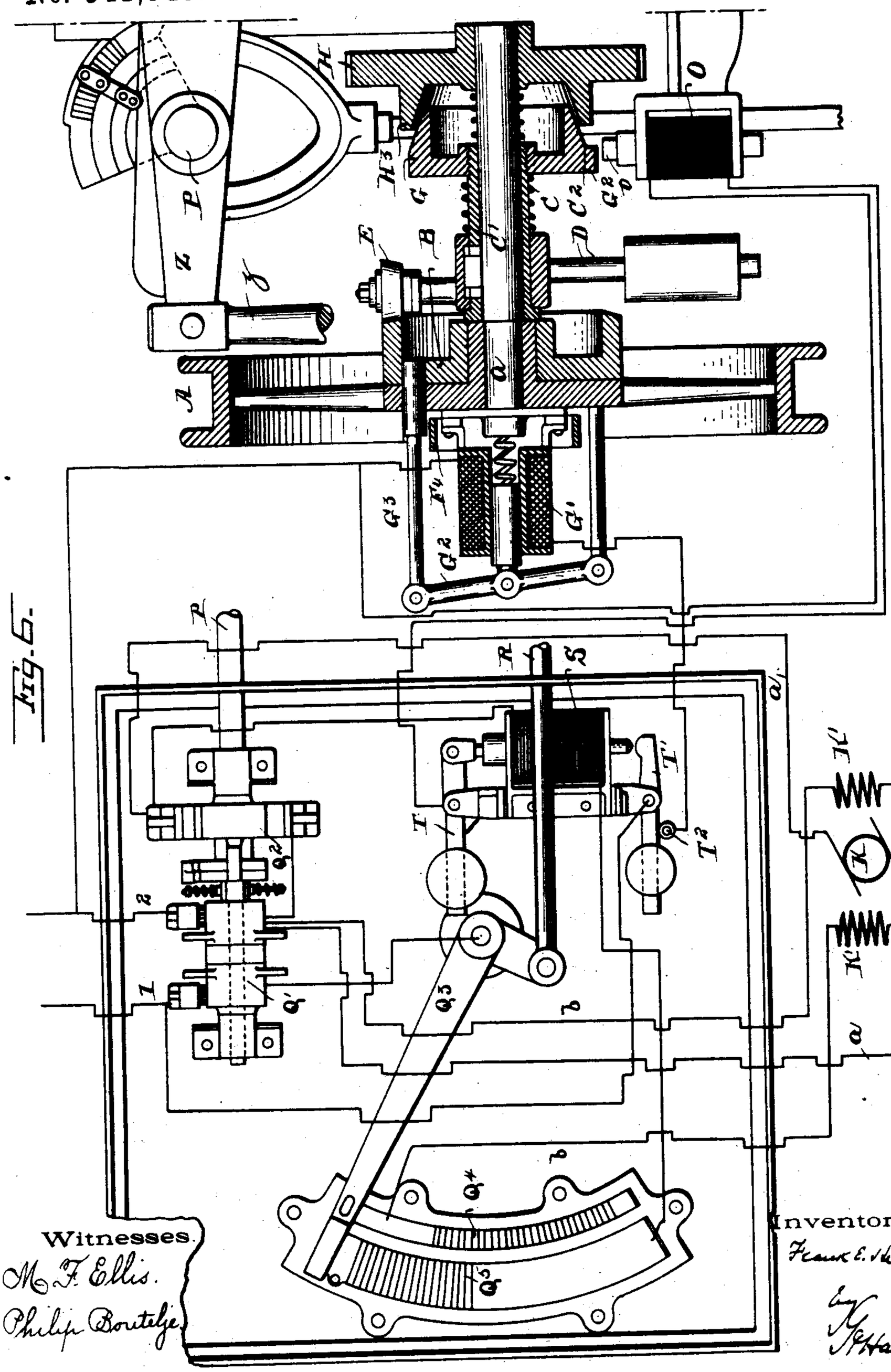

Fig. 6.

Witnesses.
M. F. Ellis.
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UNITED STATES PATENT OFFICE.

FRANK E. HERDMAN, OF WINNETKA, ILLINOIS.

AUTOMATIC-WORKING RHEOSTAT FOR STARTING ELECTRIC MOTORS.

SPECIFICATION forming part of Letters Patent No. 541,513, dated June 25, 1895.

Application filed November 24, 1894. Serial No. 529,794. (No model.)

To all whom it may concern:

Be it known that I, FRANK E. HERDMAN, a citizen of the United States, residing at Winnetka, county of Cook, and State of Illinois, have invented a new and useful Improvement in Automatic-Working Rheostats for Use in Starting Electric Motors, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form a part of this specification.

This invention consists in certain improved mechanism and electrical connections in connection with a motor in which the current is initially admitted to the armature through resistances and which are: to automatically cause a contact arm to travel over the resistances when the motor starts; to prevent throwing out the resistances more rapidly than the motor is able to take the increased current, and to increase the resistance in the armature circuit when an amount of current in excess of that which the motor can take tends to pass to the armature, and cut the current from the motor and apply a brake to the motor shaft.

I will first describe an embodiment of my invention as illustrated in the accompanying drawings, in which the motor is combined with and operates an elevator mechanism.

Figure 1 is a front elevation. Fig. 2 is a partial section on line *x x*, Fig. 1. Fig. 3 is a detail view of wheel B. Fig. 4 is a detail section on line *y y*, Fig. 1. Fig. 5 is a detail section on line *w w*, Fig. 1. Fig. 6 is a diagrammatic view showing the circuits.

A is the operating sheave controlled by the operator through the medium of a cable, or other mechanism, in the well known manner, said sheave revolving freely upon its shaft, *a*. Attached to the end of the shaft, *a*, is the magnet G′. The core of this magnet carries the lever G^2. Pivotally connected to the core between the ends of said lever, at one end of said lever, G^2, is the rod G^3, which passes through an orifice in a flange on the sheave A. B is a wheel adjacent to said sheave A, said wheel being provided with a circular ring on its outer edge, and with a recess in its central position. See Fig. 3. This wheel B has also a slot in alignment with pin or rod G^3, and into which said rod is forced when the magnet G′ is energized. On the shaft of wheel B is the hub C carrying a lever having weight D, and at the opposite side a lever carrying a roller E, which roller runs in contact with the ring on the outer edge of the wheel E.

To the hub, C, is connected a sleeve, C′, carrying the friction disk G. Between this friction G and hub C is placed a spring C^2, which tends to hold the friction G to its outer position.

Meshing with a gear, H′, on the drum shaft, H^2, is the gear, H, which carries the friction disk, H^3, adapted to co-act with friction, G. Between the friction disks G and H^3, is placed a spring, H^4, which tends to hold the frictions apart. The spring C^2, between the friction G and the hub C, is for the purpose of taking up the play between the two friction wheels G and H^3.

Connected with the friction G, are a series of teeth, G^2, and directly beneath these teeth is the electro-magnet O, the core *o* of which, when the magnet is energized, meshes with the teeth G^2. The teeth, G^2, are so cut (see Fig. 1) that when the core, *o*, meshes with these teeth, the wheel G is held from revolution in one direction, but can revolve in the other direction.

P is the operating-bar connected to wheel B, and when the magnet G′ is energized it is moved by the sheave A. Connected midway with the bar P, is the lever P′ connected to the brake arm P^3, said arm having at one end the weight, P^3, and at the other end the brake mechanism, P^4, operating upon the wheel, P^5, upon the motor shaft.

The movement of the bar from the central position in either direction allows the weight to be returned from action, and the return movement of the bar allows the weight to operate, and the brake to go into action. The bar at the end is connected to the snap switch Q′, and also to the reversing switch Q^2, sections of which are shown in Figs. 4 and 5, respectively.

K is the armature of the motor, and K′ the field magnet. Q^5 are the resistance contacts for the armature circuit, and Q^4 the resistance contacts for the field circuit, and Q^3 is the resistance arm for controlling the resistances in the armature and field circuit. This arm Q^3, is connected by means of rods R, with the lever R′, on the hub, C.

The main circuit is connected to the brushes

1 and 2, of the snap switch, and from one side of the switch the current is carried to the arm, Q^3. The other pole of the main circuit passes to one brush of the reversing switch.

The armature circuit is denoted by the letter, *a*, and terminates in brushes, a', a^2, of the reversing switch. The field circuit is denoted by letter *b*.

S is the electro-magnet in series with the armature circuit, the core of which magnet is connected with the weighted lever, T. Beneath the magnet S, is placed a weighted lever, T'. From one pole of the main current supply, outside the switch, a wire is run directly to the lever T'. From the contact T^2, a wire passes around the magnet G' and ends in contact, F^5, upon the magnet G'. This contact F^5 is in contact with a ring, F^4, connected to the hub of the operating sheave A.

F^3 is a contact in electrical connection with the other pole of the source of current supply from that to which the contact, T^2, is connected. This contact F^3 is insulated from the magnet G'. The position of the contact F^3 is such that when the operating sheave is in its central position the contact, F^3, is separate from the ring F^4, and consequently there is no current passing to the magnet, G'; but the least movement of the operating sheave to the right or to the left brings the contact F^3 into contact with the ring, F^4, thereby closing the circuit through the magnet, G', and causing the pin or rod G^3, to enter the slot in the wheel B, this slot being of sufficient length to allow the circuit to be closed through the magnet, G', in time to draw the pin or rod, G^3, into its slot on the wheel B, thereby locking the operating sheave with this wheel B. The movement of the sheave, A, then controls the movement of wheel B and thereby moving the operating shaft and throwing the roller E out of the slot in the wheel B, drawing the two friction disks together, and when the drum commences to move, motion is given to the arm, Q^3, over the resistances. The reason that this magnet, G' is connected outside of the snap switch and directly to the current, is so that the slightest movement of the sheave A will cause the magnet to be energized and connection made between the sheave A and the wheel B. The operating sheave is dependent on this connection for means to throw the operating bar P and to throw the roller E.

The magnet O is in wire connection with the lever T and with the snap switch, so that if an excess of current passes through the armature circuit, and hence through the magnet, S, sufficient to overcome the weighted lever T, contact will be made between the core of the magnet, S, and the lever, T', and the magnet, O, will be energized, and its core, *o*, mesh with the teeth on the friction disk, G, locking the further movement of the arm, Q^3, and preventing further resistances from being thrown out. If a still greater current should pass through the magnet S, it not only throws into action the magnet O, but will force the lever T' out of contact with the contact T^2, and break the circuit to the magnet G'. This will at once sever the connection between the sheave A and the wheel B, and the springs will return the frictions out of contact with each other, and the weight D will cause a reverse movement in the arm Q^3, throwing greater resistance in the armature circuit. Not only this, but under such conditions as just above described, the weight P^3 will throw the brake upon the brake wheel and force the operating bar back to its central position thereby cutting off the current, for this reason. When the sheave A is operated to move the operating bar in either direction, as before described, it lifts the weight D, releasing the brake, and also causes the two wheels A and B, to be locked together. So long as the two wheels A and B are locked together, the operating mechanism controls the position of the operating bar, but the moment the connection between the wheels A and B is severed, the brake-weight acts, throwing the brake onto the machine and forcing the operating bar to its central position, and cutting off the current.

M is the motor, the letter being placed upon the motor casing in Fig. 1; *m*, the shaft of the motor; Z, one arm of a bell crank, one end of said bell crank being connected to the operating bar, the other end being connected to a lever *z*, which is connected to the wheel B.

X is a casing which carries the connection between the motor shaft and the drum.

X' is a solenoid for controlling the brake independent of the mechanism hereinbefore described, and which forms no part of the subject matter of this application.

Having now fully described my invention, what I claim, and desire to protect by Letters Patent, is—

1. In combination with an electric motor, resistances in the armature circuit, an arm for controlling said resistances, a driving device adapted to be driven by the motor, a device adapted to be rotated by the driving device, an operating sheave, a ring contiguous to said sheave, an electric clutch adapted when energized to connect the sheave and disk together, and when demagnetized to release the disk from sheave, a notch in said disk, a hub having arms, one of which carries a roller, the other a weight, means to hold said roller against the face of the disk, a rotatable device, a sleeve connecting said rotatable device and hub, and connection between said resistance arm and hub, whereby the arm is moved over the resistances when the hub is rotated, a circuit to said disk clutch and means to close said circuit in the movement of the sheave in either direction independent of the motor switch.

2. In combination with an electric motor, resistances in the armature circuit, an arm for controlling said resistances, a driving device adapted to be driven by the motor, a de-

vice adapted to be rotated by the driving device, an operating sheave a ring contiguous to said sheave, an electric clutch adapted when energized to connect the sheave and disk together, and when demagnetized to release the disk from sheave, a notch in said disk, a hub having arms one of which carries a roller the other a weight, means to hold said roller against the face of the disk, a rotatable device, a sleeve connecting said rotatable device and hub, and connection between said resistance arm and hub, whereby the arm is moved over the resistances when the hub is rotated, a wire from one pole of the current source to clutch magnet, a wire from the other pole to a contact in electrical connection with a plate, and a wire from the clutch magnet to a contact normally out of contact with the plate but brought in contact when the sheave moves in either direction.

3. In combination with an electric motor, resistances in the armature circuit, an arm for controlling said resistances, a driving device adapted to be driven by the motor, a device adapted to be rotated by the driving device, an operating sheave, a ring contiguous to said sheave, an electric clutch adapted when energized to connect the sheave and disk together, and when demagnetized to release the disk from sheave, a notch in said disk, a hub having arms, one of which carries a roller, the other a weight, means to hold said roller against the face of the disk, a rotatable device, a sleeve connecting said rotatable device and hub, and connection between said resistance arm and hub, whereby the arm is moved over the resistances when the hub is rotated, a circuit to said disk clutch and means to close said circuit in the movement of the sheave in either direction independent of the motor switch, a switch in the circuit to the clutch magnet, a solenoid in the armature circuit adapted to break the circuit to the clutch magnet.

4. In combination with an electric motor, resistances in the armature circuit, an arm for controlling said resistances, a driving device adapted to be driven by the motor, a device adapted to be rotated by the driving device, an operating sheave, a ring contiguous to said sheave, an electric clutch adapted when energized to connect the sheave and disk together, and when demagnetized to release the disk from sheave, a notch in said disk, a hub having arms one of which carries a roller the other a weight, means to hold said roller against the face of the disk, a rotatable device, a sleeve connecting said rotatable device and hub, and connection between said resistance arm and hub, whereby the arm is moved over the resistances when the hub is rotated, a wire from one pole of the current source to clutch magnet, a wire from the other pole to a contact in electrical connection with a plate, and a wire from the clutch magnet to a contact normally out of contact with the plate but brought in contact when the sheave moves in either direction, a switch in the circuit to the clutch magnet, a solenoid in the armature circuit adapted to break the circuit to the clutch magnet.

5. In combination with an electric motor, resistances in the armature circuit, an arm for controlling said resistances, a driving device adapted to be driven by the motor, a device adapted to be rotated by the driving device, an operating sheave, a ring contiguous to said sheave, an electric clutch adapted when energized to connect the sheave and disk together, and when demagnetized to release the disk from sheave, a notch in said disk, a hub having arms one of which carries a roller the other a weight, means to hold said roller against the face of the disk, a rotatable device, a sleeve connecting said rotatable device and hub, and connection between said resistance arm and hub, whereby the arm is moved over the resistances when the hub is rotated, a circuit to said disk clutch and means to close said circuit in the movement of the sheave in either direction independent of the motor switch, a switch in the circuit to the clutch magnet, the arm of which is in line of movement of the core of a solenoid in the armature circuit.

6. In combination with an electric motor, resistances in the armature circuit, an arm for controlling said resistances a driving device adapted to be driven by the motor, a device adapted to be rotated by the driving device, an operating sheave, a ring contiguous to said sheave, an electric clutch adapted when energized to connect the sheave and disk together, and when demagnetized to release the disk from the sheave, a notch in said disk, a hub having arms one of which carries a roller the other a weight, means to hold said roller against the face of the disk, a rotatable device, a sleeve connecting said rotatable device and hub, and connection between said resistance arm and hub whereby the arm is moved over the resistances when the hub is rotated, a wire from one pole of the current source to clutch magnet, a wire from the other pole to a contact in electrical connection with a plate and a wire from the clutch magnet to a contact normally out of contact with the plate but brought in contact when the sheave moves in either direction, a switch in the circuit to the clutch magnet, the arm of which is in line of movement of the core of a solenoid in the armature circuit.

In testimony of which invention I have hereunto set my hand.

FRANK E. HERDMAN.

Witnesses:
C. D. HOYT,
JOB FISH, Jr.