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F. E. HERDMAN.

REGULATING ADMISSION OF CURRENTS TO MOTORS.

No. 567,714. Patented Sept. 15, 1896.

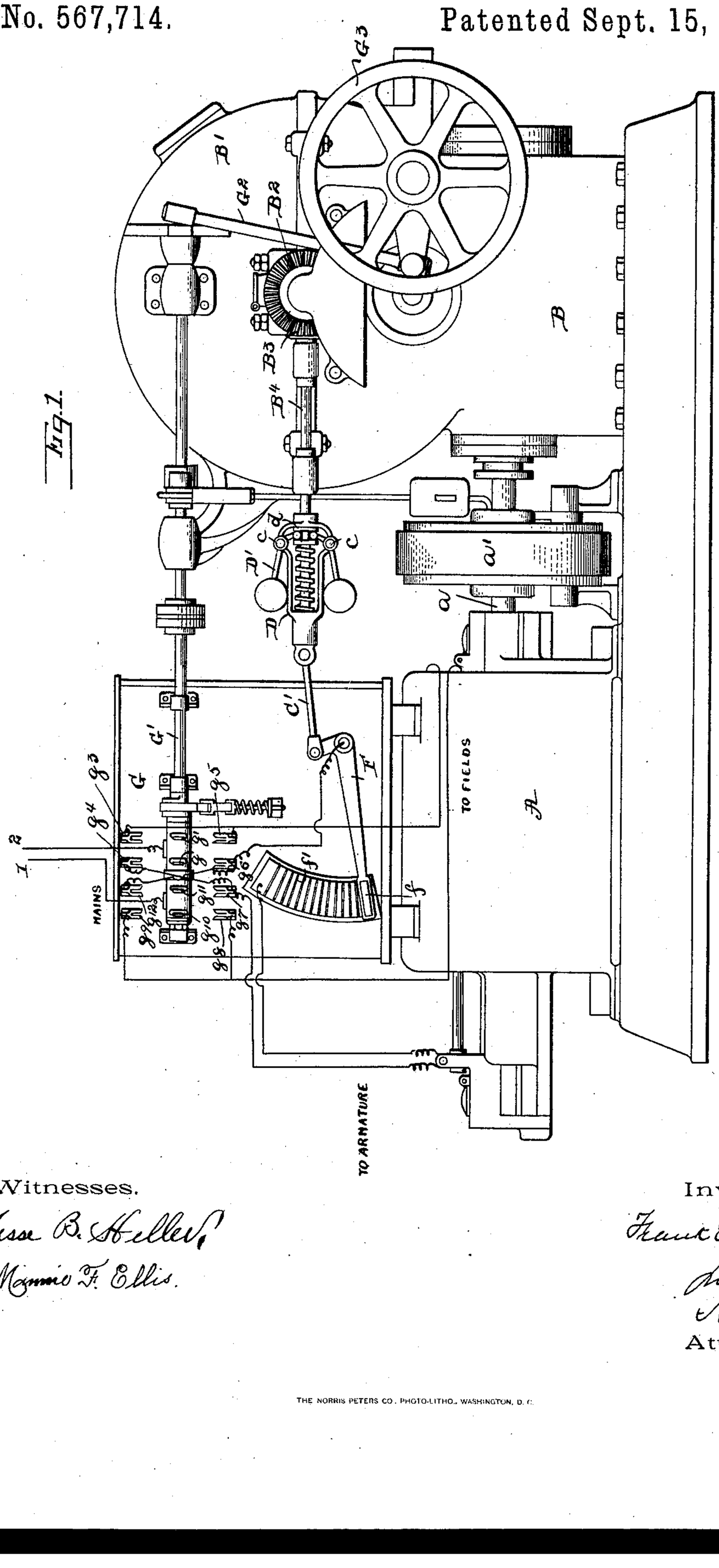

Fig. 1.

Witnesses.

Jesse B. Keller

Minnie F. Ellis.

Inventor.

Frank E. Herdman

by

A. D. Harding

Attorney.

(No Model.) 4 Sheets—Sheet 2.

F. E. HERDMAN.

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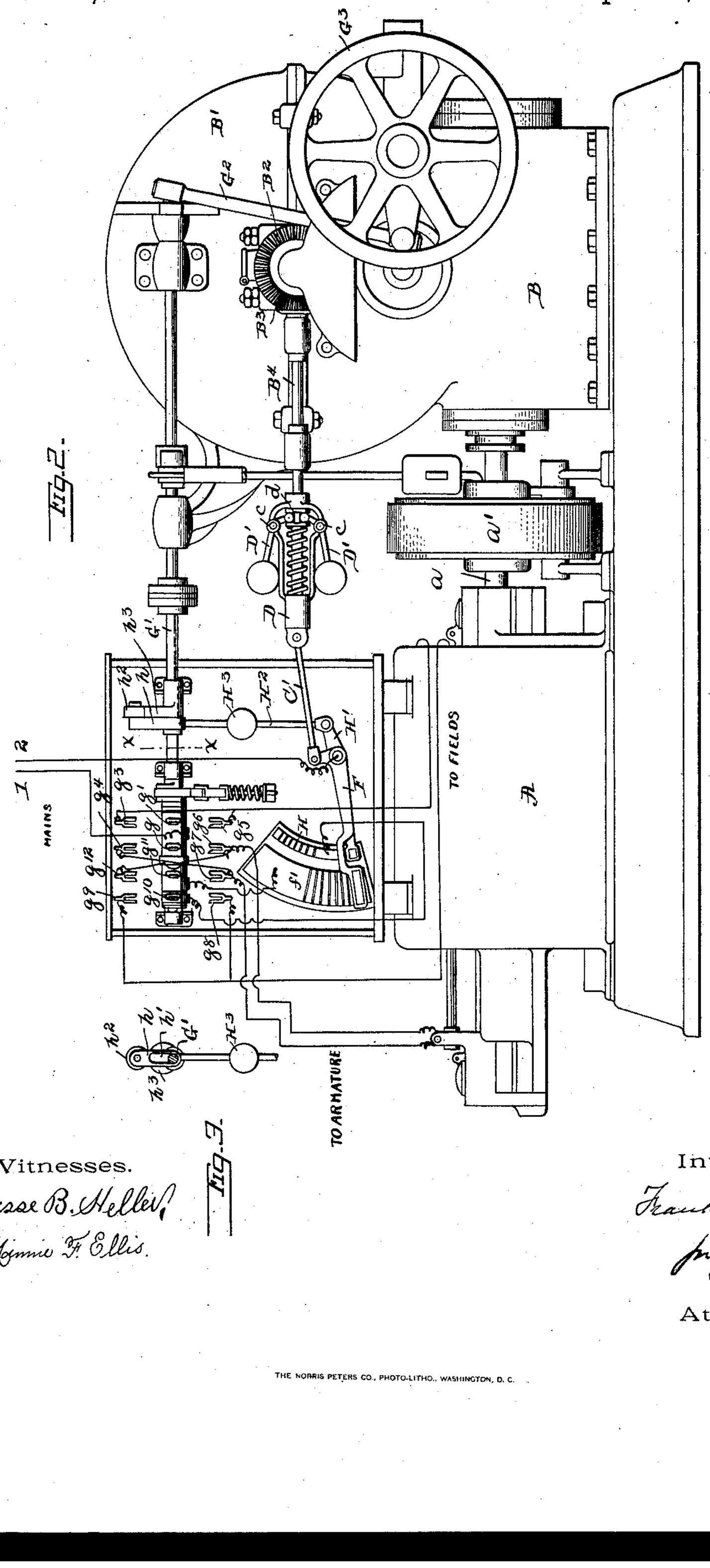

Fig. 2.

Witnesses.
Jesse B. Hellers
Minnie F. Ellis.

Inventor.
Frank E. Herdman
by G. G. Harding
Attorney.

(No Model.) 4 Sheets—Sheet 3.

F. E. HERDMAN.

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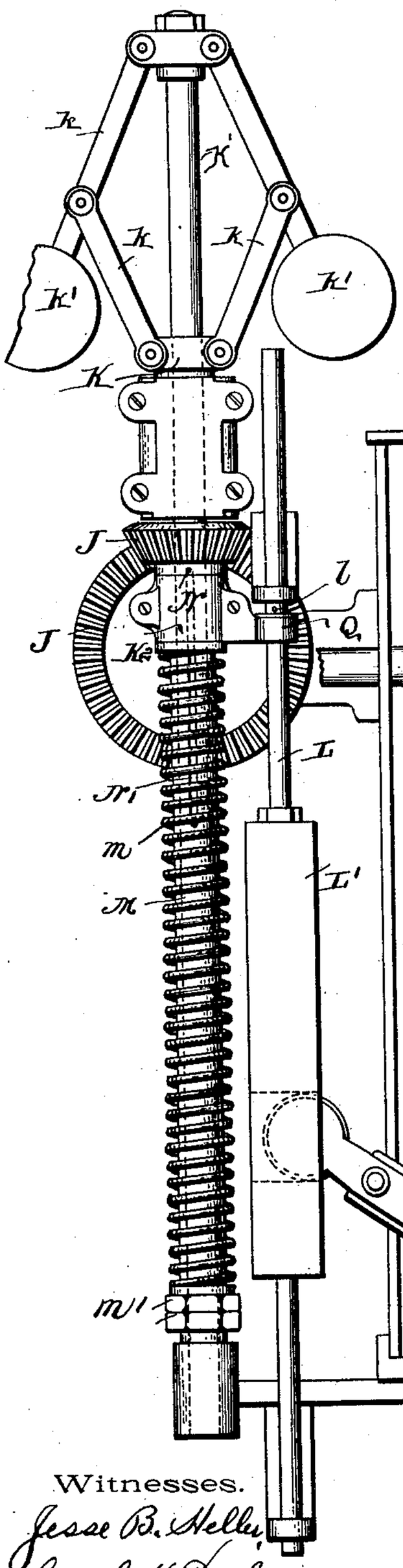
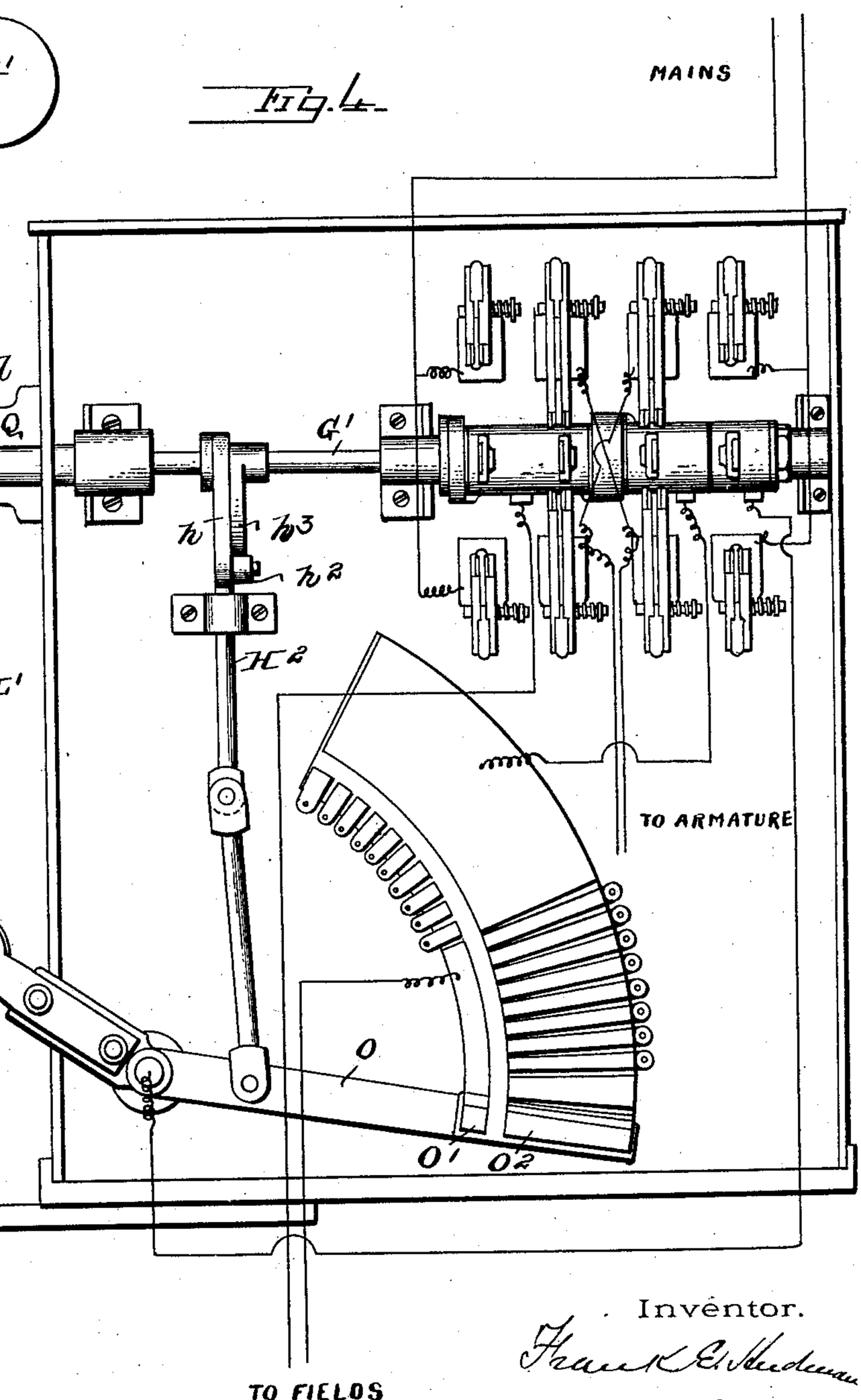

K
K'
K
K
K'
K'
K
J
J
K2
J1
m
M
M1
l
Q
L
L'

FIG. 4.



Witnesses.
Jesse B. Kelly,
Carol A. Dashong.

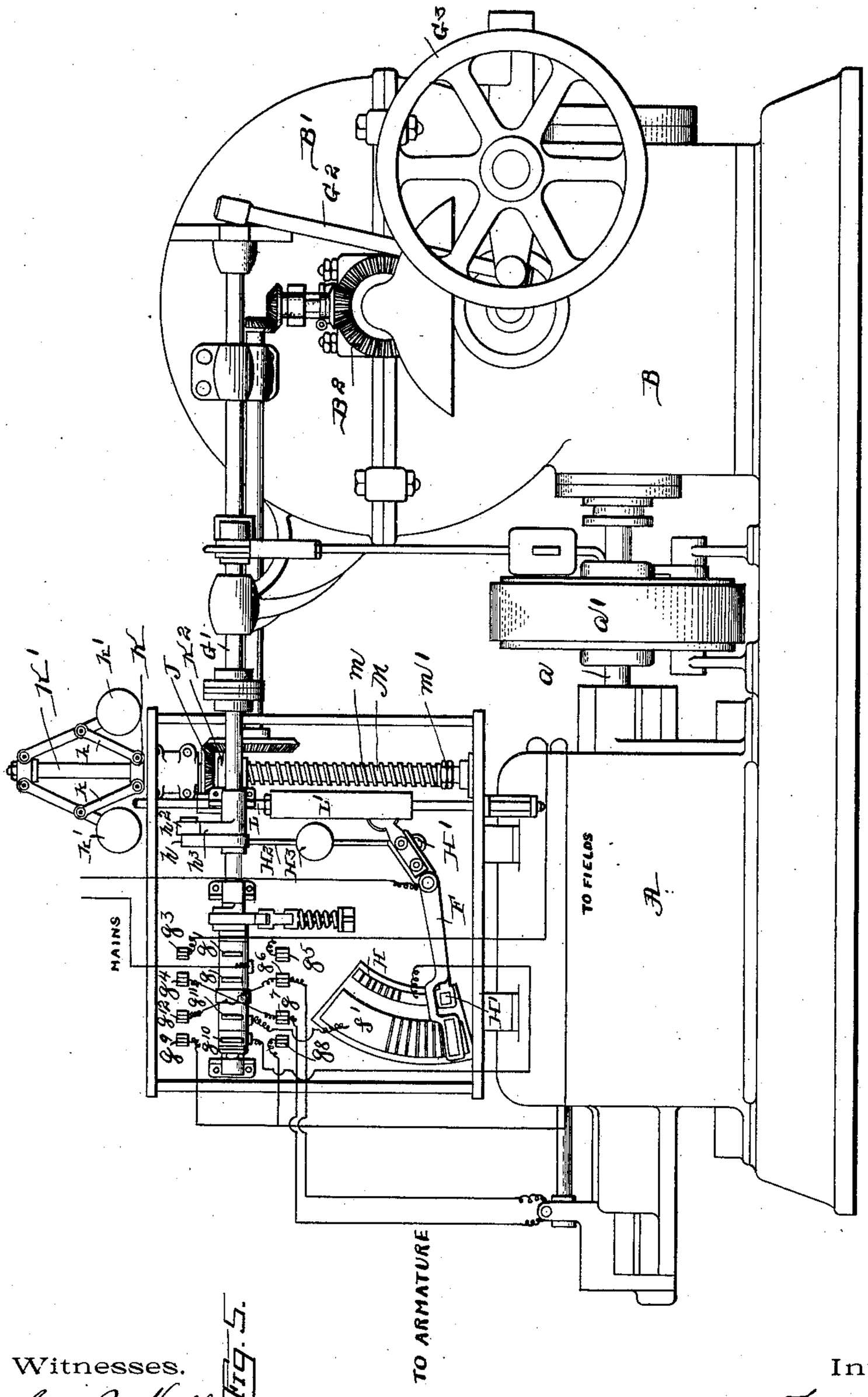
Inventor.
Frank E. Herdman
by G. H. Harding
Attorney.

(No Model.) 4 Sheets—Sheet 4.

F. E. HERDMAN.

REGULATING ADMISSION OF CURRENTS TO MOTORS.

No. 567,714. Patented Sept. 15, 1896.



Witnesses.
Jesse B. Keller.
M. F. Ellis.

Inventor.
Frank E. Herdman
by J. J. Harding
Attorney.

UNITED STATES PATENT OFFICE.

FRANK E. HERDMAN, OF WINNETKA, ILLINOIS.

REGULATING ADMISSION OF CURRENT TO MOTORS.

SPECIFICATION forming part of Letters Patent No. 567,714, dated September 15, 1896.

Application filed December 21, 1895. Serial No. 572,831. (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 Regulating Admission of Current to 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.

Broadly speaking, my invention has for its object to regulate the resistance in circuit and strength of current according to the speed with which the motor gets under way, and at all times to regulate said resistance and current strength according to the speed of the motor.

I will first describe the embodiment of my invention illustrated in the accompanying drawings, and then point out the invention in the claims.

In the drawings, Figure 1 is a side elevation of motor-casing, switch mechanism, elevator mechanism, and switch-controlling device. Fig. 2 is a similar side elevation of modified form. Fig. 3 is a section on line x x, Fig. 2. Fig. 4 is a front view of rheostat-box and modified form of governor. Fig. 5 is a similar view to Fig. 1 with modified governor as in Fig. 4.

Speaking first of the construction shown, Fig. 1, A is the motor a having the shaft, and the brake-wheel a'. B is the worm-casing, having the worm on the shaft a, which drives the drum B′. On the shaft of the drum B′ is the bevel-gear B^2, which meshes with the bevel-gear B^3 on a supplemental shaft B^4. On this shaft is a centrifugal governor consisting of the frame D, supported upon the shaft B^4 so as to have a lateral movement. Pivoted to this frame at c c are the two ball-arms D′, the short portion of which rests in a grooved collar d, fixed to the shaft B^4.

The frame D, by means of the link C′, is connected with the resistance-arm F, which has the brush f, which controls the resistance f' of the armature-circuit.

G is the snap-switch.

G′ is the operating-bar, connected by means of the link G^2 with the operating-sheave G^3.

The snap-switch is operated in the following manner: 1 2 are the wire connections with the main source of current-supply. Taking, first, wire 2, it passes to the active portion of the snap-switch G, which is in electrical connection with the blades g g'. These blades in the movement of the switch G in either direction are adapted, dependent upon which direction from the center the operating-bar G′ is moved, to make connection with the contacts g^3 and g^4 or g^5 and g^6. The contacts g^3 and g^5 are directly connected with one side of the field. Contact g^7 is connected with one side of the armature. Contact g^6 is connected with the resistance-arm F, and the resistance f' is connected with the other side of the armature. Contacts g^8 g^9 are connected with the other side of the field. The current from wire 1 passes to the switch G, in electrical connection with the blades g^{10} and g^{11}, and blade g^{11} is adapted to coact with either contact g^7 or contact g^{12}, dependent upon the direction in which it is turned, contacts g^{12} and g^6 being cross-connected, and contacts g^7 and g^4 being cross-connected. The blade g^{10} is adapted to coact with contact g^9 or contact g^8, dependent upon which way the switch is turned. Therefore it may be seen that the change of the switch from one direction to the other reverses the current in the armature, and thus reverses the motor, and that the current passes to the armature through the resistances. The movement of the balls of the governor moves the arm F over the resistances, cutting out the resistances in the armature-circuit. The speed with which the motor revolves determines the amount which the governor-balls move outward, and the amount which these balls move outward controls the movement of the arm over the resistances.

The difference between Fig. 1 and Fig. 2 consists in the following: There is, in addition to the resistance f' in the armature-circuit, resistance H in the field-circuit, the position of the resistances being reversed, as is well known, and the connection to the field is made through these resistances instead of directly, as in Fig. 1.

The resistance-arm F is curved to pass the brush of the resistance-arm H′, which controls the field-resistances, and this curved portion limits the movement of the resistance-arm H′,

the brush at the end of said arm resting against the curved portion of the resistance-arm F.

The arm H′ is connected with the operating-bar G′ in the following manner: H^2 is a rod connected to the arm H′ and having the weight H^3. This arm has a strap *h*, having a slot *h′* surrounding the operating-bar G′, and is provided at its upper end with the roller h^2. This roller rests on the surface of the eccentric cam h^3, fixed upon the operating-bar. When the operating-bar is moved from the center to operate the snap-switch to admit current, this cam h^3 is turned, and the weight operating upon the rod H^2 moves it downward, causes the arm H′ to move over the field-resistance H. This movement can only take place as fast as the arm F moves away from it. The operator has within his control, by moving the operating-bar toward the center, to move the arm H′ so as to cut out resistances in the field, and thus control the speed of the motor.

In Fig. 4 I have shown a modified form of construction of the governor. In this case K′ is the shaft of the governor.

K is the collar of the governor, fixed to the bevel-gear J, allowing the shaft K′ to slide within it. Secured by links *k* to the shaft and collar K are governor-balls *k′*. When the balls of the governor fly out, said shaft is moved downward. Upon this shaft is the collar K^2, moving up and down with the shaft. Q is a projection from this collar K^2, loosely surrounding the rod L, having the weight L′. On this rod is the pin *l*, resting on the projection Q. On the outside of the shaft K′ is a sleeve M, secured to the hub of the wheel J and extending downward and surrounded by the spring *m*, which spring rests at its lower end against the nut or projection *m′*. The sleeve M, being fastened to the hub of the wheel J, causes the spring at its lower end to be held from moving upward or downward. The shaft K′ moves inside of this sleeve M, so the sleeve revolves with it. The block carrying the collar K^2 rests on spring *m*. N is a pin secured to the shaft K′, which pin passes through a slot N′ in the sleeve M, so that the revolution of the sleeve by the bevel-gear J revolves the shaft; but the shaft can move up and down independent of the nut against the spring *m*. By this arrangement the spring can be placed to oppose the movement of the centrifugal governor, thereby giving means of regulation. The nuts *m′* are on the tube and permit of the adjustment of the tension of the springs *m*. In this case I use a single rheostat-arm O, controlling the brushes O′ and O^2, respectively, of the field and armature resistances. When the balls of the governor fly out, the collar K^2 moves downward, allowing the rod L to drop by means of weight L′, moving the arm O over the resistances, and when the balls move inward the arm O moves in the other direction.

In Fig. 5 I have shown this form of governor attachment as applied to the construction shown in Fig. 2.

Speaking generally of the operation, there is driven by the motor-shaft a centrifugal governor which receives its motion from the motor-shaft and is connected to the rheostat-arm, so that when the balls of the governor are at the point of rest the rheostat-arm is at the first contact of the resistances in the armature-circuit, and if the field-resistances be also used there will be no resistance on the field. When the operating-switch is closed to operate the elevator, then the governor obtains motion due to the motion of the motor. As it attains this motion the balls move outward, due to centrifugal force, which is directly proportioned to the speed of the motor. As these balls move outwardly they carry the rheostat-arm over the contacts with the speed due to the rapidity with which the motor attains its speed or gets under way, and whenever the balls of the governor remain at rest in any position the rheostat-arm stays at that position. As soon as there is a further acceleration of the speed of the motor the balls move outward correspondingly, and continue to carry the rheostat-arm over the contacts. Thus the position which the rheostat-arm takes with reference to the contacts is controlled by the governor, which, in turn, is controlled directly by the speed of the motor. This being the case, the rheostat-arm will be carried over the contacts at exactly the speed with which the motor gets under way, and is operated according to the load which the motor is to lift. If in closing the snap-switch there is no current on the line, then no motion is given to the armature. If no motion is given to the armature, then the governor has no motion; in consequence, the rheostat-arm does not pass over the contacts. If while the machine is in motion the current should be cut off and the motor stopped, then the governor comes to rest and brings the rheostat-arm back to its first position. If the motor continue to run with the current cut off, then, of course, the rheostat-arm would remain in a certain position on the contacts, due to the speed of the governor. This will work no harm, as, with such a speed of the motor, the proper counter electro-motive force would immediately be produced if the circuit be closed to take care of the current admitted, and, in fact, this condition of holding the resistance-arm in this position under these conditions is advantageous. If the motor should be stalled so that it cannot lift its load, then the rheostat-arm could not pass over the contacts, as the governor would have no speed. If a motor should become stalled while in motion, then, due to the slacking in speed, the rheostat-arm would be brought back toward its central position to cut in the circuit the resistance proper for this reduction of speed. If the motor gets under way slowly, the governor will accelerate slowly, and, in

consequence, will carry the rheostat-arm over the contacts slowly. If the motor gets under way rapidly, then the governor would accelerate rapidly and carry the rheostat-arm rapidly over the contacts. If the motor is only able to attain half speed, then the governor would not obtain a greater speed, and, in consequence, would only carry the rheostat-arm to a point on the contacts which is proper for this speed.

It will be also seen that, in addition, this device will also act as a weighing device, for if the machine is overloaded and cannot obtain speed the governor will prevent resistances being cut out of the circuit.

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

1. In combination with an electric motor, a source of current supply, connection between the source of current supply and the field and armature of motor, a device adapted in its movement in one direction to increase the amount of current in the armature, a centrifugal governor driven by said motor and connection between said device and the governor, the connection being such that the position of the governor limits the movement of said device in one direction, and means independent of said governor to move said device in the other direction.

2. In combination with an electric motor, a source of current supply, connection between the source of current supply and the field and armature of motor, a device adapted in its movement in one direction to increase the amount of current in the armature, a centrifugal governor driven by said motor, and connection between said device and the governor, the connection being such that the position of the governor limits the movement in one direction, and means independent of the governor for moving said device in both directions.

3. The combination with an electric motor, of a source of current supply, connection between the current supply and the armature and field of motor, a device for controlling the amount of current admitted to the armature, a device for controlling the amount of current in the field, a centrifugal governor driven by the motor, a connection between said governor and the armature-current-controlling device, the field device moving in one direction in the movement of the armature-controlling device, and its movement in the other direction being limited by the movement of the armature-controlling device, and means to move said field-controlling device in one direction, independent of the movement of the armature-controlling device, a centrifugal governor controlling the movement of the armature-current-controlling device.

4. In combination, an electric motor, a source of current supply, electrical connection between the fields and current supply, a device adapted in its movement in one direction to decrease the amount of current in the field, and in the other direction to increase the current in the field, a centrifugal governor driven by the motor, said governor limiting the movement of said device in one direction, and means independent of the governor to move said arm in either direction.

5. In combination, an electric motor, a source of current supply, electrical connection between the fields and current source, a device adapted in its movement in one direction to decrease the amount of current in the field, and in the other direction to increase the current in the field, a centrifugal governor driven by the motor controlling the amount of current admitted to the armature of the motor, an operating-bar and intermediate connection between said device and said bar, mechanism independent of the operating-bar to move said field device in the direction to decrease the current in the field, the movement of said device in that direction being controlled by the centrifugal governor.

6. In combination, an electric motor, a source of current supply, electric connection between the field and current source, a device adapted in its movement in one direction to decrease the amount of current in the field, and in the other direction to increase the current in the field, a centrifugal governor driven by the motor controlling the amount of current admitted to the armature of the motor, said centrifugal governor limiting the movement of the field device in one direction, an operating-bar, connection between said field device and said bar, and means independent of said operating-bar to move said device in both directions.

7. In combination, an electric motor, a source of current supply, electrical connection between the fields and current source, a device adapted in its movement in one direction to decrease the amount of current in the field, and in the other direction to increase the current in the field, a centrifugal governor driven by the motor controlling the amount of current admitted to the armature of the motor, an operating-bar and intermediate connection between said device and said bar, mechanism independent of the centrifugal governor to move said field device in either direction, said centrifugal governor controlling the extent of movement in one direction.

8. In combination, an electric motor, a source of current supply, electrical connection between the field and armature of the motor and source of current supply, resistances in the field and armature circuits, a device controlling said resistances, and adapted in its movement in one direction to cut out said resistances in the armature-circuit, and cut in said resistances in the field-circuit, and vice versa in the other direction, a centrifugal governor driven by said motor, and connection between said governor and the resistance-controlling device, the connection

being such that the position of the governor controls the position of the resistance device.

9. In combination with an electric motor, a source of current supply, and electrical connection between said motor and source of current supply, a device for controlling the admission of current to the motor, a governor driven by the motor, the shaft of the governor being moved by the action of said governor, a sleeve surrounding and revolving with said shaft, a spring surrounding said sleeve, a collar fixedly connected with the shaft having a vertical movement on the sleeve, a weighted rod, a projection upon said rod, there being a projection from said collar upon which said projection on the rod rests, and connection between said weighted rod and the current-controlling device.

10. In combination with a source of current supply, an electric motor, circuit connections to said motor, a switch for controlling the admission of current to the motor and operating mechanism for controlling said switch, of a device adapted in its movement to vary the current strength in the circuit to the motor, a centrifugal governor driven by said motor and connection between said governor and the current-varying device, the connection being such that the governor controls the movement of the current-varying device in one direction, and connection between the operating mechanism and current-varying device whereby the movement of the operating mechanism toward the center moves the current-varying device.

11. In combination with a source of current supply, an electric motor, circuit connections to said motor, a switch for controlling the admission of current to the motor and operating mechanism for controlling said switch, of a device adapted in its movement to vary the current strength in the circuit to the motor, a centrifugal governor driven by said motor and connection between said governor and the current-varying device, the connection being such that the governor controls the movement of the current-varying device in one direction, and connection between the operating mechanism and current-varying device, whereby the movement of the operating mechanism toward the center moves the current-varying device, and the extent of movement of the operating mechanism from the center limits the movement of the current-varying device in the opposite direction.

12. In combination with a source of current supply, a motor, circuit connections to the field and armature of said motor, resistances in both circuits, a device adapted in its movement in one direction to increase the current in the armature-circuit and decrease the current in the field-circuit, a centrifugal governor driven by said motor, and connection between said governor and the current-varying device, and mechanism adapted to act independent of said governor and move said device to increase the current in the field.

13. In combination with a source of current supply, an electric motor, circuit connections to said motor, a switch for controlling the admission of current to the motor and operating mechanism for controlling said switch, of a device adapted in its movement to vary the current strength in the circuit to the motor, a centrifugal governor driven by said motor, and connection between said device and the centrifugal governor and mechanism connected with the operating mechanism adapted in the movement of the operating mechanism toward its central position to move said current-varying device.

14. In combination with a source of current supply, an electric motor, circuit connections to said motor, a switch for controlling the admission of current to the motor, and operating mechanism for controlling said switch, of a device adapted in its movement to vary the current strength in the circuit to the motor, actuating mechanism adapted to move said device in one direction, a centrifugal governor driven by said motor, and connection between said governor and said actuating device, and mechanism connected with the operating mechanism, adapted by the movement of the operating mechanism to move said actuating device and said current-varying device in the other direction.

15. In combination with an electric motor, a source of current supply, connection between the source of current supply and the field and armature of motor, a device adapted in its movement in one direction to increase the amount of current in the armature and decrease the current in the field, a centrifugal governor driven by said motor and connection between said device and the governor, the connection being such that the position of the governor limits the movement of said device in one direction, and means independent of said governor to move said device in the other direction.

16. In combination with an electric motor, a source of current supply, connection between the source of current supply and the field and armature of motor, a device adapted in its movement in one direction to increase the amount of current in the armature and decrease the current in the field, a centrifugal governor driven by said motor, and connection between said device and the governor, the connection being such that the position of the governor limits the movement in one direction, and means independent of the governor for moving said device in both directions.

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

FRANK E. HERDMAN.

Witnesses:
G. E. WEISSENBURGER,
J. B. HUDELSON.