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6 Sheets—Sheet 1.

F. E. HERDMAN.

ELECTRIC ELEVATOR.

No. 480,845. Patented Aug. 16, 1892.

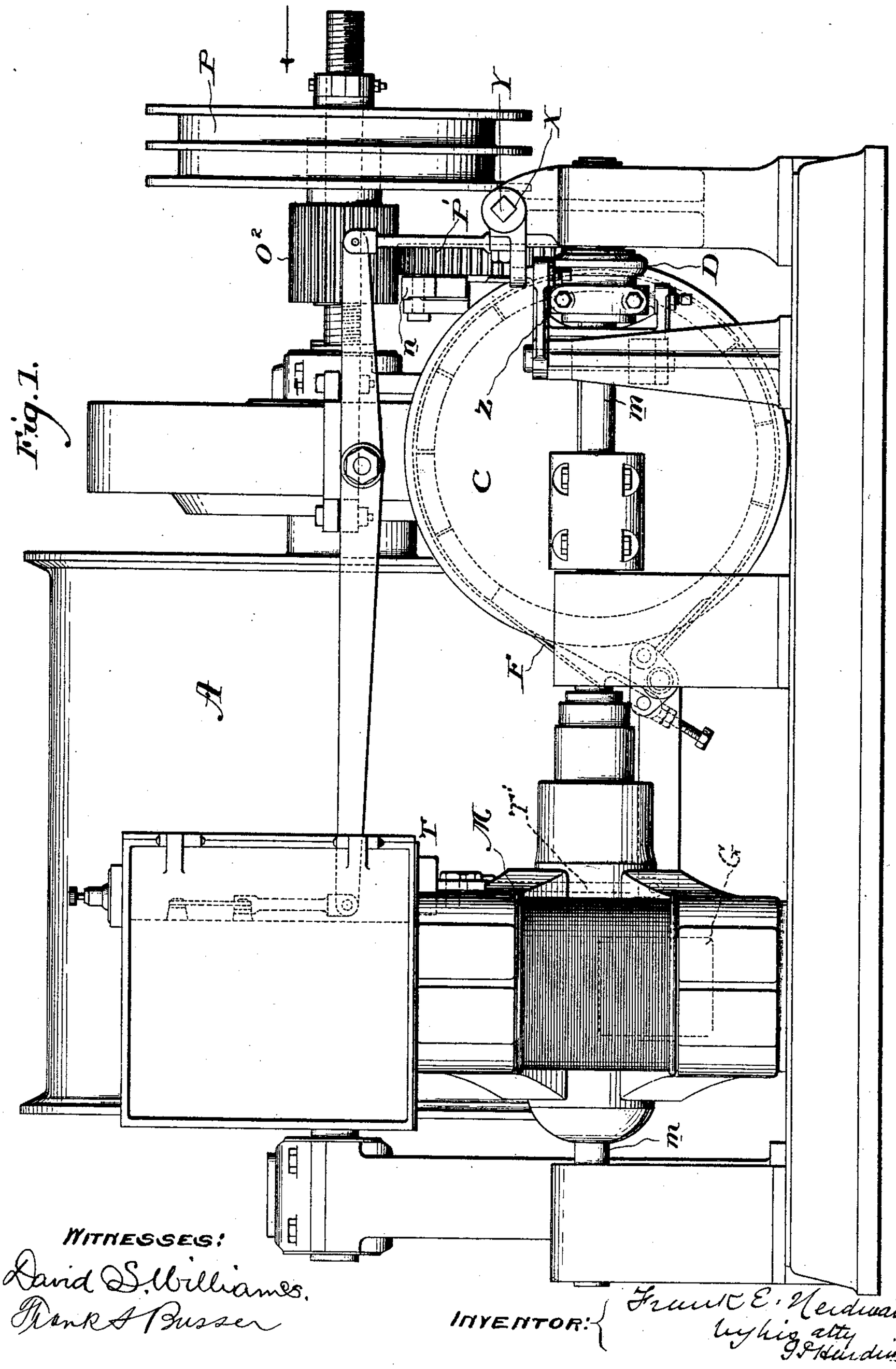

Fig. 1.

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INVENTOR:
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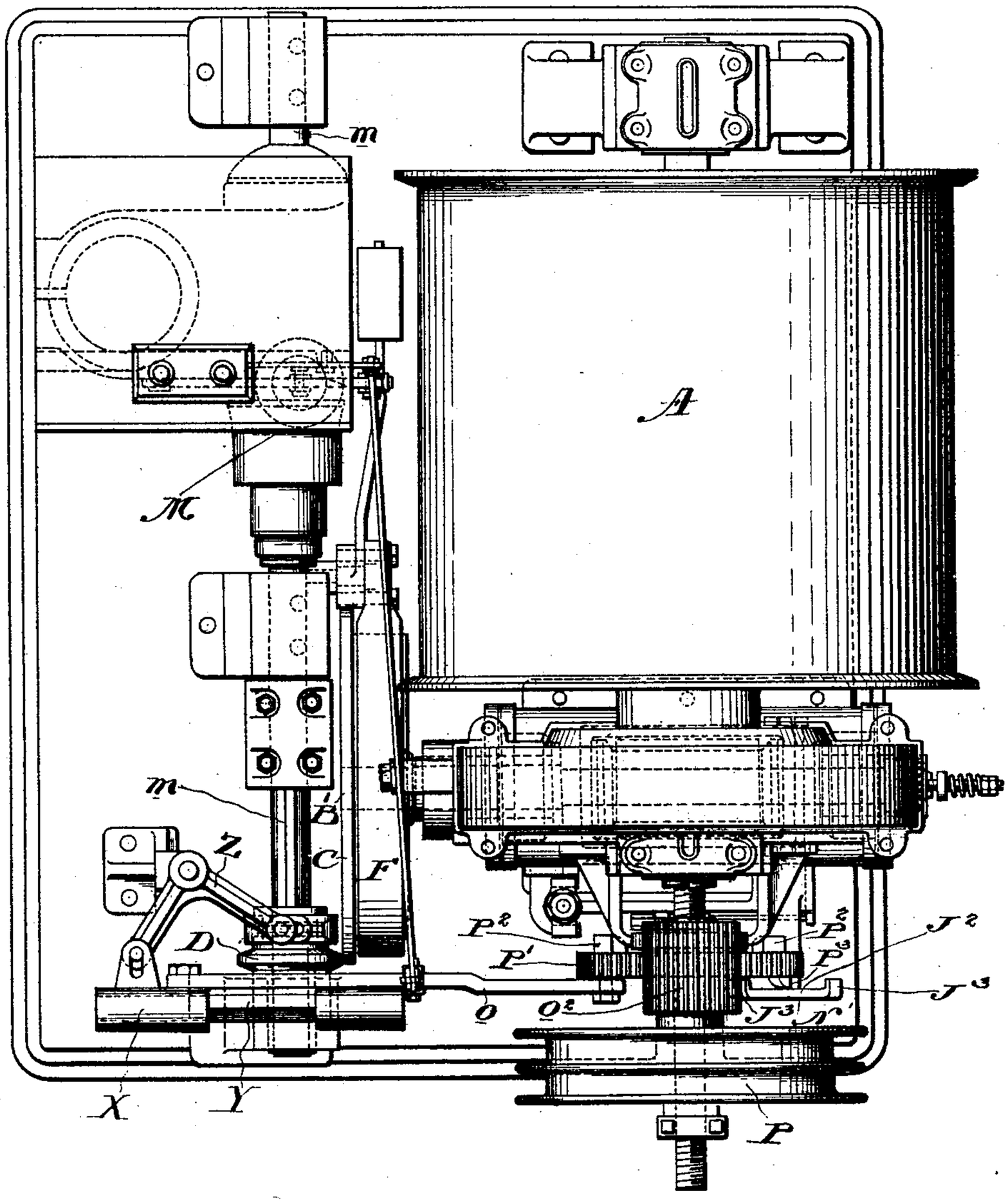
ELECTRIC ELEVATOR.

No. 480,845. Patented Aug. 16, 1892.

Fig. 2.



Witnesses:
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(No Model.) 6 Sheets—Sheet 3.

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ELECTRIC ELEVATOR.

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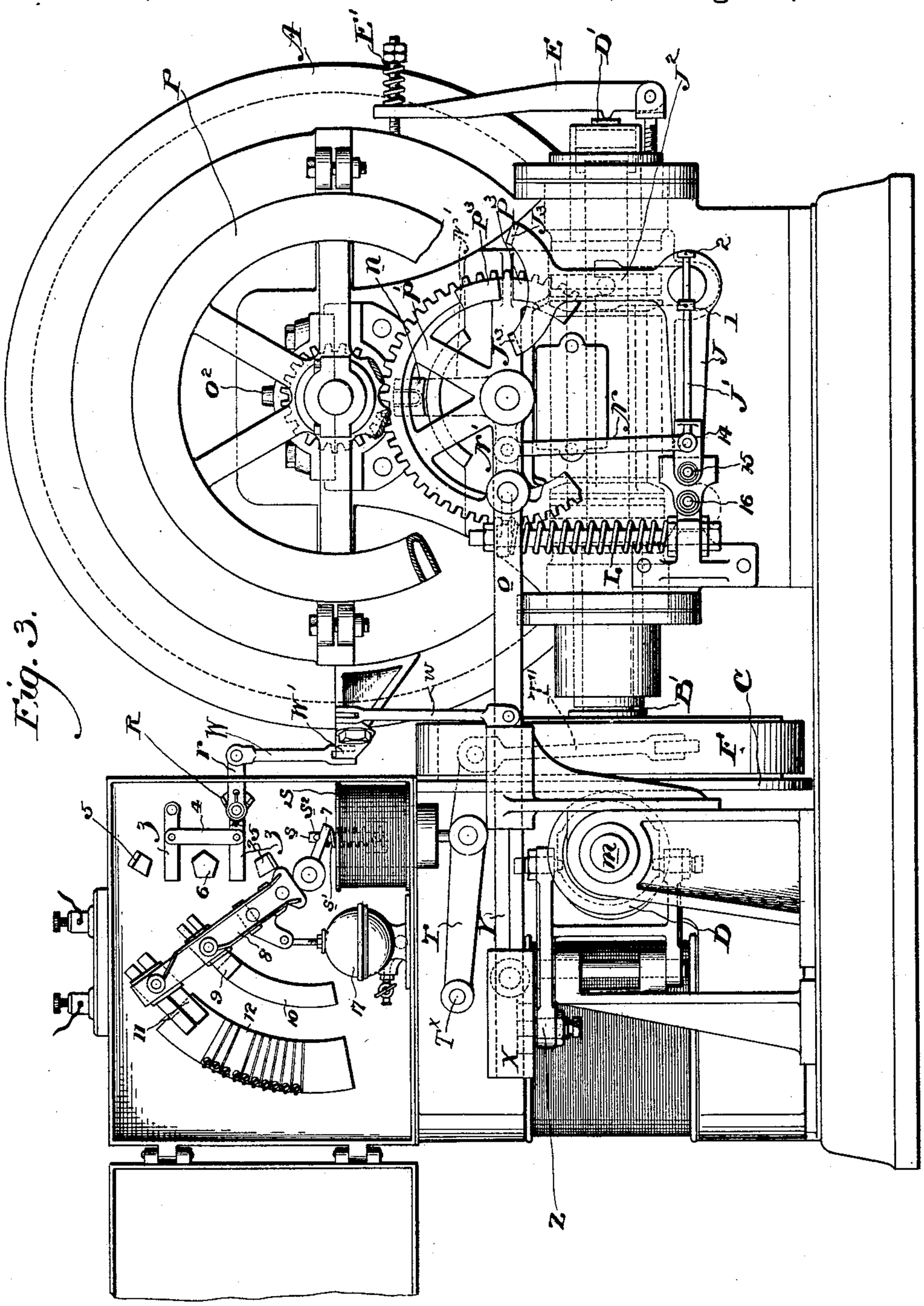

Fig. 3.

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(No Model.)

6 Sheets—Sheet 4.

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ELECTRIC ELEVATOR.

No. 480,845. Patented Aug. 16, 1892.

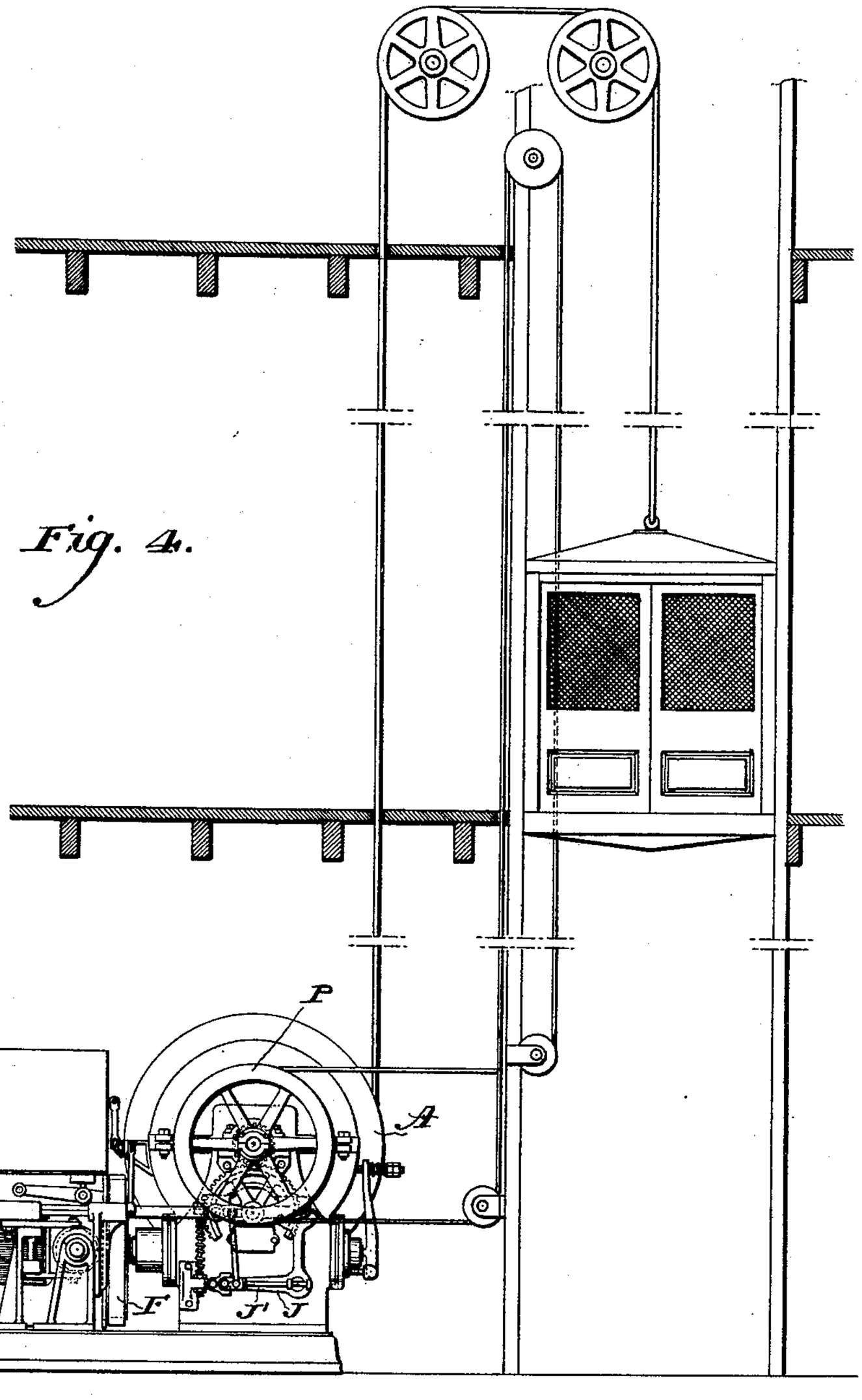

Fig. 4.

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6 Sheets—Sheet 5.

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ELECTRIC ELEVATOR.

No. 480,845. Patented Aug. 16, 1892.

Fig. 5.

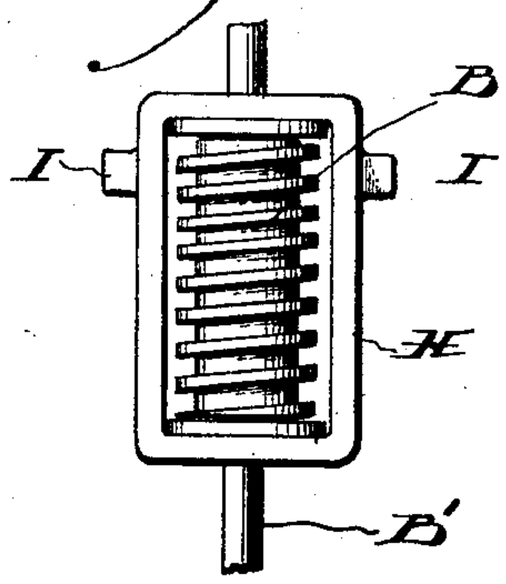
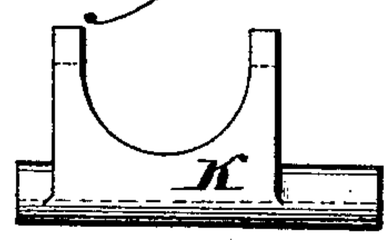


Fig. 6.



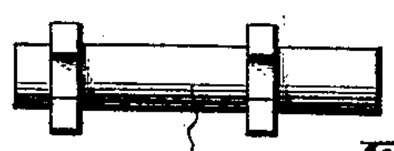


Fig. 6½.

Fig. 7.

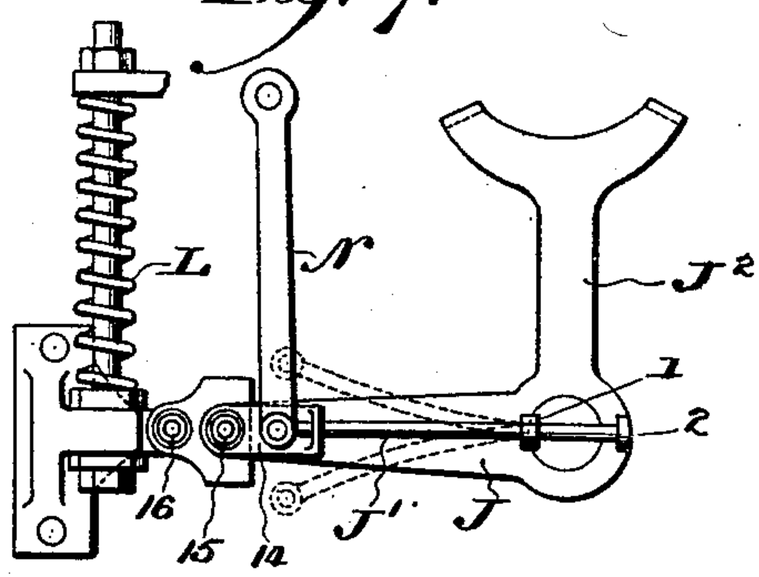


Fig. 9.

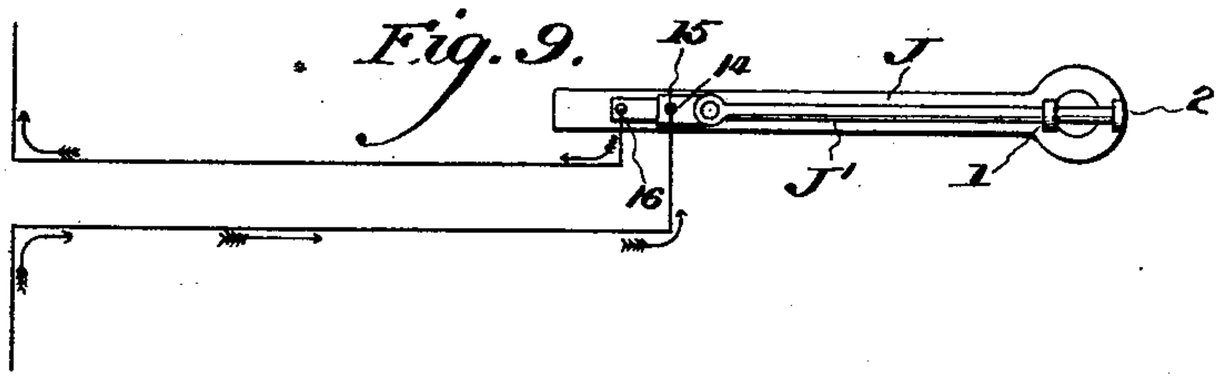


Fig. 10.

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(No Model.) 6 Sheets—Sheet 6.

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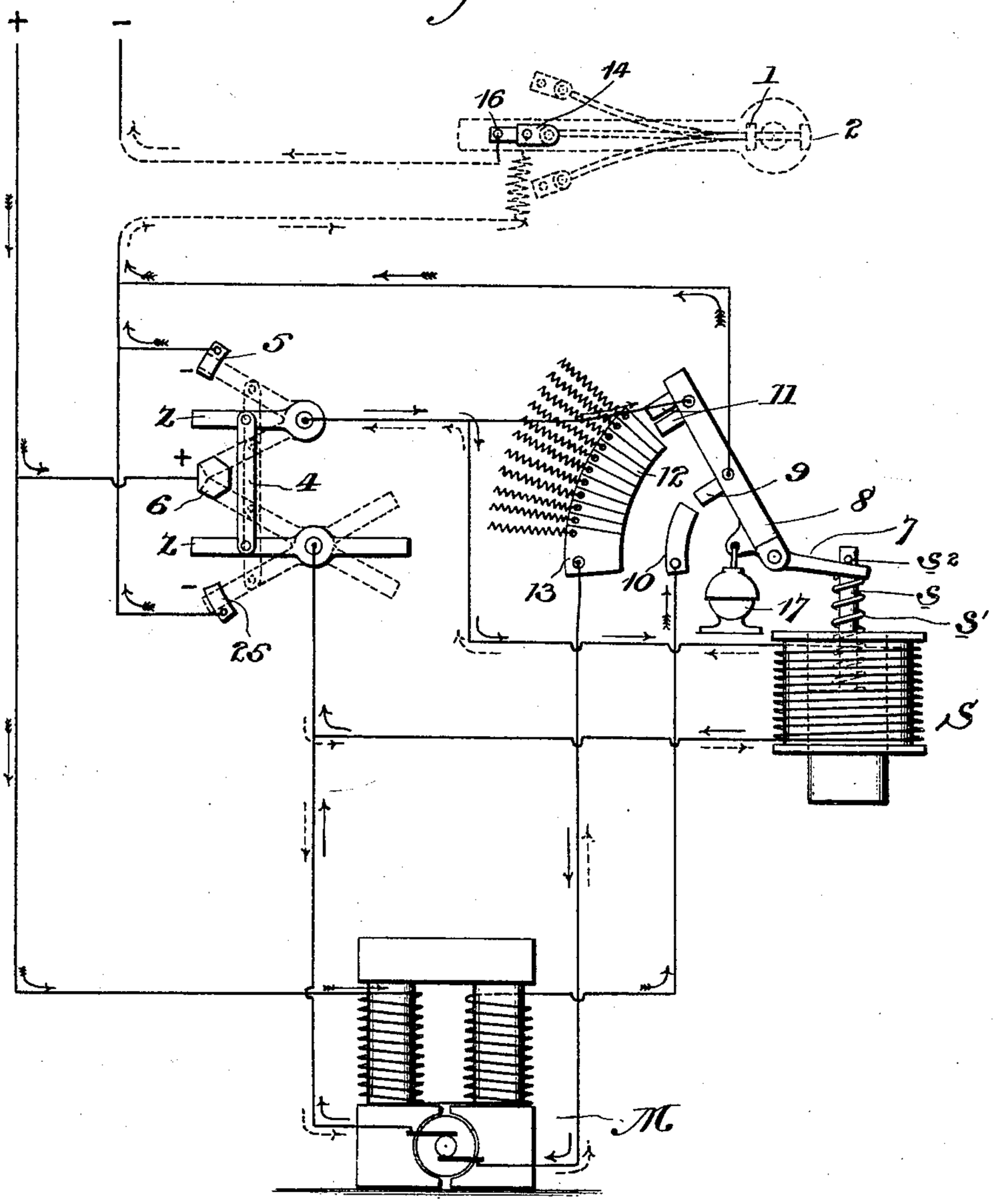
ELECTRIC ELEVATOR.

No. 480,845. Patented Aug. 16, 1892.

Fig. 8.



WITNESSES:

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Frank A. Brown

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UNITED STATES PATENT OFFICE.

FRANK E. HERDMAN, OF INDIANAPOLIS, INDIANA.

ELECTRIC ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 480,845, dated August 16, 1892.

Application filed October 20, 1891. Serial No. 409,280. (No model.)

To all whom it may concern:

Be it known that I, FRANK E. HERDMAN, a citizen of the United States, residing at Indianapolis, county of Marion, and State of Indiana, have invented a new and useful Improvement in Elevators, 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.

My invention has for one of its objects to regulate the speed of the elevator proportionate to the load, so that as the load increases over a normal the speed will decrease and the work on the motor remain constant.

I will now describe the preferred form of embodiment of my invention.

Figure 1 is a side elevation of elevator-operating mechanism. Fig. 2 is a plan view of the same. Fig. 3 is an end view, looking in the direction of the arrow, Fig. 1. Fig. 4 is a side elevation of the device as applied to an elevator. Fig. 5 is a detail view of worm, worm-shaft, and worm-yoke. Fig. 6 is a detail view of fork or rocker K. Fig. 6½ is a plan view of fork shown in Fig. 5. Fig. 7 is a detail view of lever J and spring-arm J′. Fig. 8 is a diagrammatic view of solenoid, switches, and motor, also detail of electrical connection-lever J. Fig. 9 is a detail electrical connection of current to lever J. Fig. 10 is a detail view of end of the spring J′, fastened to lever J.

A is the operating-drum, driven by the worm B on the shaft B′, the worm being loose on the shaft and surrounded by the yoke H, inside of the worm-casing. (See detail, Fig. 5.) The end-thrust of the worm is on the end of this yoke. The yoke H has the lugs I on the end of it, which are held by the fork or rocker K. (See Fig. 6.) The shaft K of this rocker extends outside of the worm-casing and has attached to it the lever J. At the end of this lever J is the tension-spring L. This lever J is connected to the bell-crank N′ by the link N, the lever J being connected to the link N by the resistance metallic strip J′, which is secured to the lever J at 1 and 2, so that in the throw of the bell-crank N′ in either direction, if its movement is stopped for any reason, the lever J will continue its movement, the strip J′ being bent, (the purpose of which will hereinafter be fully explained.)

P is the operating-sheave, and O^2 is a gear-wheel upon the shaft of the operating-sheave P. This gear O^2 meshes with the segmental gear P′, to which is attached the operating-bar *o*.

P^2 are lugs, one on each side on the back of the segmental gear, and *n* is a projection on the end of the bell-crank N′ in line of movement of said lugs P^2, and according to the position of the projection the throw of the gear P′ to the right or left is limited. Connected to the segmental gear P′ are the lugs P^3, and connected to the lever J is an arm J^2, provided with lugs J^3, which are so adjusted that when the lever J is thrown to its extreme position, either up or down, one of the lugs will pass between the lugs P^3, and thereby prevent the operation of the machine.

C is a friction-disk on the end of the worm-shaft B′, and D is a small friction-wheel feathered on the shaft of the motor. *m* is a shaft coupled thereto.

F is a strap-brake placed upon a projection on the back of the friction-disk C.

X is a sliding piece connected to the bar O and which works on the guide Y. To this sliding piece X is connected the bell-crank Z, which in turn is connected with the friction-wheel D, and the movement of the bar moves the friction-wheel D across the friction-wheel C. The pressure between the friction-disks C and D is maintained by having an end-thrust bearing D′ on the end of the shaft, the lever E being fulcrumed just below the shaft and having a spring E′ to maintain the pressure.

M is the motor, which in this case is an electric motor, and *m* its shaft.

R is a switch and *r* its handle. Upon this switch are two brushes *z z*, connected by an insulated strip 4.

5 25 are two contact-points connected to one pole of the source of current-supply, (the negative pole in this case, Fig. 8,) and 6 is a contact connected to the other pole of the source of current-supply.

S is a solenoid.

s is a rod attached to the solenoid-core, and surrounding this rod is the spring *s*′. The brushes *z z* are electrically connected with the solenoid. (See Fig. 8.)

7 is a lever, the end of which surrounds the

rod *s*, and s^2 is a pin upon said rod, and connected to this lever is the arm 8. 9 is a brush on this arm in electrical connection with the negative pole of the source of current-supply, and 10 is a contact-point in direct electrical connection with the field. 11 is a brush attached to this arm in electrical connection with the brush *z*.

12 is a resistance.

13 is a contact-point in electrical connection with the resistances and with the armature of the motor. The field of the motor is also in electrical connection with one pole of the source of current-supply.

In Fig. 8 the "plus" and "minus" denote the origin of the current. The current from one pole of the battery goes directly to the field. The other pole of the battery is in direct electrical connection with the brush 9. The solenoid is in direct electrical connection with the brushes *z z* and the field is in direct electrical connection with the contact 10. The armature is in direct electrical connection with one of the brushes *z z*, and the other electrical connection to the armature is made through the contact-point 13. The brush 11 is in electrical connection with one of the brushes *z z*.

17 is a dash-pot, which consists of a hollow casting and the rubber covering above, forming a diaphragm having a cock to regulate the rapidity of the escape of the air, in this way retarding the movement of the solenoid and switch. A check-valve, opening inward, is placed on the bottom to allow access of the air, and thereby the quicker return of the solenoid core and switch.

The operation is as follows: The operator throws the pinion connected with the operating shaft to the right or to the left, according to which direction he wishes the elevator to go. This in turn throws the segmental gear P′ to the right or left and raises or lowers the rod or bar *o*, at the same time moving it toward the right or left, which through the medium of the lever *w*, connecting lever W′ and lever W, (the last being connected to the handle *r* of the switch R,) moves the switch up or down according to the movement of the connecting-bar *o*. If the movement is up, so as to bring the brushes *z* in contact with the contact-points 5 and 6, the current passes through the contact-point 6 to the solenoid-core, returning through the contact-point 5 to the other pole of the battery. This electrifies the solenoid-core, causing the core to rise, which brings the brush 9 in contact with the contact-point 10, thereby causing the current to pass from the main-line positive pole to the field and from the field to the contact-point 10 and brush 9 back again to the other pole of the battery. At the same time the solenoid-core causes the brush 11 to pass over the resistances 12, forming a current from the positive pole of the battery through the armature and returning through the resistance back to the negative pole of the battery. The wire from the negative pole of the battery passes to the binding-post 16 and from the binding-post 15 to the switch, so that if the brush on the strip J′ is in contact with the lever J the circuit is complete; but when the spring-arm is moved out of contact the circuit is broken. When the switch is moved in the opposite direction, so that the brushes *z z* are in connection with the contact-points 6 and 25, the only differences between the direction of the flow of the currents is that the current passes from the positive pole to the solenoid through the contact-point 6 and returns from the solenoid through the contact-point 25 to the negative pole. The current to the armature passes from the contact-point 6 to the brush 11 and through the resistances to the contact-point 13 to the armature, and from the armature through the contact-point 25 to the other pole of the battery. In these cases, where in Fig. 8 two arrows are shown, one dotted and the other full on the same connection, the dotted arrow shows the direction of the current when the brushes *z z* are in contact with the contact-points 5 and 6, while the full arrows show the direction of the current when the brushes *z z* are in contact with the contact-points 6 and 25. The solenoid-core is connected with the brake-weight G of the brake F by the lever T and a link T′. The spring metallic piece J′ is secured to the lever J at 1 and 2. On the end of the metallic piece J′ is secured a piece of insulation 14, having on its end a brush forming an electrical switch and a binding-post 15. To the lever J is fastened an electrical contact, insulated from it and having a binding-post 16. The wire from either pole of the battery passes to the binding-post on the lever J. In this case the negative and a wire is connected to the binding-post on the strip J′, and continues from there to the switch, as shown clearly in Fig. 8. When the brush on the strip J′ is in contact with the electrical connection to the lever J, the circuit is complete, and when the spring arm or piece J′ is moved out of contact with the electrical connection to the lever J the switch is broken and the electric current does not pass to the main switch and the motor does not receive any current. The arm or handle *r* of switch R is connected with the operating-bar through the lever W, connecting lever W′ and lever W, said lever W being connected to the operating-bar. To operate this elevator, the operator throws the pinion connected with the operating-sheave to the right or to the left, according to which direction he wishes the elevator to go. This in turn throws the segmental gear P′ to the right or left and raises or lowers the rod or bar *o* up or down, and at the same time drawing it toward the right. The first movement of this operating-bar up or down closes the switch R up or down, thereby closing the switch, so as to give the right direction to the motor, admitting the current in one direction or the other. As the operating-bar contin-

ues to be drawn up by the motion of the segmental gear P′ it draws the sliding piece X inward, and thereby throws the friction D toward the center of the friction *c*, consequently increasing the speed of the elevator to the desired extent. The movement or throw of the segmental gear P′ is regulated by the position of the bell-crank N′, the position of the projection *n* determining the extent of movement. The spring on the end of the lever J is of sufficient stiffness to counterbalance the desired safety load; but if this load is increased above the desired amount (say fifteen hundred pounds) the lever J moves, operating the bell-crank N′, as before described, bringing the projection N in such position that the throw of the segmental gear P′ is decreased, thereby decreasing the throw of the rod *o* and thus decreasing the speed of the elevator. If the load is within the required limits, the bell-crank remains stationary. If it increases beyond this point, it is thrown to the right or left until it reaches the maximum point, when the lugs J^3 on the arm connected with the lever J pass between the lugs P^3 on the segmental gear, which would thereby prevent the movement of the segmental gear, and thus prevent the operation of the machine. If for any reason when the lever J was moved, due to the end-thrust of the worm, the bell-crank N′ failed to respond, the spring J′ would move, as shown in the dotted lines, Figs. 7 and 8, thereby breaking the electrical connection between the source of current-supply and the motor and stopping the motor.

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

1. In combination, a power-shaft, a friction-wheel upon said shaft, an elevator-driving shaft, a friction-wheel upon said shaft, said friction-wheels being in contact with each other, a driving-worm adapted to have a lateral movement upon its shaft, a lever, a resistance device connected to said lever, intermediate connection, substantially as described, between said lever and worm and between said lever and the friction-wheels, whereby the movement of the worm upon the shaft varies the extent of movement of the friction-wheels upon each other.

2. In an elevator, in combination, an operating-sheave, a gear operating with said sheave, an operating-bar, a segmental gear connected with said bar, lugs, as P^2, upon said gear, a power-shaft, a friction-wheel upon said shaft, an elevator-driving shaft, a friction-wheel upon said shaft, said friction-wheels being in contact with each other, and connection, substantially as described, between said bar and the friction-wheels, a driving-worm adapted to have a lateral movement upon its shaft, a lever, a resistance device connected to said lever, connection between said lever and the worm, substantially as described, a bell-crank, connection between said lever and bell-crank, and a projection upon the bell-crank in line with the projection upon the segmental gear.

3. In combination, an operating-sheave, a gear operating with said sheave, an operating-bar, a segmental gear connected with said bar, lugs, as P^3, upon said gear, a driving-worm adapted to have a lateral movement upon its shaft, a lever, a resistance device connected to said lever, connection between said lever and the worm, an arm connected to said lever, and lugs, as J^3, upon said arm, whereby when the worm moves laterally a distance sufficient to move the lugs J^3 upon the arm in line with lugs the segmental gear is locked.

4. In an elevating mechanism, in combination, a driving-worm, a lever, a resistance device connected to said lever, connection, substantially as described, between said lever and worm, a binding-post connected to said lever, and a contact-point, a spring-strip, as J′, a binding-post on said strip, a brush on said strip, an electric motor, a source of current-supply, a wire connecting binding-post on the lever with source of current-supply, and a wire connecting strip J′ with motor or motor-switch.

5. In combination, an electric motor, an electric switch, means to operate said switch, brushes upon said switch, an insulated strip connecting said brushes, contact-points in electrical connection with the source of current-supply, a solenoid, a rod connected to core of solenoid, a lever operated by said rod, a brush, as 9, adapted to be moved by said lever, a brush, as 11, adapted to be moved by said lever, a contact-point, as 10, in electrical connection with field and in path of brush 9, resistances, as 12, in line of travel of said brush 11, and a contact-point, as 13, in electrical connection with resistances and armature of motor and in path of movement of brush 11, direct electrical connection between one pole of the current-supply and field of motor, direct electrical connection from pole of current-supply to brush 9, electrical connection between solenoid and brushes 3 3, direct electrical connection between one of the brushes 3 3 and the armature, and direct connection between the other of brushes 3 3 and the brush 11.

6. In an elevator, in combination, a power-shaft, a friction-disk upon said shaft, an elevator-driving shaft, a friction-disk upon said shaft, said friction-wheels being in contact with each other, an operating-bar, means to operate said bar, a sliding piece, as X, connected to said bar, a bell-crank, as Z, connected to said sliding piece, and connection between said bell-crank and one of the friction-disks.

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

FRANK E. HERDMAN.

Witnesses:
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S. P. KNIGHT.