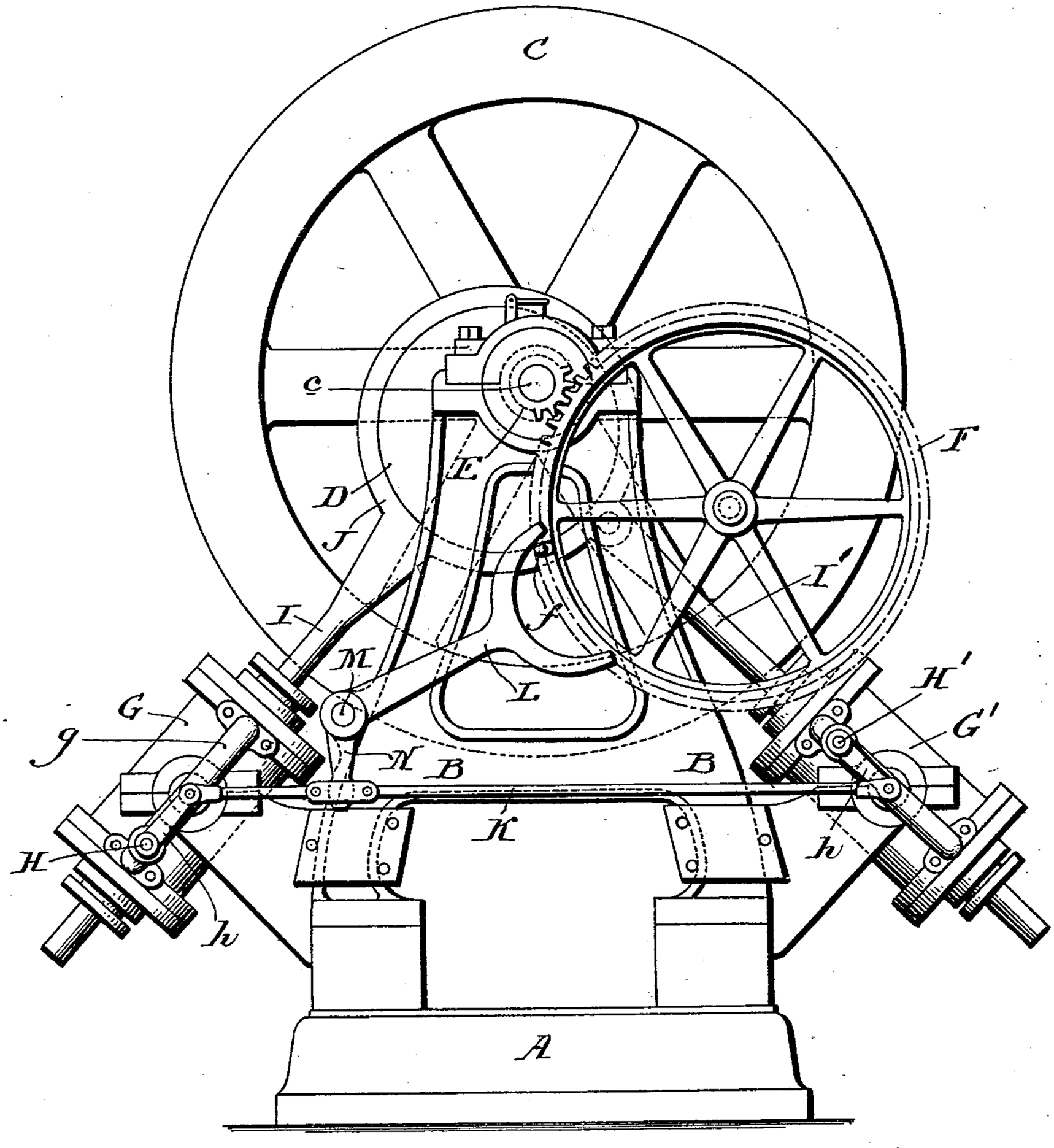
(No Model.) 3 Sheets—Sheet 1.

F. E. HERDMAN.

ELEVATOR.

No. 560,210. Patented May 19, 1896.

Fig. 1.



WITNESSES:

David S. Williams 2d

Frank L. Brasee

INVENTOR

Frank E. Herdman

by J. F. Heveling
Atty.

(No Model.) 3 Sheets—Sheet 2.

F. E. HERDMAN.

ELEVATOR.

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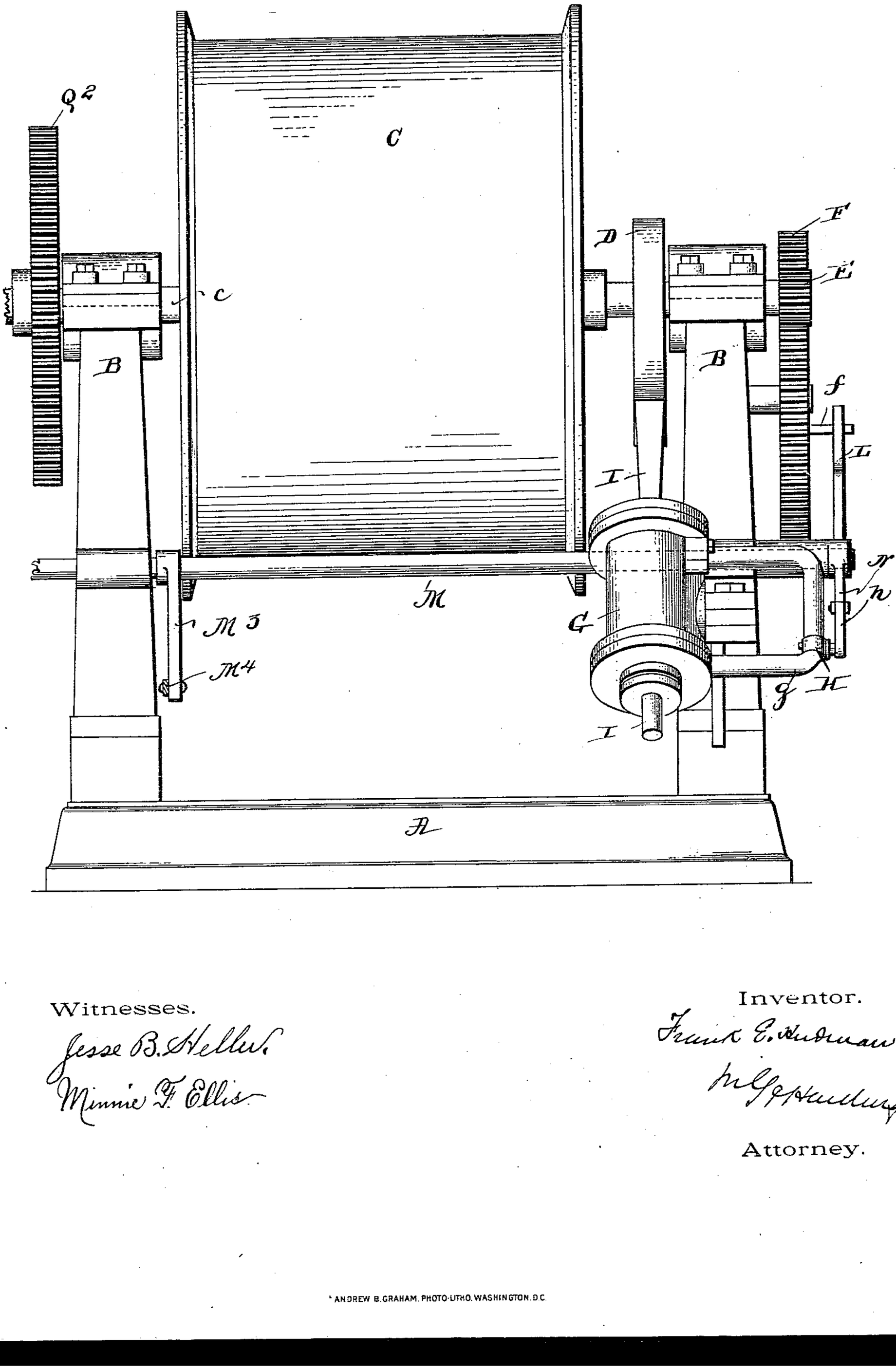
Fig. 2.



Witnesses.

Jesse B. Keller.

Minnie F. Ellis.

Inventor.

Frank E. Herdman

by G. P. Standley

Attorney.

(No Model.)

3 Sheets—Sheet 3.

F. E. HERDMAN.

ELEVATOR.

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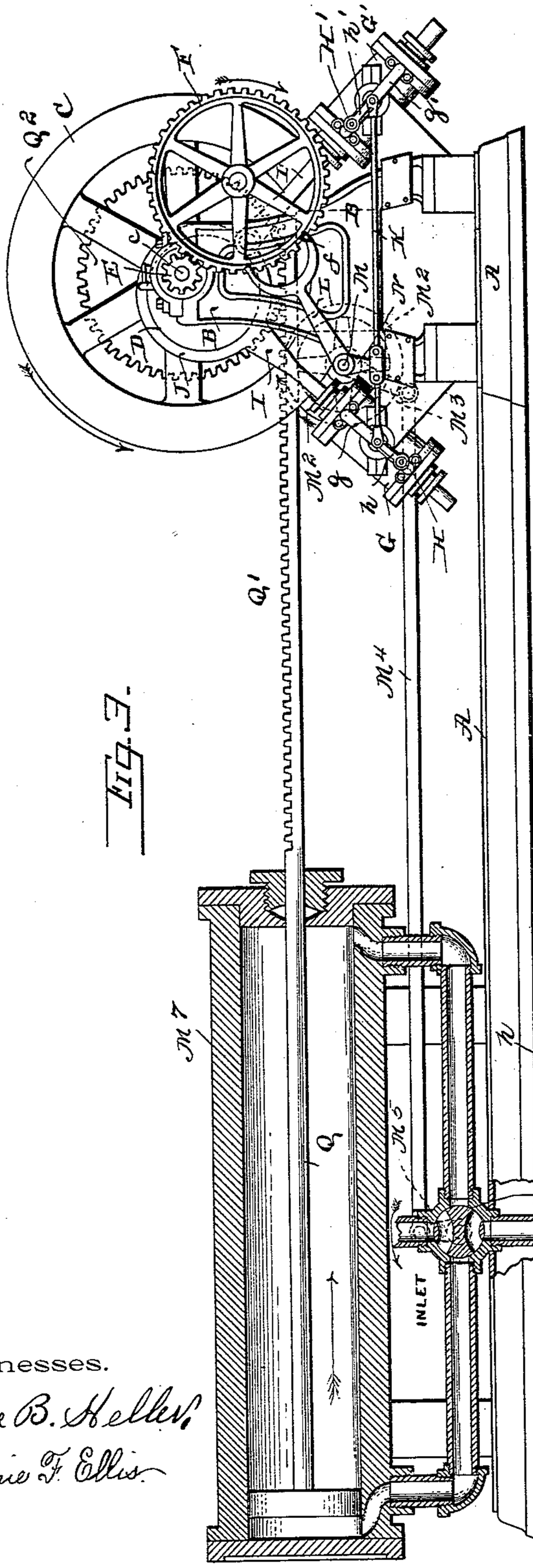

FIG. 3.

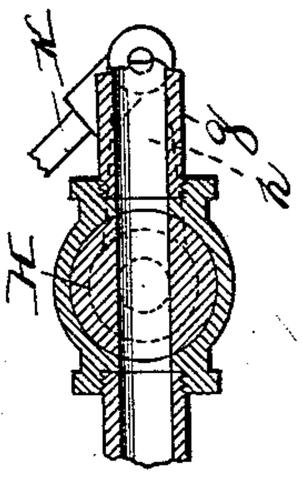

FIG. 5.

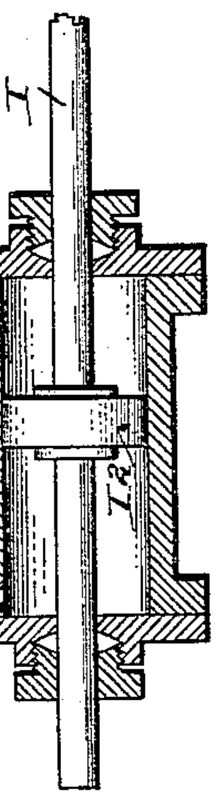

FIG. 4.

Witnesses.

Jesse B. Keller.

Minnie F. Ellis.

Inventor.

Frank E. Herdman

by B. Hunting

Attorney.

UNITED STATES PATENT OFFICE.

FRANK E. HERDMAN, OF WINNETKA, ILLINOIS.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 560,210, dated May 19, 1896.

Application filed August 7, 1895. Serial No. 558,491. (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 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 its object the automatic stopping of an elevator at the end of its travel, either up or down, and is particularly applicable to elevators operated by a winding-drum and ordinarily stopped by means of a friction-brake. The objection to the ordinary friction-brake is that, by reason of its giving a certain definite amount of resistance to the further travel of the elevator, the power cannot be proportioned to the speed of the elevator nor to the load in the car. The consequence is that if the load is heavy or the speed great the car will travel a much greater distance than it would were the load light or the car traveling slowly. Hence to prevent the possibility of the car striking considerable leeway must be given to it—that is, the friction-brake must be applied too long before the elevator reaches the end of its travel. My invention is designed to obviate this objection to the friction-brake by using mechanism in connection with the winding-drum whereby the car will be automatically stopped with certainty just before it reaches its extreme limit of movement independently of the friction-brake and without regard to the load in the car or the speed of its movement.

I will now describe the mechanism which I prefer to use to carry out my invention.

I do not illustrate the elevator-car, the stopping, starting, and reversing mechanism under the control of the operator in the car, nor the connections between them and the motor, as these embody many different constructions well known to those familiar with elevator construction and form no part of my invention.

In the drawings, Figure 1 is a front elevation of the winding-drum and mechanism connected therewith embodying my invention, and Fig. 2 is a side elevation of the same, the connection between the motor and the operating or motor-controlling shaft not being shown in these figures. Fig. 3 is a front elevation of winding-drum with motor and its valve in section, also showing connection of valve mechanism with operating-shaft. Fig. 4 is a section through cylinder G. Fig. 5 is a section on line *x x*, Fig. 4.

In the drawings, A is the bed-plate, and B the framework supporting the winding-drum. C is the drum, and *c* its shaft. On the drum is placed an eccentric D. On the drum-shaft is a small gear-wheel E, which meshes with a large gear-wheel F, which is journaled to a bracket secured to the frame B. On this gear F is a projection or pin *f*, located near its periphery. To brackets extending from opposite sides of the frame I secure the cylinders G and G′ in such manner that they are adapted to have a swinging movement on their pivotal bearings. The cylinder G has a pipe connection *g* between its upper and lower ends, and in this pipe connection is a valve H normally open. The piston I^2, carried by the piston-rod I, works in the cylinder, and the piston-rod I is enlarged at its outer end into an annular strap J, fitting closely around the eccentric D. The cylinder G′ has the valve H′ and a piston connected to the piston-rod I′, the same as cylinder G; but the piston-rod at its outer end is loosely pivoted to the annular strap J. The cylinders G and G′ and pipes *g* and *g′* are filled with a fluid, preferably oil, although water is serviceable.

The valves H and H′ are operated by the arms *h* and *h′*, respectively, and these two arms are connected by the rod K, which when moved to the right or left operates the arms *h* and *h′* to open or close the valves H and H′.

The operating or motor-controlling shaft M has upon it the sheave M^2, around which the shifting-cables pass. Connected to the shaft M is the crank M^3, which crank is connected by a link M^4 with a crank M^5, connected to the valve M^6, which valve is moved to operate the motor M^7, and upon the direction the valve is moved depends the movement and direction of movement of the motor. The piston-rod Q of the motor has connected with it the rack Q′, which meshes with the pinion Q^2 on the shaft of the winding-drum. On the shaft M is secured a lever having

the arm L and also the arm N. The lower end of the arm N extends through a slot in the rod K. The arm L is forked, as shown, and normally is in such position that when the gear F is turning in either direction one or the other of said forked members will be engaged by the pin *f*. The pin *f* is so disposed on the gear F that it will not come in contact with said forked member until just before the elevator reaches its limit of movement.

The operation is as follows: The revolution of the drum—say from right to left, Fig. 1—carries with it the eccentric D. As the eccentric revolves, the pistons are slowly moved in and out, the fluid in the cylinders circulating constantly through the pipe connections. As the elevator approaches its limit of movement, the pin *f* reaches one of the forks on arm L and carries said arm on its pivot-point in the direction in which the pin is moving, turning thereby the operating-shaft, moving the arm N in one direction or the other, and thus gradually closing the valves H and H′. As the valves close, the resistance of the fluid in the cylinders to the pistons gradually increases, until, when the valves close, the momentum of the elevator is overcome and it comes to rest. The operating-shaft having by the movement just described been gradually turned to throw off the power at the same time that the valves are gradually closed to overcome the momentum of the elevator, the turning of the operating-shaft to throw on the power will at the same time operate the arm L to restore it to its normal position and turn the arm N, so as to move the rod K and open the valves H and H′, thus removing all resistance to the operation of the elevator in the opposite direction. Near the end of its travel the pin *f* comes in contact with the other forked end of the arm L and moves the rod K in the opposite direction, closing the valves as before and stopping the elevator.

In this specification I have shown the operating-shaft M as the motor-controlling mechanism; but any other motor-controlling mechanism may be substituted without departing from my invention, the gist of my invention being connecting the mechanism or device which increases or decreases the resistance to movement of the piston in the cylinder with the motor-controlling mechanism and also controlling the operation of said device or mechanism by means of a device moved by or with the drum and adapted at predetermined point or points in the drum's travel to act on said cylinder device.

I have shown merely the application of my invention to a winding-drum, although it is obvious that when other elevator-hoisting mechanism is substituted for the drum the invention is equally applicable thereto.

The broad expressions used in the claims are used so that it may be understood that I do not restrict my invention to the precise constructions enumerated in the specification, as these will be varied by the skilled mechanic to suit his convenience or the exigencies of particular cases. To indicate, however, the particular parts described in the specification which would be included by the broad expressions used I submit the following explanation: The term "connection between the piston and the hoisting mechanism" refers to the eccentric D, the expression "mechanism between the retarding device and the operating-shaft" refers to the pipe *g*, valve H, rod K, and arm N, while the words "connection between the operating-shaft and the hoisting mechanism" indicate the forked arm L, the wheel F, pin *f*, and the gear-wheel on the drum. The phrases "device moving with the hoisting mechanism" and "mechanism having a movement relative to the drum" denote the wheel F and pin *f*, while "the mechanism normally inoperative" relates to the valve H, rod K, and arms N and L. The "motor-controlling mechanism" indicates generally the motor-controlling shaft and the means (not shown) for turning or operating the shaft from the car, as well as the crank M^3, link M^4, crank M^5, and valve M^6. The "device adapted to increase the resistance to movement of the piston in the cylinder" is the pipe *g* and valve H, while "the connection between this device and the motor-controlling mechanism" refers to the rod K and arm N. The term "valve-closing mechanism" includes the rod K and arms N and L. The expressions "mechanism between the retarding device and the operating-shaft" and the "connection between the operating-shaft and the hoisting mechanism," above explained, are both included by the words "mechanism between the hoisting mechanism and the retarder."

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

1. In an elevator, the combination with the hoisting mechanism, of a cylinder adapted to contain a fluid, a piston in said cylinder, a pipe connecting the ends of the cylinder a valve in said pipe, a rod connected with said valve, a wheel operated by the hoisting mechanism, a projection on said wheel, a lever connected with said rod and in path of travel of said projection, and connection between the piston and the hoisting mechanism.

2. In an elevator, the combination with the hoisting mechanism, of a cylinder adapted to contain a fluid, a piston in said cylinder, a pipe connecting the ends of the cylinder, a valve in said pipe, a rod connected with said valve, a wheel operated by the hoisting mechanism, a projection on said wheel, a lever connected with said rod and in the path of travel of said projection, the piston being operatively connected with the hoisting mechanism.

3. In an elevator provided with an operating-shaft, the combination with the hoisting mechanism of a retarding device consisting

of a cylinder adapted to contain a fluid, a piston in said cylinder, a connection between the retarding device and the hoisting mechanism, the operating-shaft, mechanism between the retarding device and the operating-shaft, adapted when the shaft is turned to increase the resistance to movement of the piston and a connection between the operating-shaft and the hoisting mechanism, whereby said shaft is turned at predetermined points in the operation of the hoisting mechanism.

4. In an elevator provided with an operating-shaft, the combination with the hoisting mechanism of a cylinder adapted to contain a fluid, a piston in said cylinder, a connection from one side to the other of the piston-head forming a passage for the fluid, the operating-shaft, connection between the piston and the hoisting mechanism, a connection between the connecting-passage and the operating-shaft adapted, when the shaft is turned, to close said passage, and a connection between the operating-shaft and the hoisting mechanism, whereby said shaft is turned at predetermined points in the operation of the hoisting mechanism.

5. In an elevator, the combination with the hoisting mechanism of a cylinder adapted to contain a fluid, a piston in said cylinder, a connection from one side to the other of the piston-head, forming a passage for the fluid, a valve in said connecting-passage, mechanism connected with and adapted to close said valve, a connection between the piston and the hoisting mechanism, and a device moving with the hoisting mechanism adapted at predetermined points in the latter's operation to move said valve-closing mechanism and close said valve.

6. In an elevator, the combination with the hoisting mechanism of a cylinder adapted to contain a fluid, a piston in said cylinder, a connection from one side to the other of the piston-head, forming a passage for the fluid, a valve in said connecting-passage, mechanism connected with and adapted to close said valve, a connection between the piston and the hoisting mechanism, and a device moving with the hoisting mechanism adapted at predetermined points in the latter's operation to move said valve-closing mechanism and close said valve and independent means to move said mechanism to open said valve.

7. In an elevator, the combination with the hoisting apparatus of a cylinder provided with a piston and containing a fluid, there being a passage for the fluid from one side to the other of the piston, mechanism having a movement relative to the hoisting apparatus, and other mechanism normally inoperative, but adapted when operative to gradually cut off said passage, the former mechanism being adapted at predetermined points in the operation of the hoisting apparatus to render the latter mechanism operative.

8. In an elevator, the combination with the hoisting mechanism, a motor for operating the same, and motor-controlling mechanism, of a cylinder, a piston in said cylinder, connection between said piston and the hoisting mechanism, a device adapted to increase the resistance to the movement of the piston in the cylinder, a device moved with the hoisting mechanism and adapted in the movement thereof to operate said cylinder device, and connection between said cylinder device and the motor-controlling mechanism.

9. In an elevator, the combination with the hoisting mechanism, of a retarder consisting of a cylinder adapted to contain a fluid and a piston adapted to move in said cylinder, and mechanism between the hoisting mechanism and the retarder operated at predetermined points in the operation of the hoisting mechanism to increase the resistance to movement of the piston in said cylinder.

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

FRANK E. HERDMAN.

Witnesses:

HENRY E. TURNER,

STERLING H. CONE.