No. 692,286. Patented Feb. 4, 1902.

F. E. HERDMAN.

ELEVATOR.

(Application filed Mar. 16, 1900.)

(No Model.) 4 Sheets—Sheet 1.

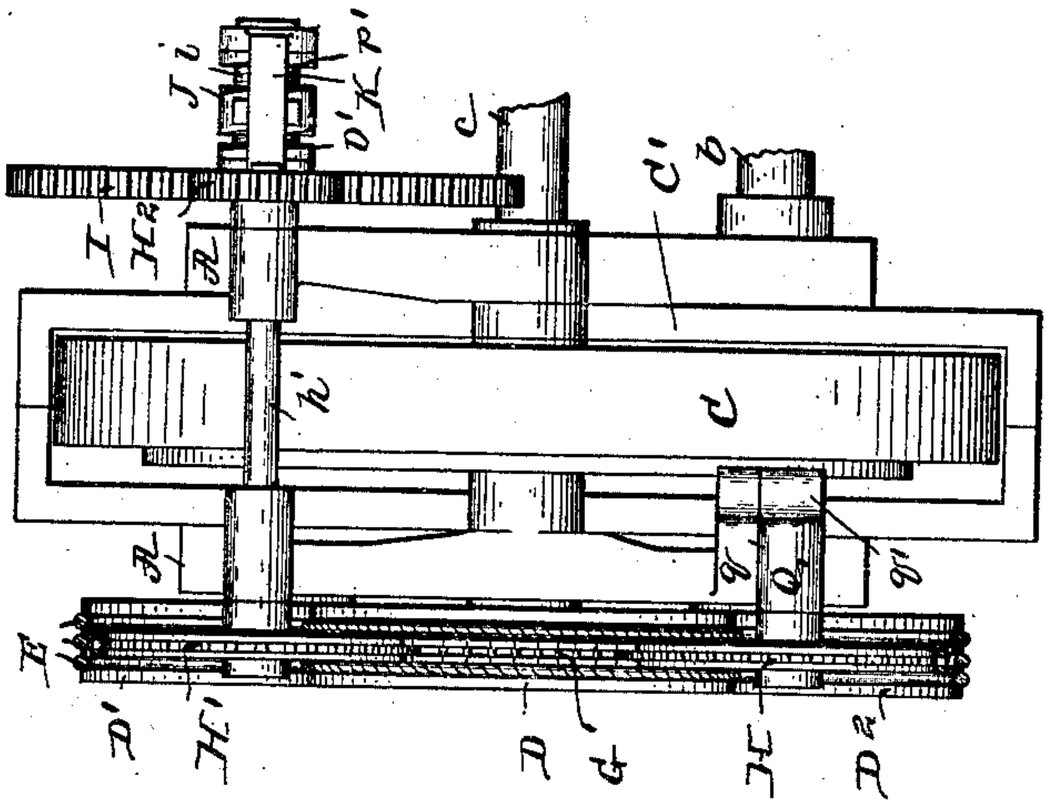

FIG. 2.

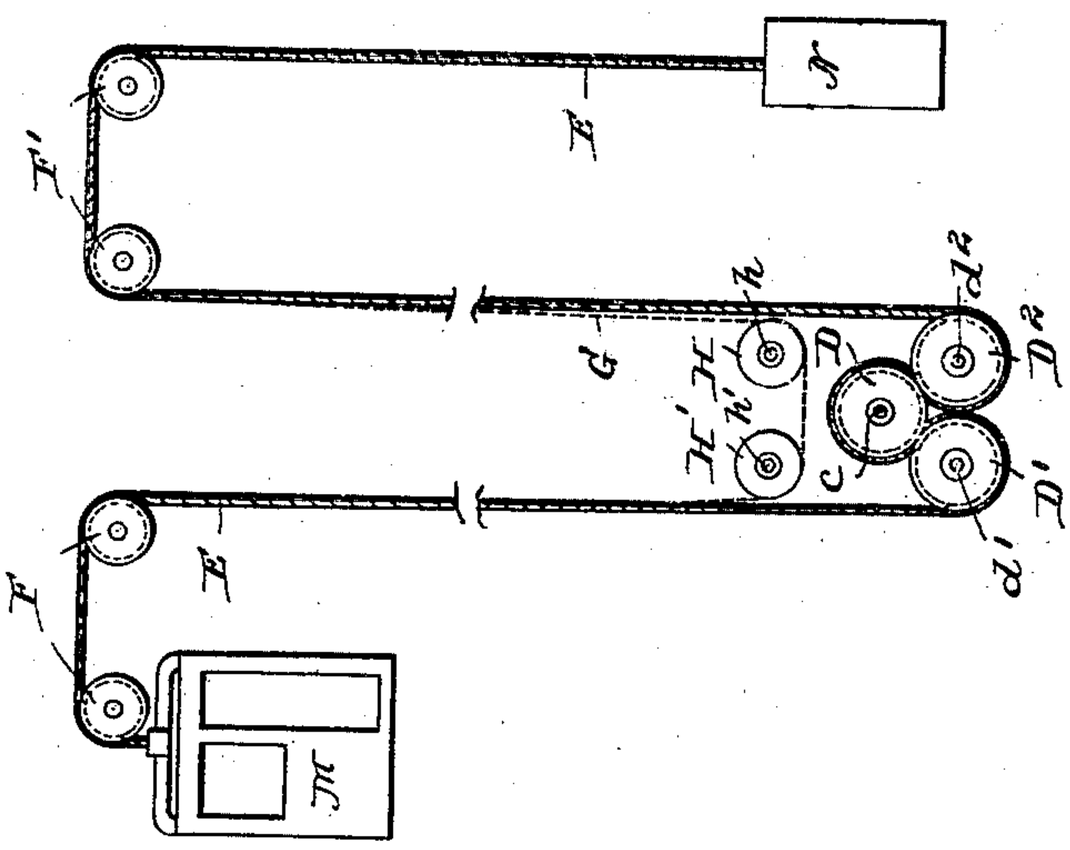

FIG. 1.

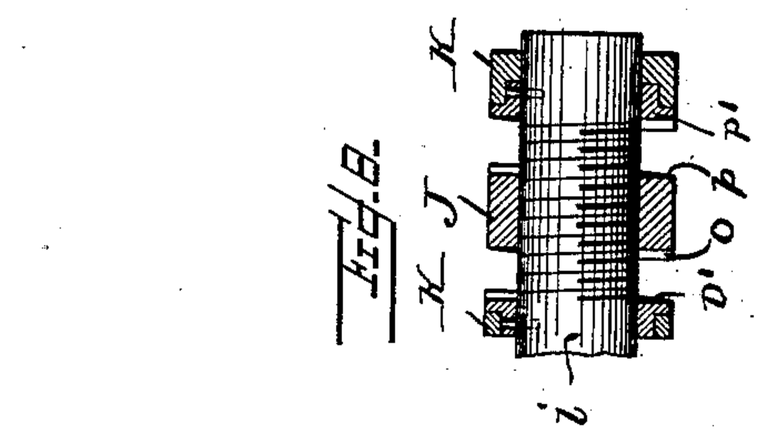

FIG. 3.

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FIG. 1.

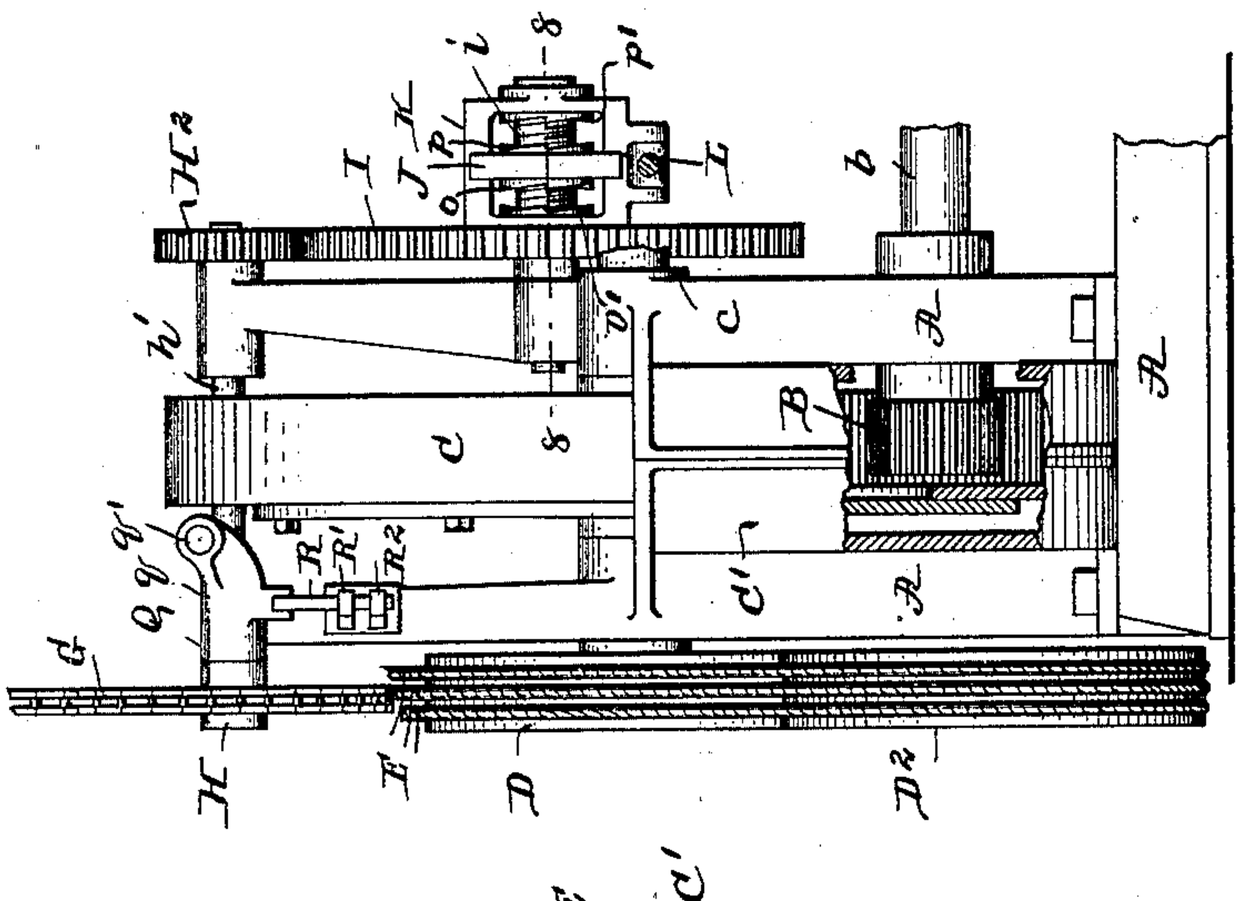
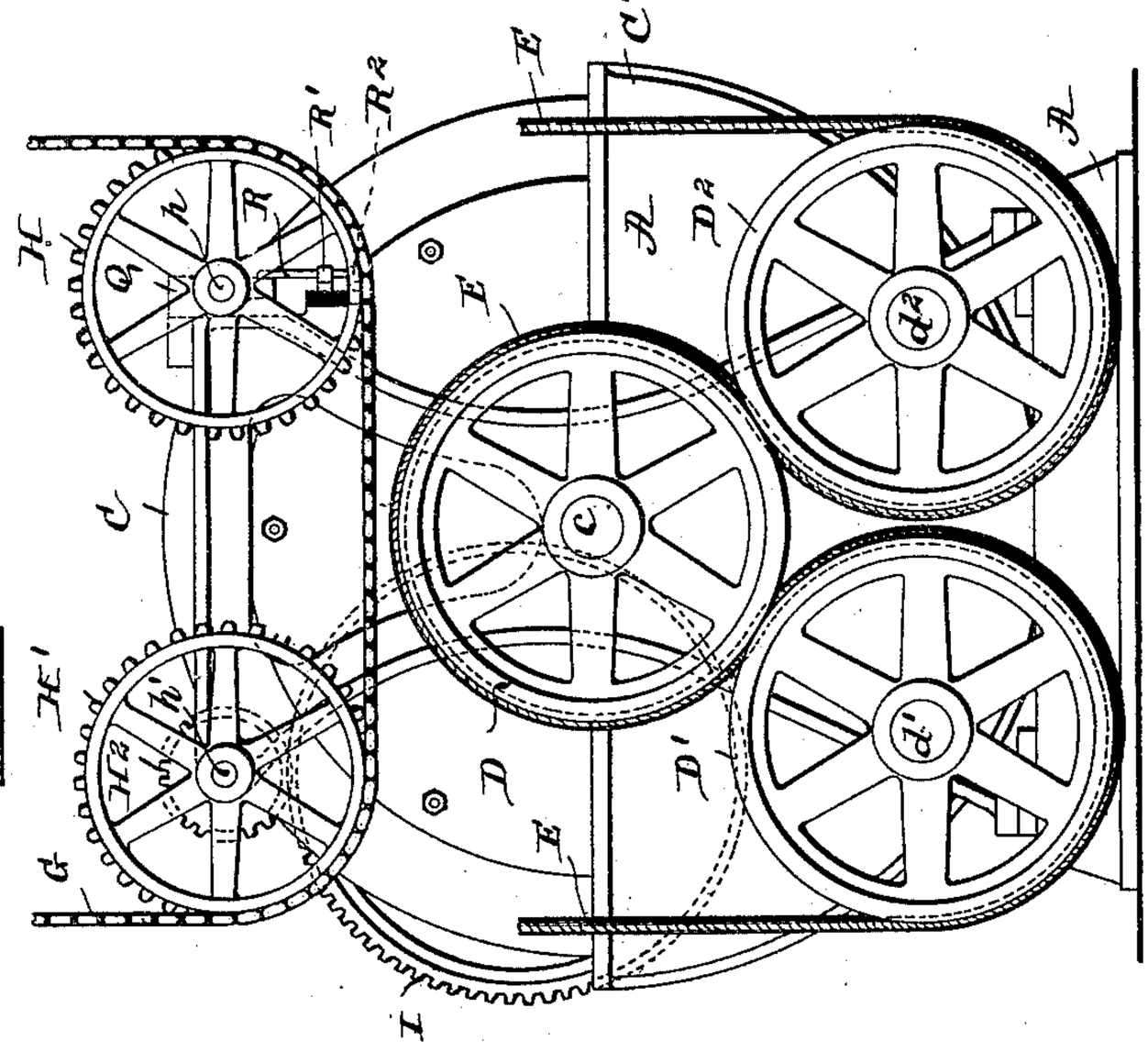


FIG. 2.



WITNESSES:

Jesse B. Heller,

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(No Model.) 4 Sheets—Sheet 3.

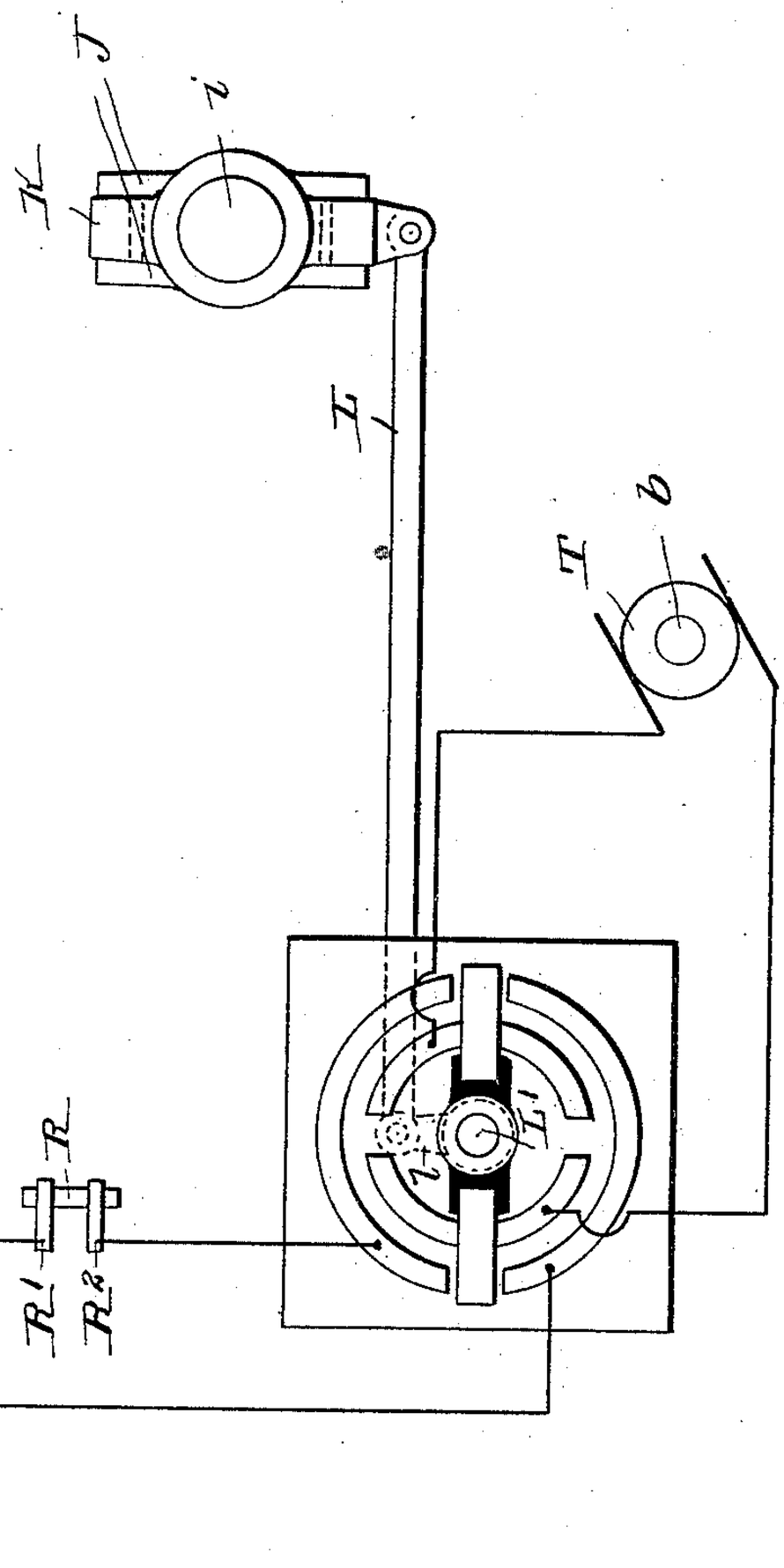

Fig. 5.

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By his Attorneys
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Fig. 7.

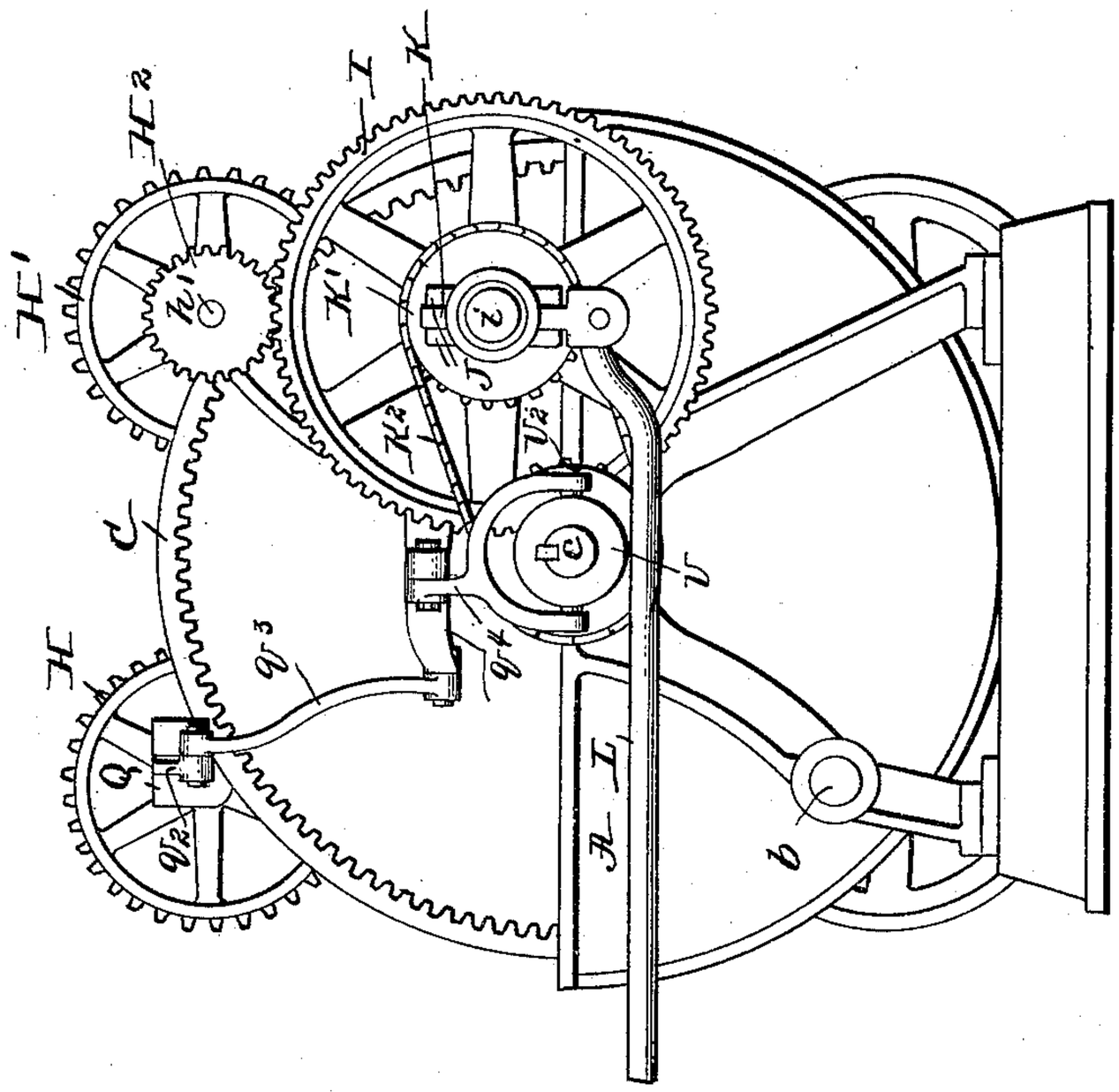
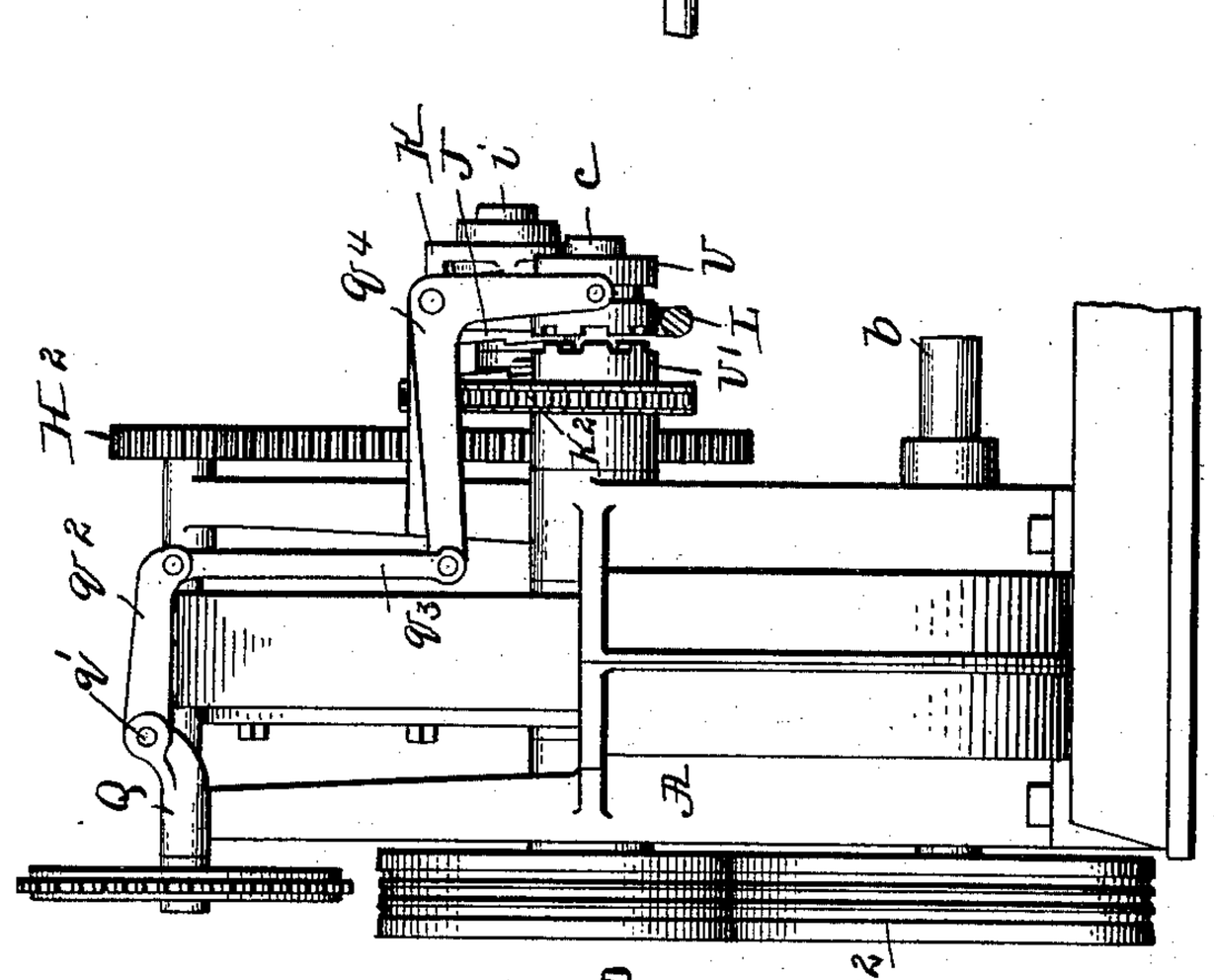


Fig. 8.



WITNESSES:
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Frank E. Herdman
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ATTORNEYS

UNITED STATES PATENT OFFICE.

FRANK E. HERDMAN, OF WINNETKA, ILLINOIS.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 692,283, dated February 4, 1902.

Application filed March 16, 1900. Serial No. 8,880. (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 relates to elevators, and more particularly to mechanism for hoisting the car and automatically stopping it at its limit of travel in either direction.

The invention has for its object to provide a system of friction-sheaves to take the place of the ordinary cable-wound drum and to so construct and arrange said sheaves relatively to each other and to the cable wound about them as to create a tractive force between them proportional to the load; also, to so connect the cable or sheaves with the operating-shaft that when the car nears the end of its travel either up or down the operating-shaft will be thrown to the center to stop the car; also, to stop the car automatically in case of breakage in the last-named connections.

The invention consists, generally speaking, of the described construction and arrangement of friction-sheaves and cable and of the described construction of automatic stop, although not limited to specific details, the scope of the invention being particularly defined in the claims.

In the drawings, Figure 1 is a diagram of the sheaves and cable connections. Fig. 2 is a front view, Fig. 3 a plan view, and Fig. 4 an end view, of the sheaves, cables, automatic stop mechanism, and some of the elevator mechanism. Fig. 5 is a diagram of the motor, controlling-switch, and circuit connections of an electrically-operated elevator to which my improvement may be applied. Fig. 6 is an end view showing a modified form of automatic stop. Fig. 7 is a rear view of the same, and Fig. 8 is a section on line 8 8 of Fig. 4.

A is the framework.

b is the driving-shaft, supported in bearings on the frame.

B is a pinion on the driving-shaft *b*, (actuated by an electric motor or otherwise,) and C is an internal gear meshing with pinion B and mounted on the shaft *c* in bearings on the frame. Also mounted on shaft *c* is the sheave D. The sheave D is therefore positively driven by the driving-shaft.

C′ is a casing inclosing the lower half of the gear.

D′ and D² are two rotatable sheaves which may be mounted somewhat loosely, so as to turn on pins *d*′ and *d*² on the frame, or the sheaves may be tight on the pins, the pins turning in their bearing in the frame. An edge view of the sheaves shows their peripheries provided with grooves for the cables and contiguous friction-surfaces, the sheaves D′ and D² being in frictional contact with sheave D.

M is the car, and N the counterbalance therefor. The lifting cable or cables E extend from the car up over the idle pulleys F, thence down under and around sheave D′, thence up over and around sheave D, thence down under and around sheave D², thence up over the idle pulleys F′, and thence down to the counterbalance.

The driving-shaft *b* is actuated by any desired controlling mechanism. It positively drives the sheave D, and the sheave D drives the cables. The arrangement of sheaves gives great traction-surface to the cables. There is little liability of slippage, for in case of a sudden stop, where the cables tend to slacken and thereby slip, they would lessen only on sheaves D′ and D⁵ and not on D, as they pass over and not under sheave D. By reason of the frictional contact between D′ and D and D² and the loose bearing of sheaves D′ and D² the latter are held against sheave D, so as to create a traction force between them proportional to the load and giving greater traction-surface for the cables. The friction-surfaces of the sheaves instead of being flat may be grooved, so as to increase the traction.

The amount of looseness in the bearings of sheaves D′ and D² or the amount of play which they have relatively to sheave D may vary somewhat. If constructed with care, a play of one one-hundredth of an inch would be sufficient to attain the desired object.

With the sheaves free from each other the traction between the driving and the driven cables would be confined to the contact between the sheave D and the cables, and in

the event of the cables slipping the sheaves D′ and D² would not help prevent that slippage, but would revolve freely with the cables. As arranged in my invention sheaves D′ and D², being frictionally geared with sheave D, tend to resist any slippage of the cables, and to the extent that the load increases to that extent the tractive force between the sheaves increases, thus reducing the liability to slippage to a minimum.

The construction of the automatic stop mechanism is as follows: Secured to the cables E and connecting points on either side of the friction-sheaves is a sprocket-chain G, extending underneath and engaging the sprocket-wheels H and H′, mounted on shafts in the frame. The shaft *h′* of wheel H carries a pinion H², which meshes with a gear I on the shaft *i*, journaled on the frame. The shaft is projected out beyond the frame and is screw-threaded and carries a nut J, having arms which engage a yoke K. The yoke is connected to a link L, which is connected, by means of a bell-crank *l*, to the rotatable operating-shaft L′, controlled from the controlling mechanism in the car. The link L, in fact, represents any connection to the controlling mechanism of an elevator whether operated by steam, electricity, or hydraulic power. The nut has the two clutch members *o* and *p* and the screw-shaft the two clutch members *o′* and *p′*.

The operation is as follows: The traveling of the lifting-cables operates the sprocket-chain, which in turn operates the sprocket-wheels. The revolution of shaft *i* causes the nut to travel longitudinally of the shaft until the clutch members *o* and *o′* or *p* and *p′* (dependent upon the direction in which the car is traveling) are engaged, whereupon any further rotation of the screw rotates the nut, tilts the yoke, and operates the operating-bar. The gearing and the length of screw are adjusted so that the nut will be caused to engage one of the clutches fastened to the shaft near the desired limit of upward travel of the car, while it will engage the other clutch near the desired limit of downward travel of the car.

To provide against a break in the chain, the wheel H′ is mounted in a journal-box Q, having an arm *q*, pivoted at *q′* to the frame. Secured to the box or arm is a bar R, which is a knife-switch interposed in the controlling-circuit of an electric elevator and bridging the contacts R′ and R². In case the chain breaks the wheel H′ and box Q, being otherwise unsupported, will drop and carry the switch-blade R away from contacts R′ and R², breaking the circuit.

Fig. 5 is a diagram showing the connections between the switch R, the main controlling and reversing switch S, actuated by the operating-bar L′, the motor T, and the circuit connections where my improvements are applied to an electrically-operated elevator. The switch R, arranged as described, controls the main circuit, although this is not essential, the special form of stopping or brake mechanism controlled by the switch being immaterial and constituting no essential part of my invention.

Instead of operating an electric switch, as just described, for opening the controlling-circuit or actuating a special brake mechanism when there is a break in the chain mechanical devices may be substituted to directly actuate the operating-bar. In Figs. 6 and 7 I have illustrated such devices. *q²* is an arm pivoted between its ends at *q′* and having at one end the journal-box Q. The other end of the arm is linked, by means of link *q³*, with one arm of the bell-crank *q⁴*, the other arm of the bell-crank engaging a clutch member U, feathered on the shaft *c*, so as to have a free end motion. A clutch member U′ is loose on this shaft *c* and has a sprocket-wheel U². The clutch may be a positive clutch, as shown, or a friction-clutch. K′ is a sprocket-wheel attached to the yoke K. K² is a sprocket-chain connecting sprocket-wheels K′ and U². If the sprocket-chain Q breaks, the journal-box Q drops, and through arm *q²*, link *q³*, and bell-crank *q⁴* the clutch member U is moved endwise and locks with clutch member U′, and by so doing the motion of shaft *c* is transmitted to sprocket-wheel U² and through sprocket-chain K² to sprocket-wheel K′, thereby revolving the yoke K and bringing the operating mechanism central in the manner before described.

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 cable or cables, of a sprocket-chain attached thereto and operated thereby, a sprocket-wheel gearing with and operated by said sprocket-chain, a shaft on which said wheel is mounted, a screw-threaded shaft, gearing between said shafts, a nut on the screw-threaded shaft, a yoke loose on said shaft, and engaging said nut so as to normally hold it from rotation, controlling mechanism, and complementary clutch members on said nut and screw-shaft, whereby the nut will engage said shaft in its limit of travel in either direction, and turn said yoke to operate the controlling mechanism, substantially as described.

2. In an elevator, the combination, with the hoisting cable or cables, of a sprocket-chain attached thereto and operated thereby, a sprocket-wheel gearing with and operated by said sprocket-chain, the elevator controlling mechanism, means for directly operating said controlling mechanism, and mechanism actuated by said wheel and adapted, at a predetermined point in the travel of said chain, to engage and actuate the means for operating said controlling mechanism, substantially as described.

3. In an electrically-operated elevator, the combination, with the hoisting cable or ca-

bles, of a sprocket-chain attached to and operated by the hoisting cable or cables, sprocket-wheels gearing with and operated by said sprocket-chain, the elevator-controller, means for directly operating said controller, mechanism actuated by one of said wheels and adapted at a predetermined point in the travel of said chain to engage and actuate the controller-operating means, the other of said wheels being pivotally supported and upheld by said chain, and connection between said last-mentioned wheel and the means for operating the controller, whereby the breaking of said chain will permit said last-mentioned wheel to drop and actuate said controller-operating means, substantially as described.

4. In an elevator, the combination with the hoisting cable or cables, the elevator controlling mechanism, an electric circuit, a switch interposed in said circuit, a plurality of wheels connected with and operated by said cable or cables, means for directly operating said controlling mechanism, mechanism actuated by one of said wheels and adapted, at a predetermined point in the travel of the hoisting cable or cables to engage and actuate said controlling-mechanism-operating means, the other wheel being pivotally supported and upheld by said chain, and the switch being connected to and carried by said wheel, whereby the breaking of said chain will permit said wheel to drop and open the switch, substantially as described.

5. In an elevator, the combination with the hoisting cable or cables, of a sprocket-chain attached thereto and operated thereby, a sprocket-wheel gearing with and operated by said sprocket-chain, a shaft on which said wheel is mounted, a screw-threaded shaft, gearing between said shafts, a nut on the screw-threaded shaft, a yoke loose on said shaft and engaging said nut so as to normally hold it from rotation, controlling mechanism connected with said yoke, and complementary clutch members on said nut and screw-shaft, whereby the nut will engage said shaft in its limit of travel in either direction, and turn said yoke to operate the controlling mechanism, a second sprocket-wheel gearing with and operated by said sprocket-chain and upheld by said chain and pivotally supported, an electric circuit, a switch carried by said second wheel and interposed in said circuit, whereby the breaking of the chain will permit said wheel to drop and open the switch, substantially as described.

6. In an elevator, the combination, with the car, of the lifting cable or cables therefor, a sprocket-chain connected with and operated thereby, sprocket-wheels engaging the sprocket-chain, car-stopping means connected with one of said wheels and adapted to be thrown into operation at a predetermined point in the travel of the lifting-cables, and car-stopping means connected with the other wheel and adapted to be thrown into operation by the dropping of said wheel.

7. In an elevator, the combination, with the hoisting cable or cables, of devices connected with each other and with the cable and operated by the cable, car-stopping means connected with one of said devices and adapted at a predetermined point in the travel of the hoisting-cable to be thrown into operation thereby, and car-stopping means connected with the other of said devices adapted to be thrown into operation thereby when the latter drops by reason of the severance of connection between said devices and the cable or the breaking of the cable, substantially as described.

8. In an elevator, the combination with the hoisting cable or cables, of an apparatus connected with said cables so as to be operated thereby during the travel of said cable in the shaft, car-stopping means connected with said apparatus and adapted to be operated thereby at a predetermined point in the travel of the hoisting-cables, and car-stopping means, normally inoperative, but adapted to be thrown into operation by said apparatus when the latter drops by reason of the severance of connection between it and the cable or the breaking of the cable, substantially as described.

In testimony of which invention I have hereunto set my hand, at Winnetka, on this 7th day of February, 1900.

FRANK E. HERDMAN.

Witnesses:

ALBERT S. CAPRON,

J. A. BURKITT.