No. 610,587. Patented Sept. 13, 1898.

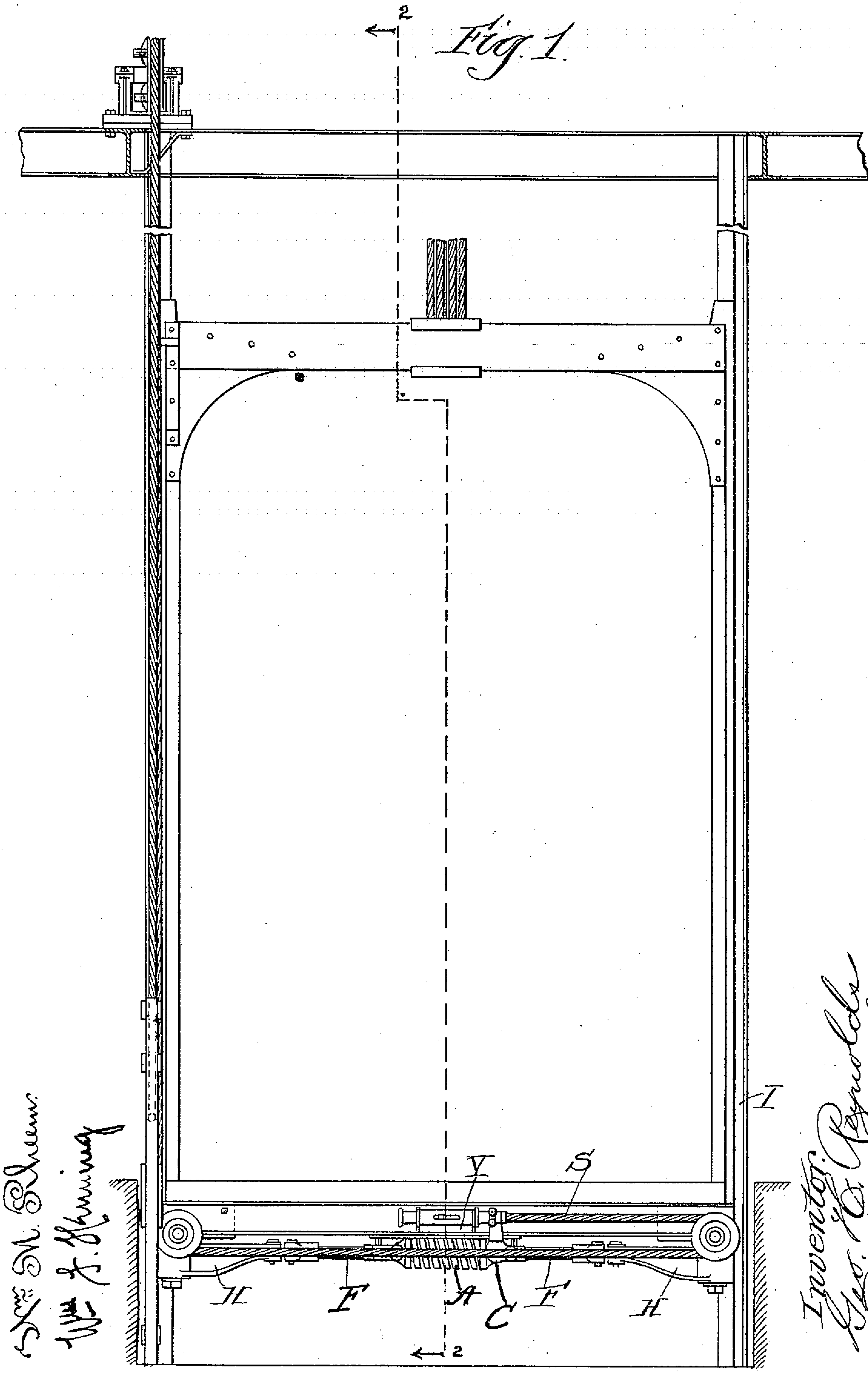
G. H. REYNOLDS.

AUTOMATIC SAFETY STOP.

(Application filed Feb. 16, 1895.)

(No Model.) 5 Sheets—Sheet 1.

Fig. 1.



Witnesses.
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Wm. J. Hunning

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No. 610,587. Patented Sept. 13, 1898.

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(No Model.) 5 Sheets—Sheet 2.

Fig. 2.

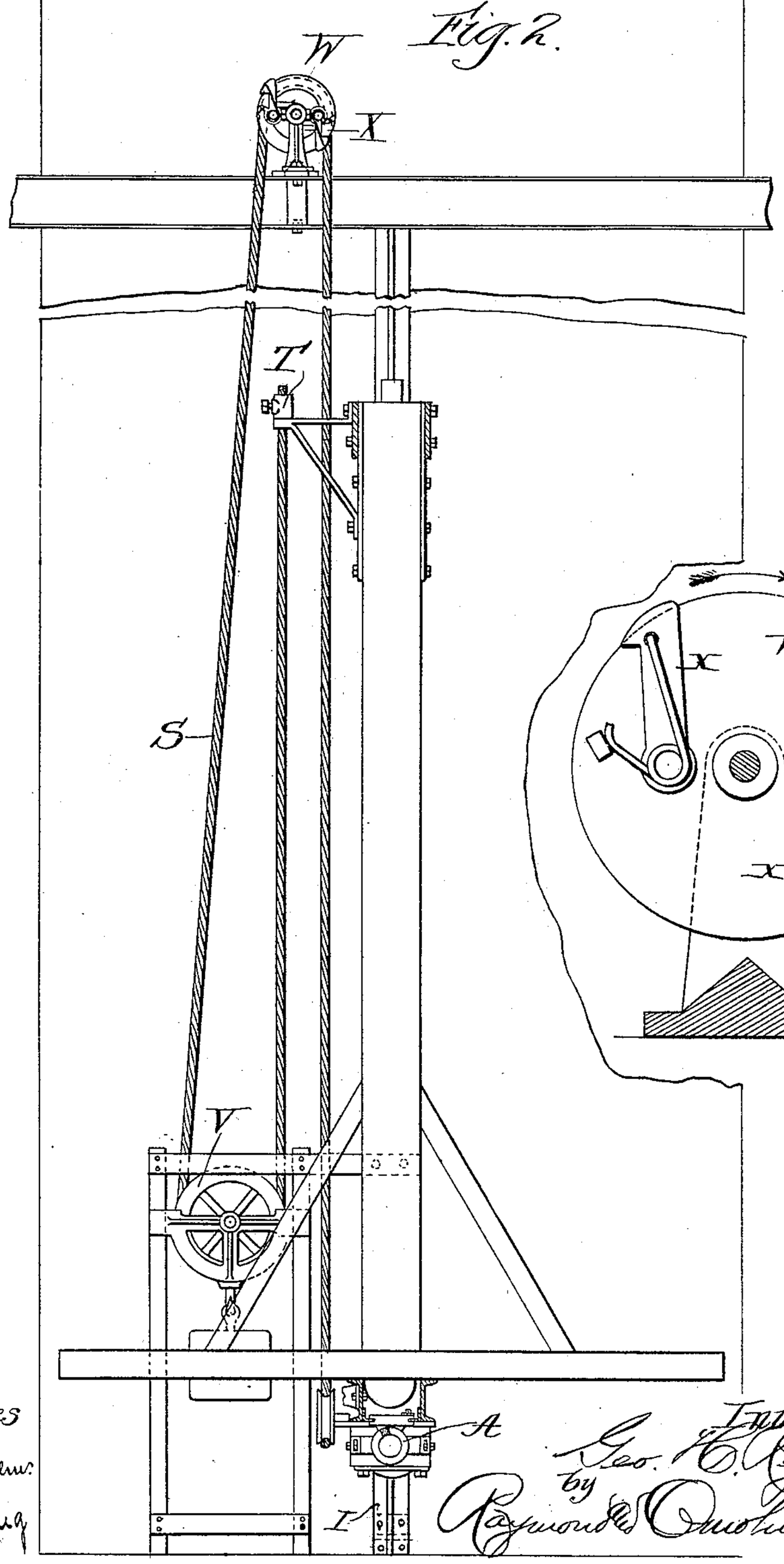

Fig. 11.

Witnesses
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5 Sheets—Sheet 3.

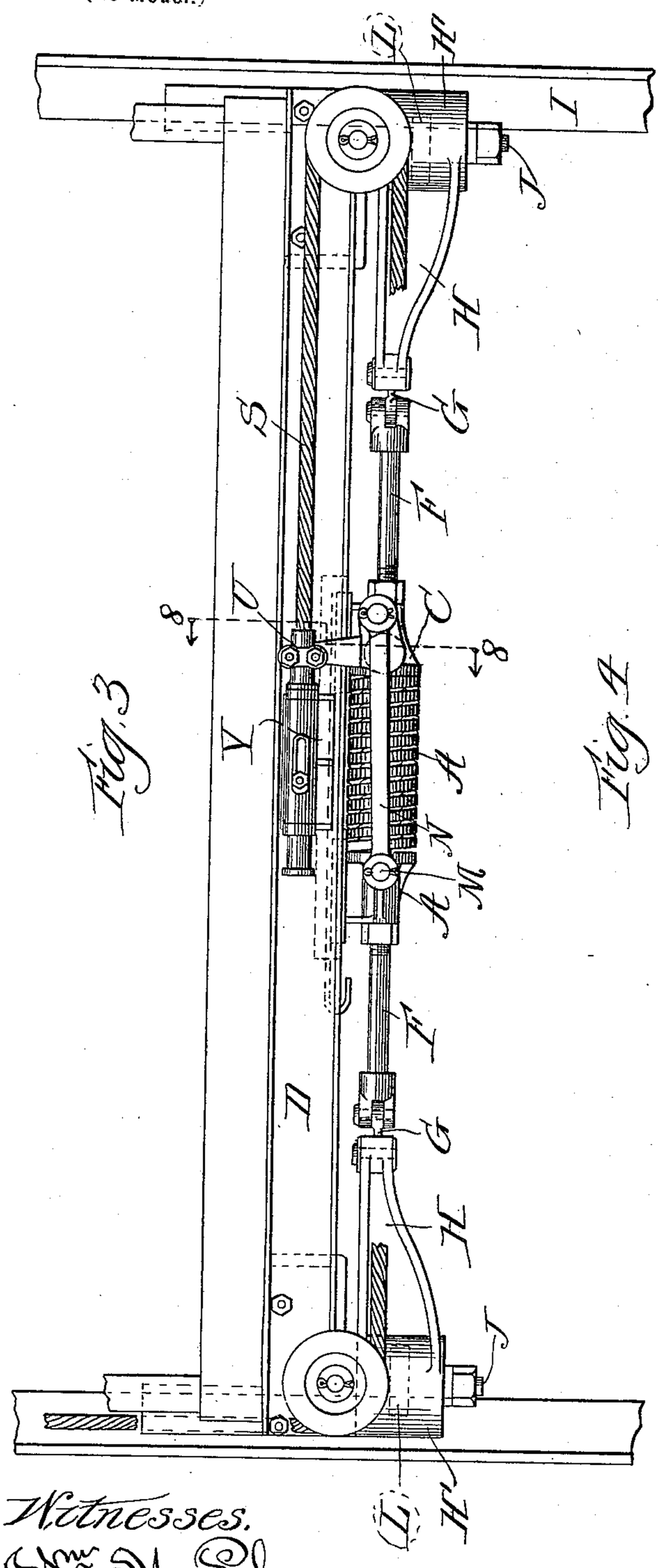

Fig. 3

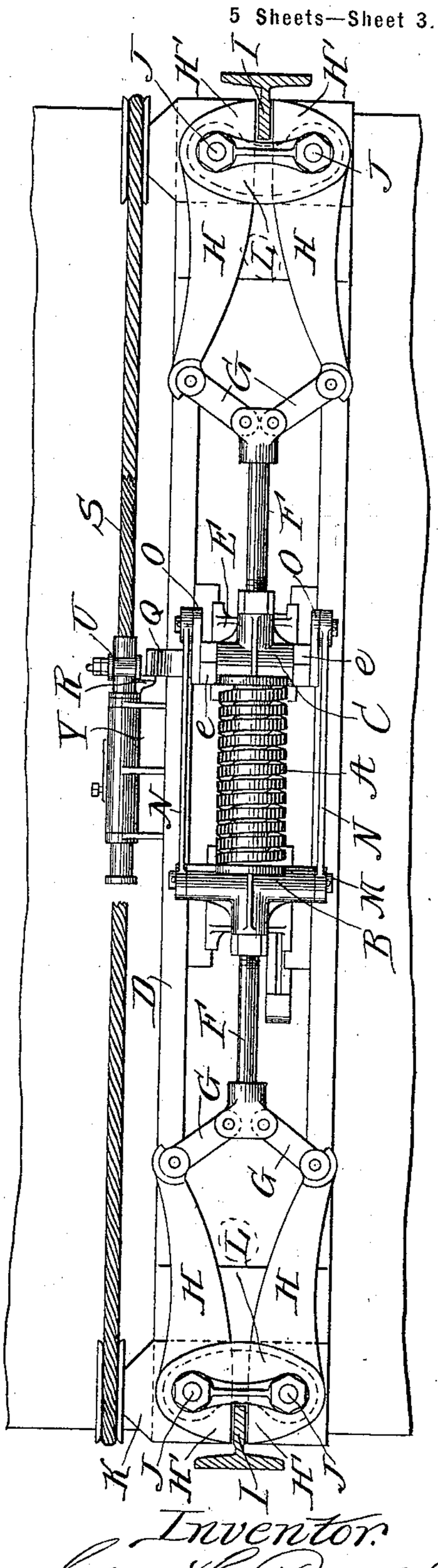

Fig. 4

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No. 610,587 | Patented Sept. 13, 1898.

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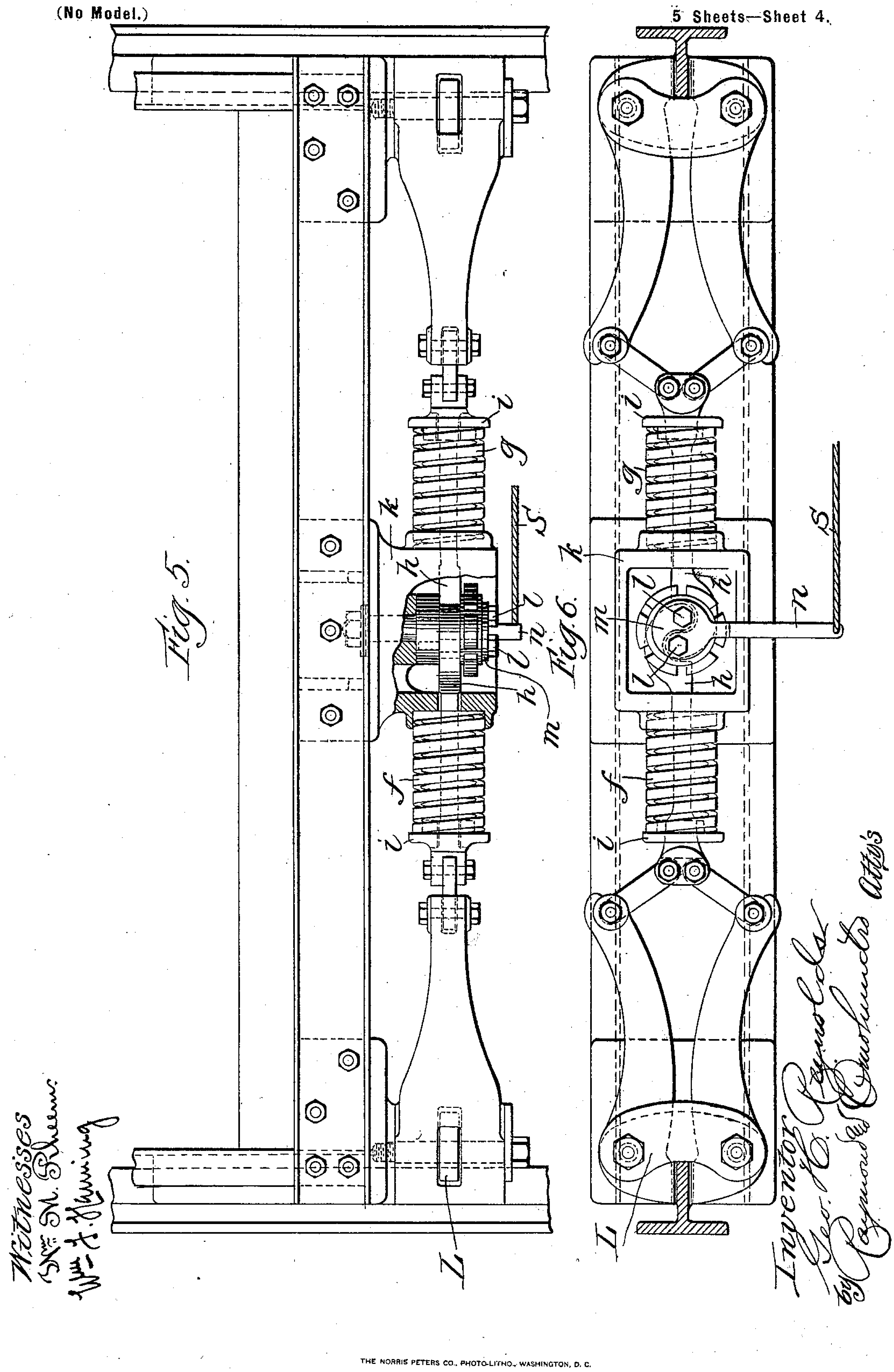
(No Model.) | 5 Sheets—Sheet 4.



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(No Model.) 5 Sheets—Sheet 5.

Fig. 7.

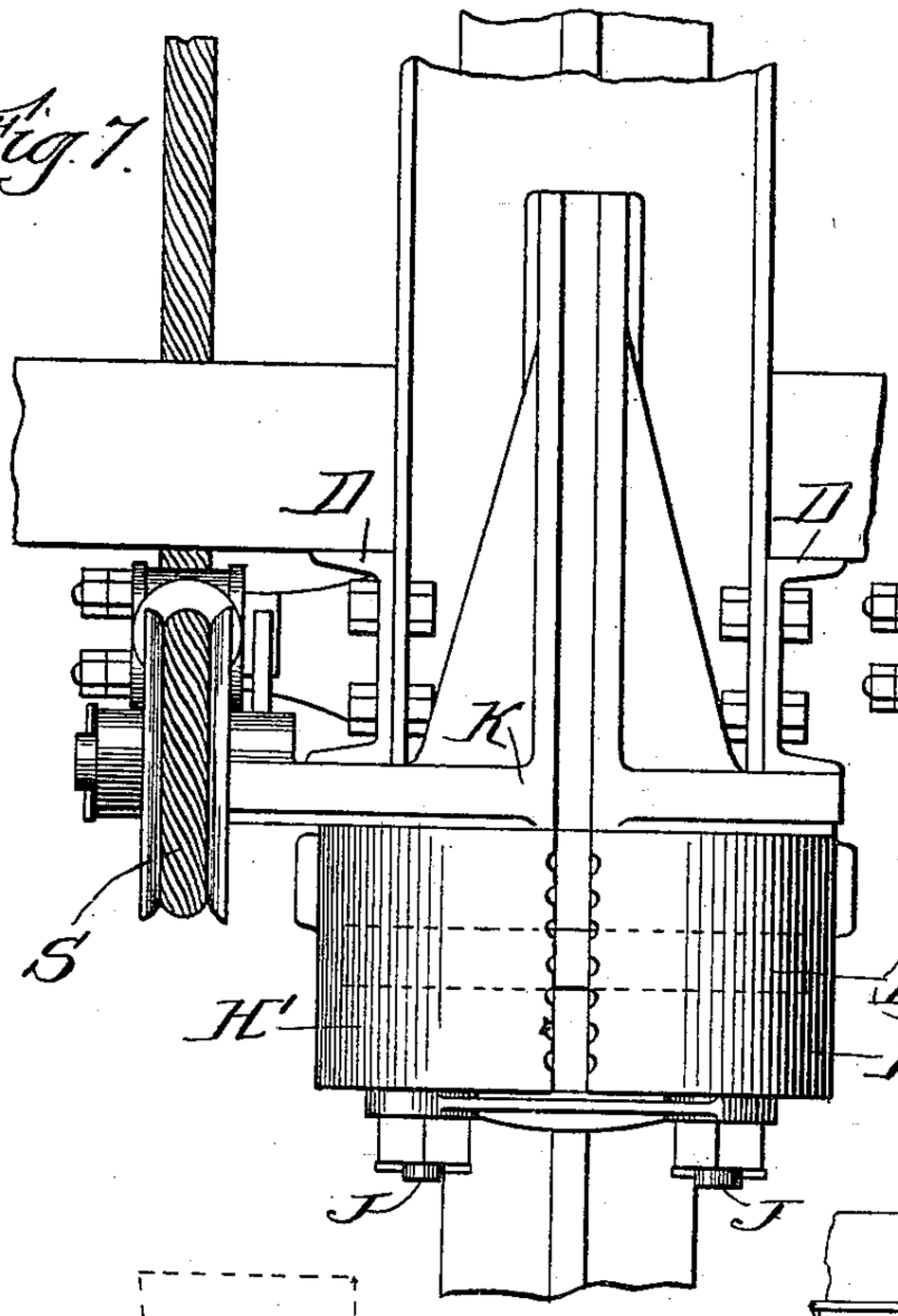


Fig. 8.

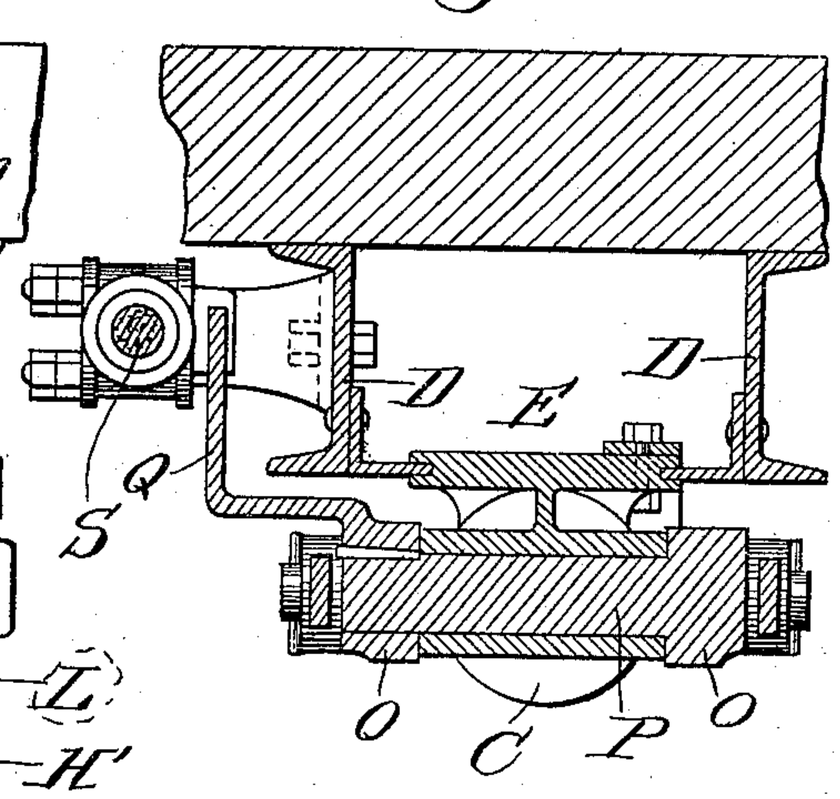


Fig. 9.

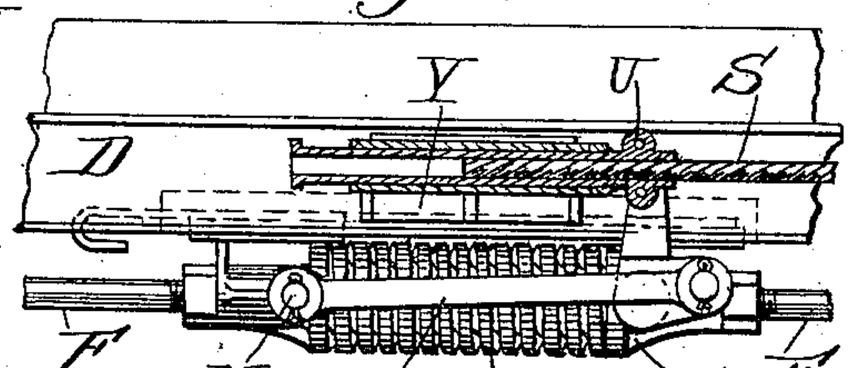
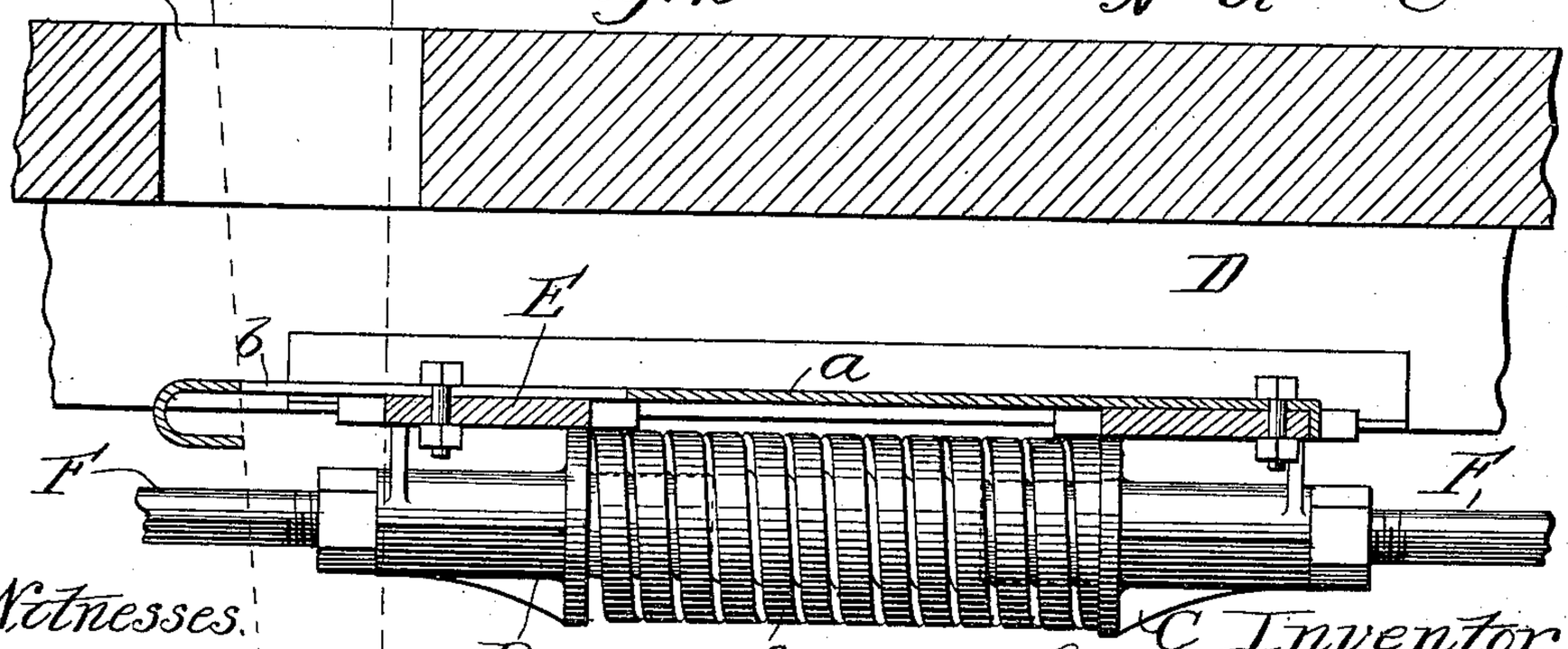


Fig. 10



Witnesses.

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Wm. F. Fleming.

Inventor.

Geo. H. Reynolds

by Raymond & Quackenbush

Atty's

UNITED STATES PATENT OFFICE.

GEORGE H. REYNOLDS, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE CRANE ELEVATOR COMPANY, OF SAME PLACE.

AUTOMATIC SAFETY-STOP.

SPECIFICATION forming part of Letters Patent No. 610,587, dated September 13, 1898.

Application filed February 16, 1895. Serial No. 538,642. (No model.)

To all whom it may concern:

Be it known that I, GEORGE H. REYNOLDS, a citizen of the United States, residing in Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Automatic Safety-Stops for Elevators, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

This invention relates to that class of safety-stops that are automatically thrown into operation whenever the car attains a speed above the maximum to which the governor is set, whether as a result of the breaking of the lifting-cables of the car or for any other cause. Prior to my invention such automatic safety-stops have been open to two serious objections, one of which is the comparative sluggishness with which the device operates and the suddenness with which the traveling car is arrested when the operation takes place, causing a jar or shock to the freight or passengers on the car and to the building almost as great as if the car were permitted to run to the bottom of the well. This will be better appreciated when the speed of a heavy falling body is borne in mind, the distance that a loaded or even unloaded car would fall in a couple of seconds, and the instantaneous effect of the gripping devices when thrown into operation. The other serious difficulty encountered with prior safety-stops is the inability to release the car and move with safety from a point between the doors to the doors or to the bottom of the shaft, such operation being out of the question with the safety devices as now constructed.

My invention has among its primary objects a practically instantaneous action of the safety device with a gradual but quickly-increasing force, whereby the possible length of fall is reduced to the minimum, while the shock or jar to either the passengers or the building incident to the stopping is practically obviated.

Another primary object is to have the stop devices capable of immediate release from within the car and at comparatively slight expenditure of force on the part of the operator sufficiently to permit the car to move down the shaft practically without other support than that afforded by the stop devices.

Other objects of my invention are to have the stop devices of such character as to be capable of use in connection with metallic guides without producing any damage thereto in effecting an automatic stop of the elevator-car and to have the stop devices capable of being immediately and completely released from engagement with the guide-bars and reset for another operation at the expenditure of comparatively small force on the part of the operator.

These and such other objects as will appear farther on are accomplished by the devices illustrated in the accompanying drawings, in which—

Figure 1 represents a side elevation of the skeleton of an elevator-car and a portion of the guides and supporting-beams therefor with devices embodying my invention applied thereto. Fig. 2 is a vertical section on the line 2 2 of Fig. 1, looking in the direction indicated by the arrows. Fig. 3 is an enlarged detail side elevation of the preferred embodiment of my improved stop device; Fig. 4, an inverted or bottom plan view thereof; Figs. 5 and 6, views similar to Figs. 3 and 4, respectively, but illustrating a modification of my invention. Fig. 7 represents a detail end elevation of the stop devices and their immediate supports. Fig. 8 represents an enlarged detail vertical section on the line 8 8 of Fig. 3, looking in the direction indicated by the arrows; Fig. 9, a detail view of the anchor for the lower end of the governor-rope, and Fig. 10 an enlarged detail section illustrating the means for temporarily releasing the stop devices when set; Fig. 11, an enlarged detail view of the governor, showing the bracket therefor in section.

Similar letters of reference indicate the same parts in the several figures of the drawings.

Referring by letter to the accompanying drawings, A indicates a powerful coil-spring located, preferably, at a central point immediately beneath the floor of the car and confined between two movable abutments B and C, each of which abutments is provided with a suitable projection extending a sufficient

distance within the ends of the spring to afford a guide and support therefor. Each of these abutments has a sliding support upon the frame of the car, preferably by a tongue-and-groove connection between channel-beams D, supporting the timbers of the car, and a projection E, of any suitable character, extending upwardly from each of said abutments, as more clearly illustrated in Figs. 4 and 8. Into each of these abutments on the axis of the spring A is screwed or otherwise permanently secured a connecting-rod F, each of which rods is connected by links G with the long arms of a pair of gripping-levers H of the first class, the short arms or opposite ends of which levers terminate in gripping-jaws H′, that normally rest in close proximity to the opposite side faces of the metallic guides I, secured in any suitable manner to the framing of the elevator-shaft. While the gripping-levers are pivoted upon the bolts J, which pass through said levers near the gripping-jaws H′ thereof and through a suitable guide-bracket K, rigidly secured to the framing of the elevator-car, at the same time the bracket is relieved of the strain upon the bolts by a steel link L, (shown in dotted lines in Figs. 3 and 4 and in full lines in Figs. 5 and 6,) occupying suitable recesses in the adjacent jaws, so that when the long arms thereof are spread so as to cause the short arms or gripping-jaws thereof to slightly grip the guides I at the sides of the shaft the strain on the pivots of said jaws, which tends to force them apart, is taken up wholly by this link, so that the guide-bracket of the elevator is entirely relieved of this strain and therefore need not be of the cumbersome weight and strength that would otherwise be required if it had also to support the strain as well as guide the elevator.

To hold the jaws of the gripping-levers H normally out of contact with the guides I, I provide a rock-shaft, or, if preferred, a pivoting-bolt M, in one of the movable abutments—say the abutment B—on the ends of which bolt are pivoted the ends of a pair of crank-rods N, the opposite ends of which are pivotally connected with crank-arms O, formed rigidly with or keyed upon a crank-shaft P, suitably journaled in the abutment C. One of the crank-arms O is in the shape of a bell-crank lever, the free arm Q of which is adapted and arranged to engage a movable stop R upon the anchor of the governor-rope S after the crank-arms have passed the dead-center.

In the drawings the crank-arms are shown as slightly past the dead-center, and at this time the coil-springs A are under compression, so as to cause the jaws of the gripping-lever to release the guides I. In practice I prefer that the crank-arms O shall slightly pass the dead-center before the arm Q engages the stop R, so as to insure against the accidental setting of the stop devices by any unusual jar on the car. The parts will remain in this position until, through the medium of the arm Q, the crank-arms are moved back past the dead-center, when the spring A will instantly expand, force the abutments B and C away, and, through the rods F and links G, cause the grip-levers to take a frictional hold upon the guide-beams with sufficient force to prevent a heavily-loaded car from falling more than three to five feet, and yet bringing it to a gradual stop. It is obvious that this gripping force may be varied to suit the character of work to be performed by the elevator by simply varying the strength of the spring A and the leverage of the gripping-jaws, thus rendering it possible to adapt the devices for elevators carrying from the very lightest to the very heaviest loads practicable.

The devices for holding the actuating-spring of the gripping-jaws under compression and releasing the same through the action of the governor, as will be described farther on, I will designate, for convenience, a "tripping mechanism," intending to include by such term any kind of mechanism which shall operate to hold the spring under compression and to trip and release the spring by the automatic action of the governor, and I may here state that I do not desire to limit myself to the crank-arm arrangement shown and described or to any other particular form of tripping lever or latch.

As will be seen from an inspection of the drawings, both ends of the governor-rope S are attached to the car, one preferably at the point T near the top of the car and the other to the anchor U beneath the floor of the car in close proximity to the spring A and its accompanying devices for operating the gripping-jaws. The rope is also trained around a weighted or other suitable compensating or tension pulley V, permanently located near the bottom of the elevator-shaft, and over a governor-wheel W at the top of the shaft, which is provided with a spring-actuated dog X, of any suitable character, adapted and arranged when the governor-wheel exceeds the maximum desired speed to be thrown out by centrifugal force into engagement with the bracket supporting the governor or any other stationary part, and thus instantly arrest the rotation of the governor-wheel. The lower end of the rope is anchored at U with capability of a limited movement sufficient, through the medium of the arm Q, to move the crank-arms O past the dead-center. Under ordinary running of the car below the maximum speed the two ends of the governor-rope, being attached to the car, will be synchronously paid out and taken up, and hence the anchors of the ends of the rope will be subjected to only such strain as is produced by the weight of the cable and the friction of the running pulleys. When, however, the speed of the car in traveling down the shaft exceeds the maximum, as a result of the breaking of the operating-ropes, overload, or any other cause,

the rotation of the governor-wheel W will be instantly arrested, necessitating the dragging of that portion of the rope between the car and the wheel over this wheel, which immediately creates such friction as to cause the anchor U to move slightly, and thereby, through the arm Q and crank-arms O, throw the gripping-jaws into operation. I may here state that the anchor U is adjustable, so that the initial position thereof may be changed to permit the crank-arms to pass the dead-center a greater or less distance, according to the work to be performed by the elevator and the requirements to insure against accidental setting of the stop devices, this adjustability being through the medium of an ordinary bolt-and-slot connection between the casing or bracket Y (by which the anchor is secured to the car) and the channel-beam D or other fixed part of the car.

Should the car come to a stop between floors, it is of course desirable that the car may not only be safely lowered to the next landing without delay to discharge the passengers, but may also be safely lowered to the bottom of the well, where the operating-cables, if broken, may be mended or renewed with the least delay. To accomplish this, I provide a bar *a*, which is rigidly secured at one end to one of the movable abutments—say the one C—and at its opposite end has a slot-and-bolt connection with the other abutment B, the slot *b* therein extending a sufficient distance beyond the abutment to receive a wedge or key *c*, (shown in dotted lines in Fig. 10,) the small end of which is passed down through an opening *d* in the floor of the car, which is normally closed by a suitable cap or plug. With a sufficient pressure or blow from the foot of the operator or any suitable instrument this wedge can be driven down between the abutment B and the end of the bar *a* through the slot in said bar, which results in drawing the two abutments toward each other, and thereby overcoming the force of the spring A sufficiently to slightly relax the hold of the gripping-jaws upon the guide and permit the car to slide down slowly to the next floor or to the bottom of the shaft. After the repairs are made wrenches may be applied to the squared portions *e* of the crank-shaft *p* and the tension of the spring overcome, so as to throw the crank-arms O again to or past the dead-center, and thus entirely release and reset the stop devices.

In Figs. 5 and 6 I have shown a modification of my invention which simply consists in the employment of two springs *f g* instead of the one spring A, (shown in the preferred construction,) with the changes incident to such construction. These changes consist in having shouldered rods *h* passing through the springs and, in effect, corresponding with the rods F of the preferred construction, the outer ends of which are provided with annular shoulders *i*, against which the outer ends of the springs *f* and *g* abut, the inner ends of said springs abutting against the bracket K, rigidly secured to the frame of the car. The inner ends of the rods *h* terminate in oppositely-curved ends complementary to each other, and each is connected by a pivot *l*, eccentrically at opposite sides of the center, with a disk or double-armed lever *m*, to which is rigidly secured a lever-arm *n*, which when moved to the position shown in the drawings carries the pivots *l* of the two rods *h* past the dead-center and holds the springs *f* and *g* under compression. The governor-rope S is anchored directly to the end of the lever *n*, and when the strain is put thereon, in the manner before described, the disk or double-armed lever *m* will be caused to rotate, and thus move the pivots *l* past the dead-center, whereupon the springs *f* and *g* instantly expand and set the gripping-jaws in the manner before described. A temporary releasing-key, such as the one *c*, may obviously be employed in the same manner as previously described in connection with this modification of my invention.

In the preferred construction adjustability of the apparatus to shafts of different widths is afforded by the screw connection between the connecting-rods F and the movable abutments within limits; but where there is a wide difference it is only necessary to insert a connecting-rod of greater length connected with the abutments in the same manner, although, of course, turnbuckles in the rods would subserve the same purpose without the necessity for adjustability in any other part of the apparatus.

While I have shown and described particular mechanisms for carrying out my invention, these are to be understood as simply a specific embodiment or exemplification thereof, and therefore so far as relates to the broad idea of my invention, I do not desire to limit myself to the particular construction or mode of operation of the devices herein shown and described, as obviously various changes, modificatious, and variations in the construction and mode of operation of devices for carrying out my invention would readily suggest themselves to one skilled in the art to which it appertains without departing from the spirit of my invention.

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

1. The combination, in an elevator apparatus, of an elevator-car, spring-actuated pivoted gripping-jaws, devices for holding said jaws normally open, a governor supported independently of the car for releasing said devices to set the jaws, and means for temporarily rocking said jaws upon their pivots, thereby releasing said jaws, substantially as described.

2. The combination, in an elevator apparatus, of an elevator-car, spring-actuated pivoted gripping-jaws, devices for holding said jaws normally open, a governor supported in-

dependently of the car for automatically tripping said devices to set the jaws, and means, operated from the car, for rocking said jaws upon their pivots, thereby temporarily releasing the jaws after they are set, substantially as described.

3. The combination, in an elevator apparatus, of an elevator-car, a spring-actuated gripping mechanism on the car, and a tripping mechanism for automatically operating the same, comprising a trip-lever, a speed-governor supported independent of the car, and a rope or cable attached rigidly at one end to the elevator-car, and engaging at its opposite end with said trip-lever, substantially as described.

4. The combination, in an elevator apparatus, of an elevator-car, a spring-actuated gripping mechanism on the car, and a tripping mechanism for automatically operating the same, comprising a trip-lever, a speed-governor supported independent of said elevator-car, and a rope or cable connecting said governor and car, rigidly secured at one end to said car and movably secured at its opposite end to said car in position for operative engagement with said tripping-lever, substantially as described.

5. The combination, in an elevator apparatus, of a pair of guides, a pair of jaws adapted to grip each guide, a pair of movable abutments, lever connections between said abutments and pairs of jaws, respectively, a coil-spring adapted to act upon and normally force said abutments apart, means for holding said spring under compression between the abutments, and a governor for automatically tripping said holding means, substantially as described.

6. The combination, in an elevator apparatus, of a pair of guides, a pair of jaws adapted to grip each guide, a pair of movable abutments, levers connecting said abutments with the pairs of jaws, respectively, a coil-spring confined between said abutments and normally acting to force them apart, crank-arms pivoted to one of said abutments, a pair of horizontal links pivotally connected at their ends, respectively, to said crank-arms and to the other abutments, and a governor for automatically throwing said crank-arms past the dead-center, substantially as described.

7. The combination, in an elevator apparatus, of a pair of guides, a pair of gripping-levers for each of said guides, gripping-jaws on each of said levers, a pair of movable abutments, a pair of toggle-links connecting each abutment with one pair of the gripping-levers, a coil-spring confined between said abutments and normally acting to force them apart, means for holding said spring under compression, and a governor for automatically tripping said holding means, substantially as described.

8. The combination, in an elevator apparatus, of an elevator-car, a pair of guides, a pair of jaws adapted to grip each of said guides, a pair of movable abutments connected with so as to operate said jaws, a coil-spring confined between said abutments and normally acting to force the same apart, a pair of crank-arms pivoted to one of said abutments, a pair of connecting-rods pivotally secured at their ends, respectively, to said crank-arms and to the other abutment, said crank-arms and rods serving as a means for holding the spring under compression when the arms pass the dead-center, a projection on one of said arms, a governor device, a rope or cable operatively connected therewith and rigidly secured at one end to said elevator-car, and a movable anchor for the other end of said cable also attached to the elevator-car, and a projection on said anchor adapted for engagement with the projection on the crank-arm, substantially as described.

9. In an elevator apparatus, pivoted gripping-jaws, means for holding said gripping-jaws in open position, a governor for automatically releasing said holding means to set said jaws, and means for temporarily rocking said jaws about their pivots thereby releasing said jaws, substantially as and for the purpose set forth.

10. In an elevator apparatus, gripping-jaws, means for holding the same in open position, a governor for automatically releasing said holding means to set said jaws, and means, operated from the car, for rocking said jaws about their pivots, thereby temporarily releasing the jaws after they are set, whereby the car can be eased down to a landing, substantially as and for the purpose set forth.

11. In an elevator apparatus, a guide, a gripping mechanism comprising a pair of spring-actuated pivoted jaws, a trip, an arm adapted to be held by said trip, connections between said arm and jaws whereby said jaws are held in open position, and a governor for automatically tripping said trip to release said arm, as and for the purpose set forth.

12. In an elevator apparatus, a guide, a pair of spring-actuated pivoted gripping-jaws, a trip, an arm adapted to be held by said trip, connections between said arm and jaws comprising a system of toggle-levers, and a governor for automatically tripping said trip, as and for the purpose set forth.

13. In an elevator apparatus, a pair of guides, a pair of spring-actuated jaws adapted to grip each guide, a trip, an arm adapted to be held thereby, a system of levers adapted to simultaneously set said jaws, connections between said arm and levers and a governor for automatically tripping said arm, as and for the purpose set forth.

14. In an elevator, a safety device consisting of the combination of pivoted gripping-jaws, toggles coöperating with, so as to operate, the jaws, a spring for operating the toggles, means for latching the spring with the gripping-jaws open, and a governor for un-

latching the spring to apply the grip, substantially as described.

15. In an elevator apparatus, a safety device consisting of the combination of two gripping-jaws, toggles connecting them, a spring to operate the toggles and apply the gripping-jaws, means for holding the toggles with the spring under strain, and a governor to release the spring, substantially as described.

16. The combination, in an elevator apparatus, of a guide, a pair of gripping-jaws, a spring normally adapted to press said jaws against said guide, a trip-lever, connections between said lever and jaws consisting of a system of toggle-levers and a rod connecting said trip-lever and toggle-levers, and a governor for automatically tripping said trip-lever, substantially as described.

17. The combination, in an elevator apparatus, of a guide, a pair of spring-actuated pivoted gripping-jaws adapted to press against said guide, a trip-lever, connections between said lever and jaws consisting of a system of toggle-levers and a rod connecting said trip-lever and toggle-levers, and a governor for automatically tripping said lever, substantially as described.

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Witnesses:
M. E. SHIELDS,
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