(No Model.) 3 Sheets—Sheet 1.

J. FENSOM.

HYDRAULIC ELEVATOR.

No. 362,070. Patented May 3, 1887.

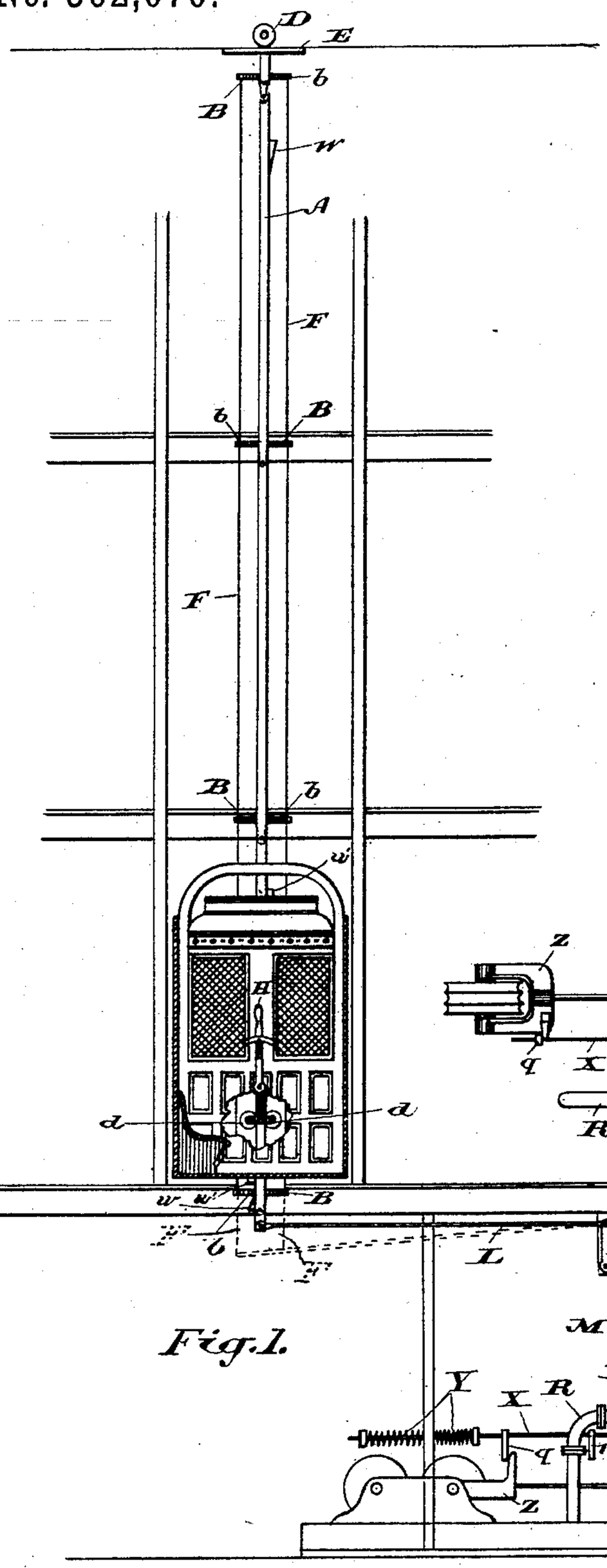

Fig. 1.

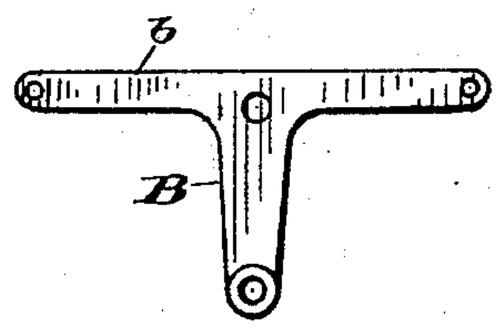

Fig. 6.

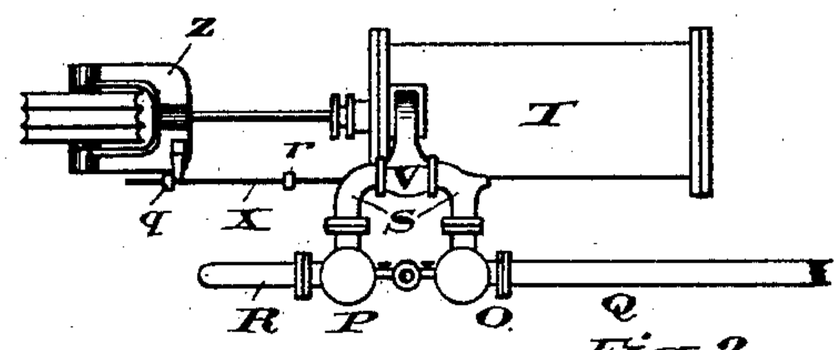

Fig. 2.

Witnesses.
F. B. Fetherstonhaugh
J. M. Jackson

Inventor:
John Fensom
by Donald C. Ridout & Co
Attys

(No Model.) 3 Sheets—Sheet 2.

J. FENSOM.

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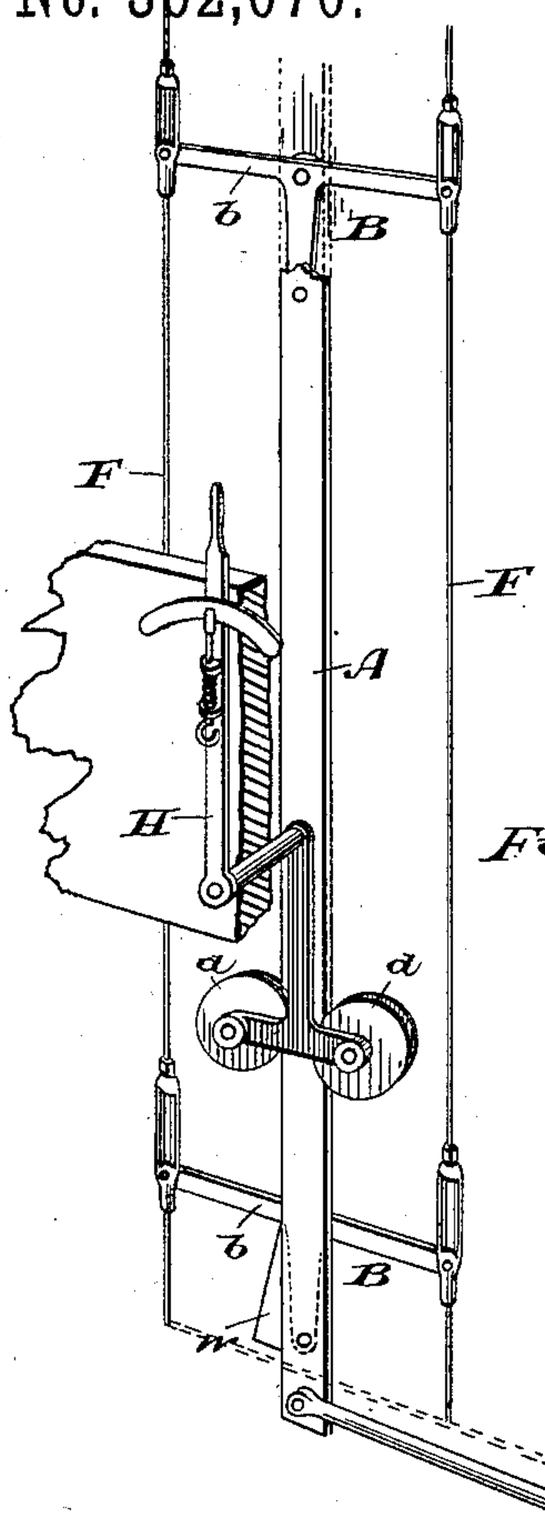

Fig. 3.

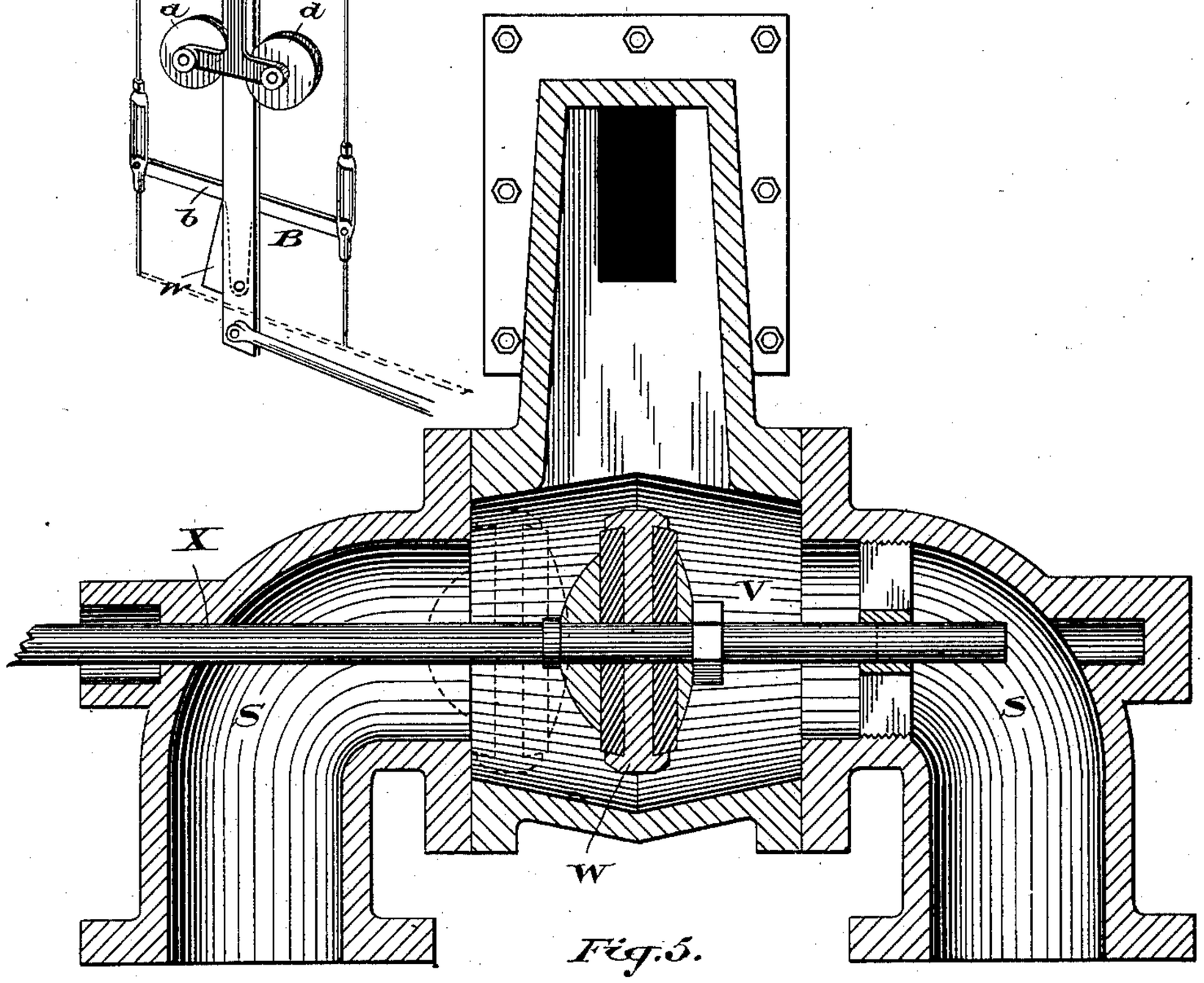

Fig. 5.

Witnesses.
F. B. Fahnestock
J. M. Jackson

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(No Model.) 3 Sheets—Sheet 3.

J. FENSOM.

HYDRAULIC ELEVATOR.

No. 362,070. Patented May 3, 1887.

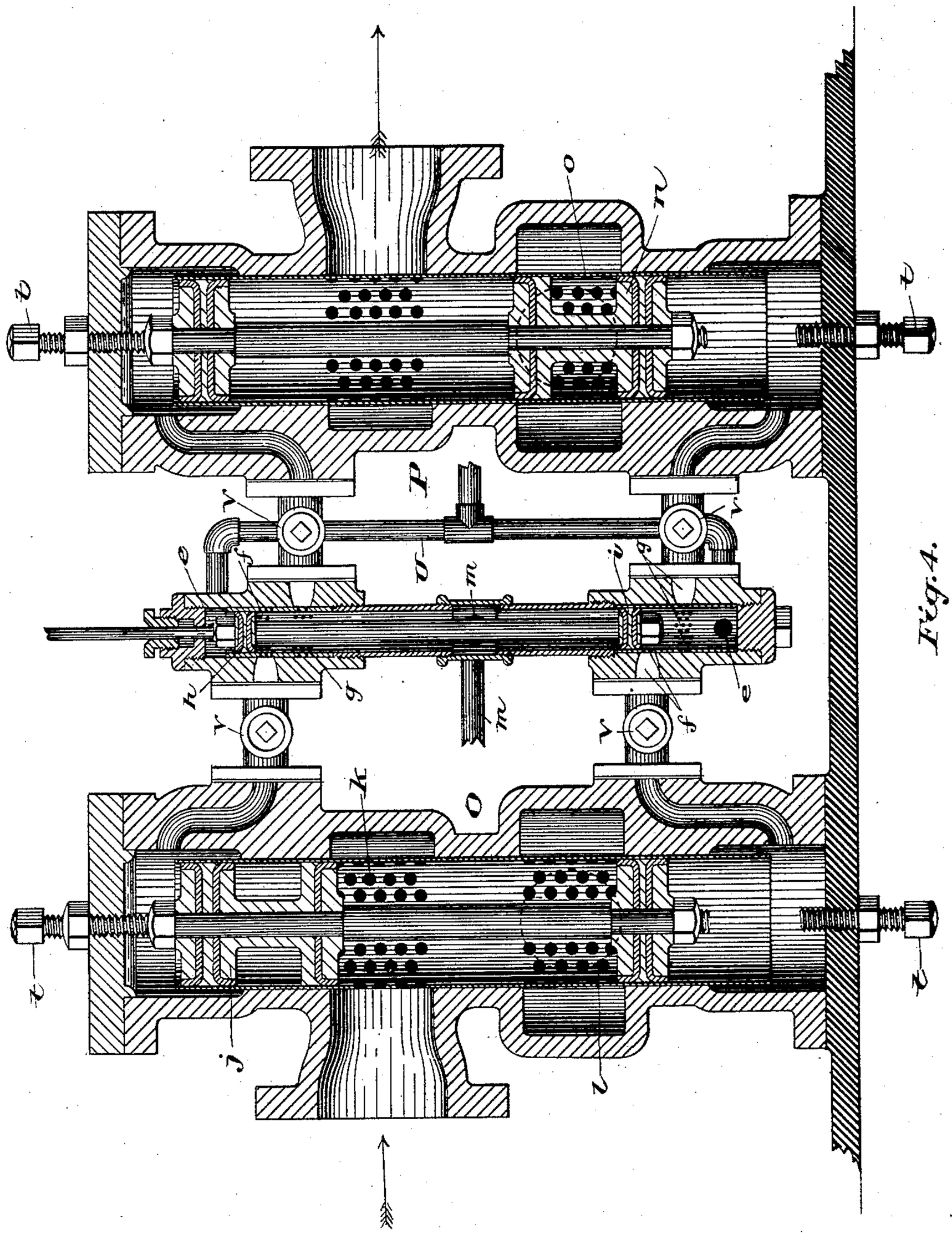

Fig. 4.

Witnesses.
F. B. Fetherstonhaugh
J. M. Jackson

Inventor:
John Fensom
by Donald C. Ridout & Co
Attys

UNITED STATES PATENT OFFICE.

JOHN FENSOM, OF TORONTO, ONTARIO, CANADA.

HYDRAULIC ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 362,070, dated May 3, 1887.

Application filed May 27, 1886. Serial No. 203,408. (No model.)

To all whom it may concern:

Be it known that I, JOHN FENSOM, of the city of Toronto, in the county of York, in the Province of Ontario, Canada, engineer, have invented new and useful Improvements in Hydraulic Elevators, of which the following is a specification.

The objects of the invention are, first, to design simple, easily-operated, positive mechanism to operate the valve mechanism; secondly, to arrange simple valve mechanism capable of being effectually operated by a balanced reversing-valve designed to operate and adjust the supply and discharge valves independent of each other; thirdly, to provide a simple valve by which the elevator-car is automatically stopped when it reaches either the top or bottom of the building without cutting off connection between the elevator's cylinder and its valve-operating mechanism.

The first part consists, essentially, in suspending a bar from a track at the top of the well and connecting the said bar to a series of T-cranks, the side arms of which are connected together by two parallel rods which move vertically in opposite directions to each other whenever the bar is moved laterally, the vertical movements of the rods or the horizontal movement of the bar being utilized for the purpose of operating the balanced reversing-valve; secondly, in providing a balanced reversing-valve connected to two valve-chambers provided with piston-shaped valves arranged to operate independent of each other, both valve-chambers being connected to the main hydraulic cylinder, one chamber and its valve being used for admitting the water-pressure into the cylinder, while the other chamber and its valve is arranged to regulate the discharge; thirdly, in placing a valve-chest at the junction of the two pipes leading from the two main valve-chambers and the pipe leading into the main hydraulic cylinder, the whole being arranged to operate in conjunction with each other, substantially as and for the purposes hereinafter described.

Figure 1 is an elevation showing the arrangement of the parts involved in my invention. Fig. 2 is a plan of the main hydraulic cylinder and valves connecting therewith. Fig. 3 is a detail showing the connection between the bell-cranks, vertical bar, and parallel vertical rods. Fig. 4 is an enlarged section of the main valve-chests and their valves. Fig. 5 is an enlarged section of the stop-valve by which the car is automatically stopped either at the top or bottom of the building. Fig. 6 is a detail of T-crank.

In the draft like letters of reference indicate corresponding parts in each figure.

A is a stiff bar, preferably made of iron or steel and suspended from a swinging bar or from the roller D, carried on a track, E, which is securely fastened to stationary timbers attached to the building.

In Fig. 1 I show simply three floors, which will be sufficient for the purpose of illustrating my invention.

It will be noticed that I pivot a T-crank, B, at each floor and the vertical bar A to the vertical arm of each T-crank B. The horizontal arms *b* of the T-cranks B are all connected together by the vertical parallel rods F. The hand-lever H is pivoted in a suitable manner to the car. This hand-lever is T-shaped, and is designed to carry sliding boxes or the two friction-rollers *d*, which are located, as indicated, upon either side of the vertical bar A, which they are designed to grasp. By connecting the vertical bar A to a series of pivoted T-cranks B, and connecting all the horizontal arms of the said T-cranks together by the vertical parallel rods F, the side movement of the bar A will cause all the T-cranks B to rock upon their pivots, and it is this connection between the rods and pivoted crank which causes the bar A to move its entire length and maintain at all times a vertical position, no matter from what point in its length it may be acted upon by the hand-lever H; and no matter in which direction the bar A is moved, it will always remain parallel with the vertical rods F, which are always parallel with each other; and I am able to utilize either the horizontal movement of the bar A or the vertical movement of the rods F for the purpose of adjusting the balanced reversing-valve referred to, or such other valve as the elevator may be provided with.

In Fig. 1 I show the vertical bar A connected to the bell-crank K by the rod L. The other arm of the bell-crank K is connected by the rod M to the spindle of the reversing-

valve N, so that by this connection the horizontal movement of the vertical bar A imparts the necessary vertical movement to the reversing-valve N to operate it, as hereinafter described. It will be seen that by very little change in the mechanism described—such, for instance, as illustrated by dotted lines in Figs. 1 and 3—the vertical movements of the rods F may be utilized for the purpose of operating the reversing-valve N.

It will be noticed on reference to Figs. 1 and 2 that the reversing-valve N is located between and connected to the two main valves O and P, the valve O being connected to the supply-pipe Q, while the valve P is connected to the discharge-pipe R, both valves being connected by the branch pipes S to the main hydraulic cylinder T of the elevator.

On reference to Fig. 4 the operation of the reversing and main valves will be understood. In this figure, U represents the branch pipe through which the water-pressure is admitted through the apertures *e* into the valve-chamber N. As these apertures are at both ends of the valve-chamber N, the valve within it will be balanced, and consequently may be worked with very little exertion.

It will be noticed that there are two sets of perforations, *f* and *g*, through the lining in the chamber N, the perforations *f* being designed to connect the interior of the valve-chamber N with the interior of the supply-valve chamber O, while the perforations marked *g* connect the interior of the valve-chamber N with the interior of the discharge-valve chamber P.

In Fig. 4 the reversing-valve is drawn up so that its piston-heads *h* are above the perforations *f* and *g;* but, as the upper piston-head *h* separates the upper aperture *e* from the perforations *f* and *g*, the water-pressure entering through the upper aperture *e* is cut off from the upper ends of the valve-chambers O and P, while the location of the lower piston-head is such that the water-pressure entering at the lower aperture *e* passes freely through the perforations *f* and *g* into the lower side of the valves of both valve-chambers O and P, thereby forcing both of the valves up into the position in which they are shown in Fig. 4. The supply-pipe Q, as before stated, is connected to the valve-chamber O, and when the piston-head *j* is raised, as shown, above the perforations *k* the water-pressure will enter into the chamber O and pass from it through the perforations *l* into the cylinder T, forcing the piston in the said cylinder, so as to operate the elevator in the ordinary way, and cause the car to move upwardly. In order to stop the elevator, the reversing-valve N is adjusted so as to bring its upper piston-head *h* between the perforations *f* and *g*. Its lower piston-head will be in a similar position between the lower perforations *f* and *g*. Consequently the water-pressure entering at the lower aperture *e* is cut off from the lower side of the valve-chamber O, while the water-pressure entering at the upper aperture *e* will pass freely into the upper end of the valve-chamber O, thus reversing the pressure, and will naturally cause the piston-head *j* to fall till it closes the perforations *k*, and thus cutting off the supply-pressure from the main cylinder T; and the car is standing when the piston-head *j* is in the position just described. The lower end of the chamber O is in direct communication with the center of the reversing-valve chamber, so that the water in the lower end of the cylinder O will flow freely through the outlet *m*. During the period that the supply-valve is operating, as described, the piston-head *n* is held over the perforations *o*, thereby preventing the water in the cylinder T from escaping. In order to let the water out of the cylinder T, the piston-heads *h* and *i* are forced below the perforations *g*, thus admitting the water-pressure to enter through the aperture *e* into the upper end of the chamber P, forcing the piston-head *n* below the perforations *o*, thereby opening a passage for the water in the cylinder T through the perforations *o* into the chamber P, and thence through the perforations *p* out of the discharge-pipe R, and the car will move down.

Between the branch pipes S and the hydraulic cylinder T, I place the cut-off-valve chamber V, which is provided with three passage-ways, one leading to the valve O, another to the valve P, and a third to the cylinder T. The passage-way leading to the cylinder T always remains open; but a piston or disk valve is provided for the purpose of cutting off the other passage-ways. This valve is secured to the spindle X, which has a spring or springs, Y, arranged to hold the spindle X, when not otherwise acted upon, in such a position that the piston or disk-shaped valve W shall be in the center of the chamber V, leaving both passage-ways through the branch pipes S in open communication with the passage-way leading to the cylinder T.

Two stop-blocks, *q* and *r*, are secured to the spindle X in such a position that a bracket on the cross-head *Z* will come in contact with either one or other of the stop-blocks *q* or *r*, and thereby adjust the spindle K so as to close, by the valve W, the passage-way leading to the valve O when the elevator has reached the top of the building, or to adjust the valve W so as to close the passage-way leading to the valve P when the car has reached the bottom of the building. In this way the car is automatically stopped at either the top or bottom of the building, as the case may be, while the valve W is so adjusted by the springs Y that it will not interfere with the passage-ways should the elevator be operated to work between the two extreme points mentioned; and as the supply-valve and discharge-valve are independent of each other, and as the valve W never cuts off both passage-ways at

the same time, the valve mechanism employed, as described, to operate the elevator is never cut off from the cylinder of the latter.

In Fig. 1 I show the vertical bar A arranged to operate the valve mechanism of a horizontal hydraulic cylinder; but it will of course be understood that the valve mechanism of a vertical cylinder might be as advantageously employed.

I also describe the valve mechanism as being operated by an independent reversing-valve; but it will be understood that, while this is the preferable arrangement, the ordinary valve-motion of an ordinary hydraulic elevator might be operated by the parallel motion of the bar A and rods F, hereinbefore explained.

A further point, which I perhaps ought to have referred to before, relates to the means I provide for regulating the strokes of the piston-head *j n*. At each end of the valve-chamber O and P, I place set-screws *t*, which extend into the valve-chambers, and which may be adjusted so as to lengthen or shorten the strokes of the valve or piston heads *j* and *n*. As these adjustments may be made independent of each other, I am able to regulate to a nicety the supply and discharge, so that the speed of the car when going up may be altered without affecting its speed in coming down, or vice versa.

In order to enable the supply of water for operating the valves in the chambers O and P to be easily regulated, I place in each of the passage-ways *f* and *g* a cut-off valve, *v*, each valve being independent of the others, and which may be readily altered to admit more or less water, as may be required, at either of the ends of the chambers O and P, thereby enabling the speed at which the said valves open and shut to be easily and readily regulated. In addition to the valve W, I provide means for automatically adjusting the bar A before the car reaches the top or bottom of its travel. This plan is indicated in Figs. 1 and 3, and consists in placing a wedge-shaped projection on the side of the bar A, a beveled projection, *w*, designed to come in contact with a projection, *w'*, attached to the car. These projections are arranged at both the top and bottom of the bar A, at such a point that the downward and upward movement of the car will force the bar A over before it reaches the extreme length of its travel, thereby giving ample time for the valve-chambers O and P to operate.

Certain features herein shown and not claimed—such, for instance, as the combination of the cylinder T, valve-chambers O and P, and the cut-off-valve chamber V, having three independent passages leading to said valve-chambers and cylinder, with valve W, designed to be acted upon by some moving part of the elevator, and the combination of the aforesaid devices with a spring designed to hold the valve in the center of its motion—are claimed in another application filed by me March 22, 1887, Serial No. 231,955.

What I claim as my invention is—

1. In a hydraulic elevator, a series of T-cranks, B, a vertical bar, A, connected to said series of pivoted T-cranks B, and passing in proximity to the car of the elevator, and suitable valve-connections, in combination with the vertical parallel rods F, arranged to connect the T-cranks B together, substantially as described, whereby the vertical bar and rods F shall, in their adjustment described, maintain a parallel relation to each other for the purpose of operating the valve mechanism of the elevator, substantially as and for the purpose specified.

2. In a hydraulic elevator, a vertical bar, A, connected to a series of pivoted T-cranks, B, and passing in proximity to the car of the elevator, and suitable valve-connections, in combination with the lever H, pivoted in the elevator-car and carrying friction-rollers *d*, one upon each side of said bar, and the vertical parallel rods F, arranged to connect the T-cranks B together, substantially as described, whereby the vertical bar and rods D shall, in their adjustments described, maintain a parallel relation to each other for the purpose of imparting motion to the spindle of the balanced reversing-valve N, substantially as described.

3. The vertical bar A, adjustably supported at the top of the building and pivoted to the vertical arms *b* of the T-cranks B, and the hand-lever H, pivoted in the car I, in combination with the parallel rods F, connected to the horizontal arms *b* of the T-cranks B, substantially as described, whereby the vertical bar and rods D shall, when adjusted by the hand-lever H, maintain a parallel relation to each other for the purpose of operating the valve mechanism of the elevator, substantially as and for the purpose specified.

4. In a hydraulic elevator, the valve-chamber O, a valve therein controlling the passage through the supply-pipe Q and to the hydraulic cylinder T, a valve-chamber, P, a valve therein controlling the passage through the discharge-pipe R, and the branch pipe S, connecting said valve to the hydraulic cylinder T, said supply and discharge valves operating independent of each other, in combination with the laterally-movable bar A, an independent reversing-valve, N, and connections, substantially as described, between said bar and reversing-valve, as and for the purpose specified.

5. A reversing-valve, N, supplied with water through the aperture *e*, and connected to the top and bottom of the valve-chamber O through the perforated passage-ways *f*, and independently connected to the valve-chamber P through the perforated passage-way *g*, in combination with the supply and discharge valves, and the double piston-heads *h* and *i*, designed to operate the supply and discharge valves independent of each other, substantially as and for the purposes specified.

6. The combination, with the elevator-car provided with projection *w'*, of the laterally-

moving bar A, suspended from its top and provided with a projection, *w*, substantially as and for the purpose specified.

7. The combination, with the elevator-car provided with a projection, *w'*, at top and bottom, as described, of the laterally-moving bar A, suspended from its top, and the wedge-shaped projections *w* on said bar, one near each end thereof, substantially as and for the purpose specified.

8. The combination, with the elevator-car and its operating mechanism, of the laterally-moving bar A, suspended from its top, the bell-crank levers K, the rod L, connecting one arm of said lever with the bar A, and the rod N, connecting the other arm of said lever with the valve-reversing lever N, substantially as and for the purpose specified.

Toronto, May 14, 1886.

JOHN FENSOM.

In presence of—
CHARLES C. BALDWIN,
ALICE K. THOMPSON.