2 Sheets—Sheet 1.

J. FENSOM.

Hoisting-Machine.

No. 217,600. **Patented July 15, 1879.**

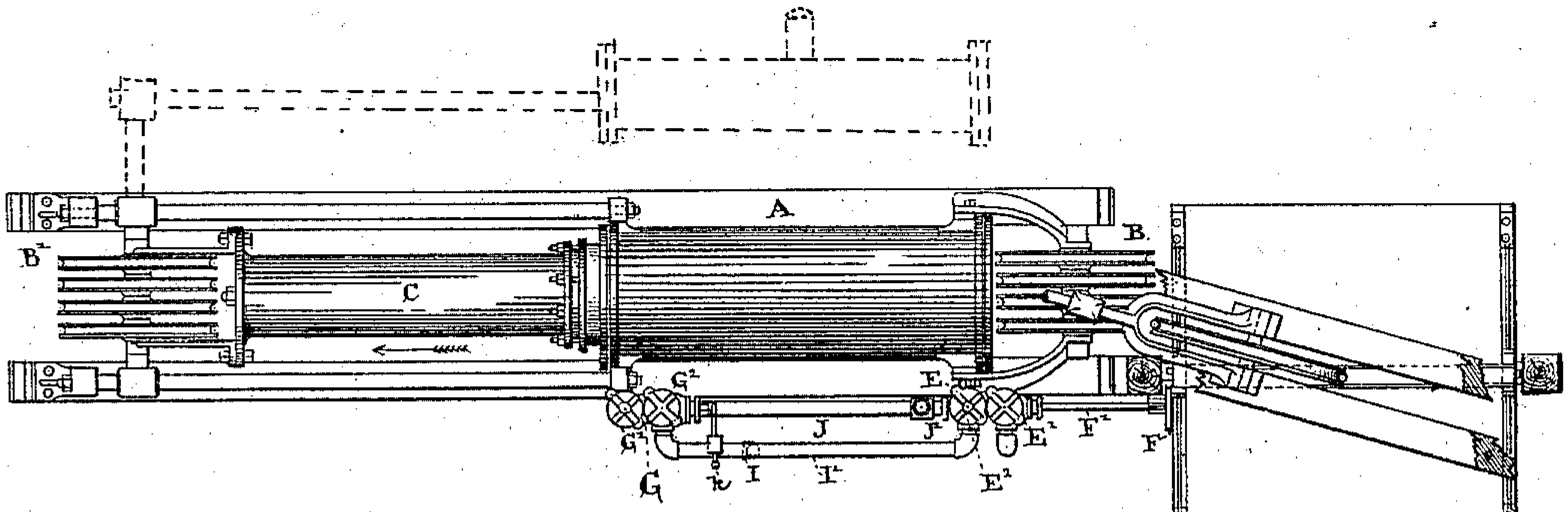


Fig. 1.

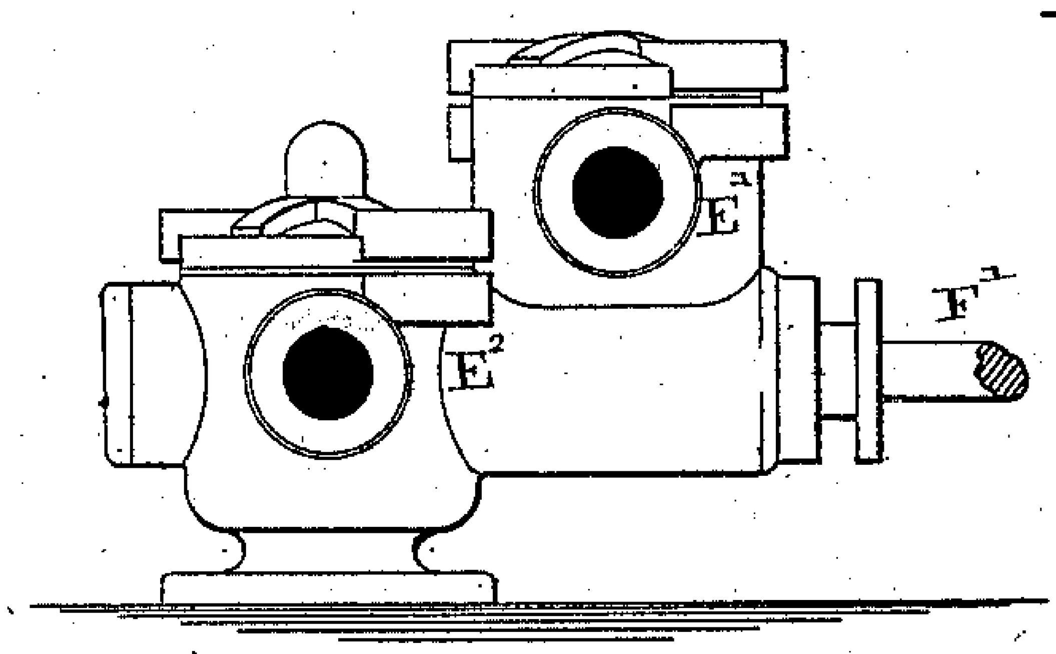


Fig. 3.

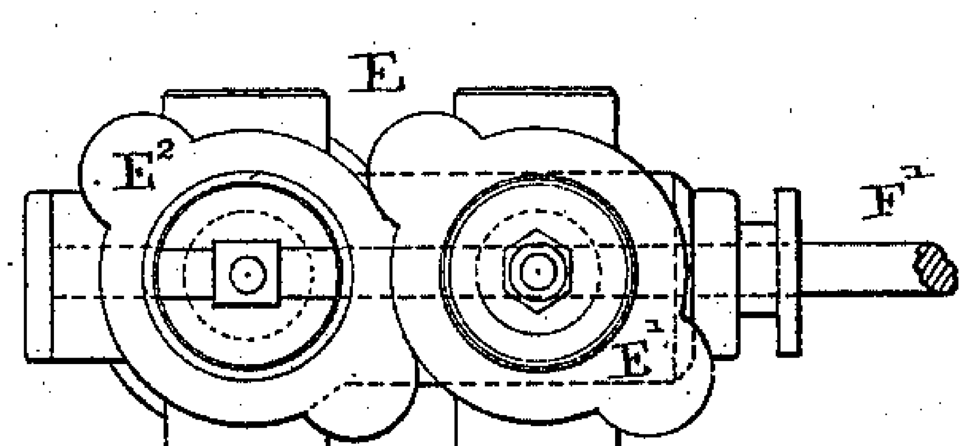


Fig. 4.

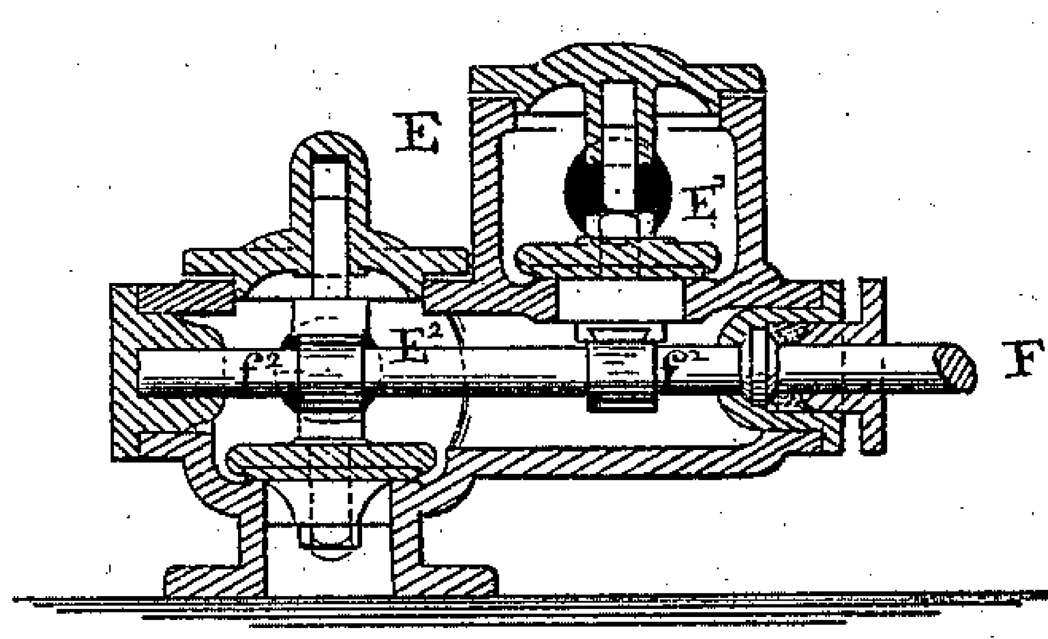
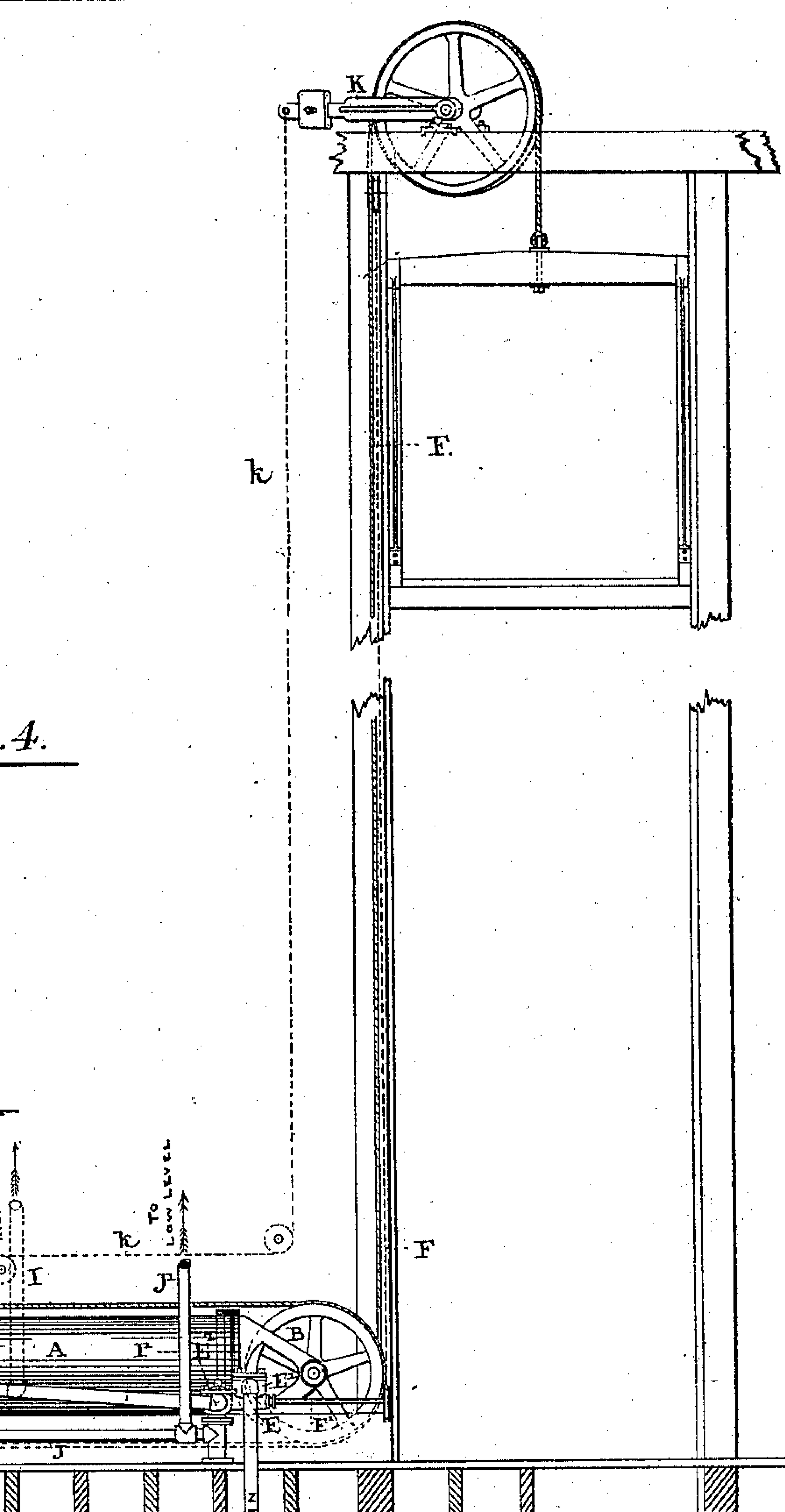


Fig. 5.



WITNESSES:

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J. A. J. Strong

Fig. 2.

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J. FENSOM.
Hoisting-Machine.

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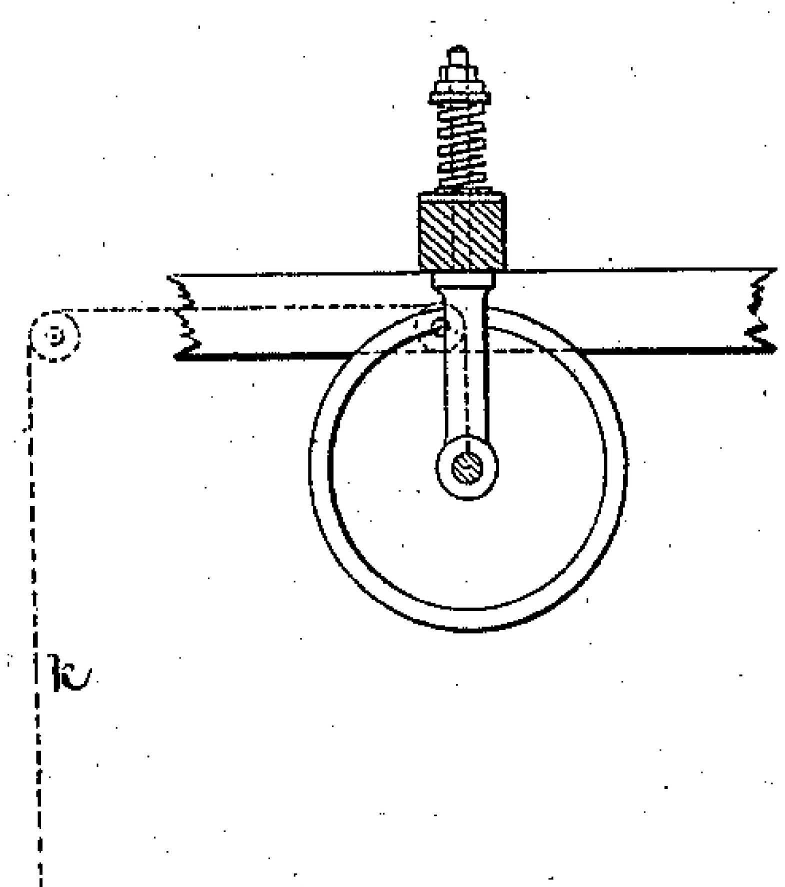

Fig. 7.

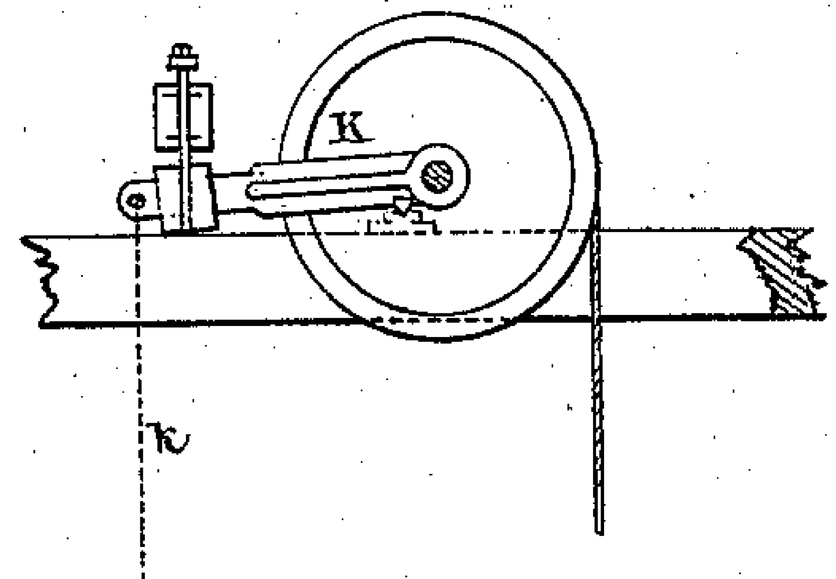

Fig. 6

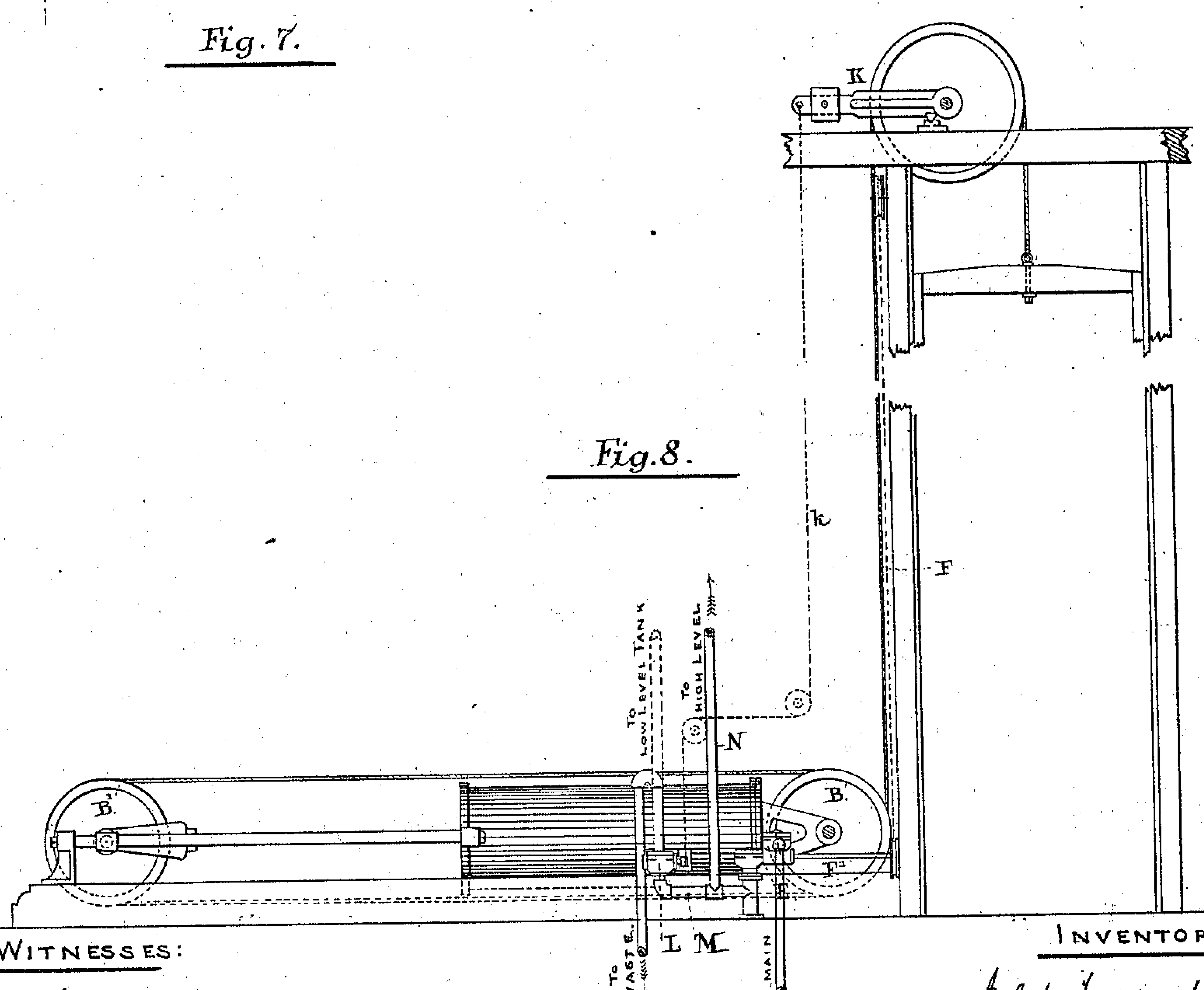

Fig. 8.

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N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JOHN FENSOM, OF TORONTO, ONTARIO, CANADA.

IMPROVEMENT IN HOISTING-MACHINES.

Specification forming part of Letters Patent No. **217,600**, dated July 15, 1879; application filed October 26, 1878.

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, have invented certain new and useful Improvements in Hoisting-Machines, of which the following is a specification.

This invention has relation to improvements in hydraulic hoists, by means of which improvements the surplus power of the pressure of water over that required for lifting the load on the car, or the load on a descending car, can be utilized either for the purpose of forcing the waste-water to an elevated tank, or to force a portion of it back into the supply-pipe, or for other purposes, as hereinafter set forth.

My said improvements are designed to operate automatically, or may, if desired, be placed in connection with a check-rope and controlled therewith.

In applying my improvements to hoisting-machines I have adopted two systems of construction, both embodying my invention. In the first system the discharge-water is elevated by the surplus power of the water-pressure in elevating a load. In the second system the discharge-water is elevated by the weight of the descending load.

The principle upon which the operation of my improvements are based, as applied in the first system of construction, is that of a differential water-pressure on opposite sides of a piston working within a cylinder closed at both ends. In order that this may be more clearly understood it should be explained that the water used in what I term the "working end" of the cylinder in elevating a load is discharged on the return stroke of the piston into the opposite end of the cylinder. Thus the cylinder is always kept full of water on each side of the piston. When water under pressure is admitted to the working end of cylinder for the purpose of lifting a load, the water in the opposite end is forced out, and may, by the surplus power of the water over the load, be either discharged into an elevated tank, or forced back into the supply-main, or be discharged into an accumulator, or, when the load on the hoist and the power of the water are nearly equal be discharged into a low-level tank, from either of which places it can be distributed and used over again for various purposes.

Under the second system of construction the water is discharged by the direct pressure of the piston, due to the load, &c., on the car.

In the accompanying drawings, Figure 1 is a plan, and Fig. 2 a side elevation, of a machine embodying my improvements. Figs. 3, 4, and 5 are details of the valve mechanism. Figs. 6, 7, and 8 are views showing alternative methods of construction.

Figs. 1 and 2 show my hoist when the cylinder is placed in a horizontal position and the connections arranged under the first system hereinbefore referred to; but I wish it to be understood that my improvements are equally applicable and advantageous to cylinders placed in an upright or any position, or to any of the various descriptions of hoists now in use, the form shown being selected for convenience of illustration only.

In Figs. 1 and 2, A is a water-cylinder, closed at both ends, and B B′ are the rope-sheaves. The former set of sheaves is permanently secured to one end of the cylinder or other suitable point, and the latter set is fastened to the end of the piston rod or trunk C, moving as it moves, and operating the rope connected to the car in a manner well understood, so that the car is elevated or lowered in unison with the movement of the piston of cylinder.

E is the working-valve of the working end of cylinder, which valve is operated from the check-rope F, and G is the discharge-valve of the opposite end of cylinder, connected to the tilting lever K, over a pulley mounted on which lever the hoist-rope passes to the car. The operation of this lever in connection with a varying load on the car is fully described in my Patent No. 209,336, granted to me October 29, 1878; but its operation, in connection with my improvements new embodied in this application, will be hereinafter described.

The working-valve E of the hoist is provided with an inlet-valve, E^1, and a discharge-valve, E^2, placed in water-chambers which connect. These valves are opened and closed by cams f^1 and f^2 on a shaft, F′, to which shaft the check-rope is connected. The check-rope is operated in the ordinary way and rotates the shaft F′, causing the valves to open and shut and admit water to or allow it to discharge from the cylinder as the operator desires to raise or lower the car.

The opposite end of the cylinder is provided with two independent valves, G^1 G^2, also working in chambers which connect, through either of which valves, as the load on the hoist determines, the water from this end of the cylinder may be discharged. The valve G^1 is placed in direct connection with the tilting lever K, and is opened by it when an extra load on the car causes said lever to tilt. The valve G^2 may be a simple check-valve, or it may be connected to the tilting lever also.

The object of having separate valves is to provide two distinct and independent outlets for the water, to correspond with the action of the tilting lever under light and heavy loads. The several parts are connected by pipes to convey the water, as hereinafter described.

In adapting a hoist while elevating light loads for the purpose of raising the waste-water to an elevated tank, two methods of construction are at disposal, and the first of these methods is applicable either for elevating a portion of the water to a high-level tank, or to return a portion into the water-main or to force it into an accumulator, and it consists in making the piston with a differential area on opposite sides, so that the pressure of the water on one side of the piston will overcome the pressure of the water contained in the cylinder on the opposite side of the piston and the load on the hoist.

Referring to Figs. 1 and 2, water from the main is admitted to the working end of the cylinder through the valve E^1, in its passage flowing over the valve E^2. The other end of the cylinder is full of water received on the previous return stroke of the piston, as hereinafter explained.

The area of the face of the piston facing this side of cylinder is reduced by the enlargement of the piston-rod C, while the area of the opposite side of the piston is increased or proportioned so that the pressure of the water on this side is sufficient to overcome the pressure of the water on the opposite side, together with the applied weight of the load on the car. The weight of water on the face of piston having the smaller area may be derived from the height to which said water has to be lifted, or the resistance in forcing it from one end of the cylinder to the opposite end or into the supply-main, or the resistance of forcing it into an accumulator. In determining the proportion that the area of one side of the piston shall bear to the other side, the weight of the load and the resistance or weight of the water to be lifted or moved out of the smaller end of cylinder form the basis of calculation.

Referring to Figs. 1 and 2 again, as the piston moves, in elevating a load, in the direction of the arrow, the water is forced out of the smaller end of cylinder over the valve G^1 and through the valve G^2, thence up through the pipe I to a high-level tank or to an accumulator; or the pipe may be connected to the other end of the cylinder or to the supply-main, as shown, through the pipe I′.

In lowering the car, the valve E^2 is opened and the valve E^1 closed. The water from the working end of the cylinder is then discharged (by the return of the piston) through the valve E^2, thence through the pipe J and valve G^1 into the other end of the cylinder, and after filling it the surplus discharges through the pipe J′ to a low-level tank or may be allowed to waste. The height to which this surplus water may be carried to a low-level tank is dependent on the weight exerted by the car, piston, and connections in returning.

When the weight on the car is sufficiently great to tilt the tilting lever K, the said lever, by the connecting-rope *k*, opens the discharge-valve G^1, and the water from the smaller end of the cylinder is then permitted to discharge into a low-level tank through the pipes J and J′. Thus relieved the water from the main exerts almost its full pressure against the weight of the load.

The second method, hereinbefore referred to, for elevating the water into a high-level tank when the hoist is elevating a light load consists in reducing the piston-rod to an ordinary size, sufficient only for strength, and in discharging the water through the valve G^2, pipe I, up to the high-level tank or accumulator. The receiving-tank in this case should be placed at a level which will permit the pressure of water from the main on the piston to lift the load, and also the backwater to the tank, and in this case there would not be a connection between the opposite ends of the cylinder, as in the system where a differential area on opposite sides of the piston occurred.

When a load is placed on the car, which, together with the weight of the discharge-water, would exceed the lifting capacity of the piston, then the tilting lever is adjusted to tilt and open the valve G^1, as before, permitting the water to discharge into a low-level tank or to waste. On the return stroke of the piston the water from the working end of the cylinder flows into and fills the opposite end of the cylinder, as before, the surplus wasting or being collected at a low level.

In order to insure the filling of the cylinder at the back of piston on its return stroke, I prefer to extend the mouth of the pipe J′ above the cylinder, so as to form a seal.

From the above description it will be understood that the tilting lever directly and automatically controls the lifting capacity of the hoist, a single water-cylinder only being required, which cylinder, while it has capacity sufficient to elevate the heaviest load its service requires, will have its capacity governed to suit its load, and be automatically regulated to consume a limited quantity of water sufficient for light loads; and of this limited quantity a large proportion is either used over again or forced up to a high-level tank, or into an accumulator, from which it may be drawn and utilized for domestic or other purposes; and when the water is discharged to a low-level tank it is then available and saved, and can be used for many purposes in the lower portions of buildings.

To illustrate the advantages of my improvements more fully, take the case of a large hotel, in which the hoist is designed to lift, say, twelve people, but in which the majority of loads are very light, ranging from one to three persons. The water elevated by the frequent light trips of the hoist can be forced to the upper flat or roof, or into an accumulator, and, with the force due to its elevation or the pressure in the accumulator, can then be distributed all over the building for baths, water-closets, toilet, or any other service, thus saving a large item of expense, while the water discharged into the low-level tank can be drawn off and used for kitchen and laundry purposes. By this system of high and low level tanks all the water consumed in the working of the hoist is utilized, and the water for hoisting purposes made to practically cost nothing.

By the term "accumulator," herein used, is meant either a high-level tank or a receptacle into which the water is forced under or against a pressure of air, weights, or other resisting medium which will serve as an agent for distributing the water through the pipes of a building.

Although the tilting lever is shown as located above the hoist in the several figures, it is not confined to that position, as it may be introduced at any convenient point on the hoist-rope where it would be subject to the weight of the car and load.

Instead of a tilting lever a carefully-adjusted spring could be used, as shown in Fig. 7, as an equivalent, which spring, under weight, would compress, (or extend,) and be connected so as to communicate the desired movement to the valve governing the discharge to the high and low level tanks. I prefer, however, to use a tilting lever with its fulcrum placed, as shown, below the center of the hoist-wheel, as its action is positive and the leverage increases as the lever tilts, while the action of a spring would not be regular, because its resistance to compression increases in proportion to the degree to which it is compressed.

The tilting lever, as shown in Fig. 6, or the spring could be arranged to still further vary the capacity and water-consumption of the hoist beyond that shown in Figs. 1, 2, and 8 by the addition of accumulating stop-weights, and working in connection with a three-way cock on the pipe leading to the upper-level tank, or with separate valves, so that as the load on the hoist varied to the different weights, so in proportion would the height to which the water could be forced vary. In this case tanks would have to be provided at the different levels corresponding to the height to which the water could be forced under the different weight of loads. For practical purposes, however, I consider that one movement of the tilting lever is sufficient.

In Fig. 8 my improvements are shown as applied to a hoist under the second system, hereinbefore referred to, and which is designed to elevate the discharge-water by the weight of a descending load on the car. In this construction, when the weight of the load is sufficient, the tilting lever is moved, closing the valve L on the discharge-pipe M, and the water is then forced to an upper-level tank through the pipe N. When the weight on the car is insufficient to move the tilting lever, the water discharges into a low-level tank through the valve L.

If desired, the discharge-water can be elevated under both systems of construction described by means of a pump connected to the cross-head of piston-rod or to any suitably-operating part. One mode of attachment is shown by dotted lines in Fig. 1.

The forcing power of the pump would be derived from the surplus power of the pressure of water over the load when applied under the system of construction shown in Figs. 1 and 2, or by the weight of the load on the piston when applied under the system of construction shown in Fig. 6. In both cases the use of a pump would be the equivalent of the construction and operation set forth in the foregoing description.

In many cases of hoists already running, the pump could be applied with advantage.

I claim as my invention and desire to secure by Letters Patent—

1. A tilting lever, or its equivalent, placed in connection with the hoist-rope, and adjusted to operate in proportion to the load on the hoist-car, in combination with the discharge valve or valves of a water-cylinder, which valve or valves and connections are arranged to permit the discharge-water to be forced to a high-level tank or against pressure when the load on the hoist is light, or to permit the discharge-water to pass into a low-level tank or to waste when the load on the hoist is sufficient to operate said tilting lever.

2. A tilting lever, or its equivalent, placed in connection with the hoist-rope of an elevator, in combination with a valve or valves on the discharge-pipe of the water-cylinder.

3. A hydraulic hoist in which the discharge of the water is automatically controlled by the weight of the load on the hoist, substantially as specified.

4. The combination, with the cylinder of a hydraulic hoist and the working or check-rope valve of the same, of a valve or valves placed in the discharge-pipe of said cylinder, and arranged to automatically regulate the discharge of waste-water therefrom independently of the working-valve, substantially as specified.

5. A working-valve for a hydraulic hoist having independent inlet and discharge valves

connected by a water-passage, which valves are operated by a double-cam shaft passing through valve-case, and connected to the check-rope of hoist or other governing part in such manner that said valves may be opened or closed by the rotation of the cam-shaft.

6. The combination, with the cross-head or other suitably-operating part of a hydraulic hoist, of a supplementary pump or pumps arranged to elevate the waste-water of hoist by the surplus power of the pressure of the water over the weight of load.

JOHN FENSOM.

Witnesses:
GEO. A. AIRD,
L. WHITEHEAD.