(No Model.)

2 Sheets—Sheet 1.

T. W. HEERMANS.

VARIABLE PRESSURE HYDRAULIC ELEVATOR.

No. 398,044. Patented Feb. 19, 1889.

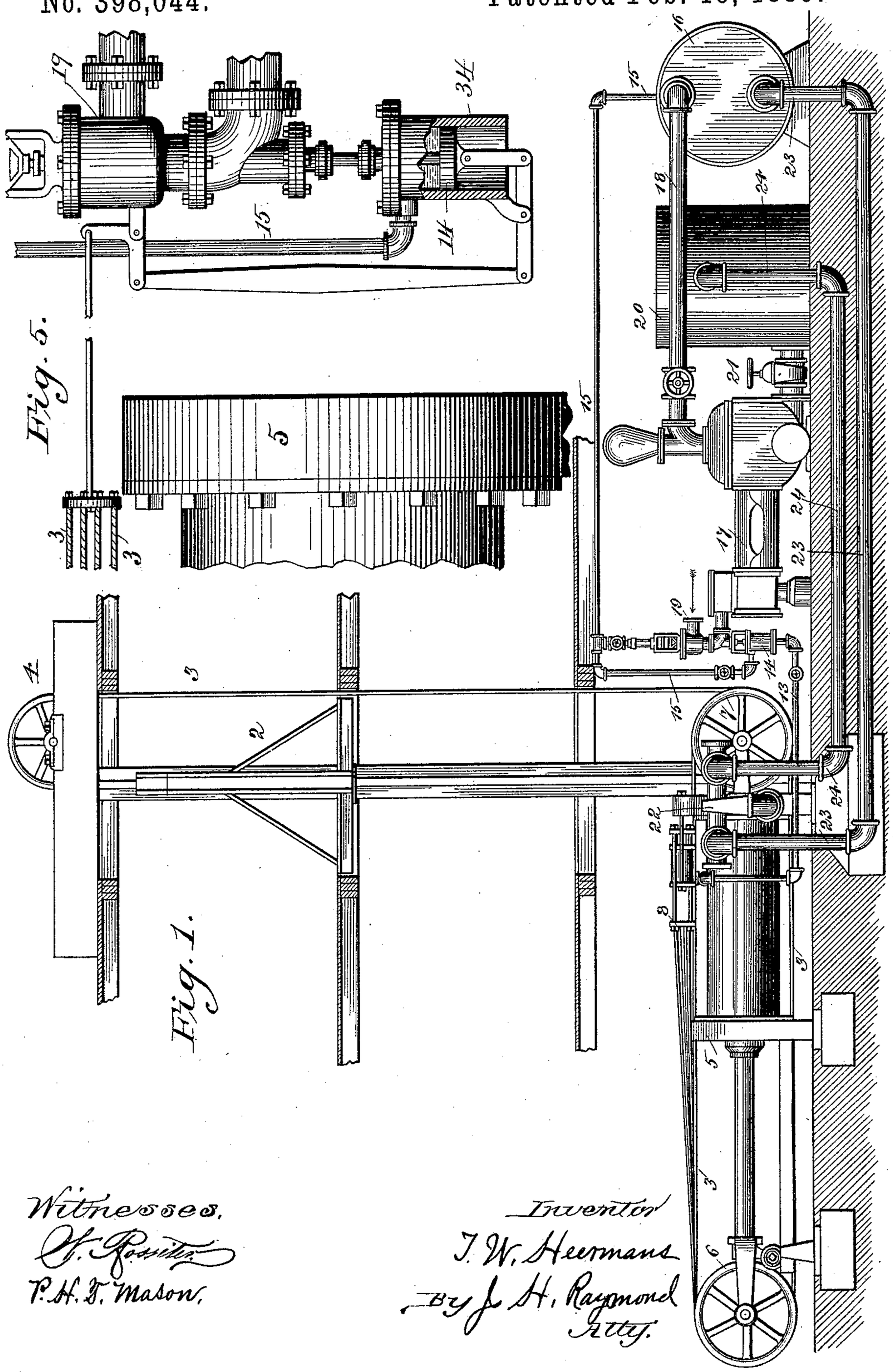

Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

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VARIABLE PRESSURE HYDRAULIC ELEVATOR.

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Fig. 4.

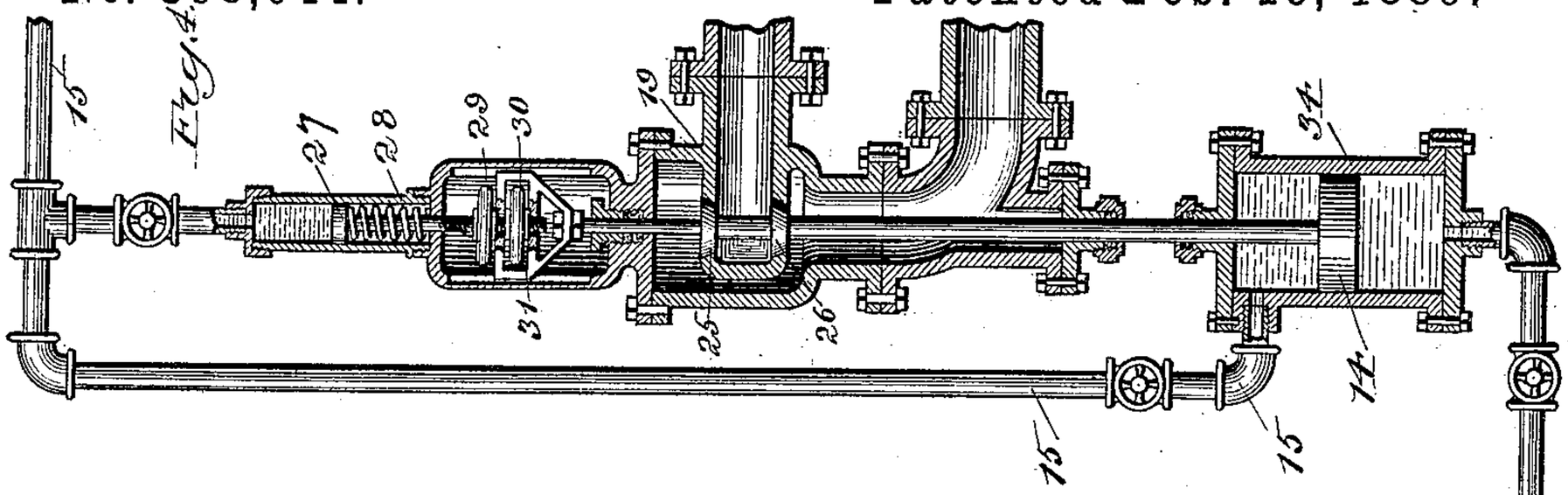


Fig. 3.

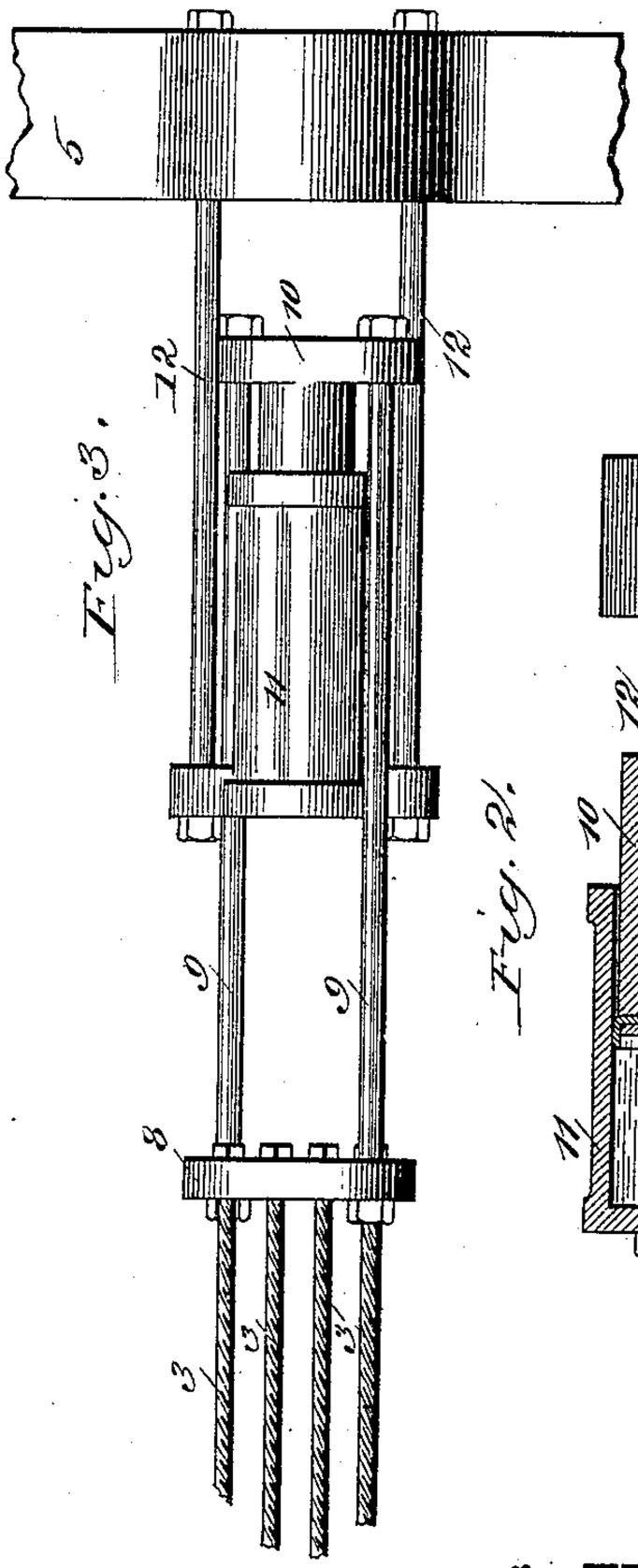
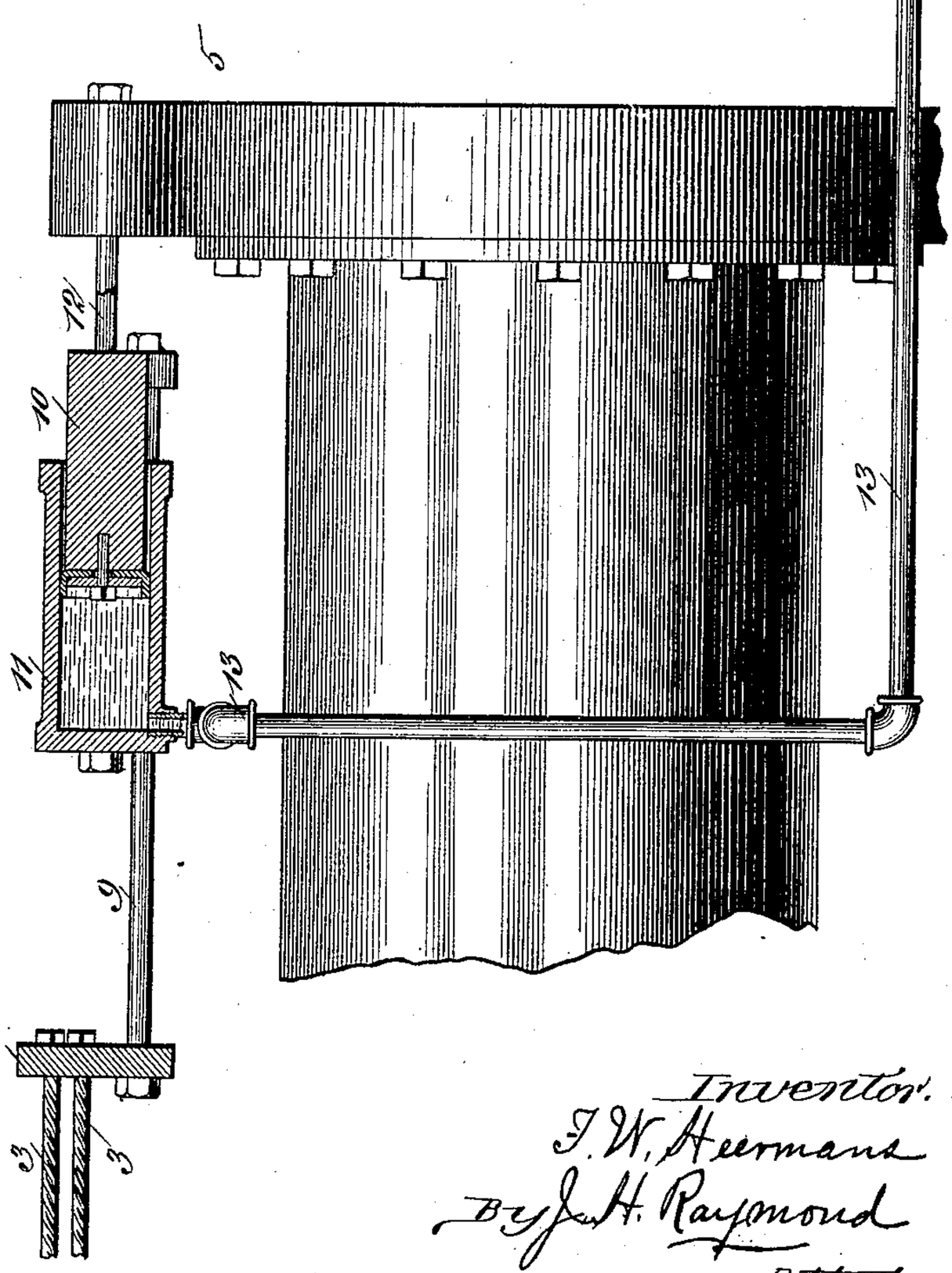


Fig. 2.



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UNITED STATES PATENT OFFICE.

THADDEUS W. HEERMANS, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE CRANE ELEVATOR COMPANY, OF ILLINOIS.

VARIABLE-PRESSURE HYDRAULIC ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 398,044, dated February 19, 1889.

Application filed July 12, 1888. Serial No. 279,740. (No model.)

To all whom it may concern:

Be it known that I, THADDEUS W. HEERMANS, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Variable-Pressure Hydraulic Elevators, of which the following is a full and complete specification.

In hydraulic elevators as usually constructed there is a great waste of power, for the reason that the water used for raising the car is a fixed quantity and is supplied under a fixed head or pressure, so that the power consumed is the same whether the load raised is a maximum or a minimum, the power being always a maximum.

Power may be economized either by varying the quantity of water to suit the changes in the load or by varying the pressure under which it is supplied. The latter is the method which I have chosen to adopt, and my invention relates to apparatus and devices for automatically proportioning the pressure to the load with accuracy and without the intervention of the operator, who has only to manipulate the ordinary handling-gear in the ordinary manner.

My invention consists in the parts and combinations hereinafter described, and pointed out in the claims.

In the accompanying drawings, Figure 1 is a side elevation of an elevator apparatus embodying my invention. Fig. 2 is a view, partly in section, of the end of the water-cylinder and its attached load-weighing cylinder. Fig. 3 is a top view of the load-weighing cylinder, and Fig. 4 is a vertical section of the pressure-regulating valves and connections. Fig. 5 is a view showing another mode of transmitting the tension of the lifting-cables to the valve-controlling piston.

2, Fig. 1, is an elevator car or platform, whose hoisting cable or cables 3 pass in the usual manner over a pulley or pulleys, 4, at the top of the shaft, and thence downward to the hydraulic engine 5. Here they pass several times back and forth over the pulleys 6 and 7, and their ends are fastened to the anchor-piece 8, as more clearly seen in Figs. 2 and 3. Bolts 9 9 join the piece 8 to a plunger, 10, working in a cylinder, 11, the latter being secured by bolts 12 to the main cylinder 5 of the engine, said main cylinder forming the fixed anchorage against which the strain of the cables is exerted. Leading from cylinder 11 is a pipe, 13, to one side of the piston 14 in cylinder 34. From the other side of piston 14 is a pipe, 15, to the pressure-tank 16. (*Vide* Fig. 1.)

17 is a steam-pump, which takes water from the exhaust-tank 20 through pipe 21 and forces it into tank 16 through pipe 18. The use of a tank 16 is purely optional, as it is not needed for storage, the pumping being practically direct; but it is convenient for connecting the various lines of pipe, and is used as an air-chamber.

22 is a hydraulic valve of any approved pattern, which is operated by the elevator-attendant in any well-known manner. As the appliances for this purpose are well known and form no part of the present invention they are not here illustrated. The pipes 23 and 24 connect said valve 22 to the pressure and exhaust tanks 16 and 20, respectively. Steam is admitted to the pump 17 through the valve 19, which is shown in detail in Fig. 4. As will be seen, it is a balanced valve, the steam-pressure on one disk, 25, being counteracted by the pressure on the other disk, 26. No novelty is claimed for the valve itself, and any other balanced valve might be used in its stead.

The disks 25 and 26 are connected to the piston 14, and to a second piston, 27. One side of piston 27 is exposed to the pressure of water from the pipe 15—that is to say, the same pressure as that on one side of piston 14 and in the pressure-tank 16. To this water-pressure on piston 27 is opposed the force of the spring 28, which may be compressed more or less by the operation of the threaded hand-wheels 29 and 30, which, by means of the yoke 31, connect the spindle of valve 19 to the rod of piston 27.

The operation is as follows: It is evident that the load on the lifting-cables will be accurately measured by the pressure on the water in cylinder 11, (*vide* Figs. 2 and 3,) and that such pressure will be communicated to the corresponding side of piston 14. It is also evident that the pressure on the opposite side of piston 14 will correspond to that in the

main cylinder, communication being free through pipes 15 and 23. The valve 19 will thus be under the influence of two opposing forces acting on piston 14, and being connected, as described, to the piston 27, will also be under the influence of the opposing forces exerted by the spring 28 and the fluid-pressure from the main cylinder acting on said piston. The net result of these forces is that the pressure from the main cylinder tends to close the valve 19, while the tension of the lifting-cables and the spring 28 tend to open it, and in order to have the apparatus work properly a certain balance or proportion must exist between these opposing forces, as will appear. Suppose, now, that the operator puts the main cylinder in communication with the pump in order to make the car ascend. If the pressure in the main cylinder is not sufficient, or a little more than sufficient, to raise the load at the desired speed, the apparatus being properly proportioned, it will also be insufficient to keep the valve 19 closed, and the combined tension of the cables and spring 28 will open and keep open the valve 19; but if the pressure in the main cylinder exceeds the desired limit for which the apparatus is adjusted the valve 19 will close more or less and diminish or cut off the supply of steam to the pump. Of course in descending, as the water is simply let out of the cylinder and no power is used, the functions of my improved apparatus are not brought into play.

The function of spring 28 is plain from the foregoing description. If it were practicable to perfectly proportion the parts so that the proper relations would exist between the opposing forces acting on valve 19, then the spring 28 could be dispensed with; but as it is difficult to secure such exact proportions between the various parts the introduction of a variable pressure—such as that acting on valve 19—serves to compensate for errors of proportioning or variations in ease of working. I therefore regard said spring or its equivalent as an important though not indispensable feature of the apparatus.

Steam is saved by this device, because the pump is never working against a greater pressure than is necessary, the pump being held at a constant speed by any well-known governor to raise the load, while in the usual arrangement the head must be sufficient to raise the greatest load the elevator is designed to carry.

It is to be understood that a system of levers—as, for example, shown in Fig. 5—or any other equivalent for the plunger 10, cylinder 11, and pipe 13, if used to transmit pressure from the cables 3 to piston 14, would be within the scope of my invention.

It is also obvious that the use of fluid-pressure above piston 27 is not absolutely necessary, because the comparative pressure on the opposite sides of piston 14 might be so proportioned as to counterbalance the spring 28. For example, the enlargement of plunger 10 would diminish the pressure per square inch below piston 14 and would render the pressure above piston 27 unnecessary.

I am aware that hoisting apparatus has been heretofore contrived in which the load on the car or the tension thereby imparted to the lifting-cables was utilized to open a valve, which admitted compressed air into the water-tank, and thereby forced the water into the main cylinder and lifted the car, such an apparatus being shown in Patent No. 220,479 to Johnson and Bailey; but as no means were provided for returning the water to the tank or cylinder if it should be permitted to escape the apparatus just described differs from my invention in that the management of the ascent and descent of the car requires the manipulation by the attendant of separate valves by which the air and water are independently controlled.

I am also aware that it is not new, broadly, to so connect the steam-valve of a pump that increase in the resistance will cause a greater supply of steam to be admitted to the pump, and I do not claim such as my invention.

I claim—

1. In a hydraulic hoisting apparatus, the combination of a tank or reservoir for containing the water-supply, a steam-pump pumping therefrom direct to the main cylinder, a valve controlling said pump, a piston exposed on one side to the pressure from the main cylinder, and on the other to pressure produced by tension of the lifting-cables, said piston being so connected to said valve that the pressure from the main cylinder tends to close and the pressure produced by the lifting-cables tends to open said valve, and a valve controlled by the operator and adapted to admit water to the main cylinder from the pump or to permit the water to escape from the main cylinder to said tank, substantially as described.

2. The combination, with a control-valve, as 19, operated by a piston, 14, exposed on one side to pressure from the main cylinder and on the other side to pressure produced by the tension of the lifting-cables, of a regulating-spring, 28, and a piston, 27, the pressure of said spring being opposed by fluid-pressure from the main cylinder, as and for the purpose set forth.

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