T. LARSSON.

HYDRAULIC ELEVATOR.

APPLICATION FILED JAN. 27, 1903. RENEWED SEPT. 21, 1906.

899,224. Patented Sept. 22, 1908.

2 SHEETS—SHEET 1.

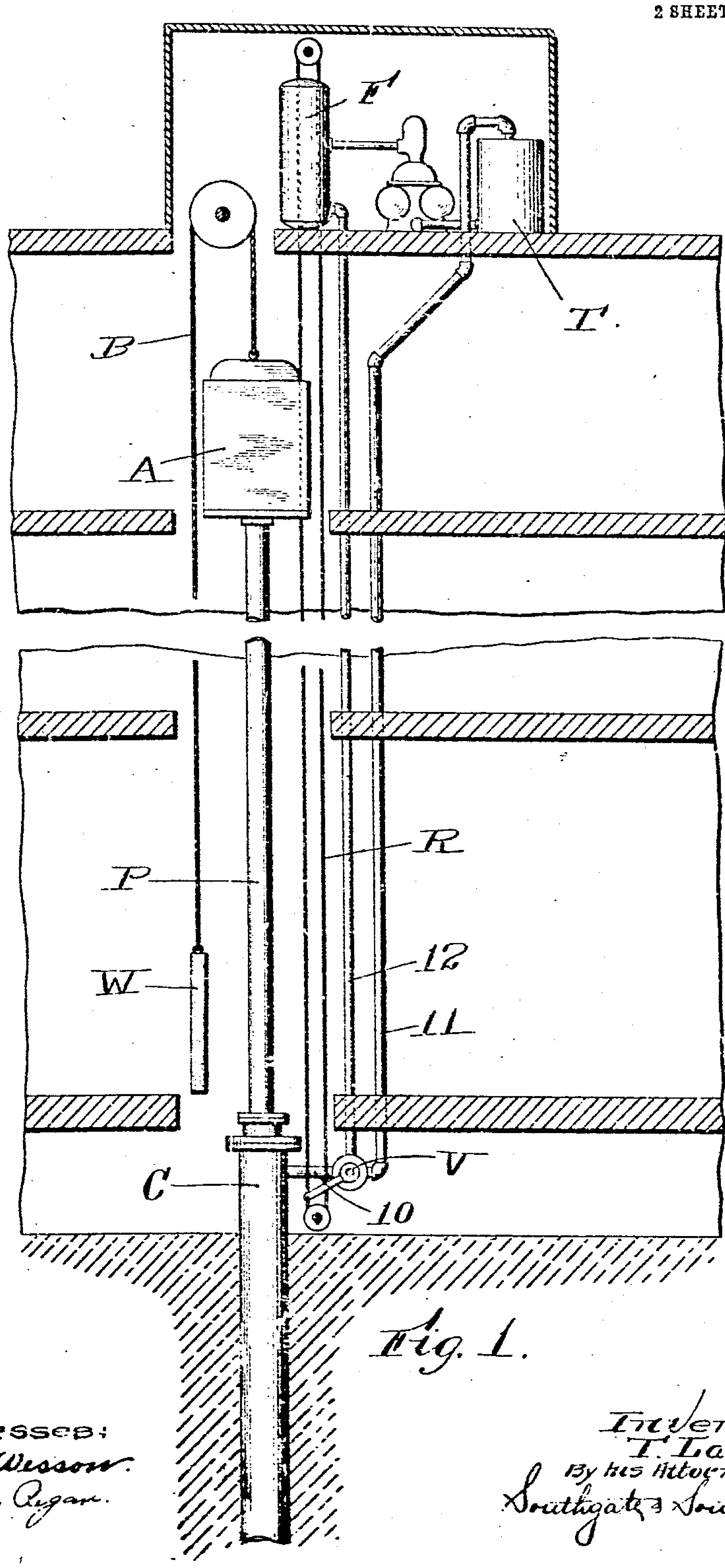

Fig. 1.

Witnesses:
C. F. Wesson.
M. E. Regan.

Inventor:
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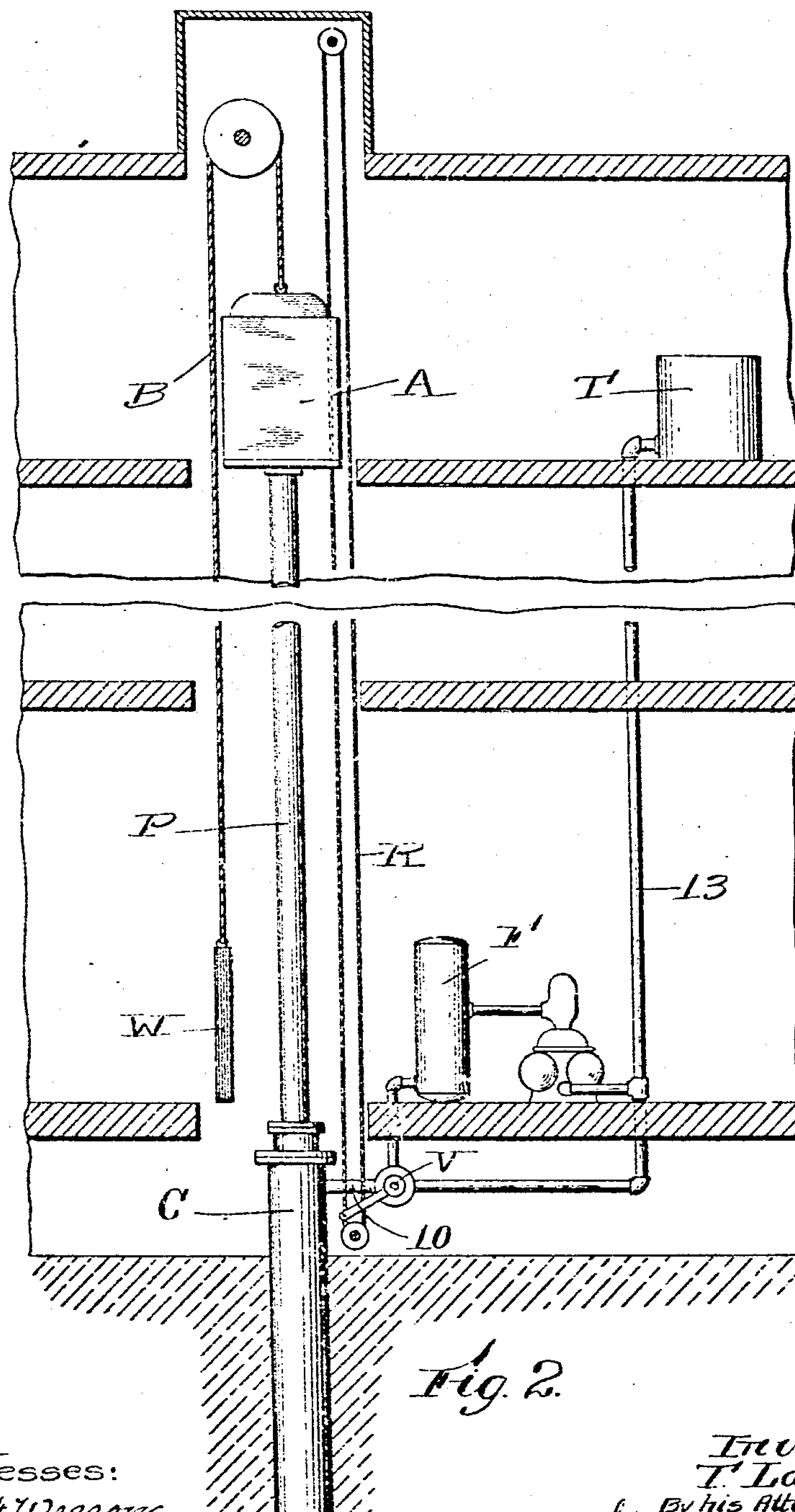

Fig. 2.

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UNITED STATES PATENT OFFICE.

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HYDRAULIC ELEVATOR

No. 899,224. Specification of Letters Patent. Patented Sept. 22, 1908.

Application filed January 27, 1903, Serial No. 140,722. Renewed September 21, 1906. Serial No. 335,646.

To all whom it may concern:

Be it known that I, THURE LARSSON, a subject of the King of Sweden, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented a new and useful Hydraulic Elevator, of which the following is a specification.

This invention relates to hydraulic elevators of the direct acting plunger type.

The object of this invention is to provide a direct acting plunger elevator which can be used in high buildings and at high speeds with equal or higher efficiency than other types of elevators which are now used.

To these ends, this invention consists of the plunger elevator, and of the combinations of parts therewith as hereinafter described and more particularly pointed out in the claims at the end of this specification.

In the accompanying drawings, Figure 1 is a sectional view of sufficient parts of a building to illustrate the application of my invention thereto, and Fig. 2 is a similar view illustrating a slightly modified construction.

The plunger elevator on account of its comparative simplicity and absolute safety has long been recognized as one of the most desirable and practical types of hydraulic elevators for comparatively short runs or for use in situations where high speeds are not desired.

In the larger or taller business blocks, some of which are built to heights of from two hundred to four hundred feet, it has been thought that the plunger type of elevator could not be used to advantage. In some recent installations, however, plunger elevators have been employed for runs of nearly two-hundred and twenty-five feet in length, and it has been found that while these elevators can be installed at prices which will compare favorably with elevators which cannot be operated with the same degree of safety, and while these long-run plunger elevators have been found to operate smoothly and to be readily controlled, yet it has been found in practice that the absolute efficiency of these long-run plunger elevators does not reach a very high percentage. This is due to the fact, that in raising a long plunger and a comparatively heavy car, comparatively heavy weights are set in motion. This, in itself, would not be found to be objectionable if it were possible to counter-weight the plunger and car up to the full limit of weight less the amount of weight required to start the unloaded car on its downward travel, which is the limit to which comparatively short-run low-speed plunger elevators may be counter-weighted. The reason why this cannot be done in a long-run high-speed direct plunger elevator is, that during the upward travel of the elevator, the preponderance of the car and plunger over the counter-weight must be sufficient to overcome the inertia of the moving parts.

If a long-run high-speed direct plunger elevator system should be too heavily counter-weighted, it would be impossible to accurately control the upward travel of the car, and in an over counter-weighted system of this kind, the car would continue its upward travel even after the controlling valve was shut. This upward jump and uncontrolled motion of the car would draw air down through the stuffing box, introducing an air cushion inside the elevator cylinder, and entirely destroying the reliability of operation.

In the high speed plunger elevator plants of over two hundred feet run which have already been practically installed it has been found necessary to have a preponderance of weight in the plunger and car over the weight of the counter-weight of nearly thirty-five hundred pounds, and the efficiency of such elevators as heretofore installed has been decreased by the amount of power necessarily wasted in raising this unbalanced dead-weight at each stroke of the elevator.

The especial object of this invention is to provide a water circulating system for plunger elevators in which a water column will be acted upon by the unbalanced weight of the plunger and the car during the down stroke of the elevator, whereby a certain amount of pressure will be stored for use at the next operation, which pressure will assist the operation of the supply pump, so that the amount of work to be actually performed by the supply pump will be diminished, and a greater efficiency thus secured, while at the same time, the counter-weight will be employed to provide a compensating balance for the greater part of the weight of the plunger and car.

Referring to the accompanying drawings for a detail description of a plunger elevator system constructed according to my invention, Figure 1 shows a section of a building having its pumping plant located on one of the upper stories. Fig. 2 shows a similar construction with the pumping plant located on the lower floor or basement.

The drawings show only sufficient floors of a building to illustrate the operation of the system, it being understood that my invention is especially applicable to long-runs and to a considerably greater number of stories than in the buildings herein illustrated.

As shown in Fig. 1, C designates the elevator cylinder which sets into the ground below the building a distance equal to the length of the elevator run. Working up and down in the cylinder C, and extending through a stuffing box in the upper end thereof, is the plunger P, carrying the car A on its upper end. Connected to the car A are the counter-weight ropes B, which connect to a counter-weight W for counterweighting so much of the weight of the car A and plunger P as may be possible, while still leaving the required preponderance of plunger and car to stop the upward travel.

The weights of the cables or counterweight ropes B and the counter-weight W are preferably proportioned according to the recognized practice which secures the best results in a plunger elevator. That is to say, the weight of the cables or counterweight ropes B for a given length is made substantially equal to one-half the buoyancy of a corresponding length of elevator plunger. This distribution of the weight of cables or counter-weight ropes provides a compensating counter-balance which automatically offsets the buoyancy of the plunger. For example, when the car is near the top of its run, as illustrated in Fig. 1, substantially the entire weight of the counter-weight rope B will be added to the weight of the counterweight W; while when the car is near the bottom of its run, and the plunger has displaced an equal volume of water, and has therefore its greatest amount of buoyancy tending to raise the same, the weight of the counterweight rope or cable will oppose the action of the counterweight.

Opening into the upper end of the cylinder C is a to-and-from pipe 10 which may be connected by the valve V either with the inlet pipe 12 or the exhaust pipe 11. The valve V may be controlled from the car A in any of the ordinary manners, for example, by the standing controlling rope R.

The parts as thus far described, may be substantially the same as in any of the standard plunger elevator constructions, except that the inlet and outlet pipes have heretofore connected with the supply pump and storage tank in the basement or lower part of the building, while in an apparatus constructed according to my invention, the inlet and outlet pipes 11 and 12 extend up into the building for sufficient distance to form water columns to act as hereinafter described. At its upper end, the outlet pipe 11 is connected with a storage tank T, and the water from the storage tank T is pumped into an air pressure tank F.

In some cases instead of having two separate water columns 11 and 12 for the inlet and outlet pipes, and instead of locating the pumping plant in the upper part of the building, I may employ a single water column 13, as illustrated in Fig. 2, which water column is connected to the lower part of the storage tank T.

A water column thus located will aid the operation of the ordinary double-acting pumps employed in the usual elevator plants in the proportion that the static pressure of the water column bears to the working pressure required for the elevator. That is to say, in an ordinary double-acting force pump, both sides of the pump piston are in contact with the water, and if the water is admitted under pressure to the pump cylinder, this pressure acting on the back or inoperative side of the piston will aid in moving the piston on its working stroke. I prefer, however, to locate the pumping plant and the pressure tank in the upper part of the building, because when located in this position, the pump and the pressure tank will operate only under such additional pressure as must be added to the water column in the supply pipe 12 to make the pressure required to operate the elevator, while in the construction shown in Fig. 2, the pump and pressure tank are required to withstand the full working pressure required in the elevator cylinder.

In the construction shown in Fig. 1, the inlet pipe 12 forms in effect a continuation of the pressure tank F, and for this reason, the construction illustrated in Fig. 1 will permit the use of a somewhat smaller pressure tank than will the construction illustrated in Fig. 2.

In the operation of a plunger elevator constructed according to my invention, the necessary preponderance of plunger and car over the counter-weight will operate during the down stroke of the elevator to raise a water-column, lifting a certain amount of water to the elevated storage tank which will give a certain static head, or pressure of water, which will diminish the amount of work required to be done by the supply pump. For example, in a two-hundred and fifty foot run elevator plant where the required preponderance of the car and plunger over the counterweight is approximately thirty-five hundred pounds, a plunger six and one-half inches in diameter will require two-hundred pounds working pressure to secure the desired speed of operation.

In direct plunger elevator systems as heretofore installed, this entire working pressure of two-hundred pounds is furnished entirely by the supply pump, while in an apparatus constructed according to my invention, more than half the working pressure will be supplied by the water column.

I am aware that many different water-circulating systems have been devised for operating elevator plants, and that water has been exhausted from elevator constructions in a number of different ways, and used for different purposes, and my invention does not relate to such systems broadly, the especial object of my invention being to combine a direct plunger elevator with a water-column for preventing the requisite preponderance of elevator and plunger over the counter-weight from resulting in loss of efficiency.

I am also aware that changes may be made in applying my invention to hydraulic elevators.

I do not wish, therefore, to be limited to the construction I have herein shown and described, but

What I do claim and desire to secure by Letters Patent of the United States is:—

1. In a hydraulic elevator system, the combination of a vertical cylinder, a plunger running in said cylinder, a car on the upper end of the plunger, a counter-balance for the greater part of the weight of the car and plunger with the counter-weight cables acting to offset the buoyancy of the plunger, a to-and-from pipe opening into the upper end of the cylinder, a storage tank connected thereto and located far enough above the upper end of the cylinder so that its static pressure will substantially balance the preponderance in weight of plunger and car over their counter-balance, a pressure tank, and a pump intermediate the storage tank and pressure tank, said parts being arranged so that the static pressure of the storage tank will assist the operation of the pump in raising the elevator.

2. In an elevator system, the combination of a vertical cylinder, a plunger working therein, a car on the upper end of the plunger, a counter-balance for the greater part of the weight of the car and plunger with the counterweight cables acting to offset the buoyancy of the plunger, a to-and-from pipe connected to the upper end of the cylinder, an elevated storage tank, an outlet pipe leading thereto, a pressure tank, a pump intermediate the pressure tank and storage tank, an inlet pipe from the pressure tank to the to-and-from pipe, and a valve controlled from the car for connecting the to-and-from pipe with the inlet pipe and the outlet pipe as required.

In testimony whereof I have hereunto set my hand, in the presence of two subscribing witnesses.

THURE LARSSON.

Witnesses:
LOUIS W. SOUTHGATE,
PHILIP W. SOUTHGATE