(No Model.) 2 Sheets—Sheet 1.

W. P. GIBSON.

PNEUMATIC ELEVATOR.

No. 412,326. Patented Oct. 8, 1889.

Fig. 1.

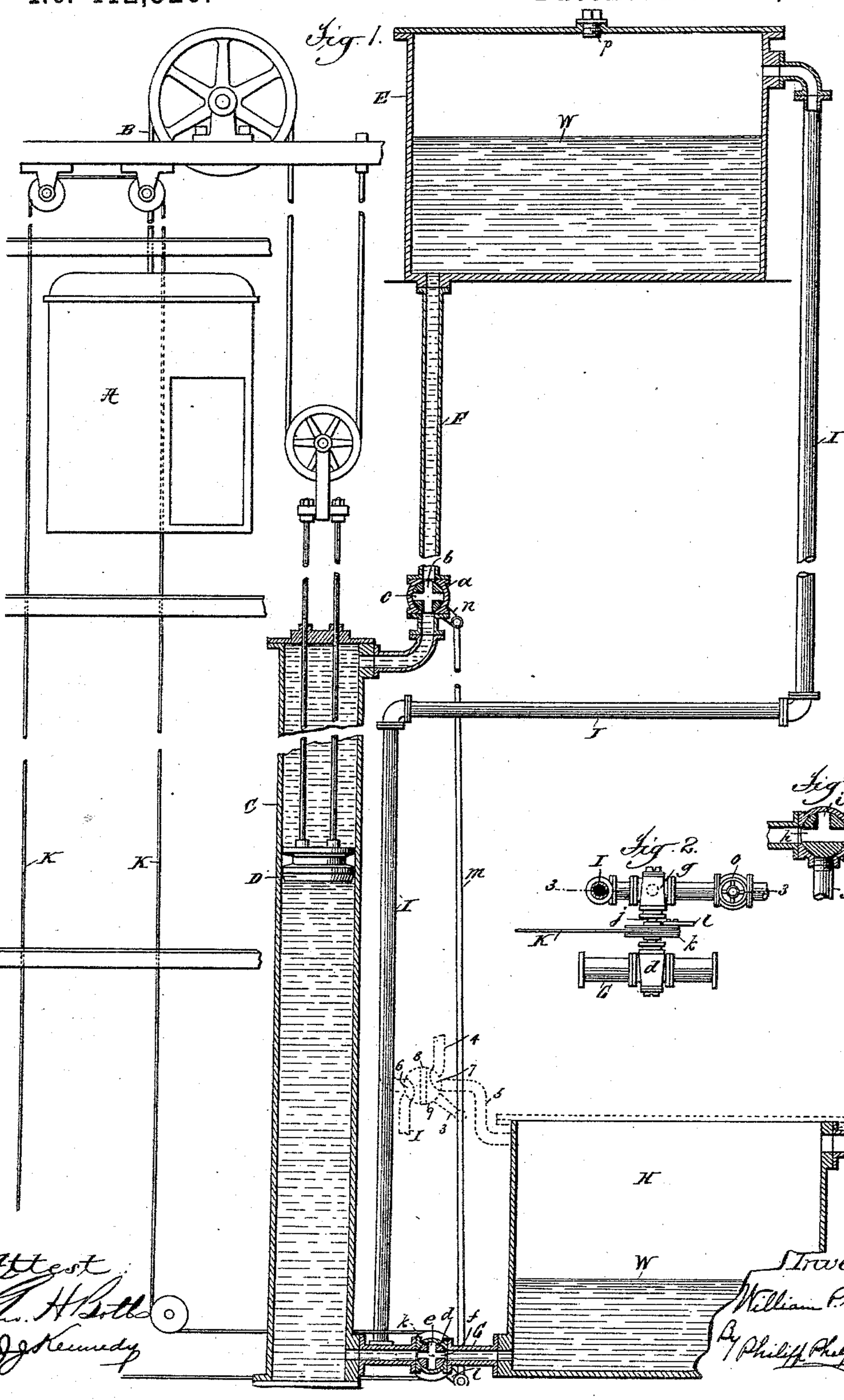

Fig. 2.

Fig. 3.

Attest:
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Attys

(No Model.) 2 Sheets—Sheet 2.

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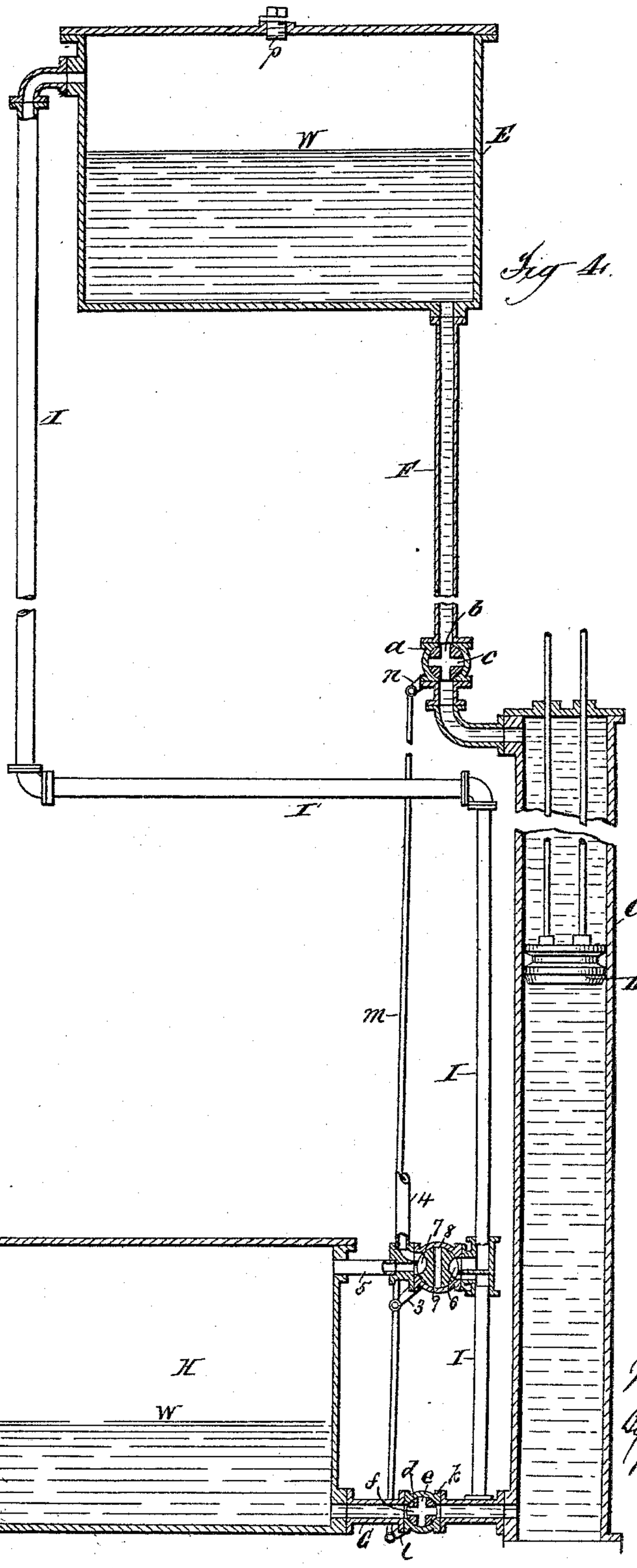

UNITED STATES PATENT OFFICE.

WILLIAM P. GIBSON, OF NEW YORK, N. Y.

PNEUMATIC ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 412,326, dated October 8, 1889.

Application filed December 31, 1888. Serial No. 294,994. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM P. GIBSON, a citizen of the United States, residing at New York, county of New York, and State of New York, have invented certain new and useful Improvements in Pneumatic Elevators, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to an elevator which is operated by pneumatic pressure as distinguished from those elevators the operation of which is effected by hydraulic or steam pressure.

This elevator is more particularly adapted for and is intended principally for use in those localities or buildings in which the head or pressure of the water-supply is so light as to preclude the use of elevators in which the motor-fluid is water without the addition of a pump for forcing the water from the street-main or other source of supply to a tank or reservoir located above the cylinder of the elevator, from which tank or reservoir the water is conducted to the place of use, and in those localities where a supply of air under pressure is more readily attainable than a steam-power or a supply of water under sufficient head or pressure. A great objection has, however, existed to the use of pneumatic elevators, and one which has prevented their coming into general use, in that the movements of the elevator-car in ascending and descending are spasmodic and jerky. This is due to the fact that the pressure of the compressed air when exerted directly upon the piston, owing to the elasticity of the air and the resistance of the piston and its connected parts, and the load which it is required to raise, and the leakage of the air beyond the piston, is exerted with varying intensity according as the resistance of the piston increases or decreases.

It is the object of the present invention to obviate this objectionable feature in these elevators, and to provide a construction in which uniformity of pressure and consequent steady movements of the elevator-car shall be insured, and in which liability of leakage of the compressed air beyond the piston and consequent waste of the same shall be avoided.

To this end the invention consists in interposing between the compressed air and the piston a body of water or other non-elastic fluid, against which the pressure of the compressed air will be exerted, and by it communicated to the piston instead of being exerted directly against the piston, and by providing the cylinder upon the opposite side of the piston with a second body of water, which flows into and out of the cylinder as the piston moves, and thus water-locks the piston on both sides of the same, as in the well-known hydraulic elevator, in which the water circulates from one end to the other of the cylinder. By reason of this construction also liability of leakage of compressed air beyond the piston is avoided. Suitable means will also be provided for the ingress and egress of the water to and from the cylinder and for the supply and exhaust of the compressed air at the proper times.

The invention further consists of a peculiar arrangement and combination of valves and valve-operating mechanism for controlling the ingress and egress of the water and the supply of compressed air and the exhaust of the same, and their attachment to the hand-rope of the elevator by which the several valves are moved at the proper times in the proper directions relatively to each other simultaneously from the car by a single pull upon said hand-rope, all of which will hereinafter fully appear.

Although, as illustrated in the drawings forming a part of this application, and as hereinafter described, the invention is shown and described as applied to an elevator mechanism in which the cylinder is of the vertical form, yet it is to be understood that the invention is applicable as well to elevator mechanisms in which the cylinder is of the horizontal type, and also to mechanisms in which the piston oscillates, as shown and described in a companion application for Letters Patent filed January 5, 1889, Serial No. 295,548.

In the accompanying drawings, Figure 1 is a sectional elevation of an elevator mechanism embodying my invention. Fig. 2 is a plan view of the valve mechanism for controlling the supply and exhaust of the compressed air and the valve mechanism for con-

trolling the ingress and egress of the water to and from the lower end of the cylinder; and Fig. 3 is a longitudinal section of the compressed-air valve, the same being taken on the line 3 3 of Fig. 2. Fig. 4 is a view similar to Fig. 1, illustrating a slightly-different organization, which will be hereinafter referred to.

Referring now particularly to Fig. 1, it will be understood that A represents the elevator-car, B its hoisting-cable, and C the elevator-cylinder in which works a piston D. The hoisting-cable B is connected to the car A and to the piston D in the usual manner. Located in any convenient position is a closed tank or reservoir E, provided at its lower end with a pipe F, through which it communicates with the upper end of the cylinder C upon the power side of the piston D. The tank E is supplied with a body of water or other non-elastic fluid sufficient to slightly more than fill the cylinder C at the proper time. The cylinder C also communicates through a pipe G with an open tank H, also containing a body of water or other fluid capable of slightly more than filling the cylinder C below the piston D. The tank E has also connected at its upper portion, above the level of the liquid contained therein, a pipe I, connected with the source from which the supply of compressed air is fed to said tank. The source of supply may be an air-compressor provided for the purpose; or the supply may be had from a street-main for the distribution of compressed air through different parts of large cities and towns. The pipe I has also connected to it a waste-pipe J for the discharge of the compressed air after use.

The pipe F is provided with a valve *a*, having two ducts or passages *b* and *c* cut therein at right angles to each other, as shown, so that each one-quarter turn of said valve from the position in which it is shown in Fig. 1 re-establishes communication between the tank E and the upper end of the cylinder C, the intermediate position of said valve cutting off such communication. The pipe G is also provided with a valve *d*, constructed and operated in a manner similar to that just described, and having two ducts or passages *e* *f* cut therein at right angles to each other, which valve controls communication between the lower end of the cylinder C and tank H.

The tanks E and H will, previous to the operation of the elevator, be each provided with the requisite amount of water or other liquid W, which may be supplied to the tank E through the port *p*, which will be closed tightly by means of a plug, as shown, to prevent the escape of compressed air.

The pipe I is provided at its lower end, where it runs parallel to the pipe G (see Fig. 2) and at the point of its junction with the air-exhaust pipe J, with a valve *g*, having a duct or passage *i* communicating with the duct *h* and cut at right angles thereto, as shown in Fig. 3, by which communication is controlled between the pipe I and the source of supply of compressed air, and by which, also, communication is established at the proper time in the operation of the elevator mechanism between the pipe I and the air-exhaust pipe J, to permit the exhaust of the compressed air from the pipe I and tank E after use or during the upward movement of the piston D.

The valves *d* and *g* are each connected to a shaft *j*, carrying a small pulley *k*, (see Fig. 2,) about which passes the hand-rope K of the elevator, as shown in Figs. 1 and 2. The pulley *k* has secured to it (see Figs. 1 and 2) a lever *l*, to the free end of which is pivotally connected the lower end of a rod *m*, the upper end of which is also pivotally connected to a lever *n*, secured to the stem of the valve *a*.

The pipe I may be provided with a valve *o*, by which the pressure at which the compressed air is to be supplied to the tank E may be regulated, or by which such supply may be cut off when desired. By reason of the connecting together of the valves *d*, *g*, and *a* in the manner described but a single operation of the hand-rope K will be necessary to move said valve simultaneously, each in the proper direction relatively to the others.

The operation of the mechanism which has been described is as follows: When the various parts are in the position shown in Fig. 1, communication will be established between the tank E and the upper end of the cylinder C, between said tank and the source of supply of compressed air, and between the tank H and the lower end of the cylinder C. It will be noticed that when the valve *g* has opened communication between the pipe I and the source of supply of compressed air it at the same time cuts off communication between the pipes I and J and prevents the escape of compressed air. The compressed air passing through the pipe I enters the tank E and forces the water contained in said tank into the cylinder C against the power side of the piston D, which it will force downward, thereby raising the elevator-car, the downward movement of the piston forcing the water in the cylinder beneath it into the tank H. When it is desired to arrest the car at its upper limit of movement or at any intermediate landing, the conductor will draw upward upon the hand-rope K and move the pulley *k* from right to left until a one-eighth turn has been imparted to the valves *d* and *g*, this movement of the pulley *k* raising the lever *l* and rod *m*, and through the latter the lever *n*, and imparting a corresponding movement to the valve *a*. When the parts have been thus moved, the valve *d* will be in position to cut off communication between the tank H and the cylinder C, the valve *a* will cut off communication between said cylinder and tank E, and the valve *g* will cut off communication also between the pipe I and the source of compressed-air supply, communi-

cation also between the pipe I and the exhaust-pipe J still remaining cut off. The escape of water from below the piston being thus prevented, further movement of the piston downward will be arrested and the car be brought to rest. When it is desired to move the car downward, the conductor will again draw upward upon the hand-rope K, thereby moving the pulley *k* until the duct *e* of the valve *d* has been brought into register with the pipe G, when communication will be opened between the cylinder C and tank H. When the pulley *k* has been thus moved, the valve *g* will be operated through the shaft *j* to bring its ducts *h* and *i* into position to open communication between the pipes I and J and to shut off the further admission of compressed air to the pipe I. This movement of the pulley *k* will also raise the rod *m* and lever *n* and through the latter bring the duct *c* of the valve *a* into register with the pipe F. Communication being thus established between the pipes I and J, the compressed air confined in the pipe I and the tank E will escape therefrom through the pipe J into the open air. As the piston D is thus relieved of its pressure, the car will begin to descend by its own weight and the piston to rise, the latter as it rises forcing the water from the cylinder C through the pipe F into the tank E. As the upward movement of the piston continues, the water which has been forced from below it into the tank H in its descent will be drawn back to the cylinder C beneath the piston. This will continue until it is desired to stop the car. To accomplish this, the conductor will draw the hand-rope K downward, thereby through the pulley *k* and shaft *l* giving a one-eighth turn to the valves *d* and *g* in a direction contrary to that just described, this movement of the pulley *k* causing the rod *m* and lever *n* to descend and through them operating the valve *a* to close the pipe F. The parts will then be in the positions which they occupied in the description heretofore given of the operation of stopping the car, and the ingress and egress of water to and from the cylinder C and the supply and discharge of compressed air to and from the tank E be prevented. When it is desired to again cause the car to ascend, the conductor will again draw downward upon the hand-rope K until the valves *a* and *d* and *g* are returned to the positions in which they are shown in the drawings, when the duct *f* of the valve *d* will open communication between the tank H and the lower end of the cylinder, the duct *b* will open communication between the tank E and the upper end of the cylinder, and the duct *h* of the valve *g* will establish communication between the compressed-air pipe I and its source of supply, at the same time cutting off communication between the former pipe and the exhaust-pipe J and preventing the further exhaust of compressed air. The operation of the piston D will then be the same as that already given when the operation of raising the elevator-car was described.

The hand-rope K has been shown and described for convenience; but the term is to be understood as including any of the forms of apparatus for controlling the valves from the car, which apparatus is to be considered as the equivalent of the hand-rope. The speed of the car in moving up and down is controlled by the position of the valves *a d*, which determine the rate at which the water shall enter and escape from the cylinder, and thus regulate the speed of the piston. If desired, the connections may be so organized that the air, instead of being exhausted from the tank E, will, during the upward movement of the piston D, circulate from the tank E to the tank H, (the latter tank being of course closed,) and be thence exhausted during the next downward movement of the piston. In such case the valve *g* will be omitted and the connections will be organized, as indicated in Fig. 4 and by dotted lines in Fig. 1—that is to say, the tank H will be provided with a valve 9 having ports 6 7, by which the air can be allowed to enter the tank E and at the same time escape from the tank H through pipes 5 4 as the piston D descends, and having a port 8, by which, when the valve is given a quarter-turn, the pipes I and 5 will be brought into communication, so as to allow the air to circulate from the tank E to the tank H as the piston ascends. When the valve 9 is in an intermediate position, the pipes I and 5 will both be closed, so as to prevent the entrance of air to the tank E and its escape from the tank H. The valve 9 will be provided with an arm 3, similar to the arms *l n*, by which it will be operated through the rod *m* simultaneously with the valves *a d*.

What I claim is—

1. The combination, with the cylinder and piston of a pneumatic elevator, of a closed tank containing a body of liquid interposed between the pressure side of the piston and the compressed air for operating the same and filling the cylinder, a tank communicating with the cylinder upon the opposite side of the piston and containing a body of liquid sufficient to fill the cylinder upon that side of the piston, valves *a d*, for controlling the flow of the two bodies of liquid to and from the cylinder, and a hand-rope for operating said valves from the car, substantially as described.

2. The combination, with the cylinder and piston of a pneumatic elevator, of a closed tank containing a body of liquid interposed between the pressure side of the piston and the compressed air for operating the same and filling the cylinder, a tank communicating with the cylinder upon the opposite side of the piston and containing a body of liquid sufficient to fill the cylinder upon that side of the piston, valves *a d*, for controlling the flow of the two bodies of liquid to and from the cylinder, a valve *g*, for controlling the supply

and exhaust of compressed air to and from said closed tank, and a hand-rope for operating said valves from the car, substantially as described.

3. The combination, in a pneumatic elevator, of a cylinder and piston, closed tanks communicating with the cylinder upon the opposite sides of the piston and containing bodies of liquid sufficient to fill the cylinder upon said respective sides of the piston, pipes and valve mechanism for admitting air under pressure to one of said tanks to drive the piston in one direction and for allowing said air to circulate from said tank to the other tank as the piston moves in the other direction and for allowing the air to escape from said last tank, and connections for operating said valve mechanism from the car, substantially as described.

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

WM. P. GIBSON.

Witnesses:
J. J. KENNEDY,
EDWARD WOOD.