No. 654,876. Patented July 31, 1900.

J. A. DEAN.

PLUNGER ELEVATOR.

(Application filed Sept. 23, 1899.)

(No Model.)

FIG. 1.

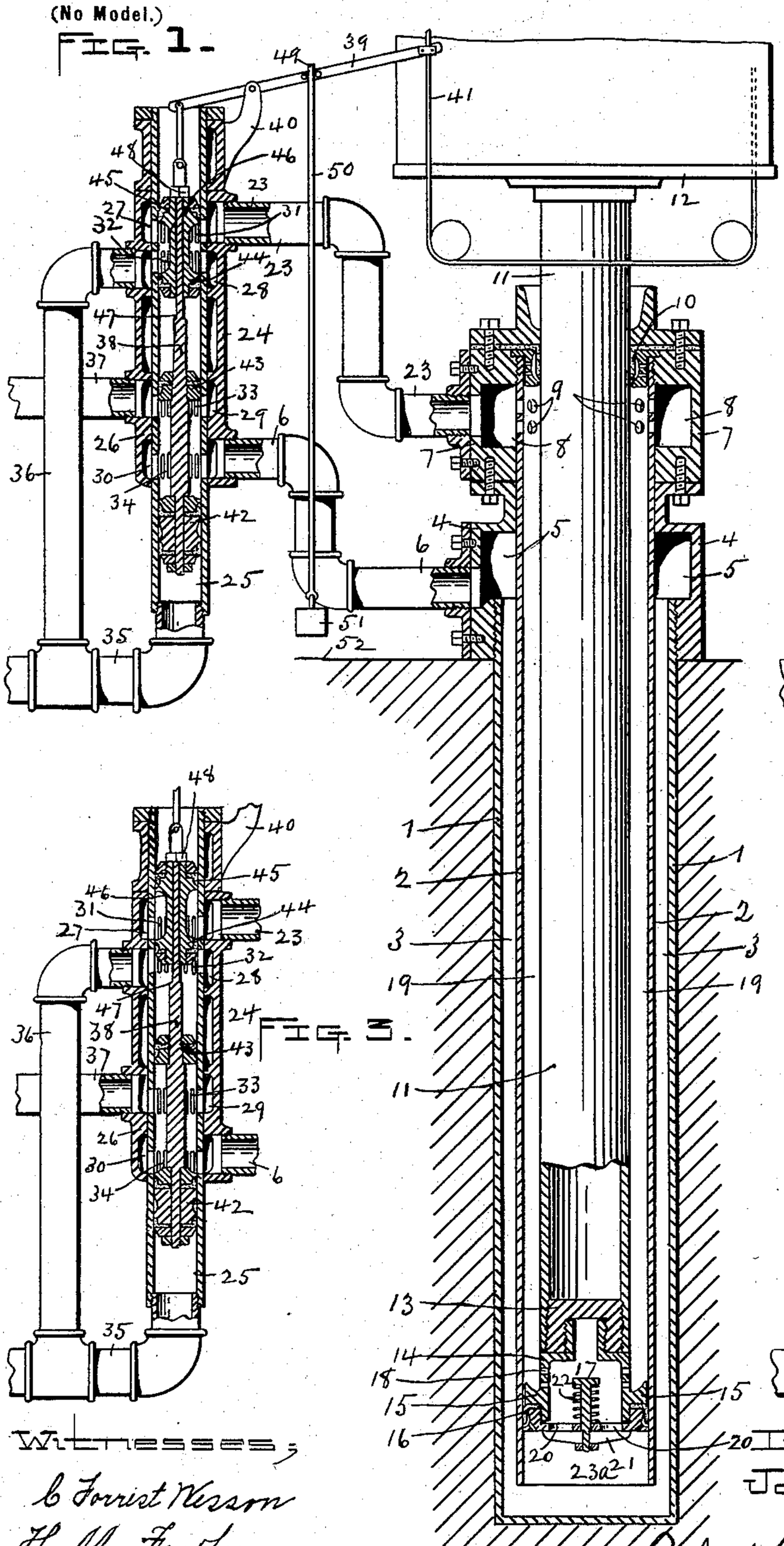

FIG. 2.

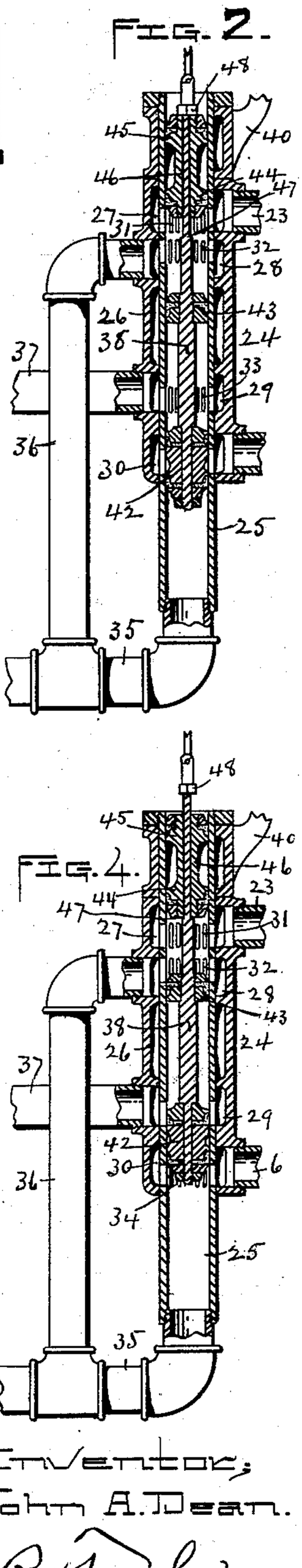

FIG. 3.

FIG. 4.

Witnesses;

C. Forrest Wesson

H. M. Fowler

Inventor;

John A. Dean.

By Rufus B. Fowler Att'y.

UNITED STATES PATENT OFFICE.

JOHN A. DEAN, OF WORCESTER, MASSACHUSETTS.

PLUNGER-ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 654,876, dated July 31, 1900.

Application filed September 23, 1899. Serial No. 731,395. (No model.)

To all whom it may concern:

Be it known that I, JOHN A. DEAN, a citizen of the United States, residing at Worcester, in the county of Worcester and Commonwealth of Massachusetts, have invented new and useful Improvements in Plunger-Elevators, of which the following is a specification, accompanied by drawings forming a part of the same, in which—

Figure 1 represents a side elevation of a plunger-elevator with the water-cylinder, valve-cylinder, and valves shown in vertical central sectional view, with the valves in position to operate the elevator in raising a heavy load. Fig. 2 is a vertical central sectional view of the valve-chambers and valves with the latter in position when the elevator-car is held at rest. Fig. 3 is a vertical central sectional view of the valve-chamber and the valves with the latter in position to operate the elevator in raising a light load. Fig. 4 is a vertical central sectional view of the valve-chamber and valves with the latter in position to allow the elevator-car to descend.

Similar numerals refer to similar parts in the different figures.

The object of my present invention is to provide means for raising the car of a plunger-elevator under the conditions of a light or heavy load by varying the effective surface subjected to water-pressure, thereby effecting economy in the use of water when a light load is to be raised by decreasing the volume of water to be taken from the water-main; and it consists in the construction and arrangement of parts as hereinafter described, and set forth in the annexed claims.

Referring to the drawings, 1 denotes a water-cylinder of a plunger-elevator, and 2 the inner cylinder, preferably made of brass, held concentrically within the cylinder 1, with an annular water-space 3 between the cylinders 1 and 2. The cylinder 1 is closed at the bottom, and mounted upon its upper end is an annular shell 4, inclosing an annular water-chamber 5, communicating with the annular water-space 3 between the cylinders 1 and 2 and having a supply-pipe 6 leading from the valve. Mounted upon the annular shell 4 is an annular shell 7, inclosing the annular water-chamber 8, communicating, by means of the holes 9, with the inner cylinder 2. The inner cylinder has its upper end screwed into the annular shell 7 with its lower end open and terminating a short distance above the bottom of the water-cylinder 1. Attached to the upper end of the annular shell 7 is a stuffing-box 10, through which passes a plunger 11, having a car 12 mounted thereon and having its lower end closed by a plug 13, in which is screwed a shell 14, having a projecting flange 15, nearly filling the interior of the inner cylinder 2 and suitably packed to prevent the passage of water, in the present instance by means of a leather washer 16. The shell 14 incloses the chamber 17, which communicates by holes 18 with the annular space 19 between the plunger 11 and the inner cylinder 2. The chamber 17 communicates by holes 20 with the space below the plunger, and the holes 20 are closed by a check-valve 21, which is held in its normal position by a spiral spring 22. The check-valve 21 allows water to pass from the annular space 19 to the space 23^a beneath the plunger. The annular water-chamber 8 in the upper shell 7 is connected by a pipe 23 with the valve-cylinder 24. The valve-cylinder 24 consists of an inner pipe 25 and an outer jacket 26, having interior flanges fitting the pipe 25 and inclosing a series of annular chambers 27, 28, 29, and 30, each of which communicates with the inner pipe 25 by apertures 31, 32, 33, and 34. The lower end of the inner pipe 25 communicates with an exhaust-pipe 35, and the annular chamber 27 is connected with the annular chamber 8 by a pipe 23. The annular chamber 28 is connected with the exhaust-pipe 35 by a pipe 36. The annular chamber 29 receives a water-supply pipe 37, leading to the water-main or other source of water under pressure, and the annular chamber 30 is connected with the annular chamber 5 by a pipe 6, through which water under pressure is delivered to the water-cylinder of the elevator. The inner pipe 25 incloses a valve-spindle 38, to which a reciprocating motion is given by a lever 39, pivoted to a bracket 40, projecting from the valve-cylinder and having its opposite end connected with a tiller-rope 41 in the usual manner. The valve-spindle 38 is provided with valves 42 and 43, attached to and

moving with the spindle, and also with the valves 44 and 45, carried by a spool 46, which is capable of a limited sliding motion on the valve-spindle 38, between the shoulder 47 and a nut 48 on the valve-spindle.

When the elevator-car is held in a state of rest, the valve-spindle and the valves assume the position represented in Fig. 2, with an open communication between the pipes 23 and 36, but with the communication between the pipes 37 and 6 closed, thereby preventing the flow of water to the elevator, which would raise the plunger, and with the passage between the pipes 6 and 35 closed, thereby preventing the escape of water from the elevator to the exhaust-pipe, which would cause the plunger to descend.

When it is desired to raise the car in lifting a heavy load, the valve-spindle 38 is moved down, bringing the valves into the position represented in Fig. 1, carrying the valve 42 below the pipe 6, closing the communication between the pipe 6 and the exhaust-pipe 35, and stopping the valve 43 just above the apertures 33, thereby opening the communication between the water-supply pipe 37 and the pipe 6, admitting water under pressure to the annular chamber 5 and through the annular water-space 3 to the space 23ª beneath the plunger, causing the plunger to be raised by a water-pressure applied to a surface equal to the area of the inner pipe 2 in cross-section, any water that may be in the annular space 19 being allowed to flow out through the pipe 23 and pipe 36 to the exhaust-pipe 35.

In order to cause the elevator to descend, the valve-spindle is raised, bringing the valve 42 between the pipes 37 and 6, thereby opening the communication between the pipe 6 and the exhaust-pipe 35 and stopping the valve 43 just below the apertures 32, which communicate with the pipe 36. The elevation of the valve-spindle 38 will raise the spool 46, by means of a shoulder 47, above the apertures 31, communicating with the pipe 23, thereby opening the communication between pipes 23 and 36. As the plunger descends the water contained in the inner cylinder 2 is forced down by the plunger and up through the space 3 through the pipe 6 to the exhaust-pipe 35, and the descent of the plunger will produce a partial vacuum in the annular space 19, which will become filled with water flowing upward from the exhaust-pipe 35, through pipes 36 and 23, into the inner cylinder 2. As the plunger descends it is brought to a state of rest at any desired position by shifting the valve stem and valves from the position shown in Fig. 4 to that shown in Fig. 2, in which the valve-stem 38 is moved from the position shown in Fig. 4 just far enough to close the communication between the pipes 6 and 35 without opening the communication between the pipes 37 and 6 and allowing the spool 46 to remain in its elevated position, as shown in Fig. 2.

When the car is to be raised with a light load, the valve-stem 38 is moved down, carrying the valves from the position shown in Fig. 2 to that shown in Fig. 3, bringing the valve 42 below the apertures 34, thereby closing the communication between the pipe 6 and the exhaust-pipe 35 and opening the communication between the water-supply pipe 37 and the pipe 6, thereby admitting water from the annular space 3 to the space 23ª beneath the plunger and moving the spool 46 down until the valve 44 is brought between the apertures 31 and 32, thereby closing the communication between the pipe 23 and the pipe 36, so that as the plunger is raised the water contained in the annular space 19 is prevented from flowing through the pipe 23 and is made to pass through the chamber 17 by the check-valve 21 into the space 23ª beneath the plunger, thereby supplying a portion of the water required to fill the inner cylinder 2 as the plunger rises by transferring the water in the inner cylinder, which is above the flange 15 to the space below the flange, and as the pressure above the flange 15 counterbalances the corresponding pressure below the flange the effective water-pressure applied to raise the plunger will be equal to that applied to an area equal to the diameter of the plunger instead of an area equal to the diameter of the inner cylinder, as when the water in the space 19 is exhausted through the pipe 23 in raising a heavy load. If the water-pressure applied to raising the plunger be equal to one hundred pounds to the square inch and the area of the inner cylinder 2 be fifty inches, a lifting pressure of five thousand pounds will be applied to raise the plunger, whereas if the area of the plunger in cross-section be eighteen inches the effective pressure in lifting a light load will be only eighteen hundred pounds, and an economy in the use of water will be effected equal to the volume of water contained in the annular space 19.

When both light and heavy loads are to be raised, the valve-spindle is moved downwardly from its position when the plunger is held in a state of rest, which is the normal position of the valve-stem and the position shown in Fig. 2 of the drawings; but the downward motion is greater in case a heavy load is to be raised, allowing the valves to be moved downwardly a short distance in order to raise a light load and in case the water-pressure is not found sufficient to be moved still farther in order to release the water in the space 19, and thereby increase the effective pressure on the plunger. The extreme movement of the valves 44 and 45, carried in the spool 46, is less than the extreme movement of the valves 42 and 43, carried on the valve-stem 38, and this difference in movement is provided for by the lost motion caused by the spool sliding on the valve-stem between the shoulder 47 and nut 48.

In order to indicate to the attendant when in the movement of the tiller-rope, the movement of the valves necessary to raise a light load has been fully completed, various devices may be used; but in the accompanying drawings I have shown one method by which this may be conveniently accomplished The lever 39, by which the valve-spindle is moved, is made to pick up a weight when the downward motion of the valve-spindle has reached the proper point to raise a light load. The rising end of the lever 39 is made to engage a hook 49 on the end of a rod 50, attached to a weight 51, which normally rests upon the floor 52 or other support.

I am aware that it is not new to construct a hydraulic elevator with two lifting capacities depending on the area of effective water-pressure; but I believe it to be new to provide means whereby this result can be accomplished in the case of a plunger-elevator where the water-cylinder is sunk below the surface of the ground, making it necessary to admit water to the top of the cylinder only.

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

1. In a plunger-elevator, the combination of an outer cylinder, an inner cylinder united at its upper end to said outer cylinder and having its lower end opening into said outer cylinder, a plunger inclosed in said inner cylinder, an annular space between said cylinders, a water-supply pipe communicating with said annular space, substantially as described.

2. In a plunger-elevator, the combination of an outer cylinder, an inner cylinder united to said outer cylinder at its upper end and having its lower end open, a plunger inclosed in said inner cylinder, an annular space between the outer and inner cylinders, a water-supply pipe communicating with said annular space, an inclosed annular space between said inner cylinder and said plunger, a water-passage connecting said annular space around the plunger with the inner cylinder and a check-valve closing said water-passage, substantially as described.

3. In a plunger-elevator, the combination of an outer closed cylinder, an inner cylinder communicating at the lower end with said outer cylinder, a plunger inclosed in said inner cylinder with an annular space between said cylinders and an annular space between said inner cylinder and said plunger, a water-pipe communicating with the annular space between said cylinders, a pipe communicating with the annular space between said inner cylinder and said plunger, and a valve mechanism for controlling the passages in said water-pipes, substantially as described.

4. In a plunger-elevator, the combination with the outer closed cylinder 1 and the inner cylinder 2 open at its lower end, and a plunger inclosed in said inner cylinder and having a flange fitting said inner cylinder with an annular space 3 between said cylinders and an annular space 19 between said inner cylinder and said plunger, of a water-pipe communicating with the annular space between said cylinders, a water-pipe communicating with the annular space between said inner cylinder and said plunger, valve mechanism for controlling the passages in said water-pipes, a water-passage between said annular space 19 and the space beneath said plunger and a check-valve closing said water-passage, substantially as described.

5. In a plunger-elevator, the combination of an outer closed cylinder 1, a shell 4 attached to the upper end of said cylinder and inclosing an annular chamber 5 communicating with said cylinder, a shell 7 attached to said shell 4 and inclosing an annular chamber 8, an inner pipe 2 having its upper end attached to said shell 7 and communicating at its lower end with said outer cylinder, water-pipes communicating with the annular chambers 5 and 8, valve mechanism for controlling the passages in said pipes, a plunger inclosed in said inner cylinder and having a flange fitting said inner cylinder, a water-passage between the spaces above and below said flange and a check-valve by which said water-passage is closed, substantially as described.

6. In a plunger-elevator having an outer and an inner cylinder and a plunger sliding in said inner cylinder, a valve mechanism for controlling the water-supply and exhaust comprising a valve-stem having a reciprocating motion, valves carried by said valve-stem, a spool held on said valve-stem and capable of a limited sliding motion thereon and valves carried by said spool whereby the reciprocating motion of said valve-stem will impart a less reciprocating movement to said spool, substantially as described.

7. In a plunger-elevator, the combination with an outer and an inner cylinder communicating at their lower ends, a flanged plunger acting in said inner cylinder with a water-passage connecting the opposite sides of said flanged plunger, and a check-valve closing said water-passage, as described, of a valve-cylinder, an exhaust-pipe, a water-supply pipe, a pipe leading from said valve-cylinder to said outer cylinder, a pipe leading from said valve-cylinder to said inner cylinder, a pipe connecting the upper end of said cylinder with said exhaust-pipe and a valve mechanism by which the passages in said pipes are controlled, substantially as described.

8. In a plunger-elevator, the combination of a closed outer cylinder, an inner cylinder communicating with the outer cylinder at its lower end, a flanged plunger inclosed in said inner cylinder forming an inclosed annular space around said plunger, a water-passage

between said annular space and beneath the plunger, a check-valve closing said water-passage, water-supply and exhaust pipes connected with said outer cylinder, a water-passage from the annular space around said plunger to the exhaust-pipe and a valve mechanism for opening and closing said passages, whereby said annular space is emptied into or filled from said exhaust-pipe, substantially as described.

Dated the 19th day of September, 1899.

JOHN A. DEAN.

Witnesses:
RUFUS B. FOWLER,
H. M. FOWLER.