No. 666,536. Patented Jan. 22, 1901.

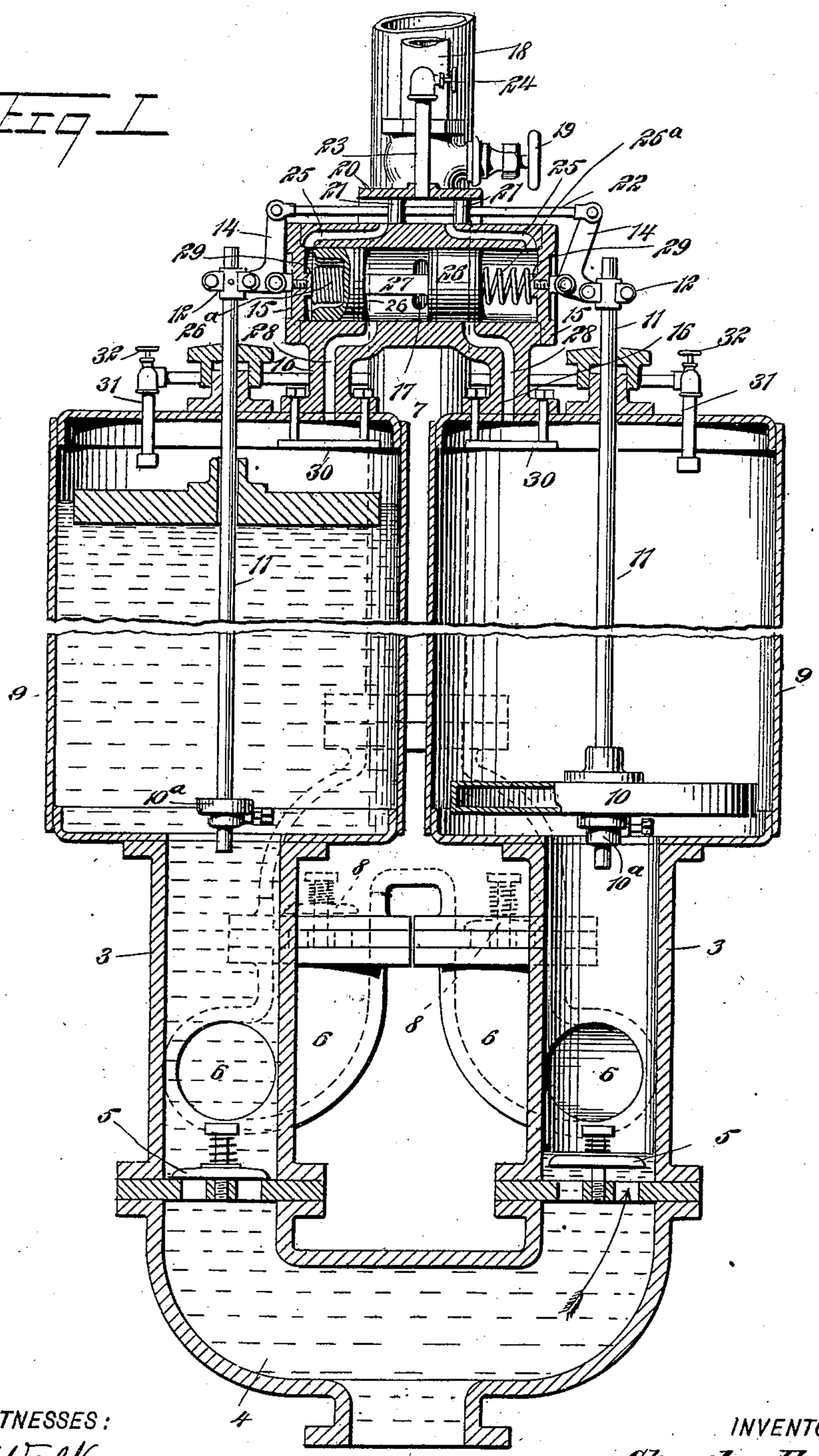
C. E. LEGGETT.

VACUUM PUMP.

(Application filed June 25, 1900.)

(No Model.) 2 Sheets—Sheet 1.

Fig 1



WITNESSES:
H. Walker
S. B. Queen.

INVENTOR
Charles E. Leggett
BY Munn & Co.
ATTORNEYS

No. 666,536.

Patented Jan. 22, 1901.

C. E. LEGGETT.

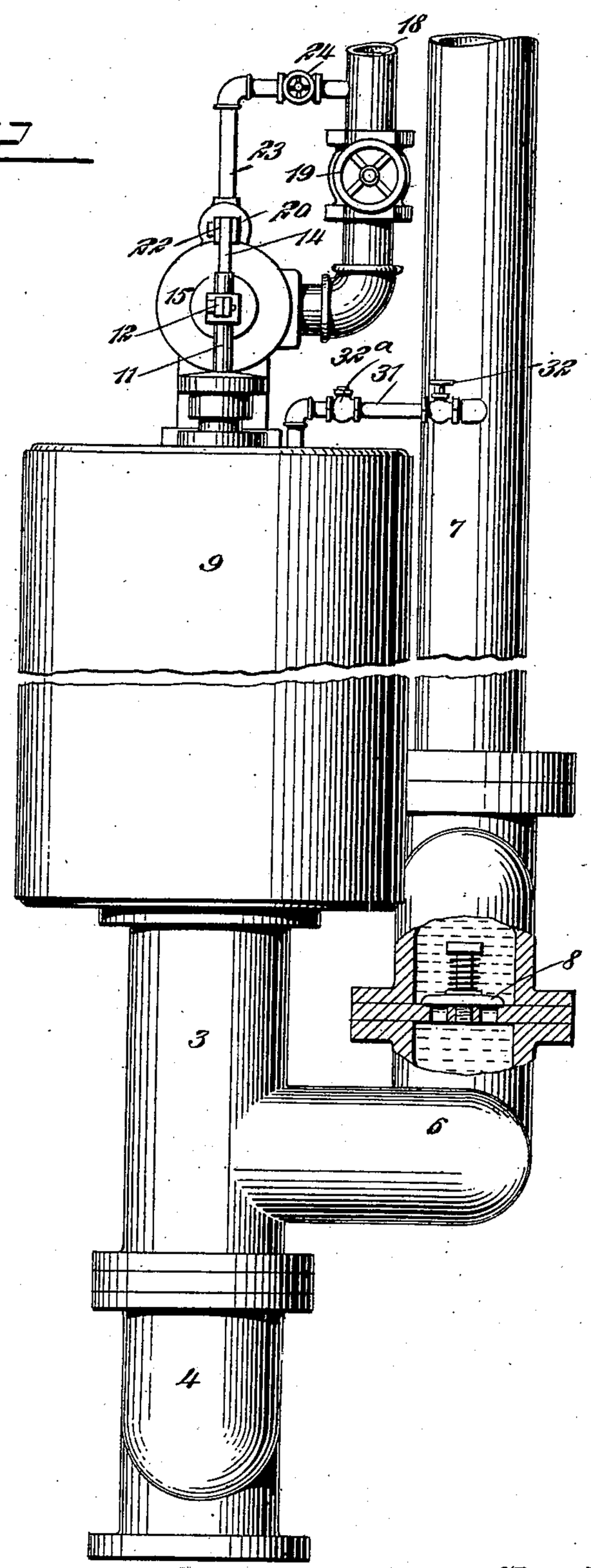
VACUUM PUMP.

(Application filed June 25, 1900.)

No Model.)

2 Sheets—Sheet 2.

Fig 2



WITNESSES:

H. Walker

B. B. Queen.

INVENTOR

Charles E. Leggett.

BY Munn & Co.

ATTORNEYS

UNITED STATES PATENT OFFICE.

CHARLES E. LEGGETT, OF JOPLIN, MISSOURI.

VACUUM-PUMP.

SPECIFICATION forming part of Letters Patent No. 666,536, dated January 22, 1901.

Application filed June 25, 1900. Serial No. 21,467. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. LEGGETT, a citizen of the United States, and a resident of Joplin, in the county of Jasper and State of Missouri, have invented a new and Improved Vacuum-Pump, of which the following is a full, clear, and exact description.

This invention relates to a pump which is actuated by the pressure of steam against water to expel the same from the pump cylinder or reservoir, the steam being then condensed to form a vacuum or partial vacuum into which water flows to fill the cylinder.

The apparatus is constructed with special reference to its use in mines where it is necessary to have a pump capable of handling a great deal of water in a short time and also capable of being economically slowed down when the water in the mine has been placed under control.

This specification is the disclosure of one form of the invention, while the claims define the actual scope thereof.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in both views.

Figure 1 is a vertical section of the invention, and Fig. 2 is a side elevation thereof with parts broken away.

The pump is of the duplex sort and comprises two cylinder extensions 3, which communicate with an elbow 4, leading from the source of water. The cylinder extensions 3 are respectively commanded by valves 5, which open upward or into the cylinder extensions to admit water therein, but which serve to prevent water flowing back into the elbow 4. The cylinder extensions 3 discharge into branches 6 of a pipe 7, which carries off the water from the pump, and the branches 6 are respectively provided with outwardly-opening valves 8, serving as check-valves to prevent the backflow of water. The upper ends of the cylinder extensions 3 communicate directly with cylinders 9, which serve also as condensers, the cylinders receiving the steam, which serves alternately to force the water out of the cylinder extensions and upon the condensation of the steam to create a partial vacuum, into which additional water flows by atmospheric pressure, as is common in this class of apparatus.

In each cylinder 9 a preferably disk-shaped float 10 is arranged. These floats are respectively carried loosely on stems 11. The downward movement of the floats on the stems 11 is limited by collars 10^a, fastened to the lower ends of the stems, whereby the stems are moved downward when the floats drop. The stems pass up centrally through the cylinders 9 and out at the upper ends thereof, the stems 11 being connected to clamps 12, which are fixedly secured thereto and pivotally mounted on the short arms of bell-crank levers 14, which are fulcrumed, respectively, on the ends a cylindrical valve-casing 15, mounted rigidly by legs 16 on the upper ends of the reservoirs 9. The ends of the cylindrical valve-casing 15 are closed, and communicating with the middle of this casing by a port 17 is a steam-supply pipe 18, having a valve 19 in command thereof. Carried on top of the valve-casing 15 is a cylindrical auxiliary valve-casing 20, each end of which is open and in which work two piston-valves 21, such valves being spaced apart and fastened on a stem 22, which passes longitudinally through the supplemental valve-casing 20 and has its ends respectively in connection with the bell-crank levers 14. A pipe 23 passes from the steam-supply pipe 18 at a point above the valve 19 and communicates with the interior of the valve-casing 20 at the middle thereof. This pipe 23 is commanded by a cock 24. The auxiliary valve-casing 20 communicates with two ports 25, which pass oppositely and respectively into communication with the end portions of the cylindrical valve-casing 15. The piston-valves 21 are so disposed with respect to the ports 25 that when moved in one position, as shown in Fig. 1, the right-hand port 25 will be placed in communication with the steam-pipe 23, so that steam-pressure will be exercised in the right-hand end of the valve-casing 15, and when the valves 21 are in the position opposite to that shown in Fig. 1 the left-hand port 25 will be placed in communication with the steam-pipe 23. When one port 25 is in communication with the steam-pipe 23, the other port is in communication with the atmos-

phere. The valves 21 are actuated by the movements of the floats 10 as they drop in the cylinders 9 upon the movement of the water out of the cylinders. One of the floats 10 is constructed heavier than the other, so that when the floats are not under the influence of the water (*i. e.*, when the pump is at rest) the heavier float will hang lower than the other, and thus the valves 21 will always be held at one of the extreme positions, so that one of the ports 25 is always in communication with the steam-pipe 23, and the action of the pump may be instantly started by simply opening the cock 24. This arrangement avoids the necessity of manually adjusting the floats before starting the operation of the pump. It is immaterial which of the floats 10 is the heavier. In Fig. 1 I have shown the right-hand float as hollow, and considering that each float is made of some buoyant material it therefore follows that the left-hand float is here supposed to be the heavier of the two.

Within the main or cylindrical valve-casing 15 works a duplex piston-valve, comprising heads 26, held apart by a stem 27. Leading from the valve-casing 15 and through the legs 16 and into the respective reservoirs 9 are ports 28, which are located one at each side of the port 17 at the middle of the valve-casing 15, and which, with the valve-heads 26, are so arranged that when the piston-valve of the casing 15 is in the position shown in Fig. 1 the left-hand port 28 will be open to communication with the port 17 and the right-hand port 28 will be closed. When the valve is in the opposite position, the communication of the ports 28 is reversed. Ears 29 are respectively formed on the inner faces of the heads of the valve-casing 15, such ears being engaged by the piston-valve 26 to prevent the valves from entirely closing the end of the casing 15, thus leaving always a space in each end of the valve-casing 15 into which steam may pass from the ports 25 for the purpose of actuating the piston-valve 26. Expansive springs 26ª are arranged to bear, respectively, against the piston-heads 26, so as to retard the movement thereof, all of which will be fully explained hereinafter. Baffle-plates 30 are arranged in the upper ends of the reservoirs 9 respectively opposite the ports 28 to diffuse the steam as it enters the reservoir. Tubes 31, passing from the water-pipe 7, extend, respectively, into the reservoirs 9 and are commanded by cocks 32. Check-valves 32ª are also provided for the pipes 31, the check-valves serving to prevent the steam from rushing from the cylinders into the pipe 7. These tubes serve to conduct and spray water into the reservoirs 9 to effect the condensing of the steam therein.

Assuming that the parts of the apparatus are in the position shown in Fig. 1 and that the cocks 19 and 24 are open, the steam entering between the valve-heads 26 by way of the port 17 passes via the left-hand port 28 into the left-hand cylinder 9, it there acting upon the water in the left-hand cylinder 9 and cylinder extension 3 and forcing the water out of the same by way of the left-hand branch 6 of the pipe 7. The steam from the pipe 23 passes by way of the right-hand port 25 into the right-hand end of the casing 15 and there acts upon the valve 26 to hold it in the position shown. The right-hand port 28 having been closed by the right-hand valve-head 26 and the steam in the right-hand cylinder 9 having been condensed, a partial vacuum is formed, which results in the opening of the right-hand valve 5 and in the inrush of water into the right-hand cylinder 9, as indicated in Fig. 1. These operations go on (the right-hand float 10 moving up on the stem 11 as the water rises in the right-hand cylinder 9) until the water lowers in the left-hand cylinder sufficiently to cause the left-hand float 10 to drop on its collar 10ª. This throws the valves 21 to the position opposite that shown in Fig. 1, causing the left-hand port 25 to communicate with the pipe 23 and opening the right-hand port 25 to the atmosphere. When this takes place, the piston-valve 26 is thrown to the position opposite to that shown in Fig. 1, thus closing the left-hand port 28 and opening the right-hand port 28. The water in the left-hand cylinder 9 and cylinder extension 3 will by this time have been ejected therefrom, and when the steam is cut off from the left-hand cylinder 9 the steam remaining in the reservoir is condensed, thus forming a partial vacuum, which results in drawing a new charge of water into the left-hand cylinder. Simultaneously with these operations the instant that the right-hand port 28 is placed in communication with the port 17 the steam rushes into the right-hand reservoir 9 and acts on the water in the right-hand cylinder, forcing said water out, as has been explained. In this manner the pump operates automatically and continuously until the valves 19 and 24 are closed, thus stopping the operation of the pump.

The steam in the cylinders is condensed by water passing through pipes 31 from the pipe 7. During the operation of the pump the cocks 32 are open and the steam entering the cylinders has at first sufficient pressure to preponderate the water-pressure in the pipes 31, and thus the water is kept out of the cylinders. When the steam is cut off, it still has preponderating pressure, thus keeping the water back and allowing the steam to act expansively in the cylinders. Finally, the steam-pressure becomes so reduced that it is no longer greater than that of the water, and the water rushes into the cylinder to condense the steam. At this instant the vacuum is formed, and the water rushes into the cylinder through the valve 5.

In connection with this invention it is pointed out that during the operation of the pump to regulate the output it is not necessary to adjust the valve 19. The steam is al-

lowed to pass through the port 17 in an unvarying volume. By regulating the valve 24 the amount of steam passing into the auxiliary valve-chamber 20 may be controlled, and since this steam actuates the valve 26 I am therefore able to control the speed at which this valve operates, causing it to shift rapidly or slowly, according to the exigencies of the situation. It is further explained that the valve-heads 26 being of the relative width shown will bring about the closure of both of the ports 28 every time that the valve 26 is shifted. Reference to Fig. 1 will show that as the valve 26 goes from the position illustrated in that view to the opposite position the heads of the valve respectively cover the ports 28 for a certain period of time, the duration of which depends upon the rapidity with which the valve 26 is shifted. The result of this arrangement is that the steam is cut off from both of the reservoirs once for each movement of the valve 26. Consequently ample time is allowed for the condensing of the steam and the formation of the consequent vacuum, so that the tendency is to keep the cylinders and reservoirs full of water rather than full of steam, and this insures keeping the reservoirs cool, and therefore in condition properly and effectively to condense the steam. In pumps of this class it has been frequently found to be a serious disadvantage that the condensation of the steam is not sure, resulting at times in drawing out the water from both cylinders and in filling the same with steam, which cannot be condensed and which therefore stops the operation of the pump until the reservoirs and cylinders can be cooled. The springs 26ª also serve to retard the movement of the valve 26 from one extreme position to the other, since the springs are of equal strength and act to keep the valve in the neutral position, during which both ports 28 are closed. The time at which the valves 21 are actuated may be regulated by adjusting the stems 11 in the clamps 12. This matter is, however, not essential to my invention.

If desired, small pipes (not shown) may be passed into the cylinders and placed also in communication with the atmosphere. These pipes should have check-valves to prevent the escape of steam. By these means small volumes of air may be admitted into the cylinders, which will lie on top of the inrushing water and prevent the latter from rising above the baffle-plates. Then when the steam enters the cylinders, it being lighter than the air, the air will lie between the steam and the water and prevent direct contact between the two.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. A vacuum-pump having a cylinder or receiver, with an inlet and outlet port or ports for the liquid pumped, means commanding the steam-supply to the cylinder or receiver, and two floats actuating said means for commanding the steam-supply, one of said floats being heavier than the other for the purpose specified.

2. A vacuum-pump having a cylinder or receiver with an inlet and outlet port or ports for the liquid pumped, means commanding the steam-supply to the cylinder or receiver, a float located in the cylinder and connected with the said means for commanding the steam-supply to actuate the same, and a gravity device connected with said means for commanding the steam-supply and working in opposition to the float, the float and gravity device being of different weights for the purpose specified.

3. A duplex vacuum-pump having two cylinders or receivers each with an inlet and outlet port or ports for the liquid pumped, valve devices for commanding the steam-supply to the cylinders or receivers, and a float working in each cylinder and connected with the valve devices to actuate the same, the floats being of different weights for the purpose specified.

4. A duplex vacuum-pump having two cylinders or receivers, each with an inlet and outlet port or ports for the liquid pumped, a valve-casing with an intermediately-situated steam-inlet port and with steam-outlet ports at the sides thereof, the said outlet-ports leading to the respective cylinders, a reciprocal main valve working in the valve-casing and comprising two separate heads connected by a stem the heads being disposed with the steam-outlet ports so that both outlet-ports are closed during certain periods of the operation of the pumps and means for actuating the valve.

5. A vacuum-pump having a cylinder or receiver with an inlet and outlet port or ports for the liquid pumped, means conducting the steam to the cylinder, a main valve commanding the said steam-conducting means, a second means conducting steam to the main valve for actuating the same said second steam-conducting means being separate from the first steam-conducting means for the purpose specified, an auxiliary valve commanding the second steam-conducting means, and a device for actuating the auxiliary valve.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES E. LEGGETT.

Witnesses:
GEO. W. LAYNE,
R. T. HASLETT.