No. 886,440. PATENTED MAY 5, 1908.

J. K. SWEENY.

STEAM PUMP FOR PUMPING LIQUIDS.

APPLICATION FILED FEB. 27, 1906.

Fig. 1.

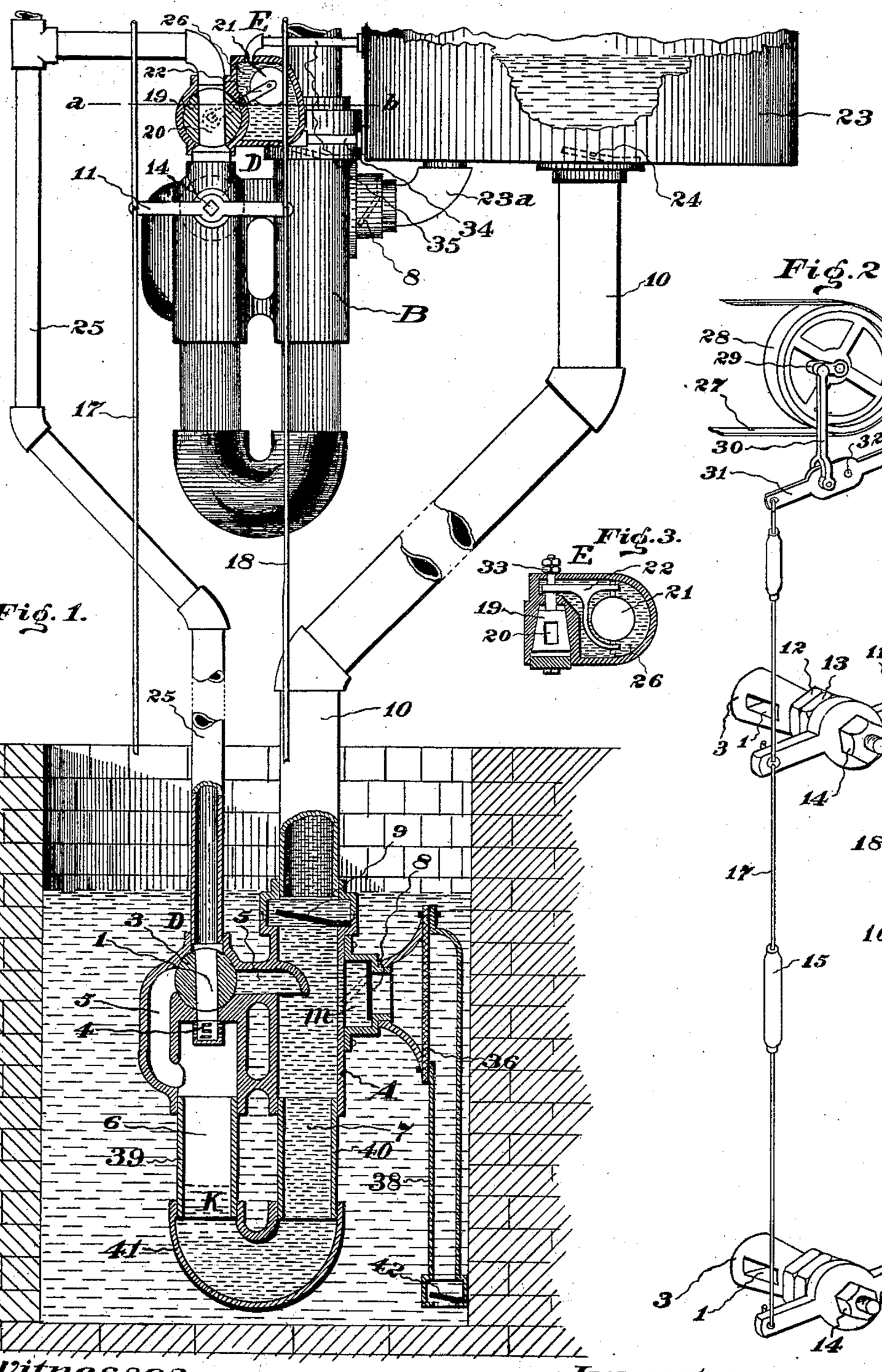

Fig. 2.

Fig. 3.

Witnesses.

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STEAM-PUMP FOR PUMPING LIQUIDS.

No. 886,440. Specification of Letters Patent. Patented May 5, 1908.

Application filed February 27, 1906. Serial No. 303,291.

To all whom it may concern:

Be it known that I, JAMES K. SWEENY, a citizen of the United States, residing at Pueblo, in the county of Pueblo and State of Colorado, have invented certain new and useful Improvements in a Steam-Pump for Pumping Liquids; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention consists of improvements in that class of pumps or water elevators, in which the pressure of the motor fluid is steam, applied direct to liquids and on top of the same, in vertically disposed chambers, having two compartments, connected at the bottoms, and having the form of inverted siphons, with suitable inlet and outlet ports in the upper parts of the vertical chambers, and inwardly and outwardly opening check valves in said ports, and a control valve.

The object of my invention and improvements, is to first, provide a control valve, actuated and adjustable by exterior means, independent of the action of the forces within the chambers, to alternately admit regulated charges of steam into the expansion chamber, and permit the exhaust of the expanded charge therefrom into the liquid, in the discharge chamber, through properly located exhaust passages. Second, to locate these exhaust passages, that a portion of the pressure fluid will be trapped in the space between the opening and the top of the chamber, and the end, opening into the discharge chamber, is at such a distance below the outlet valve, that the portion of the chamber above the exhaust inlet, will contain sufficient fluid to readily condense and absorb the heat of the exhausted charge of steam, which is forced into this liquid by the specific gravity of the liquid, seeking its level, within the two connected chambers, and also by reason of its location, the steam cannot enter into the discharge chamber without passing through this liquid. Third, to raise liquids to any desired elevation by means of two or more pumps, operatively connected together, one above the other, and their valves adjustably connected and operated in unison, to utilize the full expansion force of the steam by these short lifts, and by these means, render practical and useful this class of pumps, as fully set forth hereinafter, and as illustrated in the accompanying drawings, in which,—

Figure 1, is an elevation in partial perpendicular cross section of two of my pumps representing the stage or step by step method. Fig. 2, is a perspective view showing two of the mechanically operated valves with their connections to a pulley, that may be operated by a small steam engine or from a shaft by a belt. Fig. 3, is a horizontal cross section through line *a' b*, of a governor valve and float, operated by the rise and fall of water in the tank.

Similar numbers refer to similar parts throughout the several views.

The pump consists of a casing 39, 40,[A] in which there are two vertical chambers 6 7, connected at the bottom by bend 41, producing the general form of an inverted siphon, with legs of equal or unequal length, with an inlet port *m* near the upper end of chamber 7 for the inflow of the liquid to be elevated, and with an outlet at the top of the chamber for the discharge of the liquid through outwardly opening check valve 9, into discharge pipe 10 and receiving tank 23, through upward opening check valve 24 therein, inwardly opening check valve 8 permitting the inflow of the liquid from suction pipe 38, through foot valve 42 and screen 46. The steam from the supply pipe 25 is admitted into the expansion chamber 6 through port 1 of the control valve 3 and perforated cushion element 4 in the top of the chamber, and from the side of the chamber a relatively short distance below the inlet port, exhaust passage 5 opens outward and extends upward into the side of valve D and from the opposite side of the valve an extension of the passage 5 opens into the side of the discharge chamber 7 at a distance below the discharge port, that the portion of the chamber above the inlet of the exhaust passage will contain sufficient liquid to fully condense and absorb the heat of the exhausted charge of expanded steam, when forced into said liquid as hereinafter described.

Within the chambers is a body of liquid, partially filling the same, usually of water, but by the use of mercury, the action of the pump is greatly accelerated, because of its greater specific gravity, therefore maintains a complete separation of the fluid in the two

chambers, and the actions become more positive.

Fig. 2 represents the control valves of two stations, operatively connected. The valves are actuated by exterior means, independent of the forces operating within the chambers. As shown, crank 29 on wheel 28 driven by belt 27, is connected to walking beam 31 by link 30, it being horizontally pivoted at 32, a vertical reciprocating movement is given to the flexible vertical rods 17, 18, that extend from the ends of the beam to the valve arms 11, 11, which are adjusted on the valve stems by set nuts 12, 13 and 14, the rods have turn-buckle adjustments 15, 16. The rotary or rocker movement produced in the valves by these means operates to alternately admit the steam to expansion chamber 6 and exhaust it therefrom through passages 5, 5. As the valves are moved from the intake position as shown in apparatus A to the exhaust position, wherein the exhaust passages 5, 5 are connected through port 1, it is for a time closed by the valve casing, and the charge of steam is given time to fully expand. By the combined adjustments of the rods and arms, valves 3 should be caused to open over the inlet port just long enough to admit a charge of steam, that when fully expanded, it will not force the liquid piston from expansion chamber 6 below the water line K shown in the chamber.

The set adjustment of the valves to produce this result must be made in each pump in accordance with the height of each lift, or pressure planned for it. For a low lift, with the steam pressure high, instead of the port in the valve opening full, between the passage ports in the casing, as shown, it may be adjusted to end its opening movement, when the slightest connection has been made only for an instant of time, for the passage of steam, while the time it remains fully closed, will be the same, the exhaust passages however, being opened for a greater period of time.

Because of the elastic force of the steam, the liquid in chamber 7 is held up against the outlet check valve 9 after the force of the steam, by its expansion, has been reduced below the weight of the column of liquid over the valve, and which has closed it, and this position of the liquid in the chamber will be maintained after the exhaust position of the operating valve has been reached, until a sufficient portion of the body of steam in chamber 6 has passed into and has been absorbed by the liquid in chamber 7 to reduce the presssure of the steam below the gravity weight of the liquid in chamber 7 that is above the level of the surface of that portion in chamber 6, and until this time the liquid piston does not begin to move back into chamber 6 and force the remaining steam into the downward moving liquid in chamber 7, the continued condensation produces the vacuum that draws a new supply of liquid into chamber 7 and the liquid inlet being above the exhaust inlet, the inflowing liquid, if cool, instantly reduces the temperature in the space above the exhaust inlet, thereby augmenting the vacuum, and in actual practical use the temperature of the upper part of chamber 7 remains about the same as that of the liquid raised while the temperature of the top of chamber 6 is near that of the steam. It will be evident from this location of the exhaust inlet opening, that the steam cannot pass from chamber 6 into chamber 7 without entering into or through the liquid in chamber 7, whether the charge be excessive, or the amount adjusted to the most economical, or a quantity insufficient to force any liquid through check valve 9.

In the space above the outlet opening of exhaust passage 5 from expansion chamber 6 there will be entrapped by the liquid of the returning piston, a portion of each charge of steam, which will be slightly compressed within said space and through the perforations into hollow element 4, by the momentum of the returning piston. This heated fluid preventing excessive condensation of each subsequent new admission of steam into said expansion chamber.

A complete single pump has been described with my improvement thereto, but it may be compounded into groups of more than one in a single casting, and supplied alternately from one main pressure pipe, and one operating valve. It will also be evident that the liquid can be raised by one pump only, to an elevation, where the weight of the whole column of liquid per square inch, equals the pressure of the steam in chamber 6, that supports it. Therefore to raise liquids to any desired elevation, I have especially designed my improvements to elevate from station to station, by comparatively short lifts, thereby using the expansion of the steam from a high pressure, down to a low pressure, and then obtaining the benefit of an economical vacuum by the condensation of the exhaust steam.

Ordinarily at each upper station a receiving tank 23 is provided and is connected to the intake of the pump B by conduit 23[a]. Float chamber 26 is connected at the bottom by pipe 34 and at the top by vent pipe 35 permitting a free passage of the liquid between the two tanks. By the rise of the liquid within the tanks float 21 is lifted and opens the governor valve 19, of valve device E, permitting steam to pass to the controlling valves D, operated as shown in Fig. 2, only when there is liquid to be raised, as the lowering of the water in the tanks allows the float to fall and close the governor valve 19, shutting off the admission of steam to the

controlling valves, which may continue in operation in unison actuated by the connecting rods 17, 18, as heretofore described.

I claim as my invention,

1. The combination in that form of pumping apparatus having two vertically disposed chambers, connected at the bottom in the form of an inverted siphon, and having an outlet port at the top of the discharge chamber with an outwardly opening check valve therein an inlet port in the side of the top, with an inwardly opening check valve therein, an inlet port in the top of the short or expansion chamber for the admission of steam thereto; and a body of mercury in the bottom of said vertical chambers, partially filling the same, for part of the piston, within the said chambers, and as a separating medium between the actuating fluid in the expansion chamber and the actuated fluid in the discharge chamber, and by its greater specific gravity, accelerating the exhaust action of the pump.

2. The combination in that form of pumping apparatus having two vertically disposed chambers, connected at the bottom in the form of an inverted siphon, and having an outlet port at the top of the discharge chamber with an outwardly opening check valve therein, an inlet port in the side of the top, with an inwardly opening check valve therein, an inlet port in the top of the expansion chamber, for the admission of steam thereto; of a body of liquid therein partially filling the same, for a piston; an exhaust passage 5 opening out of the side of the upper part of the expansion chamber 6 below the inlet port and leading upward into the casing of operating valve D, the portion of the chamber between the exhaust outlet and the steam inlet port, constituting a trap into which a portion of the actuating fluid is compressed by the returning liquid piston; a continuation of the exhaust passage 5 from the opposite side of the operating valve into the side of the discharge chamber upon a level with or below the operating valve and a hood over the opening, the said exhaust inlet being at such a distance below the discharge outlet from said chamber, that the portion of the chamber above the exhaust inlet will contain sufficient liquid to condense and absorb the heat of each exhausted charge of steam, as the said liquid descends past the exhaust inlet opening to its gravity level within the two connected chambers, said exhaust action being actuated by the gravity weight of the liquid piston, as fully described.

3. The combination in a pumping apparatus as described, of a vertically disposed expansion chamber with a body of liquid therein for a piston, a hollow perforated cushion element 4, projecting inwardly from the inlet port, an exhaust outlet in the side of the upper part of the chamber, at a distance below the inlet port, forming a trap, wherein a portion of the actuating fluid is retained at each exhaust; an operating valve casing D, over the expansion chamber, with ports for the passage of the motor fluid, ports in each side of the casing for the passage of the exhausted motor fluid from said chamber, a valve 3 in said casing D, with a through port 1, adjustable arms and rods operated by a crank and other connected mechanical means to produce a rotary movement of said valve, whereby in the first position, communication is established between the steam conduit and the expansion chamber 6, to admit a regulated charge of steam thereto, on top of the liquid piston therein, means to cut off said communication and cause the valve to remain closed for a period of time to permit full expansion of the steam while the valve is being passed to the exhaust position of its movement and the port 1 forms an open connected passage between exhaust conduits 5, 5; means to again close the valve as it returns to its first position, during which time a supply of actuated fluid is received into the discharge chamber.

4. The combination in a pumping apparatus having two vertically disposed chambers connected at the bottom in the form of an inverted siphon, with inlet and outlet ports, and valves therein, and an operating valve over the expansion chamber, mechanical means that operate it to cause it alternately to admit charges of steam into the expansion chamber and exhaust the same therefrom into condensing liquid in the discharge chamber; of two apparatus A, B, or more, in series, at an elevation one above the other, mechanically and operatively connected together, pipe means to conduct the steam from one main, into each of the pumps, means for directing the discharge from the lower pump A into the suction intake of the upper apparatus B, flexible and adjustable valve rod means, arranged to move the operating valves in unison, to permit the expansive use of the steam in each apparatus; governor valve means E in the steam inlet pipe, float means arranged to open the governor valve for the admission of steam into the operating valves of the upper pumps only when there is liquid to be actuated, as fully set forth.

In testimony whereof, I affix my signature, in presence of two witnesses.

JAMES K. SWEENY.

Witnesses:

R. B. SWEENY,

H. M. TURNER.