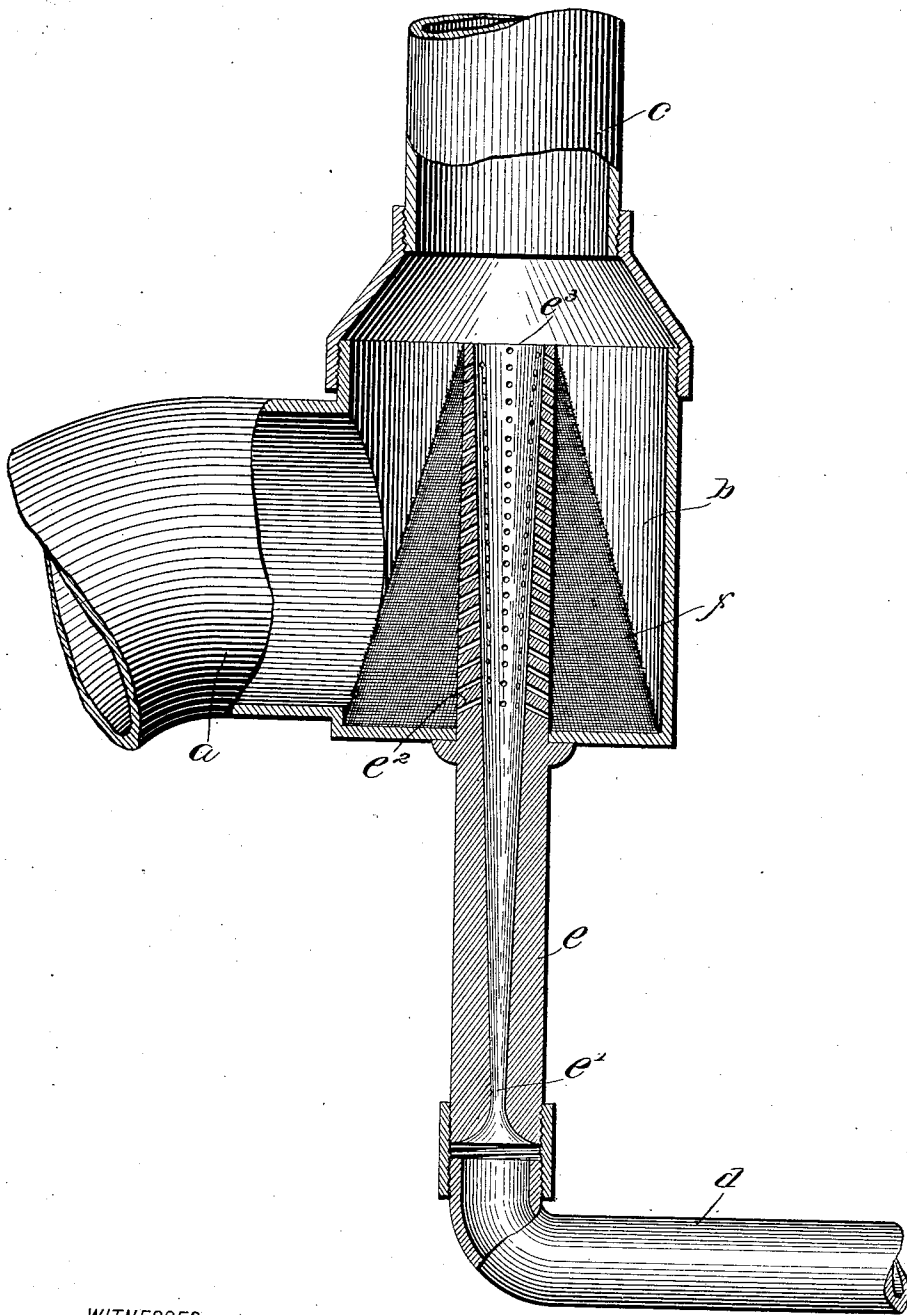


No. 826,355.

PATENTED JULY 17, 1906.

E. C. POLLARD.
STEAM PUMPING DEVICE.
APPLICATION FILED SEPT. 16, 1905.



WITNESSES:

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STEAM PUMPING DEVICE.

No. 826,355.

Specification of Letters Patent.

Patented July 17, 1906.

Application filed September 16, 1905. Serial No. 278,755.

To all whom it may concern:

Be it known that I, ENOS C. POLLARD, a citizen of the United States, and a resident of Seattle, in the county of King and State of Washington, have invented a new and Improved Steam Pumping Device, of which the following is a full, clear, and exact description.

Prime movers or engines known as "ejectors," "steam-siphons," "steam-jet pumps," &c., in which water is raised by the introduction of steam into a column of water, while admirably adapted for certain purposes owing to their simplicity of construction and operation, have not heretofore seriously competed with other and more complicated forms of engines and pumps, because of the great waste of steam-power attendant upon their use, especially when high lifts have to be made. In view of the high efficiency of recent types of steam-turbines in spite of the mechanical difficulties encountered in running them at high speeds this want of efficiency in steam-jet pumps and the like seems at first sight difficult to account for, as it would appear to be necessary only to elongate the steam-jet into an expanding nozzle similar to that used in the simple impact steam-turbines in order to secure all the available energy of the jet. The discharge into vacuum necessary to accomplish this end would seem to be obtained as the steam on leaving the nozzle comes into contact with cold water. Such, however, is not the case. The velocity of steam escaping through an expanding nozzle under any ordinary boiler-pressure is many times that of the ascending column of water, and consequently the steam must press against the base of the column, where if it remained stationary the condensation would be very slow owing to the fact that steam is a non-conductor of heat. On account of its lower specific gravity, however, the steam quickly rises in the column in the form of bubbles, which are almost instantly condensed. This condensation occurs while the steam is subject to the pressure of the column of water into which it rises in addition to that of the atmosphere.

An important object of my invention is to remove the pressure of the steam at this point and allow the steam to escape into a vacuum or partial vacuum. If discharged into the direct column of water, the steam has a higher pressure and temperature than would be the case if discharged into a vacuum,

and this excess in temperature is used in heating the water, which is wasted energy. The total energy of the steam that is applied to lifting water is that due to the velocity acquired in passing from the pressure of the boiler to a pressure equal to that of a column of water in addition to the atmospheric pressure. Therefore the efficiency is much less than that of a device in which the steam is discharged into a vacuum.

Reference is to be had to the accompanying drawing, forming a part of this specification, in which the figure shows a device provided with means for accomplishing the above-mentioned results and illustrates the principle of my invention.

The apparatus is provided with a conduit *a* for water, having a chamber *b*, which discharges into a rising pipe *c*. A steam-pipe *d* discharges through a nozzle *e* into the chamber *b*. This nozzle is contracted at its lower end, as shown at *e'*, and gradually expands to the upper end. The part of this nozzle which extends into the chamber *b* is provided with numerous perforations *e''*, which are preferably arranged spirally around the nozzle and extend downwardly from its inner passage. Surrounding the perforated portion of the nozzle is a fine-wire screen *f* keeping sediment and obstructions from the perforations *e''*.

In operation the steam passes from the boiler through the pipe *d* to the base of the expanding nozzle *e*. As the steam rises in this nozzle it expands as the cross-sectional area of the passage through the latter increases. In a device constructed strictly in accordance with the best knowledge which I have of the principles involved the steam should be expanded to a pressure less than that of the atmosphere before it reaches the part of the nozzle which is provided with perforations. This part of the nozzle is entirely surrounded by water, and as the perforations are arranged spirally the water is admitted into the presence of the steam at all elevations and from all directions. Upon entering the perforated portion of the nozzle the steam therefore encounters numerous small jets of cold water coming from every direction and is condensed almost instantaneously, producing a partial vacuum toward which the water and steam necessarily rush. The upward flow of the steam and water is more than sufficient to offset the tendency of the water to enter the nozzle from

its mouth e^3 . Therefore it enters through the apertures e^2 , forming the condensing-jets specified above. The water of condensation mingles with the water entering from the conduit a , and its energy is imparted to the entire mass. Therefore the velocity of the whole is greatly reduced; but the entire energy or moving force of the mixture of the water from the two sources is constant.

Water of condensation also rises in the nozzle in the form of a spray which becomes denser as it rises, owing to the increment of water entering through the higher apertures. Leaving the nozzle this spray imparts its energy to the column of water to be lifted, where the velocity is still further decreased, while the volume of moving water is increased sufficiently to maintain the moving force constant.

It will be observed that the total energy of the steam applied to the lifting of the water is that due to its passage from the pressure of the boiler through an expanding nozzle to that of a partial vacuum, which is created by its practically instantaneous condensation. In other words, we have here those conditions of efficiency which are identical with and of the same degree as those of the highest type of condensing-engines; but I have eliminated all of the cumbersome and complicated machinery which of necessity constitute a part of the latter. No moving parts are present except such valves as are necessary for the proper control of the water and steam, and therefore no loss of power is suffered through the friction of the moving parts, and also no wear and tear except that caused by the attrition of the grit carried by the water against the pipes.

The entire apparatus may be built of standard pipe-fittings, except the nozzle and the inclosing screen. As an engine it is believed that this apparatus comes as near to fulfilling Carnot's law of the perfect heat-engine as any heretofore devised. The downward pressure of the column of water being lifted, which is due to the action of the vacuum, is not to be considered as a loss of energy, because it is balanced by the upward flow of the water through the suction-pipe, which is due to the same cause.

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

1. In apparatus of the class described, a casing having connected thereto water supply and discharge pipes, a steam-pipe communicating with the casing in alinement

with the discharge-pipe, said steam-pipe being provided with an expanding nozzle having a plurality of perforations, whereby to admit numerous jets of water through the nozzle for condensing the steam, an unobstructed communication being left between the supply and the discharge pipe through the casing.

2. A steam force-pump comprising a chamber having water supply and discharge pipes connected thereto, a steam-pipe communicating with the casing in alinement with the discharge-pipe, said steam-pipe having an expanding nozzle provided with a plurality of perforations through the walls thereof and having an open upper end spaced apart from the discharge-pipe.

3. A steam force-pump comprising a water-conduit, a chamber connected therewith, a steam-pipe having a nozzle entering said chamber, the nozzle being provided with a passage gradually increasing in diameter toward its discharge end, and having perforations through which water may enter the nozzle from said chamber, and a discharge-pipe extending from said chamber over the nozzle and of greater cross-sectional area than the nozzle.

4. A steam force-pump comprising a water-conduit, a steam-pipe having a nozzle entering said conduit, the nozzle having a discharge-pipe gradually increasing in diameter toward its discharge end and having perforations through which water may enter the nozzle of said conduit, and a discharge-pipe extending upwardly from said chamber over the nozzle, the nozzle having an open end above said perforations.

5. A steam force-pump comprising a water-conduit, a steam-pipe having a nozzle entering said conduit, the nozzle having a discharge-pipe gradually increasing in diameter toward its discharge end and having perforations through which water may enter the nozzle of said conduit, and a discharge-pipe extending upwardly from said chamber over the nozzle, the nozzle having an open end above said perforations, said perforations being inclined backwardly with respect to the direction of motion of the water and steam.

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

ENOS C. POLLARD.

Witnesses:

J. W. RHODES,
J. C. CHRISTIANSEN.