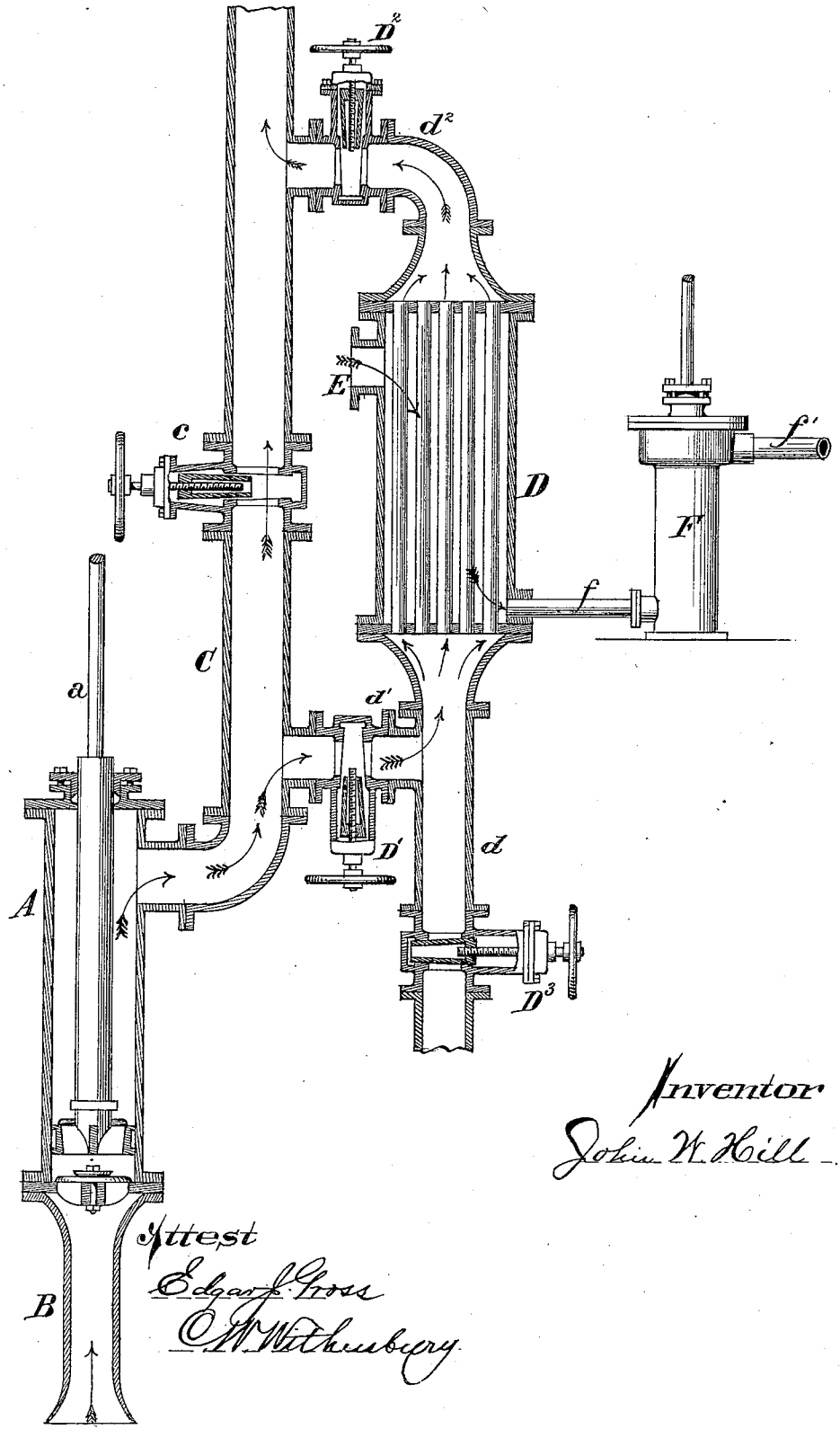
(No Model.)

J. W. HILL.

SYSTEM OF CONDENSATION FOR PUMPING ENGINES.

No. 246,773. Patented Sept. 6, 1881.



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SYSTEM OF CONDENSATION FOR PUMPING-ENGINES.

SPECIFICATION forming part of Letters Patent No. 246,773, dated September 6, 1881.

Application filed February 12, 1881. (No model.)

To all whom it may concern:

Be it known that I, JOHN W. HILL, of Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in a System of Condensation for Pumping-Engines, of which the following is a specification.

My invention relates to pumping-engines exclusively, and more particularly to pumping-engines for city water-supply which are or may be of the condensing type, and has for its object the construction and arrangement of a system of condensing apparatus which will consume a minimum of engine-power in working the connected air-pump, and will entirely dispense with the lift by vacuum or by a circulating-pump of the water used for condensation.

My invention consists in connecting with the force-pipe of a pumping-engine, between the pump and reservoir or distribution-mains, in a manner to be hereinafter explained, a surface-condenser of suitable design and proportions, with which condenser the exhaust of the engine is connected, and through which condenser so much of the water pumped for supply as may be necessary to maintain the desired vacuum in the condenser may be diverted.

My invention further consists in connecting the surface-condenser to the force-pipe in such a manner that it may be cut off from the latter and blown out or washed out to clear it of mud, debris, or other objectionable matter which may accumulate therein.

Surface-condensers attached to pumping-engines have been devised which provide for the delivery of all the water pumped through the condenser; but as the relation of the water pumped to the steam expended in pumping it will vary greatly between the different heads of supply—*i. e.*, the variation of water-level in the ponds and rivers from which the supply is drawn and the variation of heads against which the water is pumped, as in direct-pumping systems now in general use—and as the quantity of water diverted to the condenser will vary with the duty of the engine and will vary directly as the temperature of the water pumped, more water being required in summer than in winter, and as the vacuum in the condenser should be maintained at a given point—say twenty-seven (27) inches—it becomes absolutely necessary that the water to the condenser shall be under the complete control of the engineer, in order that only so much as may be necessary to produce and maintain the required vacuum shall be diverted through the condenser in transit through the force-pipe, and all those arrangements which provide for the passage of the entire water pumped through the condenser are inadmissible in practice and worthless for any useful results. The relative amount of water diverted from the force-pipe through the condenser will vary with the economy of the connected engine. With an engine developing a duty of eighty millions about five per cent. of the total water pumped through the force-pipe will be so diverted for condensation purposes, the remainder being pumped through the force-pipe in the usual manner.

In the accompanying drawing I have shown one form of application of my system of condensation.

A is the pump of a pumping-engine, which may be of any form or variety and worked in any convenient manner.

B is the suction-pipe, connected at one extremity with the source of water-supply and at the other with the pump A.

C is the force-pipe, receiving the water from the pump A and directing it into the usual reservoir or distributing-mains.

D is the surface-condenser, which may be of any approved design, to which the exhaust-pipe of the engine is attached at the nozzle E, and which is connected to the force-pipe by the inlet-pipe d' and outlet-pipe d^2.

F is an air-pump, attached to the condenser in the usual manner, and worked to discharge the water of condensation and air from the condenser D.

c is a valve or gate, placed in the force-pipe between the inlet-connection d' and outlet-connection d^2 of the condenser, by means of which more or less of the water pumped through the force-pipe C may be caused to pass in transit through the condenser D.

It is obvious that if the valve *c* were closed entirely all the water delivered to the force-pipe would be diverted at the lower connection, d', pass through the condenser D, and return to the force-pipe through the connection d^2, and that by carefully graduating the opening

in the force-pipe by means of the valve *c* only so much water as may be required to maintain the desired vacuum will be so diverted through the condenser, and be returned to the force-pipe by the connection d^2.

In adjusting the injection or supply of condensing-water to condensing-engines care is had that the least water capable of producing a given vacuum shall pass through the condenser, in order that the temperature of the hot-well or water delivered from the condenser by the air-pump shall be as high as possible, this water being used as the feed to the boilers. By delivering more water to the condenser a better vacuum may be obtained, with a corresponding reduction in the temperature of the contents of the hot-well; but experience has shown that the gain in economy by the improved vacuum is more than counterbalanced by the reduced temperature of the feed to the boilers, and that a given vacuum of about twenty-seven inches warrants maximum economy in all cases (as is usual) where the water of condensation in the hot-well is pumped back into the boilers; hence the necessity with every system of condensation of a means whereby the water of injection may be carefully adjusted to the requirements of the connected engine.

D is a valve or gate in the connection d', and D^2 a corresponding valve or gate in the connection d^2, which can be closed when desired to make repairs of the condenser D, the water meanwhile (if the engine be arranged to work with and without the vacuum) passing up the force-pipe C in the usual manner.

D^3 is a valve or gate attached to the connection *d* at the bottom of the condenser, by means of which the accumulation of sediment or debris may be blown or washed out of the condenser whenever necessary, during which operation the valve D′ would be entirely closed and the valve D^2 opened and the current of water through the condenser be reversed.

The condenser may be arranged to pass the water through a cluster of tubes set between end plates, while the exhaust-steam circulates around the tubes and is condensed in the shell, as shown in the drawing, or vice versa; or any other approved form of surface-condenser may be used, if preferred by the designer.

The heat in the steam is taken up by the water diverted from the force-pipe C through the condenser and returned to the force-pipe to be delivered to the reservoir or distributing-mains, and a vacuum formed in the condenser corresponding to the amount of water so diverted from the force-pipe.

The temperature of the water pumped by the connected engine and delivered to the distributing-mains through the force-pipe C will be slightly augmented by using a portion of it in transit to effect condensation, the ratio of increase, however, being inversely proportioned to the normal temperature of the water. Thus the increase of temperature in the summer, when the water of general supply is naturally warm, will be very slight, increasing as the temperature of the water pumped becomes colder. Where the water is pumped into a reservoir no increase of temperature would be manifest, the added heat being dissipated by the exposure of the large surface of water in the reservoir to the atmosphere.

The air-pump is required only to remove the water of condensation and air from the condenser D, and may also serve as a feed-pump to the boilers if constructed with this extra duty in view.

With my system of condensation many non-condensing engines for city water-supply and other purposes may at small cost be converted into condensing-engines, with a material reduction in the cost of the fuel, and all condensing-engines, when the water is lifted by the vacuum formed in the condenser, or by an independent injection or circulating pump, or is drawn from the mains and wasted, may apply my system of condensation with a marked improvement in the duty, by reason of the reduced labor of the air-pump, it being required only to discharge the water of condensation and air from the condenser, the condensing-water being also the water pumped for supply.

I am aware that surface-condensers have been attached to steam pumping-engines in such a manner that all the water pumped has been forced through the condenser, and this construction I do not claim, neither is it capable of practical adaptation, for the reason previously given.

Having described my invention, what I claim is—

1. In a system of condensation for pumping-engines, the combination of the surface-condenser connected with the exhaust of the engine, said condenser having two independent connections with the force-pipe, one of which serves to direct the water from the force-pipe to the condenser and the other to return the water to the force-pipe, with the regulating-valve arranged in the force-pipe intermediate the two connections of the condenser to control the amount of water derived from the force-pipe to the condenser, and an air-pump for removing the air and water of condensation from the condenser, the said members being constructed and arranged in the described relation to each other substantially as shown and herein described.

2. The combination, with the force-pipe C of a pumping-engine, having a regulating-valve, *c*, located between an inlet-connection, d', and an outlet-connection, d^2, of said force-pipe with a surface-condenser, of the surface-condenser D, provided with a nozzle, E, for the attachment of the exhaust-pipe of the engine, and the air-pump F, attached to said condenser, substantially as and for the purpose described.

3. The combination, with the force-pipe C of a pumping-engine, of the surface-con-

denser D, connected with said force-pipe by inlet and outlet connections d' and d^2, having valves or gates D′ and D^2, respectively, and provided with a blow-out connection, d, having a valve or gate, D^3, substantially as and for the purpose described.

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

JOHN W. HILL.

Witnesses:
AMBROSE TEMPLE,
EDGAR J. GROSS.