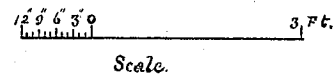


Patented March 5, 1872.



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JOHN HOUP, OF SPRINGTOWN, PENNSYLVANIA.

IMPROVEMENT IN EXHAUST STEAM-ENGINES AND FORCE-PUMPS.

Specification forming part of Letters Patent No. 124,359, dated March 5, 1872.

Specification describing a certain Improved Exhaust Steam-Engine and Force-Pump, invented by JOHN HOUP, of Springtown, in the county of Bucks and State of Pennsylvania.

My invention relates to the utilization of the exhaust or waste steam of any high-pressure steam-cylinder; of any low-pressure steam-cylinder having my exhaust-steam dividing and self-clearing jet-condenser (patent reissued May 31, 1870) attached; or from any other convenient source of waste steam that may be at hand, by causing the said steam to operate a comparatively-large cylinder of a low-pressure steam-engine, (either with or without a crank and fly-wheel attached,) by the condensation alone of said steam in the said low-pressure cylinder, at a pressure generally not much greater than the pressure of the atmosphere, and sometimes even a little below the pressure of the atmosphere, to drive a double-acting force-pump, constructed and arranged substantially as hereinafter described and set forth, for the purpose of supplying water to the steam-boiler or generator, and for other purposes.

Referring to the accompanying drawing, A is the low-pressure steam-cylinder, to be operated by condensation alone, (condenser not shown;) G, the steam-pipe to supply the said low-pressure steam-cylinder A with the exhaust or waste steam, as aforesaid. The said pipe G communicates with the low-pressure cylinder A by means of a branch-pipe, g' , and also with a steam-jacket space, a^0 , around the said cylinder A, by means of an inlet branch pipe, g'' , and an outlet branch pipe, g''' , the said exhaust-pipe G being provided with a pressure-regulating valve, g^4 , located above the said branch pipes g' g'' g''' . B is an inverted T-lever supported upon its fulcrum, with its upright or longer arm b' articulated to the piston-rod a' of the cylinder A by an intervening bar, F, and its two shorter arms, b'' b''' , articulated, respectively, to the two plunger-rods of the plungers c'' c''' of the two like upright cylinders C C' of the double acting force-pump, which is firmly secured and supported in a well or water-tank, D. The lower ends or base of the pump-cylinders C C' are respectively provided with inlet-valves 6 6, and at a short distance above their bases the cylinders have respective branch conduits E E', provided with outlet-valves e'' e''' . Each of the conduit-pipes

E E' communicates with its respective cylinder C or C' through a triangular or wedge-shaped opening, 5, which has its base upward, so that, as either of the respective plungers c'' or c''' , which has a range limited to the length of the opening, passes downward over the same, the area of the said opening will be diminished gradually until closed, and, consequently, there cannot occur any jar or shock from the plunger in reaching its lowest limit in forcing the water upward through the conduit-pipe. Each of the pipes E E' has an adjustable valve or cock, 7, whereby the passage of the water through the pipe can be regulated in quantity, so as to control the speed of the piston of the steam-cylinder A. The supply-steam may be simultaneously conveyed through the pipes G g' g'' into both the steam-chest a'' of the cylinder A and the steam-jacket space a^0 , which surrounds the said cylinder A, an outlet-pipe, g''' , allowing the steam inclosed by the jacket to communicate freely with the steam in the upper part of the main supply-pipe G, the object of the said steam-jacket and the branch-pipes g'' and g''' being to keep up the temperature of the cylinder A by the passage of exhaust steam through the space a^0 , substantially in the manner described in the patent granted to me dated the 27th day of June, 1871. At a short distance above the branch-pipe g''' the main pipe G is provided with an upwardly-opening valve, g^4 , which is intended to be adjusted to open from any slight pressure (above that of the atmosphere) of the steam in the said pipe G, because the piston of the low-pressure cylinder A is not intended to be moved by any pressure of said steam above that of the atmosphere, (because it would, to the same degree, lessen the effective power of the high-pressure engine,) but simply by a vacuum produced from the condensation of the steam in the cylinder A, before the piston. The exhaust steam in the pipe G enters the cylinder and follows the piston as it moves in the vacuum on its opposite side, and thus giving the required reciprocating motion to the same, to operate the plungers c'' c''' of the force-pump, the branch pipe g' conducting steam into the valve-chest a'' , from which it is alternately admitted into both ends of the cylinder A. The main pipe G and its branch g' are each provided with a stop-cock or cut-off valve, 8, whereby

either the whole or a portion of the supply-steam may be caused or permitted to pass through the steam-jacket space a^0 before it enters the steam-chest a'' , as may be found desirable, at any time during the operation of the engine. The valve-rod a''' of the cylinder A is articulated to one end of a lever, H, (of the first order,) and the other end of said lever is operated by two adjustable pins or stops, f' f'' , in the bar F, which alternately come in contact with the end of the lever H as the piston-rod a' moves outward and inward, and thus vibrate the lever H on its fulcrum and operate the steam-chest valve of the cylinder A. The surface of the water in the tank D is to be kept up to the dotted line V W, for the purpose of insuring a full supply beneath the plungers. Now, if the cylinder A is operating with a good vacuum and with a full stroke, the plungers of the force-pump will alternately descend to the lowest point of their respective wedge-shaped openings 5 5, and no further, and, consequently, stop the passage of any of the water from beneath the plungers, but in such a gradual manner that there will not be any objectional hammering or jar produced; but, as it is not absolutely required that this exhaust steam-engine should work at a full stroke of the piston, the adjustable stops f' f'' in the bar F must be so adjusted as to move the lever H, and consequently the slide-valve in the steam-chest a'' , within such limits as may be found desirable to prevent any excessive strain upon the pump.

I claim as my invention—

1. The combination of the low-pressure cyl-

inder A and its surrounding steam-jacket space a^0 with the steam-conducting pipes G g' g'' g''' and their respective valves g^4 8 8, in communication with the exhaust steam of any steam-engine, the said mechanical devices being constructed and arranged to operate the low-pressure cylinder A by the pressure of the atmosphere upon one side of its piston, forcing the latter into the vacuum produced by the condensation of the steam at its opposite side within the cylinder, substantially in the manner hereinbefore set forth.

2. The bar F, which is articulated to the piston-rod a' of the low-pressure cylinder A and to the upright arm b' of the pump-lever B, as set forth, in combination with the adjustable stops f' f'' and with the lever H, which is articulated to the valve-rod a''' of said cylinder, as set forth, the said mechanical devices being arranged to operate the valve of the said steam-cylinder A, and also to operate the lever B of the pump, substantially as and for the purposes described.

3. In combination with the pump-lever B, actuated by the low-pressure steam-cylinder A, as described, the plungers e'' e''' in the respective cylinders C C', the respective wedge-shaped openings 5 5 in said cylinders, and the respective adjustable gauge-cocks 7 7 in the exit-pipes e'' e''' , arranged to operate together upon the water of the tank D, substantially as and for the purpose hereinbefore set forth.

JOHN HOUP.T.

Witnesses:

SAMUEL MANN,
MADISON SHAFFER.