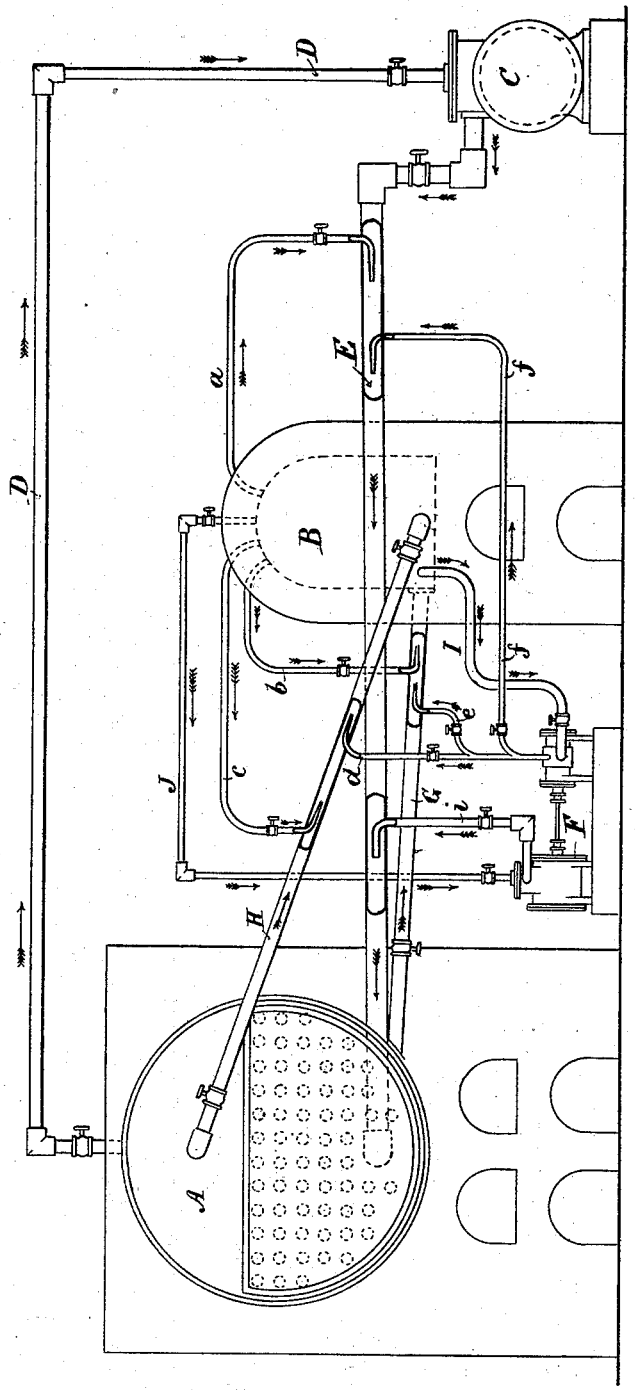
(No Model.)

H. T. LITCHFIELD & D. RENSHAW.

UTILIZING THE EXHAUST OF ENGINES.

No. 263,050. Patented Aug. 22, 1882.



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UTILIZING THE EXHAUST OF ENGINES.

SPECIFICATION forming part of Letters Patent No. 263,050, dated August 22, 1882.

Application filed December 23, 1881. (No model.)

To all whom it may concern:

Be it known that we, H. T. LITCHFIELD and D. RENSHAW, of Hull and Cohasset, in the counties of Plymouth and Norfolk, and State of Massachusetts, have invented certain new and useful Improvements in the Method of Utilizing the Exhaust of Engines; and we do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to a class of applications which have been recently filed in the United States Patent Office, and notably to those numbered respectively 41,679 and 44,987, in which exhaust is forced into a boiler by means of high-pressure steam and in the other instance into a tank. The water into which the exhaust is forced is in both cases of a temperature equal to the pressure of the working-steam, condensation taking place in neither case.

Our present invention is an improvement on the before-mentioned applications, and has for its object the economy of fuel and water, such result being produced by the utilization of the exhaust-steam of engines.

It consists in the method or process of uniting high-pressure steam-jets with pumped and highly-heated water-jets of still higher pressure for forcing the exhaust-steam of engines into the boiler from which it was taken; secondly, in the method of returning or forcing the surplus water and steam which accumulates in many such processes in the working-boiler into the boiler of higher pressure by the same means.

The water that is pumped for forcing the exhaust, in combination with the high-pressure steam, is taken from the same boiler that the steam is which runs the engine of the pump—viz., the boiler of higher pressure. The area of the steam-cylinder of pumps used for this purpose is much greater than the area of the pump-cylinder. Thus the power is much greater than the resistance, and consequently the velocity and momentum of the water, acting in combination with the high-pressure steam, is such that no difficulty is apprehended in driving the exhaust-steam along with it back to the boiler from which it emanated.

Referring to the accompanying drawings, which illustrate more particularly one way of carrying our invention into effect, A is the working or low-pressure boiler; B, the high-pressure boiler. C is the engine, and D the engine supply-pipe; E, the exhaust-steam pipe, and F the pump. G is the return or surplus-water pipe connecting the working-boiler with the high-pressure boiler, and H the pipe for the return of the surplus or accumulated steam from the steam-room of the low-pressure boiler to the water-room of the high-pressure boiler; I, the pump water-supply pipe from the high-pressure boiler, and J the steam-supply pipe to the working-cylinder of the pump. *a b c* are three steam-jets, and *d e f* are three water-jets. *i* is the exhaust-pipe of the steam-cylinder of the pump, said pipe entering and delivering into the main exhaust-pipe E. All the various pipes are of course provided with the proper valves. It is not necessary to designate them by letters.

It will be seen that steam and water jets enter each of the three main pipes as follows: *a* and *f* enter pipe E and force the exhaust of the engine into the working-boiler below the water-line. *b* and *e* enter the surplus-water pipe G, which leads from the low-pressure boiler to the high-pressure boiler, and *c* and *d* enter the return surplus-steam pipe H, which leads from the steam-space of the working-boiler to the water-space of the high-pressure boiler.

The operation is as follows: Steam being raised in the boiler A to the desired working-pressure and in boiler B to such higher pressure as may be desired, the valve on pipe *a* is opened and valve on pipe J and valve on pipe *f*, then valve on pipe D, starting the engine, when the exhaust is carried into the boiler A by the steam and water jets issuing from jet-pipes *a* and *f*, the accruing surplus steam and water in boiler A being returned to boiler B by means of the steam-jets issuing from jet-pipes *c* and *b* and high-pressure pumped water-jets issuing from jet-pipes *e* and *d*.

The pump, if preferred, may be submerged in the vessel from which the water is to be pumped, although it is obvious that should the

pump not be so submerged the force of the steam in the high-pressure vessel will be sufficient to amply supply it.

It is evident that the arrangement of the parts can be varied, as experience may suggest, without departing from the spirit of our invention. We do not therefore confine ourselves to the exact arrangement shown.

What we claim, and desire to secure by Letters Patent, is—

1. The process herein described of pumping surcharged water and uniting it with a jet of high-pressure steam in a pipe or conduit common to both, for forcing exhaust-steam back into the vessel or boiler from which it was taken, substantially as shown.

2. The process herein described of pumping surcharged water and uniting it with a jet of high-pressure steam in a pipe common to both, whereby the surplus water and surplus steam are forced from a boiler of lower pressure into a boiler of higher pressure, the water from the pump being first taken from the high-pressure vessel and forced back by a greater pressure, the motive power being derived from the same vessel, in the manner set forth.

3. In an apparatus for utilizing exhaust, the low-pressure boiler, the high-pressure boiler, the engine, the exhaust-pipe, and the pump, in combination with the combined pumped water and steam jets, by which said exhaust is forced back into the vessel from which it was taken, in the manner set forth and shown.

4. The combination, in an apparatus for utilizing exhaust of an engine, of the pipes E, G, and H, the jet-pipes *a b c* and *d e f*, all arranged for joint operation, for forcing exhaust-steam into a boiler and the accumulating surplus of steam and water in said boiler into a boiler of higher pressure, in the manner shown and described.

In testimony that we claim the foregoing as our own we affix our signatures in presence of two witnesses.

HARVEY T. LITCHFIELD.
DAVID RENSHAW.

Witnesses:
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