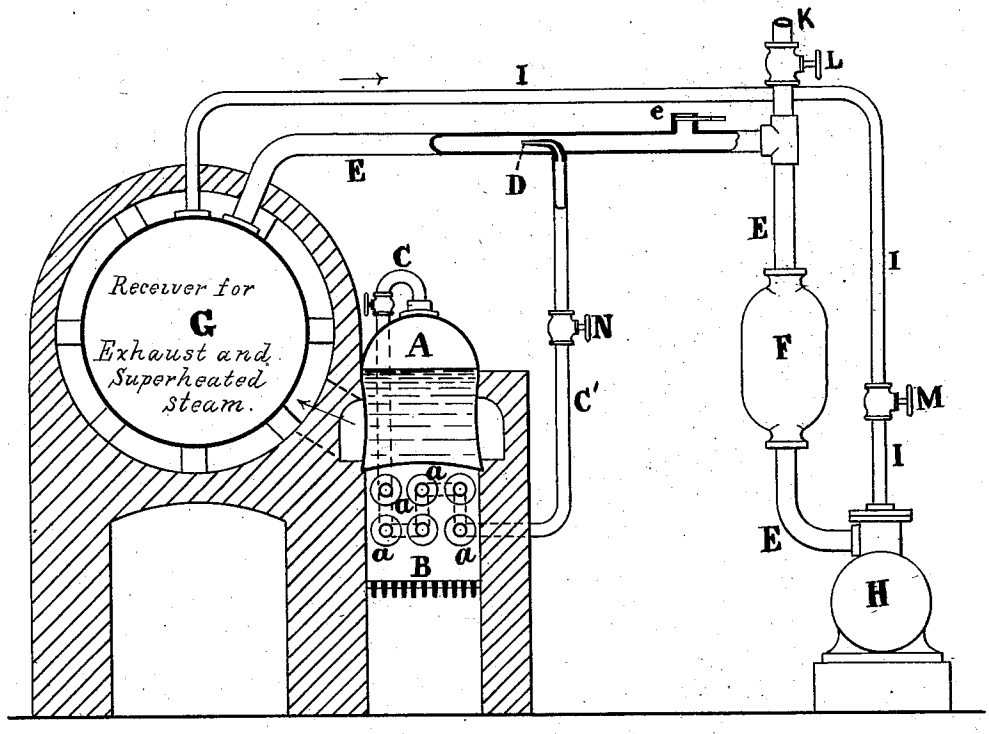
(No Model.)

H. T. LITCHFIELD & D. RENSHAW.

UTILIZING WASTE STEAM.

No. 258,933. Patented June 6, 1882.



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UNITED STATES PATENT OFFICE.

HARVEY T. LITCHFIELD, OF HULL, AND DAVID RENSHAW, OF COHASSET, MASSACHUSETTS.

UTILIZING WASTE STEAM.

SPECIFICATION forming part of Letters Patent No. 258,933, dated June 6, 1882.

Application filed July 16, 1881. (No model.)

To all whom it may concern:

Be it known that we, HARVEY T. LITCHFIELD, of Hull, in the county of Plymouth, and DAVID RENSHAW, of Cohasset, in the county of Norfolk, and State of Massachusetts, have invented a new and useful Improvement in the Process of Utilizing Waste Steam, &c., of which the following is a specification.

Our invention has for its object the utilization of the exhaust-steam of steam-engines, whereby the economy of water and fuel is produced.

The invention consists in the combination, with a steam-generator, superheater, and a reservoir, of certain other devices intermediate between the said vessels and the working engine, in such manner as to give a greater area to the exhaust as it leaves the end of the cylinder, by which the whole of the exhaust-blast is taken off from and relieves the cylinder at once of any back-pressure. To do this we locate on the exhaust-pipe a chamber of sufficient capacity and area to relieve the exhaust-blast of the cylinder, from which it is constantly carried off before the succeeding blast enters.

It further consists in the combination and arrangement of the boiler, superheater, and reservoir of the chamber F, horizontal pipe E, provided with air-valve *e*, the air and mixed-steam pipe I, and the jet-pipe C′, having jet D, with the cylinder of the engine, whereby the live steam, exhaust-steam, and air form one mixture, and are conveyed to the engine in an aeriform state to be worked continuously, as will hereinafter more fully appear.

We are aware that attempts have made in the direction of our invention—that is, before the exhaust-steam is forced into the revivifying chamber or reservoir, it has been partially condensed. Our method is diametrically in opposition to this practice, because we propose not only to save all the heat that is in the exhaust-steam, but add to it before it enters the mixing-chamber.

In the accompanying drawing, A denotes the boiler; B, the furnace; C, the steam-conveying pipe to the superheater; D, the superheated-steam-jet nozzle; C′, the superheated-steam pipe, provided with valve N; E, the exhaust-steam and air pipe, and F the exhaust-chamber on the branch exhaust-steam pipe E E′. G is the reservoir in which the mixture is formed. Surrounding this reservoir G is a flue leading from the furnace. Projecting from the sides of the flue are bearers abutting against the outer shell of the reservoir. The heat that would be otherwise wasted is utilized in keeping up and retaining the heat in the reservoir, and in this way radiation is wholly prevented. H is the cylinder of the engine, and I the steam-supply pipe. Should a portion of the exhaust-steam be required for heating buildings or for other purposes, it may be conveyed through pipe K. M is the throttle-valve to the engine; *e*, the air-inlet valve located on the exhaust-pipe E, behind the superheated-steam nozzle D; and *a a a a*, the superheater.

Operation: Steam is generated in the boiler A, then conveyed to the superheater *a a*, and thence to the pipe E through the pipe C′. The air-valve *e*, which is located behind the junction of pipe E and D, is then opened, and also steam-valve N. The steam from nozzle D draws air from the air-valve *e*, and the mixture of steam and air is then forced into the reservoir G until the working-pressure is reached. The air-valve is then closed, and the throttle-valve M opened, and the engine started. At the end of the first stroke the mixture of air and steam is exhausted into chamber F and instantly forced to the reservoir, the mixture now being combined air, exhaust and superheated steam, the temperature and pressure of the mixture being maintained by the superheated-steam jet and the waste products of combustion from the boiler-furnace under the reservoir. This operation is constantly going on while the engine is in motion. It must not be understood that to produce this result we must have a large steam-generator or furnace. On the contrary, utilizing the same steam and heat repeatedly, little additional heat is required other than to provide for the radiation and to revivify the mixture.

It is evident that many devices may be made for carrying this invention into effect. We do not therefore desire to be confined to the exact arrangement shown.

Having described our invention and the

method of carrying the same into effect, what we claim as new, and desire to secure by Letters Patent, is—

1. The process herein described of utilizing exhaust-steam by means of a boiler, superheater, and a receiver or reservoir and suitable connections, which consists in first generating steam, then superheating it and using it to draw in air, then heating the mixture to working-pressure and utilizing it as motive power, then forcing the exhaust of said mixture into the receiver and revivifying it, whereby it can be repeatedly used, in the manner set forth.

2. The combination, in an apparatus for utilizing the exhaust of an engine, of the generator, superheater, and reservoir, the exhaust-chamber F and its branch pipes, air-valve *e*, and the superheated-steam nozzle D, all arranged to operate together, for the purpose described.

3. The combination, in an apparatus for generating motive power and the utilization of the same, of the generator, superheater, and reservoir, pipe I, exhaust-chamber F and its branches E, air-valve *e*, and superheated-steam pipe C′ D, constructed and arranged in the manner shown and described.

4. In an apparatus for generating motive power, the boiler A, superheater *a a*, and the reservoir G, arranged concentrically within a flue, by which the waste products of combustion from the furnace are utilized in maintaining the temperature of its contents, and also the means for connecting one with the other, in the manner shown and described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

HARVEY T. LITCHFIELD.
DAVID RENSHAW.

Witnesses:
JOS. H. ADAMS,
B. O'HARA.