(No Model.)

H. T. LITCHFIELD & D. RENSHAW.

UTILIZING EXHAUST STEAM.

No. 264,466. Patented Sept. 19, 1882.

Fig. 1.

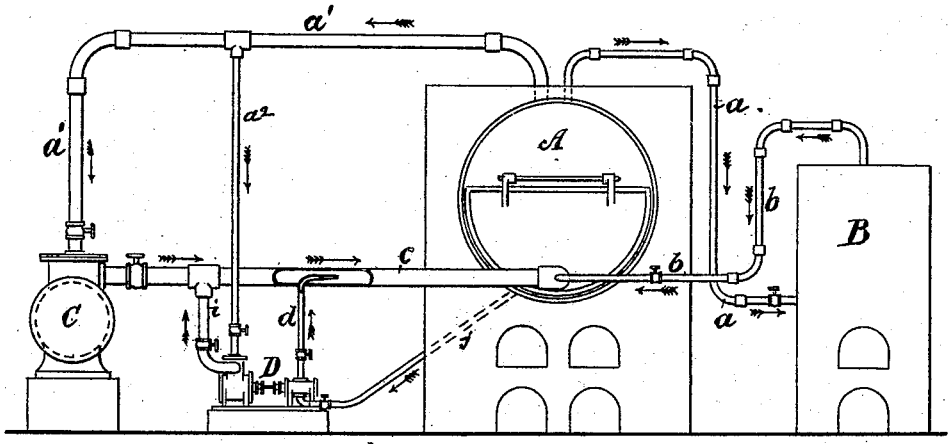
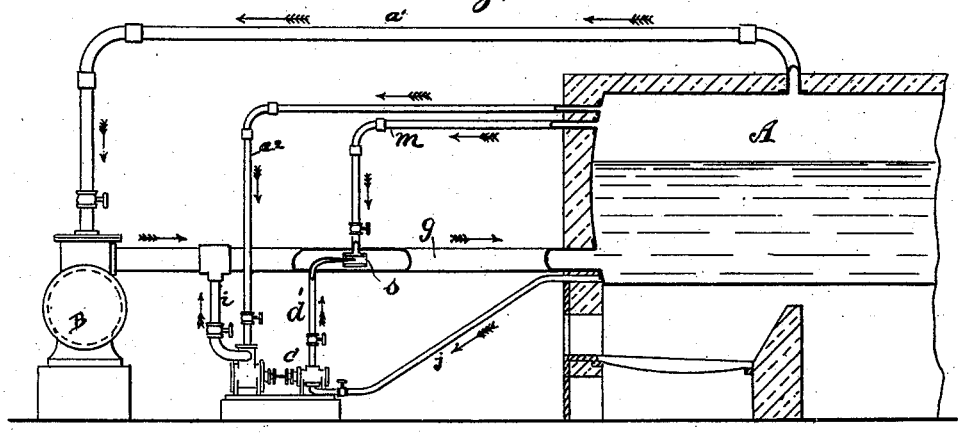


Fig. 2.



Witnesses
B. F. Gaston
Augustus Meyers

Inventors
Harvey T. Litchfield
David Renshaw

UNITED STATES PATENT OFFICE.

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

UTILIZING EXHAUST-STEAM.

SPECIFICATION forming part of Letters Patent No. 264,466, dated September 19, 1882.

Application filed January 7, 1882. (No model.)

To all whom it may concern:

Be it known that we, HARVEY T. LITCHFIELD, of Hull, in the county of Plymouth and State of Massachusetts, and DAVID RENSHAW, of Cohasset, in the county of Norfolk and State of Massachusetts, have invented certain new and useful Improvements in Utilizing Exhaust-Steam; 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 appertains 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 general system adapted by us for "utilizing the exhaust of engines," and for which applications have been filed in the United States Patent Office. The present invention, however, more particularly relates to applications numbered, respectively, 39,277 and 39,590 of serial numbers of applications filed. All these applications bear a close resemblance at first sight; but upon a closer and more studied examination it will be perceived that a different method is involved in each individual case, although the same general principle underlies the whole system. We will not, therefore, enter very largely upon the general subject, as it has been treated in our former applications, but will confine ourselves to the present construction and arrangement and mode of operation.

The object of our invention is therefore to simplify the apparatus, lessen the possibility of leakage, and utilize the principle more fully by bringing under control the various elements of its construction.

To this end, therefore, it consists in the process herein described of forcing the exhaust of an engine into the boiler from which it was taken in a live state by means of a hot-water jet pump or pumps, and a jet of the live steam from said boiler, without the interposition of intermediate mechanism less the conduit-connections.

It consists, secondly, in the adaptation of the same instrumentalities, only, should it be preferred, we add a superheater whose plane will be lower than the entrance of the exhaust-pipe to the boiler, for the reason that the superheated steam has a continuous rising path, which in a measure utilizes the difference of specific gravity between the live and superheated steam. The apparatus will, however, accomplish its purpose without said superheater.

It further consists, by the means alluded to, in establishing a circulation under pressure from the upper portion or steam-space of a working boiler to the lower portion or water-body of said boiler, as will be hereinafter described, so as to overcome the thermal pressure of such boiler and utilize the force of the dry-steam jet from the boiler, either superheated or not, in connection with the hot-water jet of the pump or pumps. Two of the methods—one a modified one—to which our invention is adapted are illustrated on the sheet of drawings hereunto appended, whereon—

Figure 1 is a front elevation of our improved apparatus. Fig. 2 is a side elevation of the boiler, and a portion of the pipes being in longitudinal section.

In Fig. 1, A represents an ordinary boiler, B the superheater, and C the engine; D, the pumps, which may be either single or double, according to requirements. *a a* is the pipe which conveys steam from the boiler to the lower portion of the superheater, and *b b* the pipe that conducts the superheated steam to the exhaust-pipe *c*, and, in conjunction with the hot-water jet-pipe *d* from the pump, the exhaust is readily forced into the boiler against its own pressure. The velocity of the superheated steam, the non-elastic nature of water, and the affinity the steam has for the water, all combine to produce this result. Steam from the boiler itself and the force of the hot-water jet from the pump would produce the same result, as will be hereinafter described. *a' a'* is the steam-supply pipe to engine, and a^2 supply to working pump-cylinder. *i* is the pump-cylinder exhaust, and *j* the conduit leading from water-space of the boiler to the pump proper.

Having special reference to Fig. 2, A is the boiler, B the engine, and C the pump. The

superheater in this instance is dispensed with, as before stated, and, instead of taking a jet of dry steam from a superheater, we take it from the steam-space of the boiler through pipe *m*.

The operation of our method, as shown by Fig. 2, is as follows: Steam being supplied through pipe *a'* to the engine, it exhausts through pipe *g*. Within this pipe *g* we preferably locate an injecting-nozzle, *s*, supplied with steam direct from the boiler, with its open end toward the boiler. Into and through the back of this nozzle we introduce the hot-water nozzle or jet-pipe *d'*. The engine and pump being started simultaneously with the live-steam jet from the boiler, and all the currents being in the same direction, as shown by the arrow, toward the boiler, the combined body is forced into the water-body of the boiler. The force of the live-steam jet and the forced solid jet of water from the pump readily overcome the pressure in the boiler, and thus an active and positive circulation of the water is maintained and the exhaust fully utilized, and consequently great economy of fuel and water is the result. The operation of the pump is the same as that shown in Fig. 1.

It will be evident that the pipes may be placed in different positions without in any manner modifying our invention. Therefore we do not desire to be limited to the exact arrangement shown.

Having now described fully the nature and objects of our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. The process herein described for utilizing the exhaust of engines, consisting essentially of a forced hot-water jet united with dry or superheated steam, said steam and water being taken from one common source, and with the said exhaust forced into the water-body of the same boiler from which they were taken, substantially in the manner set forth and described.

2. The method herein described of utilizing the exhaust of engines, consisting of the live-steam pipe, the forced hot-water jet-pipe, the exhaust-pipe, the pipes *m* and *d'*, uniting and terminating in a nozzle common to both, for forcing the united currents into the boiler from which they were taken, in the manner set forth.

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:
WILLIAM BRECK,
S. D. WILLIAMS.