

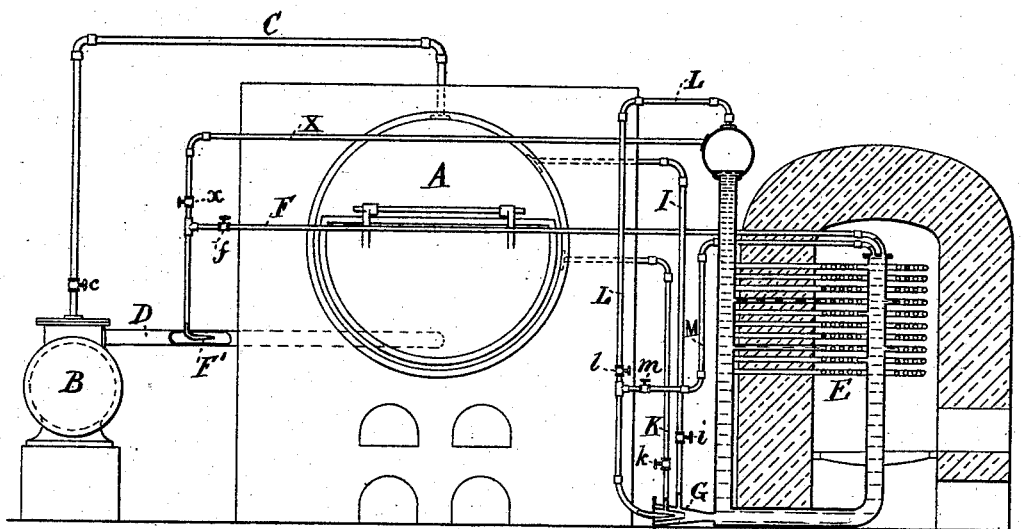
(No Model.)

H. T. LITCHFIELD & D. RENSHAW.

UTILIZING EXHAUST STEAM.

No. 262,958.

Patented Aug. 22, 1882.



Witnesses

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# UNITED STATES PATENT OFFICE.

HARVEY T. LITCHFIELD, OF HULL, AND DAVID RENSHAW, OF COHASSET,  
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## UTILIZING EXHAUST-STEAM.

SPECIFICATION forming part of Letters Patent No. 262,958, dated August 22, 1882.

Application filed September 22, 1881. (No model.)

*To all whom it may concern:*

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

Our invention has for its object an improved process for the utilization of exhaust-steam; and the invention consists in the employment of water-jets, or of water and steam jets of extraordinary velocities, obtained by means of a supplemental boiler which is so constructed as to bear the necessary working-pressures for the obtaining of such jets in communication with a boiler of lower pressure, into which the exhaust of the engine is forced by means of said mixed steam and water jets, and the surplus steam from the low-pressure boiler is constantly forced into the high-pressure boiler also by means of the mixed water and steam jets.

The reason for using water and steam mixed is that under a very high pressure the body of water has a greater momentum than the steam, and in proportion to its velocity so is the momentum. Then, having this velocity and momentum, we force the steam from the low-pressure boiler into the high-pressure boiler without a pump.

Referring to the accompanying drawing, A represents an ordinary mill-boiler, communicating with the engine B by the steam-pipe C and exhaust-pipe D.

E is a supplemental boiler, which is connected with the boiler A by means of pipe F, the jet-pipe F', and exhaust-pipe D.

G is an injector, which forms a connection between the boiler E and the boiler A by means of pipes I and K.

L is a pipe provided with a valve, *l*, leading from the steam-room of boiler E to injector G.

M is a pipe leading from boiler E, below the water-line, to pipe L, and is provided with a valve, *m*.

X is a pipe leading from the steam-room of boiler E to pipe F, and provided with a valve, *e*.

The operation is as follows: Steam being raised in boiler A to the desired working-press-

ure and in boiler E to such pressure as may be necessary for the effective working of the jets, valve *f* on the pipe F is then opened, and, if desired, valve *x* on pipe X and valve *c* on pipe C, starting the engine, the jet issuing from jet-pipe F' being relied upon to carry the exhaust back into boiler A. By this means it will be seen that the water-body in boiler A is increasing and that in boiler E decreasing. Consequently valve *m* in pipe M and valve *k* on pipe K are opened, thus returning water from boiler A to boiler E through injector G by means of a high-pressure water-jet. Valve *i* on pipe I may also be opened, carrying any surplus steam in boiler A through injector G into boiler E by means of said high-pressure water-jet, or, instead of valve *m* on pipe M being opened, valve *l* on pipe L may be opened, thus carrying the surplus steam and water accumulating in boiler A through injector G into boiler E by means of such high-pressure steam-jet. This steam or water jet, used for purposes of equalization between boilers A and E, may draw from boiler A, singly, either steam or water, or both, as may be found necessary, and it may be so drawn by the action of a water-jet from boiler E, or steam-jet from said boiler, or jets of steam and water from such boiler, as may be deemed most desirable. For the purpose of returning the accumulated steam and water from the boiler A to boiler E, the steam-jet issuing from boiler E through jet-pipe L is more particularly depended upon, as well as its attained velocity, as in the case of ordinary injectors. Furthermore, the steam necessary for such jets may be highly superheated before its delivery to the injector G, thus increasing its effect.

In the use of the ordinary injector water is raised from a tank for some distance—say ten feet—by the force of the steam from the boiler, condensation and a vacuum being caused by the steam coming in contact with cold water. In our process steam is taken from the steam-room of the high-pressure boiler and carried to the lower part of the water-body of the same boiler, thereby creating a circulation of great velocity. Water is then taken from the upper portion of the same boiler and carried down to the lower portion of the water-body, with the steam, thus causing a still greater

velocity. The water is then let in from the working-boiler, being aided by the pressure of the same, then taking the steam from the same boiler, which intermingles with the water and enters into the high-pressure boiler without the necessity of a vacuum, the working-pressure on the boiler A being greater and more positive than that caused by a vacuum created by a steam-jet in forcing cold water, the working boiler, it being understood, having a pressure of twenty-five to one hundred pounds, which is greater than any vacuum that can be created by cold water.

The power to create a forcing jet at G is due to the great velocity established by the circulation of steam and water issuing from the upper part of boiler E, in addition to gravity of the water, and when this circulation is once established it will be continuous, and is then assisted by the steam coming from boiler A, which latter has a pressure due to the

working power of the engine, thus insuring positive action.

What we claim as our invention is—

The process herein described of first generating steam in a high-pressure boiler, then forcing the exhaust into a low-pressure boiler by means of a mixed water and steam jet taken from a high-pressure boiler, then forcing the surplus water and steam from the low-pressure boiler into the high-pressure boiler by means of a mixed water and steam jet from the high-pressure boiler in the manner 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,  
E. PLANTA.