S. A. GOODWIN.

Feed-Water Heater

No. 210,934. Patented Dec. 17, 1878.

Fig 5

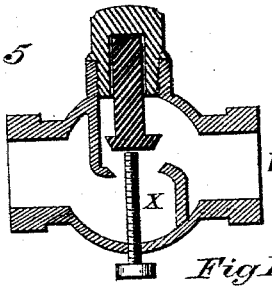


Fig 1

Fig 3

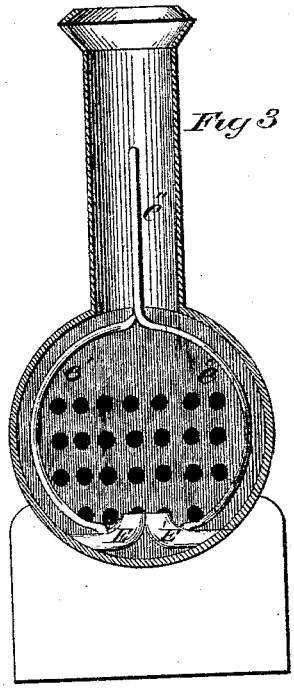


Fig 2

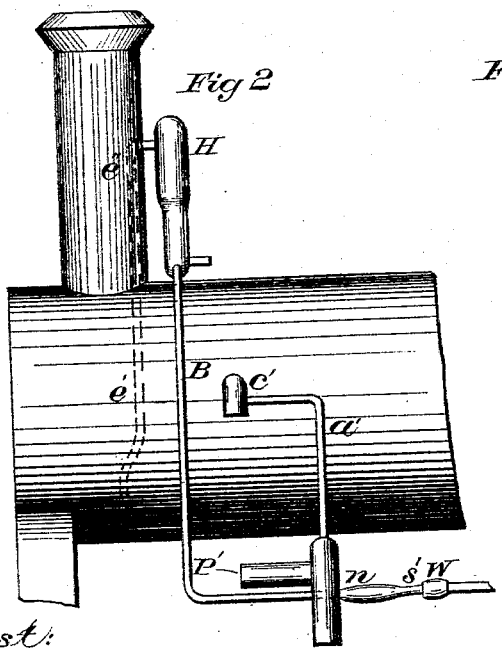
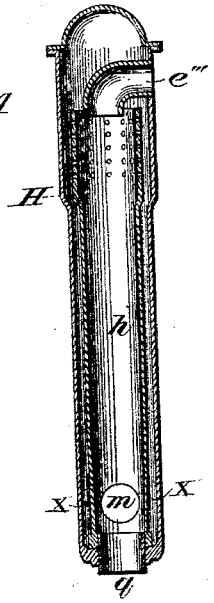


Fig 4



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UNITED STATES PATENT OFFICE.

SIMEON A. GOODWIN, OF DAYTON, OHIO, ASSIGNOR OF ONE-HALF HIS RIGHT TO JACOB O. JOYCE, OF SAME PLACE.

IMPROVEMENT IN FEED-WATER HEATERS.

Specification forming part of Letters Patent No. **210,934**, dated December 17, 1878; application filed May 24, 1878.

To all whom it may concern:

Be it known that I, S. A. GOODWIN, of the city of Dayton, Montgomery county, Ohio, have invented an Improvement in Feed-Water Heaters for Locomotives, of which the following is a specification:

The object of this invention is to provide a convenient and efficient means of heating feed-water for locomotive-engines by a portion of the exhaust-steam, and to accomplish this by simple, inexpensive, and durable appliances, that shall not be unsightly objects in the locomotive or in the way, and that will require but little attention from the engineer.

There is a small elevated heating-chamber, of novel construction, situated in rear of the smoke-stack, and connected by pipes of proper size with the two pumps of the locomotive and with the exhaust-pipes, in such a manner that one pump is employed to pump the water from the tank of the tender into the head of the heater, where it comes into contact with and is heated by a portion of the spent steam of the engines, while the other pump is used to force the water so heated into the boiler; and there is such a combination and arrangement of parts that at the pleasure of the engineer all the water may be shut off from the heater, and both pumps be used to force cold water direct from the tank to the boiler, or only one, and either may be so used; or a portion only of the water from one pump may be delivered to the heater, and the rest to the boiler.

Referring to the accompanying drawings, in which similar letters of reference indicate like parts in all the figures, Figure 1 is an elevation of a section of a locomotive-boiler, exhibiting the heater in rear of the stack or chimney and its connection with the pump of the right-hand engine. Fig. 2 is a similar view of the heater and its connection with the pump of the engine on the left-hand side. Fig. 3 is a front view, representing the pipes connecting the exhaust-pipe of each engine with the head of the heater. Fig. 4 is an enlarged vertical section of the heater, omitting some appliances for the more effectual mixing of the steam and water, which will be described and claimed in another application. Fig. 5 is a vertical section of the check-valve in the supply-pipe of the left-hand pump.

The heater H consists of a long narrow tubular heating-chamber, *h*, within a case of similar form, the two forming an annular passage for the cold water, which enters at *m* from pipe A. The tube *h* has converging sides, as shown in Fig. 4, and is perforated with small holes near its upper end. It connects with pipe B at *q*, and the exhaust-steam enters it through the elbow. (Shown in drawing at *e'''*.) This heater is attached to the chimney by suitable brackets.

Referring to Fig. 1, S represents the ordinary supply-pipe on the right-hand side of the locomotive, leading from the tank of the tender to the pump. P is the pump; *a*, the force-pipe, and *c* its check-valve, through which the water, in the present practice, is delivered to the boiler. A is a pipe which I add to the present system, connecting the force-pipe *a* with the heater, for the purpose of delivering the water into the heater, instead of to the boiler, as heretofore. *v* is a valve in this pipe, to entirely or partially close the passage to the heater when desired.

In Fig. 2, the present supply-pipe, pump, force-pipe, and check-valve on the left-hand side of the locomotive are represented by the same letters as the corresponding parts on the right-hand side. In Fig. 1, I have added the pipe B, to conduct the heated water from the heater to the suction side of that pump, where it connects with the supply-pipe S′ at *n*.

Both figures show the exhaust-pipes by dotted lines.

Fig. 3 exhibits the exhaust-pipes E E′ of the two engines, and the manner in which I prefer to connect them with the heater by means of the pipes *e e′*, uniting in the pipe *e″*, which enters the heater at *t*.

There is a check-valve, W, in the supply-pipe S′ on the right-hand side, which opens toward the tender. The office of this valve will be hereinafter explained. It is shown in section in Fig. 5. This is an ordinary horizontal check-valve, with this difference: it has a boss cast on its under side, through which passes a screw-threaded spindle, *x*, the object of which is to raise and hold the valve off its seat when-

ever it becomes necessary to eliminate said valve from the system.

Operation: The pump on the right-hand side of the locomotive takes the water in the usual manner; but instead of delivering it into the boiler, it passes by the new pipe A into the heater, and up the annular space around the tube *h* to near its upper end, where it is sprayed through numerous small holes into said tube, where it comes into contact and is mixed with a portion of the exhaust-steam entering said tube, as before described.

As the steam and water come together, the former is suddenly condensed, forming a partial vacuum, into which fresh steam rushes with great velocity, thereby insuring a thorough mixture, and a rapid and efficient heating of the feed-water in a very small space.

Experiment has demonstrated that condensation takes place much more rapidly in a chamber devoid of atmospheric air.

In this form of construction, whatever air comes in with the water is driven by the steam into the water descending the tube, and is carried along with it, and finally forced by the pump with the water into the boiler.

The heated water falls through the heater into pipe B, and is conducted to the supply S′ at *n*, on the suction side of the left-hand pump, when it is taken up by that pump and delivered into the boiler through pipe *a′*, in the usual way.

There is a check-valve at some point (as at W) in the supply-pipe S′ of the left-hand pump, as heretofore described, and the usual lazy-cock on that side and the tank-valve are left open. Now, when the pumps are working properly this check-valve remains closed; but should the left-hand pump become disabled or fail to force into the boiler the water as fast as the other pump raises it into the heater, it will not overflow the same and endanger the engine when drawing up to stations or running without steam; but the superior head of water in pipe B or in the heater will cause it to lift the said check-valve and flow back to the tank of the tender.

When for any reason it is desired to use the water directly from the said tank through the pump on that side, the check-valve is raised and held from its seat by means of the screw-threaded spindle heretofore described.

The quantity of water required for the boiler is regulated by the lazy-cock on the right-hand side, as at present, and the left-hand pump takes up the same water after it is heated and delivers it into the boiler.

Should the right-hand pump become disabled or fail to furnish sufficient water, the check-valve W may be held up, as heretofore described, and the left-hand pump be brought into requisition.

Should the left-hand pump become disabled, the right-hand can be made to force the water direct to the boiler, as in the old practice, by simply closing the valve *v* in pipe A.

The heater may be situated inside the chimney, or to the right or left of it, or in any other convenient place on the locomotive; but I prefer the rear of the chimney, as shown.

The check-valve W may be dispensed with, in which case the lazy-cock or the tank-valve on that side must, of course, be closed; but it is much better to use such a valve to prevent accident by water flowing into the cylinder to break it.

It is obvious that this combination and arrangement of the pumps with the heater is quite independent of the size, form, or position of the latter. I have demonstrated by experiment that the heating-chamber need not be larger than three and one-half inches in diameter and twenty-four inches in height.

I claim as my invention—

1. The combination of the two pumps of a locomotive—one to deliver the water to an elevated heater, and the other to force the heated water into the boiler by means of the pipe-connections A and B, substantially as described.

2. The combination of the heater H with the two pumps and with the exhaust-pipe of one or both of the engines of a locomotive, substantially as described.

3. In the feed-water heater herein described, the check-valve W in the supply-pipe S′, when arranged as and for the purpose specified.

4. The combination of the valve *v* in pipe A with the feed-water heater H herein described, constructed and arranged as and for the purpose specified.

5. The feed-water heater H, consisting of the narrow tube *h* within a surrounding case, substantially as described.

S. A. GOODWIN.

Witnesses:
R. M. MARSHALL,
E. A. BARBER.