S. A. GOODWIN & J. O. JOYCE.

Feed-Water Heater.

No. 213,892. Patented April 1, 1879.

Fig. 1.

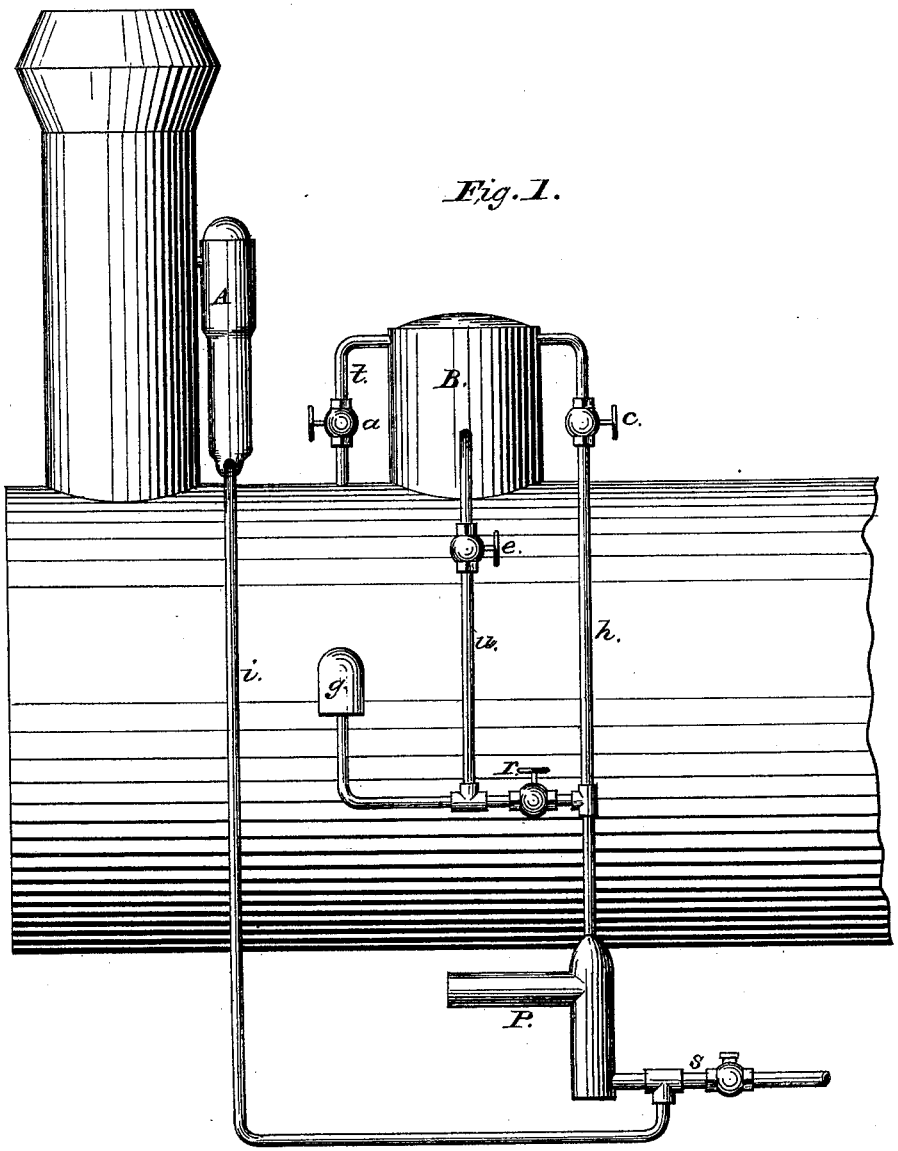
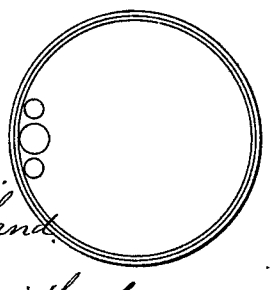
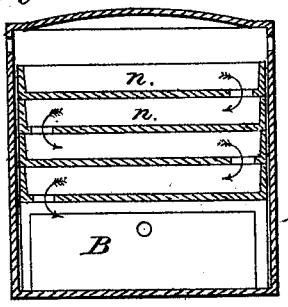


Fig. 2.





Witnesses:

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UNITED STATES PATENT OFFICE.

SIMEON A. GOODWIN AND JACOB O. JOYCE, OF DAYTON, OHIO.

IMPROVEMENT IN FEED-WATER HEATERS.

Specification forming part of Letters Patent No. **213,892**, dated April 1, 1879; application filed June 26, 1878.

To all whom it may concern:

Be it known that we, S. A. GOODWIN and J. O. JOYCE, both of the city of Dayton, Montgomery county, Ohio, have invented a new and useful Improvement in Feed-Water Heaters and Purifiers for Steam-Engines, which improvement is fully set forth in the annexed specification.

This invention relates to a system or method of heating and purifying feed-water for steam-engines in which the water is first heated in contact with a portion of the exhaust-steam of the engine and afterward reheated to near the boiler temperature before it enters the boiler for the purpose of separating the lime and other impurities held in solution.

In the accompanying drawings, which represent our invention applied to a locomotive, Figure 1 is an elevation of the front end of a locomotive-boiler with its chimney, exhibiting the purifier on top of the boiler and its pipe-connections with the primary heater, pump, and boiler. Fig. 2 is a vertical section of the purifier.

A is the primary heater; B, the purifier; *i*, a pipe leading from the primary heater to the suction side of the feed-pump; P, the ordinary feed-pump; *h*, a pipe leading from the pump to the purifier; *u*, a pipe to conduct the purified water from the purifier to the boiler through the usual check-valve at *g*; *t*, a pipe to conduct live steam from the boiler to the purifier. *c*, *r*, *e*, and *a* are valves or cocks, whose offices will be explained hereinafter.

The purifier consists of a strong case with a removable cover, having a series of shallow pans or shelves, *n n*, placed close together—about one inch apart—over which the water to be treated flows in a zigzag course, as indicated by the arrows. There is a settling-chamber at the bottom for the subsidence of such heavy impurities as are not deposited on the shelves.

The primary heater represented consists of a narrow tube standing in rear of the chimney, into which the feed-water is delivered by the pump on the other side of the boiler, where it comes into contact with, and is heated by, a portion of the exhaust-steam conducted to the head of said heater by means of suitable pipes connecting with the exhaust-pipes of the engines; but as the construction of this heater constitutes no part of the present invention it need not be further described.

Operation: The feed-water, being first heated to near the boiling-point in the primary heater A, falls through pipe *i* into the supply-pipe *s*, from which it is taken up by the pump and forced through the pipe *h* into the purifier. It then passes in a thin sheet over the shelves *n n*, as indicated by the arrows in Fig. 2, being at the same time reheated to a temperature nearly corresponding to that of the steam in the boiler by means of live steam entering the purifier by pipe *t* from the steam-space. This high temperature precipitates the lime and other salts held by the water in solution, and they adhere to the shelves. From the purifier the water falls through pipe *u* into the boiler through the usual check-valve at *g* by the force of gravity, the pressures in the purifier and boiler being kept equal by means of the open pipe *t* between them.

If at any time, or for any reason, it is desired to isolate the purifier from this system of feeding the boiler it is done by simply closing the valves *c*, *e*, and *a* and opening *r*. When the purifier is in use *r* is closed, and all the other valves are open.

The object of first heating the water in contact with a portion of the exhaust-steam is to utilize the heat that would otherwise be wasted. The object of reheating it is to more effectually separate the salts.

The object of locating the purifier above the water-level in the boiler is to prevent the shelves from becoming submerged with water—a condition supposed to be unfavorable to the deposition of the salts upon them.

The shelves are placed close together, in order to get a large surface in a small space—an important feature on a locomotive.

We are aware that there is nothing new in the construction of this purifier itself, consisting in a case containing a series of depositing-shelves, and we do not claim this; nor do we limit ourselves to the use of shelves in a purifier in this combination, for it is obvious that broken stone or spalls or other depositing surfaces or filters, or both, may be used without departing from the principle of our invention, which mainly consists in the combination

and arrangement of the primary heater with the purifier.

We claim as our invention—

1. The combination, in a feed-water heating and purifying apparatus, of a primary heater, in which the water is first heated by contact with a portion of the exhaust-steam, with a purifying-chamber, in which the same water is reheated by live steam before it enters the boiler, arranged substantially as and for the purpose specified.

2. The combination, in a feed-water heating and purifying apparatus, of the three elements, namely: an exhaust-steam feed-water heater, a purifying-chamber between said heater and the boiler, and a series of depositing-shelves within said chamber, arranged substantially as and for the purpose specified.

3. The combination and arrangement, on a locomotive, of the primary heater A with the pump P and purifying-chamber B, when connected by a pipe, *i*, leading from the primary heater to the suction side of one of the pumps of the locomotive, and by another pipe, *h*, leading from said pump to the purifier, substantially as and for the purpose specified.

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Witnesses:
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