J. L. BOGERT.
Feed-Water Heater.

No. 197,989 Patented Dec. 11, 1877

FIG. 1.

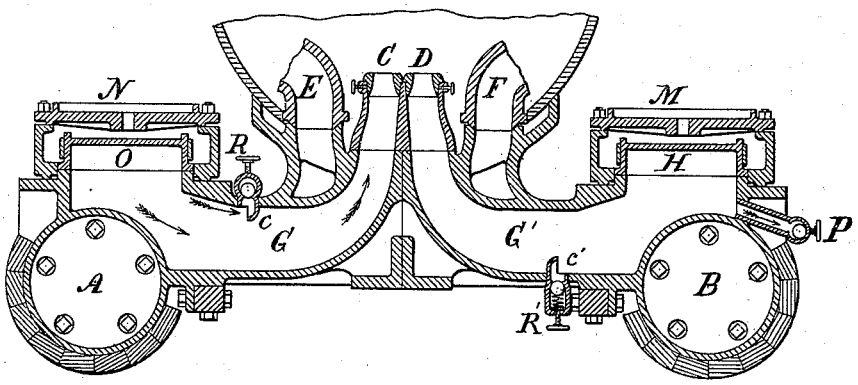


FIG. 2.

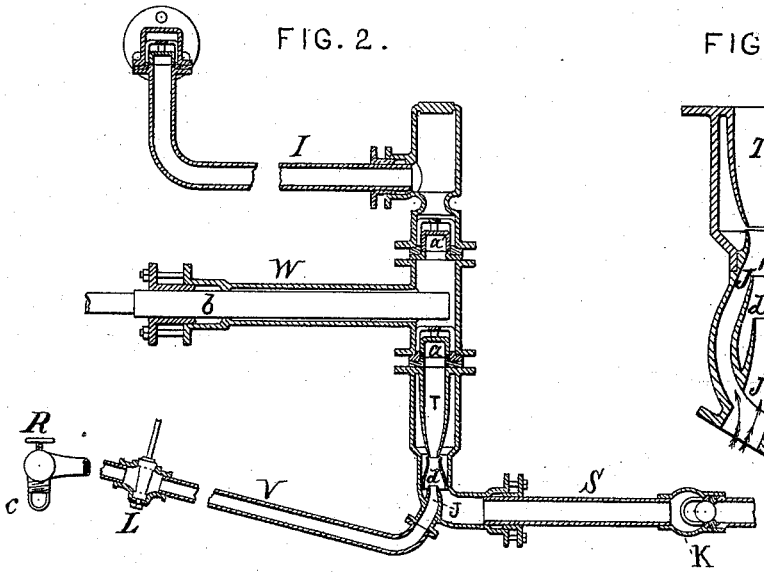
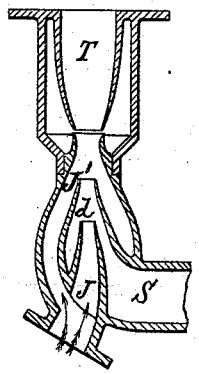


FIG. 3.



WITNESSES:

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JOHN LAWRENCE BOGERT, OF FLUSHING, NEW YORK.

IMPROVEMENT IN FEED-WATER HEATERS.

Specification forming part of Letters Patent No. **197,989**, dated December 11, 1877; application filed July 25, 1877.

To all whom it may concern:

Be it known that I, JOHN LAWRENCE BOGERT, of Flushing, in the county of Queens and State of New York, have made an invention of certain new and useful Improvements in Apparatus for Heating the Feed-Water of Steam-Boilers; and that the following is a full, clear, and exact description and specification of the same.

The principal object of this invention is to heat the feed-water of the boilers of steam-engines previous to its introduction into the boiler, and to aid the feed-pump by means of a portion of the exhaust steam escaping from the steam-cylinder.

To this end my invention consists of certain combinations of the exhaust-passage of the steam-cylinder, the feed-pump, the connections or pipes thereof, and an injector nozzle or nozzles, whereby the exhaust steam is injected into the feed-water in its passage to the feed-pump, so that the injector may aid the feed-pump, and the feed-water may be heated on its way to the boiler from the reservoir or tank, leaving the temperature of the water in reservoir or tank unaffected.

These improvements are more particularly advantageous for locomotive-engines, as there is generally much more force in the escape-steam than is required to generate the steam-blast in the smoke-box, so that a considerable portion of the exhaust steam may, by my invention, be utilized to heat the feed-water, as well as to aid the pump in urging it onward; and because, further, my invention does not affect the temperature of the feed-water in the tank, so that it may be always in a suitably-cold condition to be fed with certainty by means of the common injector, with which locomotives are now generally fitted for the purpose of supplying the boiler when the feed-pumps cannot be used on account of the stoppage of the engine.

In order that the invention may be fully understood, I have represented in the accompanying drawings, and will proceed to describe, the best mode which I have thus far devised of embodying the invention in a practical form for locomotive-engines, it being understood that the apparatus may be greatly varied without ceasing to embody the invention.

Figure 1 of the said drawings represents a vertical transverse section of the steam-cylinders and connections of a locomotive-engine with my improvements applied thereto. Fig. 2 represents a sectional view of the feed-pump and its connections. Fig. 3 represents a view, upon a larger scale, of a modification of a portion of the apparatus.

The steam-cylinders A B of this locomotive are the same in all respects as those in common use. They are fitted with steam slide-valves O H, of any approved construction, and the exhaust-port of each valve-seat is connected with the customary exhaust-passage G G′, leading to the blast-nozzles C D, through which the exhaust steam is discharged in an upward direction into the smoke-box of the boiler. The feed-pump W, including its plunger or piston, and its valves *a a′*, may also be of any approved construction, and there may be, as is customary, one feed-pump for each steam-cylinder. As, however, these two pumps and their connections may be duplicates of each other, it is not deemed necessary to represent more than one of them in the drawings; nor is it deemed necessary to represent and describe the connection between the pump-plunger *b* and the piston of the steam-cylinder, as the connection may be of any approved construction.

The feed-pump W is provided with a suction-pipe, S, connecting with the water-tank, and also with an air-vessel and pipe, I, connecting with the steam-boiler in the usual manner, (which being well known need not be described,) so that feed-water taken into the pump from the tank is forced into the steam-boiler.

In order that my invention may be embodied in the locomotive, the suction-pipe S of the feed-pump W is fitted with an injector-nozzle, J, and this nozzle is connected, by means of a pipe, V, with the exhaust-passage G of the steam-cylinder A, so that whenever steam is exhausted from the steam-cylinder, a portion of it may be injected, in the condition of a jet, into the feed-water passing through

the feed-pump connections, so that the feed-pump and the steam passing through the injector-nozzle may operate simultaneously upon the water to urge it onward to the steam-boiler.

In order that the steam injected through the nozzle J into the pump-pipe may act to the best advantage, the pump-pipe is fitted with a conical condensing-tube, *d*, into which the exhaust steam is discharged, and in which that exhaust steam combines with the feed-water, and urges it forward in the condition of a jet. The pump-pipe is also fitted with a conical or Venturé tube, T, to receive the jet of water urged toward the pump by the injected exhaust steam.

In order that the exhaust steam may be conducted to the injector-nozzle with the least loss of pressure and velocity, the receiving end of the injector-pipe V is fitted with an abstracting-mouth, *c*, which is so arranged as to face the direction in which the steam exhausts; hence, this abstracting-mouth receives the full force of the exhaust, and directs it into the injector-pipe. A check-valve is combined with the injector-pipe V, to maintain, as far as possible, a constant tension in that pipe when the force of the exhaust runs down toward the end of the stroke of the piston; and I prefer to arrange this valve R close to the abstracting-mouth *c*. It is expedient, also, to fit the suction-pipe S of the pump with a check-valve, K, at some point between the injector-nozzle J and the water-tank, so that in case the force of the exhaust steam should be excessive, the return of any feed-water to the tank is prevented.

In order that the quantity of steam injected into the feed-water may be regulated according to the variable quantity of feed-water with which the boiler is supplied by the feed-pump, the injector-pipe V is fitted with a regulating valve or cock, L, whose stem can be operated by the engineer.

The effect of the combinations of devices above described is, that while water is being fed from the tank, steam taken from the exhaust-port of the steam-cylinder is injected into the feed-water, thereby heating it, while at the same time the force of the exhaust steam issuing from the injector-nozzle urges the feed-water forward toward the boiler, thus reducing or saving the power required to work the feed-pump. The supply of exhaust steam to the injector-nozzle is under the control of the engineer, and the passage of water through the injector-pipe is prevented by the check-valve. As the water in the tank of a locomotive-tender is generally several feet higher than the injector-nozzle need be, there is but slight danger of the regurgitation of water from the suction-pipe into the tank; but such regurgitation may be effectually prevented by the use of the check-valve in the suction-pipe.

Parts of my invention may be used without the others. Thus, if it be deemed expedient, the injector-nozzle in the pump-pipe may be supplied with steam from the boiler by connecting it therewith by a pipe fitted with a valve or cock. If deemed expedient, two or more injector-nozzles may be used, instead of a single one; and when two nozzles are used, they may be combined as represented at Fig. 3, where one injector-nozzle, J, delivers the exhaust steam in a jet into the interior of the water supplied through the suction-pipe S, while the other nozzle J′ is annular, and delivers the exhaust steam at the surface of the jet produced by the action of the steam issuing through the internal nozzle J. The jet of water produced by the action of the exhaust-steam issuing through the two injector-nozzles is received in the conical or Venturé pipe T, as in the example first described.

At P, Fig. 1, is shown another mode of combining the injector-pipe with the passage from the exhaust-port of the steam-cylinder.

I claim as my invention—

1. The combination, substantially as before set forth, of the feed-pump, the pipe thereof, and the injector-nozzle, arranged to discharge a jet of steam into said pump-pipe, to both heat the water and urge it onward.

2. The combination, substantially as before set forth, of the feed-pump, the pump-pipe, the injector-nozzle arranged in said pipe so as to admit steam which both heats the water passed through the pump and urges it onward, and the condensing-tube, also arranged in the said pipe.

3. The combination, substantially as before set forth, of the feed-pump, the pump-pipe, the injector-nozzle, the condensing-tube, and the receiving-tube, the last three being arranged in the said pump-pipe so that the steam admitted therein by the injector-nozzle both heats the water which is passed through the pump and urges it onward.

4. The combination, substantially as before set forth, of the feed-pump, the injector-nozzle arranged in the pump-pipe to admit steam which both heats the water passed through the pump and urges it onward, the exhaust-steam passage from the steam-cylinder, and the pipe connecting the said injector-nozzle and said passage.

5. The combination, substantially as before set forth, of the feed-pump, the injector-nozzle, the exhaust-steam passage from the steam-cylinder, the pipe connecting the said nozzle and passage, and the check-valve for said pipe.

6. The combination, substantially as before set forth, of the feed-pump, the injector-nozzle, the exhaust-passage from the steam-cylinder, the pipe connecting the said nozzle and passage, and the abstracting mouth facing the direction in which the steam passes through the said passage.

7. The combination, substantially as before

set forth, of the feed-pump, the injector-nozzle, the exhaust-passage from the steam-cylinder, the pipe connecting said injector-nozzle and said passage, and the cock for regulating the supply of exhaust steam to said nozzle.

8. The combination, substantially as before set forth, of the feed-pump, the injector-nozzle, the suction-pipe of the pump, and the suction check-valve located between the injector-nozzle and the tank.

Witness my hand this 23d day of July, A. D. 1877.

JOHN LAWRENCE BOGERT.

Witnesses:
E. S. RENWICK,
W. L. BENNEM.