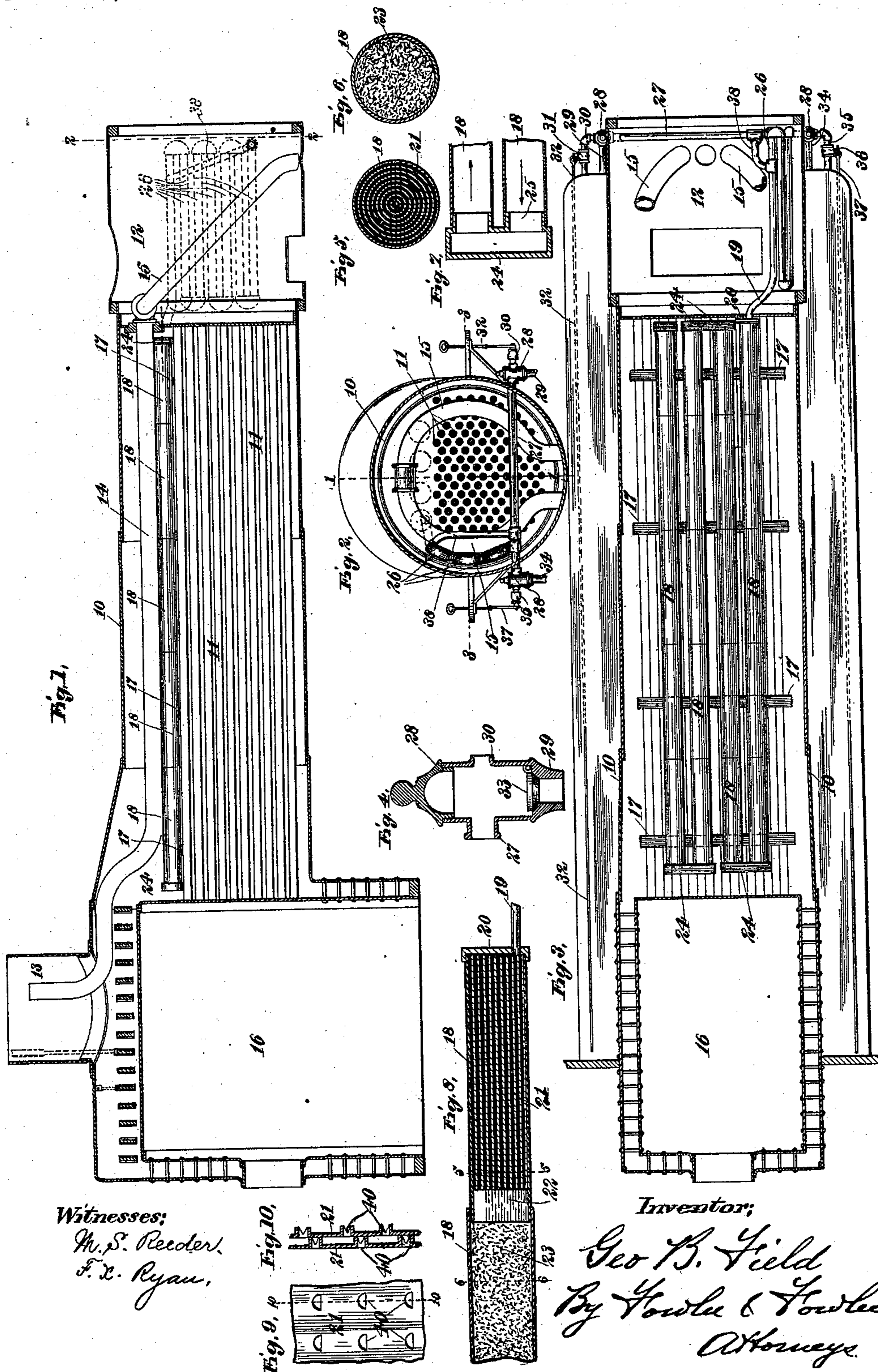


(No Model.)

G. B. FIELD.
FEED WATER HEATER AND PURIFIER.

No. 408,605.

Patented Aug. 6, 1889.



Witnesses:

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UNITED STATES PATENT OFFICE.

GEORGE B. FIELD, OF NEW YORK, N. Y.

FEED-WATER HEATER AND PURIFIER.

SPECIFICATION forming part of Letters Patent No. 408,605, dated August 6, 1889.

Application filed November 28, 1888. Serial No. 292,082. (No model.)

To all whom it may concern:

Be it known that I, GEORGE B. FIELD, a citizen of the United States, residing at New York, in the county and State of New York, have invented certain new and useful Improvements in Feed-Water Heaters and Purifiers, of which the following is such a full, clear, and exact description as will enable any one skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification.

The object of my invention is to purify the feed-water in an effective manner before it passes into the boiler, and also to heat the same by waste heat.

The invention consists in a feed-water purifier of novel construction that is located entirely within the boiler, and also of a novel form of heating device, preferably located in the smoke-box of a locomotive, and in the combination of these two devices, as well as in certain details of construction, which will now be set forth, and then particularly pointed out in the claims making a part hereof.

I have shown my invention as applied to a locomotive-boiler, but do not wish to be confined to the same, as the invention can be used with other boilers.

Figure 1 is a longitudinal vertical section of a locomotive-boiler on the line 1 1 of Fig. 2, having my invention applied thereto. Fig. 2 is a sectional view on the line 2 2 of Fig. 1. Fig. 3 is a longitudinal horizontal section on the line 3 3 of Fig. 2—that is, showing the top of the boiler removed. Fig. 4 is an elevation of a detail. Figs. 5 and 6 are transverse sections on the lines 5 5 and 6 6, respectively, of Fig. 8. Fig. 7 is a horizontal longitudinal section of a portion of my purifier on an enlarged scale. Fig. 8 is a longitudinal section of another portion of my purifier on an enlarged scale. Fig. 9 shows the sheet metal which is used in the purifier before it is made into a coil, as shown in Figs. 5 and 8; Fig. 10, a cross-section of the latter on the line 10 10 of Fig. 9.

The same figures of reference indicate the same parts throughout the various views.

I will first describe my purifier, and afterward set forth the heating apparatus, prefacing the same with a general description of the

boiler, so as to make plain how the apparatus is applied.

10 is the shell of the ordinary locomotive-boiler, and 11 are the fire-tubes located within said boiler, and 12 is the smoke-box in front of the boiler.

13 is the steam-dome, and 14 the dry-steam pipe that passes through the top of the boiler from the steam-dome to the top of the smoke-box, where it branches into two pipes 15 15, that pass diagonally down through the smoke-box to steam-chests applied to each cylinder.

16 is the fire-box of the locomotive.

The fire-tubes 11 support the purifier, the same being located between said fire-tubes and the dry-steam pipe 14.

17 are preferably boards which I place upon the fire-tubes to support the purifier.

The purifier is made up of pipes 18 of sheet metal, which are adapted to be inserted in each other like stove-pipe, to make a continuous passage. The outer end of the last section 18 is left open, so the feed-water can pass into the boiler. Any number of these sections can be put together, so as to make a purifier of any length, and any number of lengths may be joined together, as shown in Fig. 3, making a purifier of any number of turns, the one returning upon the other either longitudinally or transversely of the boiler.

19 is the feed-water pipe, which passes through a casting 20, which is placed over the end of the purifier. Within the purifier may be placed a coil of sheet metal 21 for the purpose of arresting the sediment as the feed-water flows through the purifier. The sheet-metal coil is made by taking a piece of sheet-iron and coiling it spirally and inserting it into one of the sections 18. The feed-water passes through the space between the coils of the sheet-iron. In order to regularly space the coils of the sheet metal and hold the coils in their proper position, I cut the sheet-metal plate 21, as shown in Fig. 9, leaving lips projecting about one-fourth of an inch, so that each succeeding coil will be held from the previous one by these lips, and the coils will be regularly spaced one from the other. The coil of sheet-iron is preferably made a little shorter than the cylindrical section 18, so as to leave a space 22 between the coil of sheet-iron and the succeeding section 18, which

may be filled with scrap-iron 23, or any other suitable substance to arrest the sediment. Any number of coils of sheet-iron may be placed in the different sections of the purifier and any quantity of scrap-iron can be used in the purifier. I prefer, however, to use all sheet-iron or all scrap in the purifier, although they may be alternated. I use this sheet-metal coil and the scrap-iron for the reason that metal surfaces have a strong affinity for the scale-making particles and sediment in water, which will naturally be attracted and adhere to all metal surfaces over which they pass. By these expedients I expose more metal surface to the feed-water in its passage through the chambers than is exposed by the entire internal surfaces of the boiler and fire-tubes, and I thus arrest the sediment and scale-making particles by the metal surfaces in the purifier before they reach the water in the boiler.

At the end of each length of the purifier is a casting 24, provided with two rims 25 25 for receiving the two ends of the adjacent lengths of the purifier, as shown in Fig. 7.

A purifier such as I have described can be manufactured at very small cost and is easily replaced. The coil of sheet-iron, should it become filled with sediment, may be taken out and a new sheet-metal coil inserted in lieu thereof. So also the scrap-iron may be removed and replaced with fresh scrap.

The purifier is made of very light metal, as the pressure inside and outside of the purifier is nearly equal, and need only be constructed to withstand the difference of pressure between the pressure in the purifier and that in the boiler.

The purifier should preferably be about three-quarters submerged in the water in the boiler, leaving about one-quarter of the same extending into the steam-space.

The purifier, being in sections, can be readily inserted in the boiler and easily withdrawn therefrom through the man-hole of said boiler.

Before the feed-water passes into the purifier I design to have it pass through a coil of pipe located in the smoke-box in order to heat the same. I do this as a matter of economy to utilize the waste heat in the smoke-box, and also to raise the temperature of the water in order to cause the sediment to be precipitated, which takes place more readily when the water is at a high temperature.

I wish to state here that I do not claim to be the first to put a coil of pipe in the smoke-box in order to utilize the waste heat; but my coil is arranged differently from any coil now in use, and is also used in connection with my purifier, which combination is, so far as I am aware, a new one. The coiled pipe referred to is designated by the number 26, and may be arranged upon one or both sides of the smoke-box and attached to the shell of the same between one of the dry-steam branch pipes 15 and said shell. The advantage of this

arrangement is that it leaves the end of the boiler unobstructed for cleaning the boiler-tubes, whereas when the coil is arranged across the smoke-box it obstructs the cleaning of the boiler-tubes.

27 is a pipe that connects with the lower part of the coil, and passes across the front and lower part of the smoke-box to a three-way connection 28. (Shown on an enlarged scale in Fig. 4.) The three-way connection 28 opens at its lower end into a pipe 29, that runs along the side of the locomotive, and is connected with the pump in the engineer's cab.

30 is the blow-off connection of the three-way connection 28, which is controlled by a valve 31, that is governed by a rod 32, that passes to the engineer's cab. Within this three-way connection is a valve 33, which, when the pump is in operation, is normally open, the water passing through the same from the pipe 29 to the pipe 27 through the coil of pipe 26 to the purifier. When the current is reversed by opening the blow-off and stopping the pump, the valve 33 closes and the water passes from the pipe 27 directly through the three-way connection 28 to the blow-off connection 30, taking with it the sediment deposited in the purifier and coil-pipe 26. Upon the other side of the locomotive is the injector-pipe 34, communicating with a three-way connection 28, constructed in every respect similar to that formerly described.

35 is also a blow-off pipe opening into the three-way connection 28, and is controlled by a valve 36, governed by a rod 37, which passes to the engineer's cab, as before explained. When the pump stops operating the injector will force the water through the three-way connection 28 and coil of pipe 26 to the purifier. This is brought into operation when the locomotive is standing still and the pump is idle.

Another feature of novelty of my invention is the circulating-pipe 38, which is connected between the pipe 27 and the coil of pipe 26. This pipe is designed to create a water circulation within the coil, and prevents undue heating of said coil when the engine is at a standstill.

By providing the apparatus with a heating-coil and delivering the feed-water to the purifier at a high temperature, I arrest the greater part of the sediment in the first section or two of the purifier, and these sections are perhaps the only ones that need ever to be replaced. Any other means of heating the feed-water before it is delivered to the purifier could be used without departing from my invention.

Having fully set forth my invention, what I desire to claim and secure by Letters Patent of the United States as my invention is—

1. A purifier for feed-water, made up of sections of sheet-metal pipe joined together and having in one or more of said sections a coil of sheet metal for arresting the sediment.

2. A feed-water purifier for boilers, made up of sections of sheet-metal pipe, having in one

or more sections a coil of sheet metal and scrap-iron for arresting the sediment.

3. The combination to form a feed-water purifier, located wholly within the boiler, of
5 cylindrical sheet-metal pipes 18, joined together in the manner described, one or more coils of sheet metal located in the sections of said purifier, and castings 24, joining the adjacent lengths of the feed-water purifier together,
10 in the manner described.

4. A feed-water heater consisting of a coil of pipe arranged within the smoke-box of a locomotive and having a water-circulating pipe 38 connected to the upper and lower parts
15 of the coil, for the purpose described.

5. The combination, with a locomotive-boiler, of a feed-water purifier located wholly within said boiler, a coil of pipe communicating with said purifier arranged in the smoke-
20 box of said locomotive in the direction of the length of the same between one of the steam-pipes and the shell of the smoke-box, a water-circulating pipe 38, connecting the upper and

lower part of said coil of pipe together, and a feed-water connection, substantially as and
25 for the purpose described.

6. The combination, with a locomotive-boiler, of a feed-water purifier located wholly within said boiler and made up of sheet-metal pipes having one or more coils of sheet-iron
30 therein, together with scrap-iron, a coil of pipe located within the smoke-box communicating with said purifier, a circulating-pipe connecting the upper and lower part of the coils together, a pump and injector connection
40 opening into said coil, and blow-offs controlled in the manner described.

In testimony whereof I have hereunto set my hand and affixed my seal, this 26th day of November, in the presence of two subscribing
45 witnesses.

GEO. B. FIELD. [L. s.]

Witnesses:

A. C. FOWLER,
M. S. REEDER.