Dec. 6, 1927. 1,652,037

E. E. MERCKLE

FEED WATER HEATER

Filed July 5, 1923 2 Sheets-Sheet 1

Fig. 1.

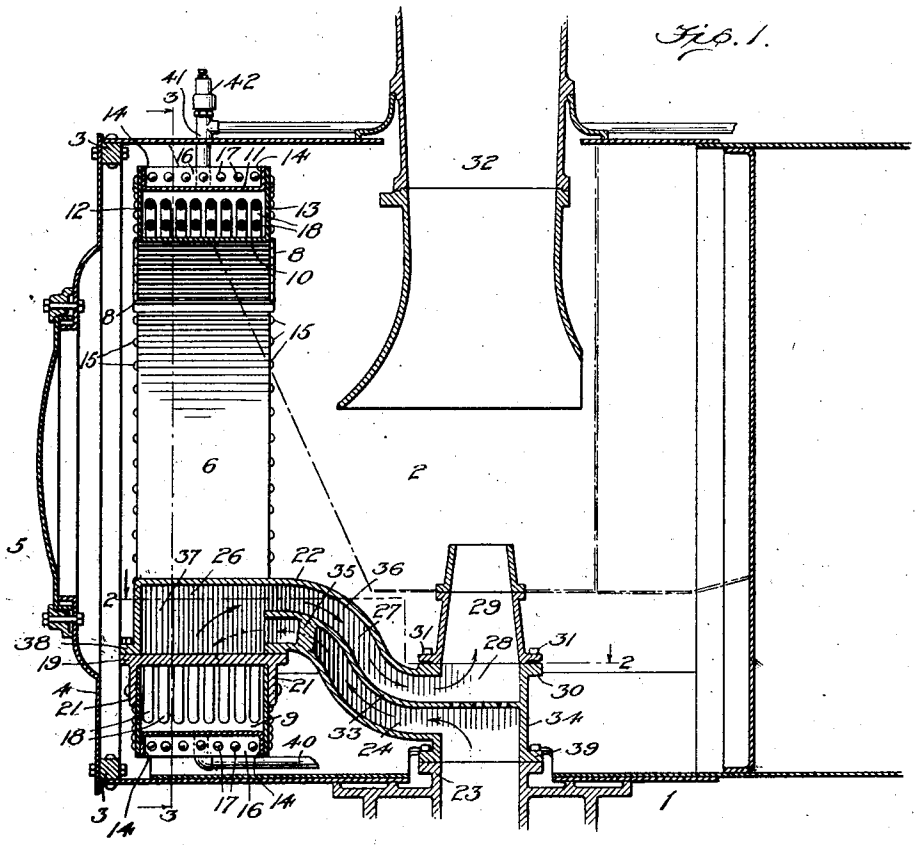
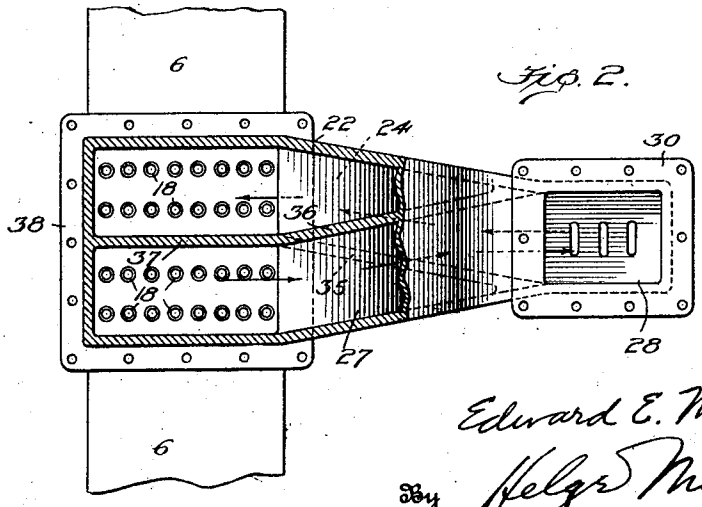


Fig. 2.



Inventor

Edward E. Merckle

By Helge Nissen

his Attorney

Dec. 6, 1927.

1,652,037

E. E. MERCKLE

FEED WATER HEATER

Filed July 5, 1923

2 Sheets-Sheet 2

Fig. 3

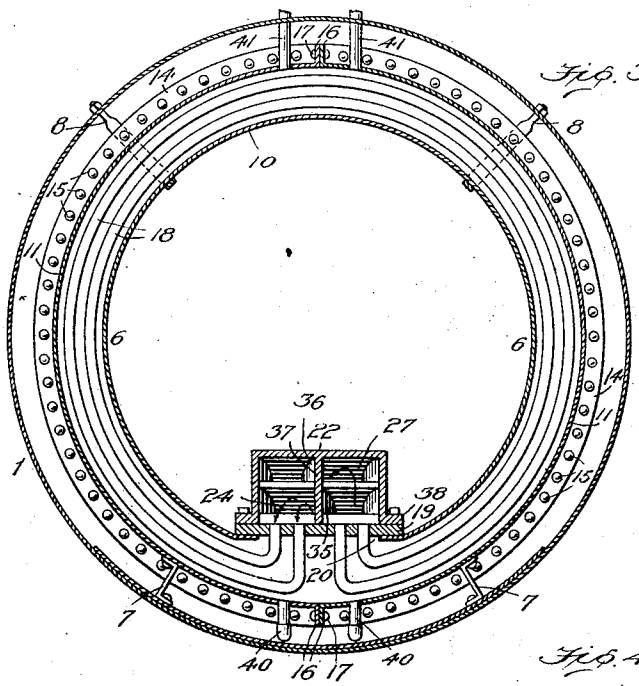
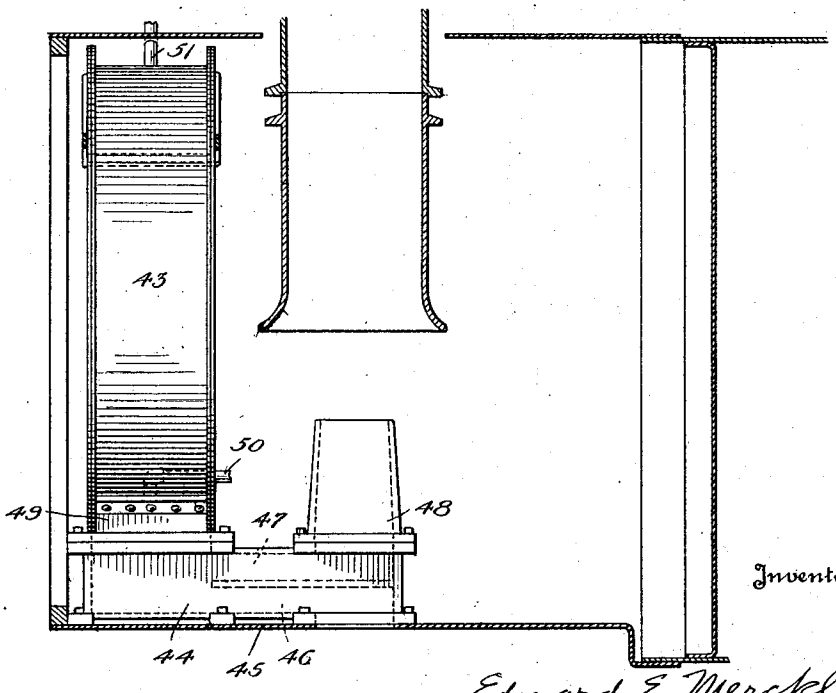


Fig. 4



Inventor

By Edward E. Merckle

Kelly Thurman

his Attorney

Patented Dec. 6, 1927. 1,652,037

UNITED STATES PATENT OFFICE.

EDWARD E. MERCKLE, OF BRUNSWICK, MARYLAND.

FEED-WATER HEATER.

Application filed July 5, 1923. Serial No. 649,765.

My invention relates to feed water heaters of the closed or non-contact type particularly adaptable for use in connection with locomotives.

The principal feature of the invention, generally stated, is to provide a feed water heater located in the smoke box of a locomotive and designed to receive exhaust steam which, together with the heat from the waste gases, produces a relatively high and rapid rise in the temperature of the feed water preparatory to its introduction into the boiler.

An object of the invention is to produce a feed water heater for locomotives in which means is provided for establishing communication between the exhaust nozzle and the water heater whereby the exhausting steam or a portion thereof is used to increase the temperature of the feed water, and subsequently returned to the exhaust nozzle for discharge through the stack, said means being designed to permit the proper flow of the steam so as not to interfere with the fire or otherwise impair the steaming qualities of the locomotive.

The invention still further consists in the combination, arrangement and construction of the several parts hereinafter described and pointed out in the claims.

In the drawings in which I have illustrated two embodiments of my invention:

Figure 1 is a vertical longitudinal sectional view through the front end and smoke box of a locomotive showing my improved feed water heater applied thereto.

Figure 2 is a detail horizontal sectional view on the line 2—2 of Figure 1, illustrating partly in section and partly in top plan the ported member or casting which establishes communication between the feed water heater and the exhaust nozzle.

Figure 3 is a vertical transverse sectional view on the line 3—3 of Figure 1, viewed in the direction of the arrows.

Figure 4 is a vertical longitudinal sectional view through a different type of locomotive, such as the Mallet compound, showing a slightly modified construction of feed water heater.

Referring to the drawings in which similar reference characters designate corresponding parts in the several views, the numeral 1 designates, generally, a locomotive and boiler, at the front end of which is located the usual smoke box 2. To the smoke box front ring 3 is connected the smoke box front 4 in which latter is provided the front end door 5, all in the usual manner.

My improved feed water heater 6 is positioned in the extreme front portion of the smoke box extension, said heater being inserted before the smoke box front is attached and suitably supported upon and bolted to Z brackets 7. Additional connecting means such as the U straps 8 are also used to firmly attach the heater to the locomotive.

The feed water heater 6 is of hollow band-like formation and comprises a relatively shallow annularly disposed water chamber 9 formed between the inner circumferentially arranged wall 10, the outer circumferentially disposed wall 11, and the respective front and rear annularly arranged end walls 12 and 13. The end walls 12 and 13 are preferably formed from the integral flanges of the inner annular wall 10. The outer annular wall 11 is also preferably formed with flanges 14, said flanges being adapted to lie against the inner opposed faces of the respective end walls and be firmly connected thereto by means of the rivets 15 preferably closely spaced about the peripheral edges of the heater to insure a tight fit between adjacent parts and prevent any leakage. The outer wall 11 is preferably made in two semi-circular sections, each of said sections being formed with outwardly projecting flanges 16 adapted to be abutted and connected by the rivets 17, as best shown in Figure 3.

The means used to permit the flow of the exhaust steam through the water so as to obtain a maximum and rapid transfer of the heat therefrom to the water involves a plurality or series of tubes 18, said tubes occupying a proportional part of the interior of the water chamber 9 and being located in spaced and substantially concentric relation thereto so as to uniformly radiate the heat from the steam to all portions of the water circulating through the heater. The tubes are supported at their ends in a plate or saddle member 19, said member being arranged to extend across an opening 20 formed in the lower portion of the inner annular wall 10. The saddle member 19 is provided with depending flanges 21 adapted to be bolted, riveted or otherwise connected

to the adjacent outside portions of the respective front and rear walls 12 and 13, as clearly shown in Figure 1.

The means for establishing communication between the tubes 18 of the feed water heater and the exhaust nozzle comprises a ported unitary member or casting 22 adapted to receive the steam at or about the base of the nozzle connection where it would ordinarily join with the cylinder saddle and smoke box supporting casting, a portion of which latter is indicated by the numeral 23 in Figure 1.

The member 22 is provided with a steam entrance port or passageway 24 through which the exhaust steam flows into a chambered portion 25 of the member having communication with one end of the series of tubes 18. After passing from the chamber 25 and through the tubes, the steam enters the chamber 26 provided in the member 22, which chamber, as will be observed by reference to Figures 2 and 3, has communication with the opposite ends of the tubes 18. Leading from the chamber 26 is an outlet port or passageway 27, said port communicating with the upper open end 28 of the member 22 to which latter is connected the exhaust nozzle 29. Surrounding the open discharge end 28 is a flange 30 having openings therein adapted to register with corresponding openings formed on the lower flange of the exhaust nozzle, cap bolts 31 being used to effect a firm connection of the member 22 and nozzle 29. The nozzle extension is maintained at its proper height with respect to the stack 32 so as to present an effective jet of steam capable of inducing the proper draft, as will be understood.

The member or casting 22 is divided horizontally by means of the partition 33, said partition extending from the end wall 34 of the nozzle end of the casting to the inner portion of the chambers 25 and 26, said partition also conforming to the offset character of the said casting, which offset tends to permit of a relatively free flow of the steam through the heater. The respective entrance and outlet ports 24 and 27 are vertically divided by the respective vertical walls or partitions 35 and 36, said partitions being united at or about the inner portions of the respective chambers 25 and 26, and forming the single vertical partition 37 separating said chamber. The casting is provided with top, bottom and side walls suitably shaped to properly enclose the respective parts, said casting being preferably formed with an attaching flange 38 by means of which it is bolted or otherwise connected to the tube supporting plate 19, and another attaching flange 39 by means of which it is bolted to an adjacent flange provided on the cylinder saddle or smoke-box supporting member. The ports and passageways through the casting 22 are of a size and shape to permit the exhaust steam to freely flow therethrough and produce a strong jet through the stack, the utilization of all of the steam or a portion thereof in the feed water heater acting to materially reduce, if not eliminate altogether, the exhaust pressure which is present when the locomotive is operating at high speeds.

In operation the feed water for the boiler is allowed to pass into the water compartment 9 through the pipes 40 shown as located in the bottom of the heater. The steam passes into the lower portion of the casting 22 from the exhaust pipes of the locomotive cylinders and then through the port 24 and into the chamber 25 from which it enters the several tubes and flows directly therethrough into the chamber 26 from which it is caused to pass through the outlet port 27 and into the exhaust nozzle 29. In its passage through the plurality of separate tubes in the water chamber 9 the heat is transferred to the water which is circulated through the heater and discharged at the top through the pipes 41 from where it passes to the boiler check for introduction into the boiler by the injectors. A safety valve 42 is preferably provided in the pipe 41 for relieving excessive pressures.

The usual petticoat pipe and other appurtenances usually provided in the locomotive smoke box, are maintained substantially intact. It will also be observed that the water heater is located relatively far from the tube sheet and sufficiently removed to insure an appreciable absorbing of the heat values from the products of combustion without subjecting the heater to the direct and detrimental action of the waste gases.

The modified construction of feed water heater shown in Figure 4 is particularly adaptable for locomotives of the Mallet compound type and comprises a band-like member 43 having an annular water chamber through which passes the steam conveying tubes. The means establishing communication between the tubes and the exhaust nozzle is of different construction, said means including a ported member 44, preferably cast, and adapted to rest upon the relatively flat base or floor 45 of the smoke box extension, such as is provided on some types of locomotives. The water heater is supported upon the ported member 44 in this form of construction with the respective steam entrance and discharge chambers, corresponding to the chambers 25 and 26 in the first embodiment, located upon the periphery of the band-like member 43. The same general arrangement of inlet and outlet ports are provided in the ported member 44, the numeral 46 indicating the steam inlet passageway and the numeral 47 designating the return or discharge passageway communi-

cating with the nozzle 48. The steam passageways are arranged horizontally in the embodiment of the invention, as shown. The ported casting 44 is connected to the band-like member by means of an interposed saddle member 49, suitably ported and connected to the steam conveying tubes above it, in the same manner in which the saddle member 19 of the first embodiment is connected to the steam tubes below it, and which forms a firm support for the heater.

The operation of this modified construction is similar to that of the first embodiment, the feed water entering the water chamber through the pipe 50 and passing out through the pipe 51 after being subjected to the heat from the steam passing through the tubes.

Suitable openings 52 may be provided in the horizontal partition dividing the inlet and outlet steam ports of the heater, said openings preferably being alined with the exhaust nozzle for permitting a portion of the steam to pass therethrough without circulating through the heater and providing a jet of steam together with the returning steam capable of inducing the proper draft for the fire. It will also be obvious that the comparative few parts comprising the heater and its connections with the exhaust nozzle, make it possible to quickly disassemble the parts for purposes of inspection and repair.

A feed water heater constructed in accordance with the present invention provides for a considerable saving in the fuel consumed. In addition, other advantages, such as reduced boiler trouble occurring in leaks and cracks, caused by expansion and contraction incident to the quick changes in temperature are obtained.

It will also be observed that the relative steaming qualities of the boiler are enhanced in that the usual accumulation of extraneous substances from the feed water upon the interior of the boiler, is materially reduced by the collecting of such substances and particles in the feed water heater, thereby providing for the absorption of maximum heat in the boiler and also increasing the life of the flues thereof. The shape and construction of the heater also lends itself to the construction of modern locomotives, and the manufacturing costs and maintenance charges incident thereto are comparatively small.

I claim:

1. In a locomotive having a smoke box provided with a water heater having heat transfer means, an exhaust steam passageway leading into said smoke box, an exhaust steam nozzle positioned above said passageway, and a unitary member having communication with the passageway, the heat transfer means of the water heater and the exhaust nozzle, said member having a partition wall dividing the latter into lower and upper passageways for conducting a portion of said exhaust steam to and from the heat transfer means, respectively, said partition having means permitting the passage of a portion of the exhaust steam directly to the exhaust nozzle.

2. In a locomotive having a smoke box provided with a water heater having heat transfer means, an exhaust steam passageway leading into said smoke box, a unitary member having communication with the exhaust steam passageway and the heat transfer means of the water heater, and an exhaust steam nozzle on said member above the said passageway having communication therewith, said member having a partition wall dividing it into lower and upper passageways for conducting the steam to and from the heat transfer means, respectively, said partition having perforations adjacent said nozzle permitting the passage of steam directly to the latter.

In testimony whereof I affix my signature.

EDWARD E. MERCKLE.