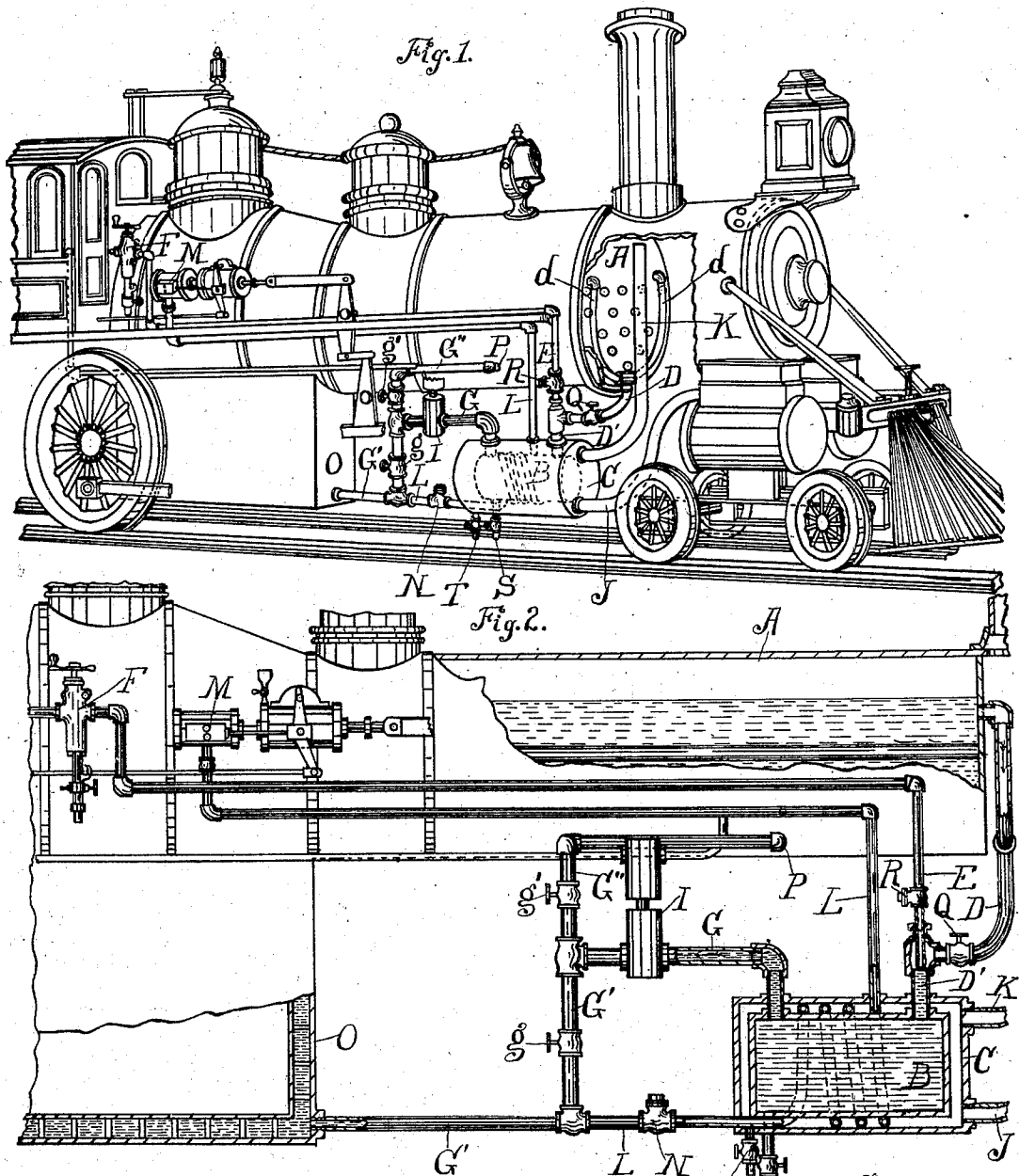


(No Model.)

J. MACDONALD.
FEED WATER HEATER AND PURIFIER.

No. 488,524.

Patented Dec. 20, 1892.



Witnesses.

M. M. Su.

Alfred J. Townsend

Inventor.

James MacDonald
by Hazard Townsend
his atty.

UNITED STATES PATENT OFFICE.

JAMES MACDONALD, OF LOS ANGELES, CALIFORNIA, ASSIGNOR OF ONE-HALF TO MARY MACDONALD, OF SAME PLACE.

FEED-WATER HEATER AND PURIFIER.

SPECIFICATION forming part of Letters Patent No. 488,524, dated December 20, 1892.

Application filed December 17, 1891. Serial No. 415,329. (No model.)

To all whom it may concern:

Be it known that I, JAMES MACDONALD, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Improvement in Feed-Water Heaters and Purifiers, of which the following is a specification.

The object of my invention is to effectually remove from water used for steam purposes the solid matter which is ordinarily contained in suspension and solution in the feed water, and which will cause what is commonly known as scale.

My invention pertains to that class of devices known as circulators and purifiers. In this class of devices it is common to withdraw the water from the boiler at an intermediate point and introduce into the stream the feed water, and then after passing it through the purifier, reintroduce it together with the feed water into the boiler at a point distant from the point at which it was withdrawn.

My improved method of purifying water is essentially different from all former methods in that while as heretofore, the hot and cold water are intermingled and the cold water is heated by the hot water and the mineral substances are thereby changed from a state of solution to one of suspension, I, unlike my predecessors, provide for the immediate subsidence of the suspended matter at the moment of its change from solution to suspension and provide against again intermingling such matter with the water.

Broadly stated my improved process consists in suddenly increasing the temperature of the injected stream of feed water to such a degree as will change mineral substances therein from a state of solution to that of suspension, and then, immediately before subsidence or deposition can occur, inducing the feed water to flow in an unobstructed stream through a suitable precipitating tank so that the suspended material will be free to precipitate from the stream and outside of the action or influence thereof.

My improved method of purifying the water and preventing the formation of scale consists of several features which I will now proceed to set forth.

My improved process consists in introduc-

ing into the axis of the stream of hot water flowing from the boiler, a stream of unpurified feed water and then immediately introducing the hot water and feed water into a suitable unobstructed precipitating tank before the same become intermingled and before the feed water can come into contact with the walls of the pipe leading to such tank so that the feed water will expand and drop its impurities within the tank and the hot water will in a degree contract with a like result so that the effect is to purify both the feed water and the water withdrawn from the boiler. I provide suitable supplemental means for maintaining a constant and continuous circulation of water through the purifier and boiler while the injector is at rest. By producing a constant circulation through the boiler at all times the impurities in the water in the boiler are caused to remain in suspension or solution while within the boiler and are not caused or allowed to deposit until they reach the precipitating tank and are caused to be deposited as above set forth.

Another feature of my invention consists of the combination with the purifying tank, the boiler, the hot water connecting pipe leading from the boiler to the purifier, the feed water pipe arranged to introduce the feed water to the axis of the stream of hot water immediately before it enters the purifier, of a return pipe leading from the purifier tank, divided and entered into the boiler at two or more points, supplemental means for forcing the water through such pipe and suitable valves arranged to control the passage of the water through the branch arms of such pipe whereby the water can be introduced into the boiler at different points successively thus to change the current in the boiler and prevent the formation of any scale which might deposit when the action is confined to a single current.

My invention also includes the combination with the above mentioned features of a suitable heating chamber arranged around the purifier tank, and the exhaust pipes of the engine arranged to discharge therein to heat such purifier tank so that the feed water is more thoroughly and evenly heated when introduced into the purifier tank.

My invention also comprises the combina-

tion with the purifier tank, the hot water pipes and the return pipes, of an air pump and pipe arranged to force air into the return pipe and from thence into the boiler, thereby assisting to maintain the current through the pipes and also to produce the effect of an aero-steam engine.

The accompanying drawings illustrate my invention.

Figure 1 shows my improved circulator purifier and heater applied to a locomotive portions of which are broken away to contract the view and to expose parts that would otherwise be hidden. Fig. 2 is a plain side elevation of the with more of the parts removed and with some of the parts in section for clearness of illustration.

A represents the boiler. B the precipitating or purifier tank. C the exhaust receiving shell or heater surrounding the purifying tank.

D is the hot water pipe leading from the boiler at an intermediate point, preferably two or three inches below the water line, to the short inlet pipe D' which is a practical continuation thereof, and leads into the top of the purifier tank, B into which it opens. This short pipe D' is larger in diameter than the hot water pipe D and is arranged to receive axially the stream from the feed water pipe E in addition to that from the hot water pipe, and immediately discharge the same into the top of said tank. The feed water pipe E leads from the injector F or other suitable means for forcing water through such pipe and into the boiler, and is designed to operate at intervals to force the water through the purifier into the boiler.

G is the return pipe leading from the top of the purifier tank to the boiler into which it empties at or near the bottom, being divided and led to the boiler in two branches or arms G', G'', which are each of sufficient size to carry the whole volume of water which the main return pipe will carry and are each provided with a valve g (g') arranged to partially or wholly close the pipe G' and G'' respectively so that the water can at will be directed into the boiler through both or either of the said pipes thus causing it to enter the boiler at both the fire box and at the middle portion of the boiler or at either of such points exclusively in succession. A suitable hot water force pump I is arranged intermediate the return pipe G to force the water through the pipe G toward the boiler. This pump is designed to be in operation at all times to maintain the circulation; but when the injector is in operation, the necessity for the pump is not so great because the injector will cause a considerable current, as is well known. The heater case or shell C is arranged to receive the exhaust through the pipe J which opens into the bottom thereof, and the final exhaust is through the exhaust pipe K, which leads from the top of the shell

and opens into the smoke stack in the usual manner. The exhaust is thus utilized to assist in heating the water.

L is an air pipe wound around the inner precipitating tank B. It is arranged to open into the lower branch G' of the return pipe and at the other end is connected with suitable means such as an air pump M arranged to force air into the boiler through such pipe thus assisting the flow of water in the pipe G' and also causing the boiler to be effective for an aero-steam engine. N is a check-valve arranged in the air pipe L to prevent back flow of water when the air pump is not in action. When the air pump is in operation to drive the heated water into the boiler, and is thus maintaining the circulation, the hot water pump may be allowed to rest.

In practice, when the steam is up in the boiler the hot water force pump I is put into operation to drive the water through the purifying apparatus, drawing it out of the top of the boiler and driving it into the bottom thereof either at the water-leg Q, or at the front portion of the boiler as at P as may be desired. When the water is introduced into the water leg Q it creates a current through the entire boiler and when the water is introduced exclusively through the pipe G'', the current is suspended except between the mouth of G'' and P and the intake mouths of the hot water pipe D which pipe is provided with the two branches d d to receive the water from the boiler. The change of current in the boiler is effective in removing scale which may have formed therein.

Q is a valve to cut off the water flowing through pipe D. R is a check-valve in the feed-water pipe E to prevent back flow.

S is the bottom blow off valve through which the impurities are discharged from the tank at intervals.

T is a drip valve to blow off the condensate from the exhaust shell C.

Now having described my invention what I claim as new and desire to secure by Letters Patent is;—

The combination set forth of the boiler, the purifier tank, the exhaust shell or heater surrounding the purifier tank, the exhaust pipes leading into and out of the shell, the feed water pipe, the hot water pipe leading from the boiler at an intermediate point to the short inlet pipe D', such inlet pipe arranged to lead into the top of the purifier tank and to receive axially the stream from the feed water pipe, means for forcing water through such pipe, the return pipe leading from the top of the tank to the boiler and supplemental means for maintaining a continuous circulation of water through the purifying device when the injector is at rest.

JAMES MACDONALD.

Witnesses:

JAMES R. TOWNSEND,
A. S. MCDONALD.