G. STEELE

FEED-WATER HEATER.

No. 188,202. Patented March 6, 1877.

Fig. 1.

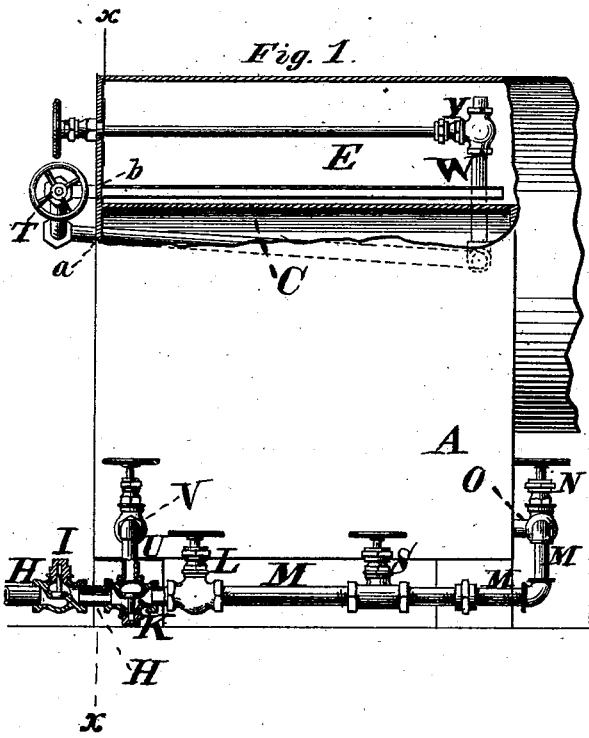


Fig. 2.

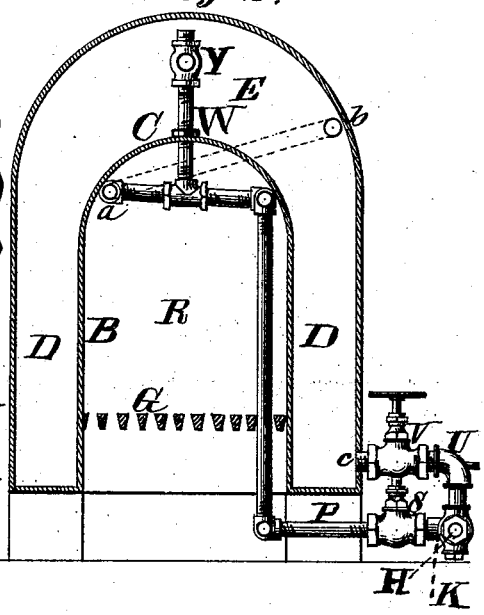
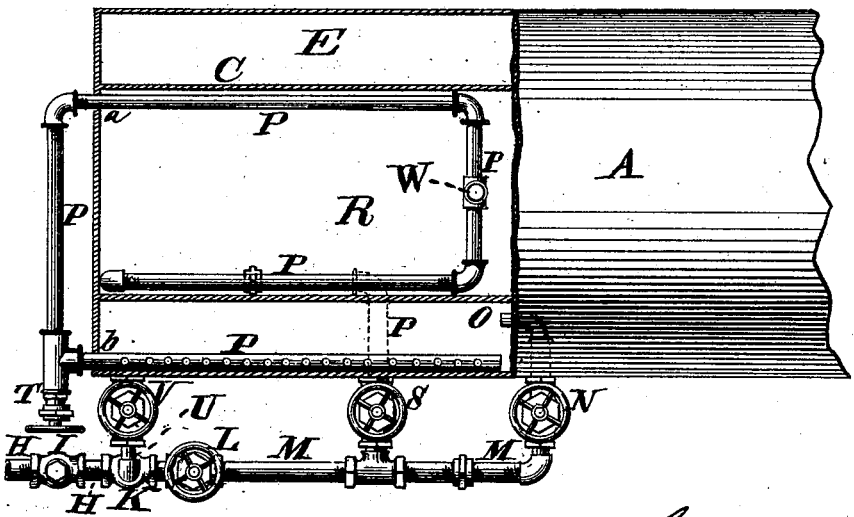


Fig. 3.



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UNITED STATES PATENT OFFICE.

GEORGE STEELE, OF NEW YORK, N. Y.

IMPROVEMENT IN FEED-WATER HEATERS.

Specification forming part of Letters Patent No. **188,202**, dated March 6, 1877; application filed July 15, 1876.

To all whom it may concern:

Be it known that I, GEORGE STEELE, of the city, county, and State of New York, have invented an Improved Feed-Water Heater for Steam-Boilers; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawing, which forms part of this specification.

The object of my invention is to supply means whereby water shall be heated on its way to the boiler from the feed-pump in a circulating-pipe passing through the furnace of the boiler, and delivered hot into the boiler, said pipe also affording a circulating-passage for heating water at times when feeding does not take place.

My invention consists in a series of peculiarly-arranged pipes, valves, and check-valves, portions of which pipes pass through the furnace of the boiler, and through which pipes the water is fed to the boiler, said pipes also affording circulating-passages for water to and from the boiler when feeding is intermitted, and arranged so that one portion of the apparatus may operate while another portion ceases its operation, as hereinafter more fully set forth.

It is well known that, other things being equal, a given volume of water is much more rapidly heated in pipes than when massed in a boiler, and this principle has been widely applied in sectional boilers. A great difficulty in the use of sectional boilers, however, arises from their liability to prime. It is also well known that, when sufficient inclination is given to a pipe, the upper part of which is connected by a descending passage with the lower part, heat, properly applied to such a pipe, causes a rapid circulation in water therein contained. These principles are applied in the heating of water in the water-backs of kitchen-ranges, the heated water passing from the heating apparatus into a receptacle or boiler. I have, however, combined the system of heating in circulating-pipes with that of heating water massed in a boiler, in such manner as to secure boilers from injury by the injection of cold water, resulting from the consequent unequal expansion of the plates, and also to secure a large measure of economy.

Figure 1 in the drawing is a side view of a part of a boiler and its furnace, a portion of the boiler-shell being broken away to show the interior. Fig. 2 is a vertical transverse section made on the line *x x*, and Fig. 3 is a top view of the boiler, with a portion of the shell broken away to show the pipes and their connections.

A represents the outer shell of the boiler, and B the inner shell of the same, inclosing the furnace, and the upper portion of which, C, is the crown-sheet thereof. That portion of the water-space in the boiler which forms the water-legs is designated by the letter D, and the steam-space by the letter E. G is the grate of the furnace. In one way of feeding the boiler water is pumped or forced into the boiler, first passing through the pipe H, which has a check-valve, I, that prevents the return of the water toward the pump. Thence the water passes through the check-valve box K, closing the valve therein, which prevents it from ascending through the pipe U, thence through the globe-valve L, the pipe M, the globe-valve N, and the pipe O, but this mode of feeding is only employed in special cases. From the pipe M extends a pipe, P, passing under the furnace R of the boiler, thence forward to the front part of the bottom of said furnace, thence upward into said furnace, thence around and obliquely upward in the said furnace near the inner shell B of the boiler, which incloses said furnace, passing around said furnace as many times as may be desired, until, finally, it passes out through the front wall of the furnace at *a*, thence obliquely upward and across in front of the front wall of said furnace to the opposite side thereof, thence through the shell of the boiler at *b*, and thence horizontally backward over the whole length of the crown-sheet C, at the back part of which it terminates; and that part of the said pipe P extending over the crown-sheet C is perforated throughout. The said pipe P is, moreover, provided with valves S and T, which either permit or stop the circulation through said pipe, according as they are opened or closed.

In the regular way of feeding the boiler, when this apparatus is employed the valve N is closed and the valves T, L, and S are opened. The water entering at H then traverses the whole extent of the pipe P, is heated in its

passage, and delivered through the perforations in that part of the said pipe P lying over the crown-sheet, and, thus heated and distributed, cannot produce any injurious and unequal contraction by sudden and extreme cooling of any part of the boiler.

From the pipe M also extends the pipe U, upward and laterally, and enters one of the water-legs, D, of said boiler at *c*, Fig. 2. This pipe is provided with a stop-valve, V. In feeding the boiler, the check-valve K prevents the water fed from passing into the boiler through the pipe U, but it allows the water which descends in the boiler in heating the same and in the production of steam to circulate downward to the pipe M; consequently, in the normal use of the boiler, when the valve V is opened and the valve N is closed, the valves T, L, and S being also opened, and when feeding is intermitted, circulation of water from and to the boiler through the system of pipes M and U is constantly maintained. This protects said pipes from undue heating, and also causes them to assist in heating the water and in steam generation. Moreover, should the crown-sheet of the boiler become uncovered by the evaporation of the water, through carelessness in feeding, the pipe M, discharging steam upon said crown-sheet, will keep said crown-sheet sufficiently cool for a considerable period to prevent the same from being injured by overheating, or from becoming so hot as to cause an explosion upon commencing to feed again—an accident which has frequently been the cause of the total destruction of boilers, and consequent destruction of life and property.

When it is desired to remove and clean or to repair the pipe H or valves I K without stopping the action of the boiler, the feeding is intermitted, the stop-valves L and V are closed, and the valves S and N are opened. The circulation will then be maintained through the pipe P, that part of the pipe M lying between the valves S and N, and the pipe O. Any of the aforesaid parts, H I K, may then be taken off and replaced without stopping the generation of steam.

To prevent accumulation in the upper part of the pipe or heater P of steam at higher tension than that in the steam-space of the boiler, I insert in the higher part of said pipe P a vertical safety-pipe, W, opening into said steam-space, and provided with a valve, Y, having a long stem extending through the steam-space of the boiler, and passing out through a stuffing-box in the front plate of the boiler. In the ordinary use of the boiler this valve remains open, and allows any accumulation of steam in the heater-pipe P to escape into the steam-space of the boiler. This safety-pipe may be applied in connection with any heating-pipe or system of heating-pipes placed in any part of the boiler, whether in the fire-box or in any situation where said heating-pipe or system of heating-pipes is exposed to the direct action of the heated products of combustion. The special function of the valve T is to shut off communication from the interior of the boiler to the heater-pipe P, which may on some occasions be necessary, as in case of injury to the said heater-pipe.

I claim—

1. The combination, with the pipe M and the pipe P, of the pipe U and check-valve K, for maintaining circulation through said pipes when feeding is intermitted, substantially as and for the purpose described.

2. The combination of the pipe P, the pipes M and O, and the stop-valves S and N, for maintaining circulation while the check-valves I K and pipes H U are closed or removed, substantially as and for the purpose set forth.

3. The safety-pipe W, inserted in the heating-pipe P, and delivering steam from the said pipe P into the steam-space of the boiler, and provided with a stop-valve, Y, to be operated from outside the boiler, substantially as specified.

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