S. N. CARVALHO.

STEAM-BOILER AND SUPERHEATER.

No. 192,678. Patented July 3, 1877.

Fig: 1.

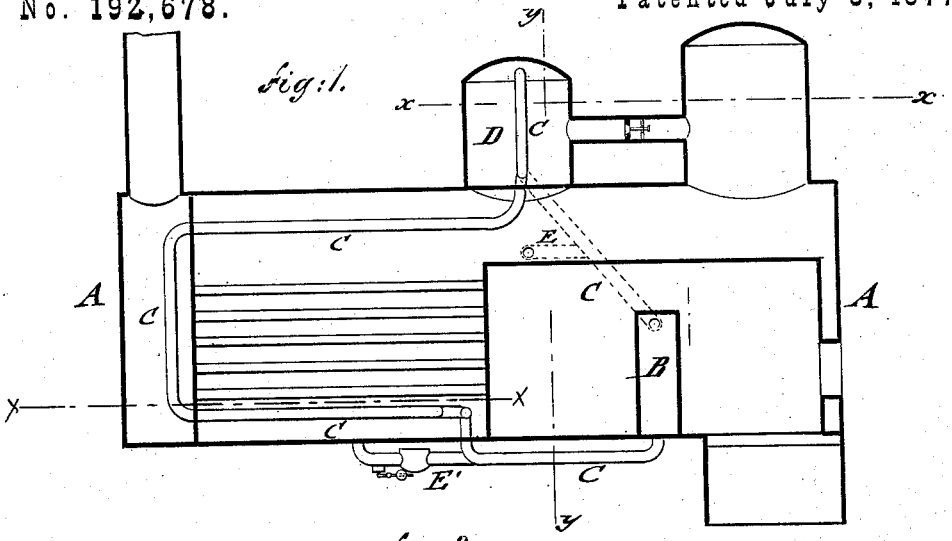


Fig: 2.

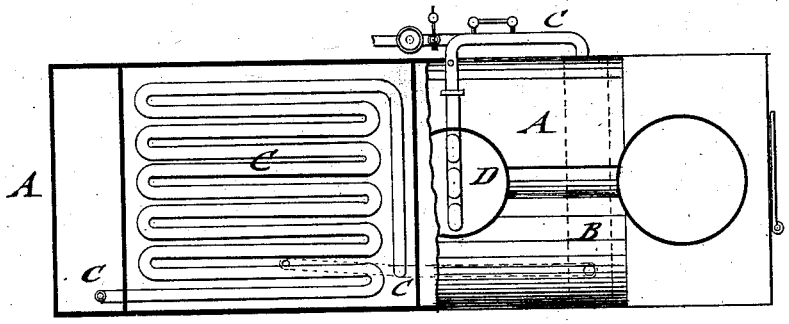
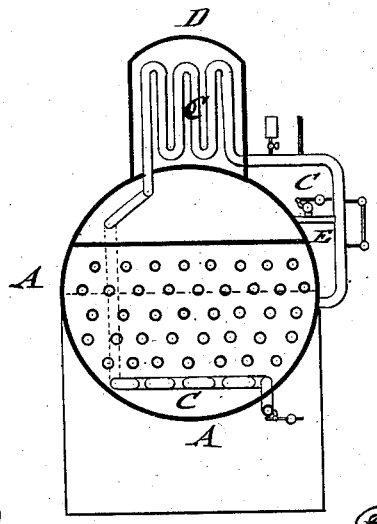


Fig: 3.



WITNESSES:

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UNITED STATES PATENT OFFICE.

SOLOMON N. CARVALHO, OF NEW YORK, N. Y., ASSIGNOR TO HIMSELF AND JAMES M. PATTEE, OF SAME PLACE.

IMPROVEMENT IN STEAM BOILERS AND SUPERHEATERS.

Specification forming part of Letters Patent No. **192,678**, dated July 3, 1877; application filed February 3, 1877.

To all whom it may concern:

Be it known that I, SOLOMON N. CARVALHO, of the city, county, and State of New York, have invented a new and Improved Steam Boiler and Superheater, of which the following is a specification:

The object of this invention is to economize fuel in the generation of steam, and to superheat the steam from the boiler in a separate and independent steam-dome, so as to prevent priming, and permit pure dry steam only to go to the cylinder of the engine.

The invention is further intended to provide in the lower part of the boiler, or any other part where there is a reduced temperature on account of the disposition of the flues, or by the entrance of the feed-water, an enlarged heating-surface that assists in and accelerates the generation of steam and the more perfect utilization of the fuel.

The invention will first be described in connection with the drawing, and then pointed out in the claims.

The exit and return sections of the heating-pipe are connected with the boiler and arranged with weighted pressure-valves to admit the escape of the water in case of too great pressure.

In the accompanying drawing, Figure 1 represents a vertical longitudinal section; Fig. 2, a top view, partly in section on line *x x*, Fig. 1; and Fig. 3 a vertical transverse section on line *y y*, Fig. 1.

Similar letters of reference indicate corresponding parts.

A represents a locomotive, marine, or other boiler; B, a hollow water-back or loose reservoir, placed in the combustion-chamber of the boiler; and C a water-conducting pipe that leaves the highest point of the water-back at the side of the boiler, and enters from the outside of the boiler into a separate steam-dome, D, that is connected by a pipe and check-valve with the main steam-dome. The heating water-pipe C is arranged in the shape of a serpentine or other coil in the separate steam-dome, and conducted then through the shell of the boiler.

The steam in the steam-dome D is superheated and made drier, being brought by the heat of the pipe C to greater pressure and elasticity than the steam in boiler, so as to be used with greater effect in the cylinders of the engine, to which the steam-dome D is connected by suitable pipes. From the superheater the pipe C runs longitudinally through the boiler to the back of the same, then down along the same, entering the boiler at the bottom or lowermost part, which is usually the coldest part, on account of the insufficient passage of the fire-gases through the lower flues.

By removing the lower flues and arranging the heating-pipe C in a serpentine coil at the lowermost part, as shown in Fig. 2, the heat of the water driven through the continuous pipe C is radiated or imparted to the water of the boiler so as to heat up that part which has hitherto received an insufficient quantity of heat. The water-pipe C is then conducted to the outside of the boiler and returned along the bottom of the same to the lowermost part of the water-back or reservoir, forming thus a continuous hot-water circulation for the double purpose of superheating the steam in the supplementary dome and of raising the temperature of the water at the bottom or coldest part of the boiler.

For marine or other boilers the serpentine coil is arranged at such place or places where the water is not sufficiently heated on account of the disposition of the draft-flues or other causes.

The continuous water-pipe C is connected at a point before it enters the superheating-dome by a short pipe, E, with the interior of the boiler, pipe E having a weighted and automatically-working safety-valve to allow the water from the water-back to discharge itself into the boiler proper, when the temperature of the water in water-back, and, consequently, the pressure, become higher than required.

A similar pipe-connection, E′, and safety-valve, allows the water from the lowermost part of the returning water-pipe to open and convey to the boiler water of less temperature, so as to insure against any possible accident or danger from the circulating-pipe. The water-back and circulating-pipe are refilled from time to time with water by a donkey-engine, and provided with water-gage, steam-gage, thermometer, and other controlling appliances.

The contents of the hot-water back may also

be conveyed directly into the lowermost part of the boiler, below the flues, when it is desired to dispense with the superheating-dome by connecting the highest part of the water-back with the continuous circulating-pipe at the lowermost part of the boiler and back to bottom of water-back, so that the coolest part of the boiler is heated up by means of the hottest water from the water-back, and thereby an economical and effective arrangement of utilizing the heat of the fuel obtained and the generation of steam in the boiler accelerated without the use of additional fuel.

Water can be raised, in a metallic vessel exposed to the direct heat of a fire, to a temperature whose height can only be limited by the vessel's power of resistance, its own expansion being resisted by a pressure that prevents it from being converted into steam. Steam having a pressure of thirty-five pounds to the square inch marks 260° on Fahrenheit's thermometer, while water having the same pressure marks 320°. Hence water at a high heat may be employed with facility to superheat steam.

In order to prevent the circulating-pipes from becoming too hot, I use a valve weighted to lift at a given pressure, thus mixing the water in boiler and that in pipes to produce a mixture at the desired temperature.

The water-back is exposed on all sides directly to the fire, contains one-tenth the heating-surface of boiler, and is provided with one-hundredth the quantity of water. Of course the proportions may be varied, but the effect is the same. In the former instance, when the steam in boiler indicates 300° the water in back will show about 400°. Hence the steam in passing to cylinder over this hotter region or hot-water coil must be superheated. The water circulates with great velocity, giving out its heat to steam in dome and water at bottom of boiler, and returns at a reduced temperature to the back, the decrease of heat being made up by the continuous supply from fire.

The automatic valve is merely intended for admitting water into the pipes in order to prevent the steam from becoming too much superheated.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination of a hollow water-back or water-reservoir, and of a continuous circulating-pipe leaving at the highest and returning at the lowest part of the water-back, with a separate superheating steam-dome, and with the lowermost or coldest part of the boiler, substantially in the manner and for the purpose set forth.

2. The combination, with the two domes shown and described, of the hollow water-back or reservoir, with a circulating-pipe passing from the highest part of the water-back through the boiler, and by serpentine coil at the lowermost part back to the bottom part of the water-back, substantially as specified.

3. The combination, with the two domes shown and described, of the circulating water-pipe C of the water-back, by short pipe-connections E E′, and safety-valves with the boiler, substantially as described.

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