

Patented Oct. 15, 1872.



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Pay to the order of _____

UNITED STATES PATENT OFFICE.

WILLARD M. FULLER, OF NEW YORK, N. Y., ASSIGNOR TO HIMSELF AND
MELCHIOR B. MASON, OF SAME PLACE.

IMPROVEMENT IN BOILERS AND FEED-WATER APPARATUS.

Specification forming part of Letters Patent No. 132,274, dated October 15, 1872.

To all whom it may concern:

Be it known that I, WILLARD M. FULLER, of the city, county, and State of New York, have invented an Improved Boiler and Steam Heating Apparatus, of which the following is a specification:

Nature and Objects of the Invention.

My improved boiler is constructed with an upper and lower annular water-chamber connected by two or more concentric ranges of vertical tubes, the tubes of the inner range being of smaller diameter than those of the outer range. The shell of the furnace completely surrounds and incloses the boiler thus formed, the grate and fire-chamber being located beneath the lower water-chamber in such a manner that the products of combustion will pass upward through the centers of the water-chambers and completely around the chambers and tubes, the greater heat imparted to the water within the inner and smaller tubes causing water to rise therein, while it descends through the outer and larger tubes. An active and constant circulation of water is thus produced. Communicating with the steam-space in the upper part of the boiler are two pipes, one of which supplies steam to a heating-coil of any proper form. The other steam-pipe communicates with an elevated water-tank through a port guarded by a valve under control of a thermal-pipe, arranged to open the valve when the water in the boiler descends below a proper level. From the water-tank a pipe passes to the water-space of the boiler, a check-valve being introduced to prevent the reflux of water from the boiler. On the closure of the thermal-valve the steam within the water-tank condenses, producing a vacuum, which causes said tank to be again filled with water through a vertical pipe from a reservoir which receives all the water of condensation from the heating-coil. Another check-valve is introduced to prevent reflux of water from the last-named pipe into the reservoir when pressure occurs in the elevated tank. The elevated tank and its connections operate as hereinafter explained to return water of condensation to the boiler and keep the water at a proper level therein.

Description of the Drawing.

Figure 1 is a plan (partly in section on the line *x x*, Fig. 2,) of a boiler and connections illustrating my invention. Fig. 2 is a vertical section of the same on the line *y y*, Fig. 1.

General Description.

A represents the outer shell of the boiler; B, the grate; C, the ash-pit; D, the fire-door; and E, the ash-door. F is an upper water and steam chamber. G is a lower water-chamber. H I are vertical tubes connecting the said chambers. These tubes are disposed in two concentric ranges, as shown in Fig. 1, the inner tubes H being of smaller diameter than the outer tubes I. J J are common try-cocks. K K are lugs or brackets to support the boiler within the furnace while permitting the gaseous products of combustion to pass around it. The flame and gases also pass upward through the central flues L M of the annular chambers F G. N represents the discharge-flue or a collar for attaching it. O is a pipe communicating with the steam-space of the boiler and supplying steam to a heating-coil, which is not shown, but may be of any form which the preference of the user or the necessities of the case may render most expedient. The said coil terminates at P in a reservoir, Q, which is adapted to receive the water of condensation. R is a pipe extending from near the bottom of the reservoir Q to an elevated tank, T. S is a check-valve arranged to prevent the reflux of water from the pipe R into the reservoir Q. The tank T communicates with the water-chamber G of the boiler through a pipe, U, guarded by a check-valve, V, to prevent the reflux of water from the boiler, and with a steam-space through a pipe, W, guarded by a valve, X, under control of a thermal-pipe, Z, opening into the boiler at the water-level, so that when the water is at a proper level the said pipe, being filled with water, will, by its contraction, keep the valve X closed, but when the water descends the pipe will fill with steam and by its expansion by heat will open the tube. Y is the rod connecting the valve X with the closed end of the pipe Z.

Operation.

The pipe O supplies the heating-coil constantly with steam, and the water of condensation flows into the reservoir Q as fast as formed. While the water in the boiler is at a proper level the elevated tank T and pipes Z, U, and R remain full of water, with the valves X, V, and S closed, as shown in Fig. 2. Supposing the water to descend below the mouth of the pipe Z the latter will be immediately emptied of water and filled with steam, causing it to expand in length and thereby to open the valve X. This places the water in the tank T under boiler pressure, and as the pressure of steam on the said water equals that on the top of the check-valve V the weight of the water will open the said valve and the water will, by its own gravity, descend out of the elevated tank T and pass into the boiler through the pipe U until its surface in the boiler-chamber F is on the same level as in the pipe U. This level being above the mouth of the pipe Z water will flow from the boiler into the said pipe as fast as the steam therein condenses by radiation of heat, and the pipe becoming comparatively cool will contract and close the valve X. The pressure in the tank T will then fall by radiation and thus cause the check-valve V to close. As a vacuum is formed in the tank T by the condensation of its contained steam a moderate pressure existing in the reservoir Q will force water up

the pipe R, filling the tank T and pipe U, and thus restoring the normal condition of the parts. The apparatus is well adapted for heating railway cars, for which purpose the entire boiler and furnace need not exceed in dimensions car-stoves now in common use. It is equally well adapted for heating buildings of all descriptions.

Claims.

I claim as my invention—

1. The boiler herein described, consisting of annular chambers F G, connected by vertical pipes H I of unequal diameter, supported over the grate B by lugs K, and surrounded by a casing A, all as herein set forth.

2. In combination with the boiler, constructed and operating substantially as herein described, the thermal-pipe Z, employed and operating as described to control the admission of steam to an elevated water-tank T, from which water is allowed to flow into the boiler by gravity when the pressure is equalized.

3. The reservoir Q and pipe R, guarded by valve S, employed in connection with the tank T to supply water to the boiler through the said tank, substantially as described.

WILLARD M. FULLER.

Witnesses:

OCTAVIUS KNIGHT,
WALTER ALLEN.