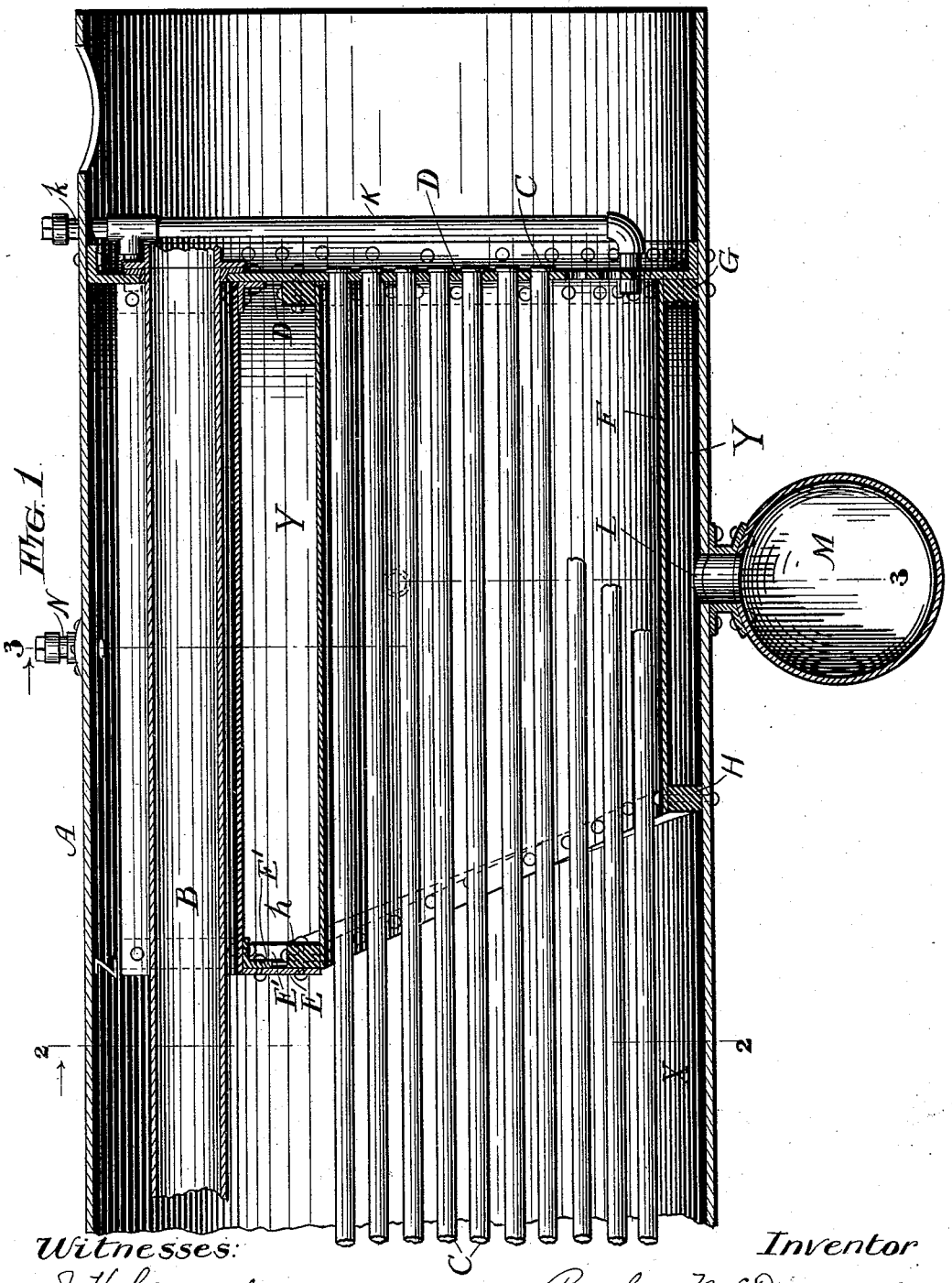
(No Model.) 2 Sheets—Sheet 1.

R. McDOUGALL.

FEED WATER HEATER AND PURIFIER.

No. 494,302. Patented Mar. 28, 1893.



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Randall W. Burns

Inventor
Ruther McDougall
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Gridley & Hopkins

(No Model.) 2 Sheets—Sheet 2.

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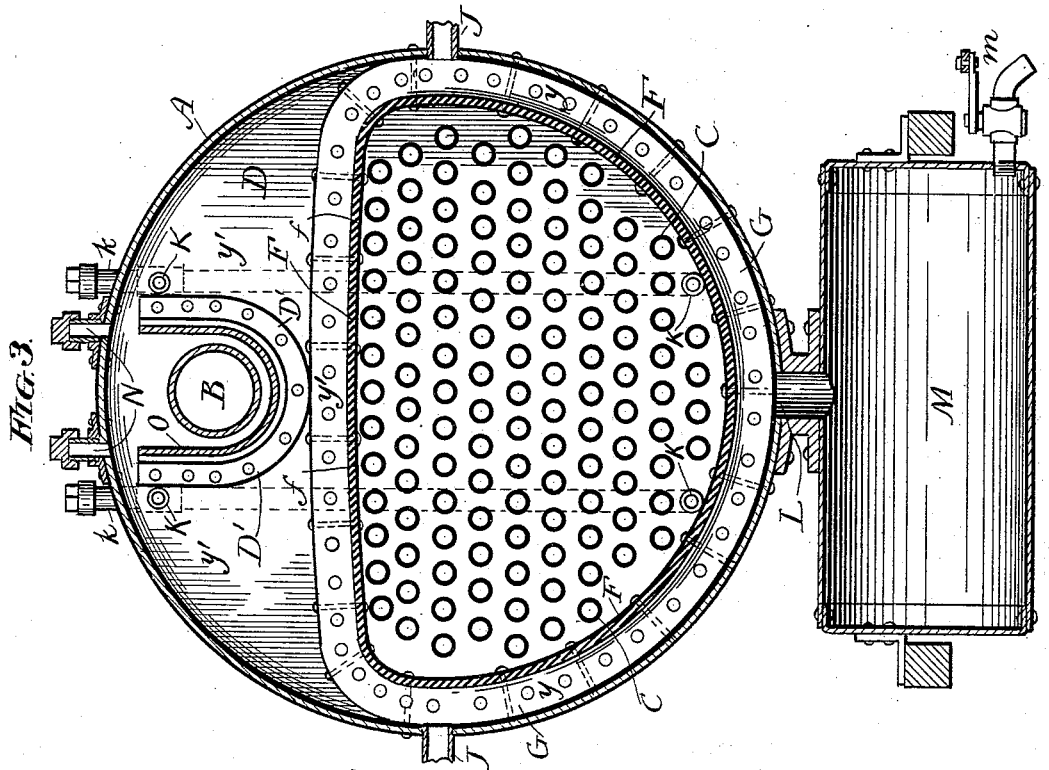

FIG. 3.

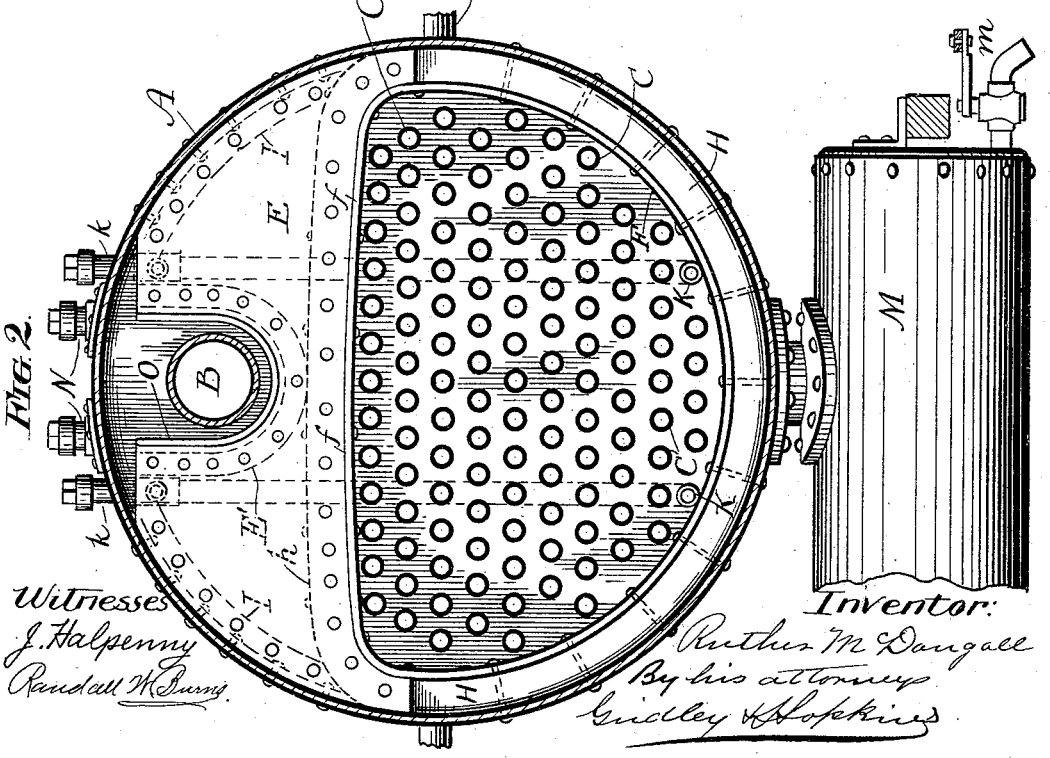

FIG. 2.

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UNITED STATES PATENT OFFICE.

RUTHER McDOUGALL, OF CHICAGO, ILLINOIS.

FEED-WATER HEATER AND PURIFIER.

SPECIFICATION forming part of Letters Patent No. 494,302, dated March 28, 1893.

Application filed April 14, 1892. Serial No. 429,179. (No model.)

To all whom it may concern:

Be it known that I, RUTHER McDOUGALL, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Feed-Water Heaters and Purifiers, of which the following is a specification, reference being had to the accompanying drawings, which are made a part hereof, and in which—

Figure 1 is a vertical longitudinal section of the improved heater and purifier, and of so much of a boiler as is necessary in order to show its application thereto. Fig. 2 is an end elevation of said heater and purifier, and a vertical transverse section of the boiler on the line 2—2. Fig. 3 is a vertical transverse section thereof on the line 3—3.

The drawings show the improved heater and purifier in connection with a locomotive boiler, but in practice it is applicable to boilers of every description, whether portable or stationary, and whatever may be their internal or external arrangement or construction. But since the arrangement illustrated is a complete and satisfactory embodiment of all that I claim as my invention, I will describe it particularly and leave it to those skilled in the art who desire to make use of my invention to suggest for themselves, when occasion shall require it, such structural changes as may be necessary in order to adapt the invention to boilers differing in construction from the one shown.

It is a known fact that when water is heated to a certain degree the impurities and foreign substances which it holds either in suspension or solution are precipitated, and the object of the present invention is to provide a device that will operate upon this principle and purify the water that is to be fed into steam generating boilers. It is to such a purifier that the invention relates principally, but incidentally it relates also to such a location of the purifier that it serves the purpose of a feed water heater.

In carrying out the invention I arrange within the shell of the boiler an auxiliary chamber, the top of which is above the water line of the boiler proper, but I leave the chamber and boiler proper in open communication with each other at top, so that the pressure is the same in both. The feed check communicates with the auxiliary chamber about its mid-height, and the water that enters, being colder than the water that it meets, passes by gravity to the bottom of the chamber, so that in the locality of the open check there is always a downward current, while at a more distant part of the chamber there is an upward current. In a device that is already in use, and that has some features in common with mine, the water flows over the wall of the auxiliary chamber and pours down on to the surface of the water in the main chamber of the boiler, but this is objectionable because it agitates the surface from which steam is rising and causes it to foam, and this is detrimental. In order to avoid this I draw the water off from the auxiliary chamber a short distance from its top and convey it thence, by a pipe, and discharge it into the main chamber of the boiler, below the water line, and preferably quite near the bottom.

In order that those skilled in the art may fully understand my invention, which consists in certain features that are particularly pointed out in the claims, I will proceed to describe it with reference to the drawings, in all the figures of which similar parts are designated by similar letters.

A represents the shell of the boiler, B the dry pipe, C the tubular flues, and D the flue-sheet.

X represents the main chamber of the boiler, and Y the auxiliary chamber, which chambers are in open communication with each other at top through the space Z that is left between the top of the partition plate E and the shell of the boiler.

The auxiliary chamber is constructed as follows. The shell of the boiler forms its outside wall while its inside wall is formed by a barrel F, the lower portion of which is cylindrical and concentric with the shell, while the upper side is flat or slightly rounding, and occupies a substantially horizontal position as shown at *f*. One end of this barrel is secured to the flue sheet D, preferably through the medium of bar G, and the other end is secured to the shell of the boiler, so far as it is concentric therewith, through the

medium of a similar bar H, which bars are continued across the top *f* of the barrel, and have their ends united. Secured to the portion *h* of the bar H is the plate E, already referred to, which extends upwardly nearly to the top of the shell, its ends being secured to the shell through the medium of angle plates I, I. The flue sheet D and bar G thus form one end of the auxiliary chamber, while the plate E and bar H form its other end. The chamber thus constructed is annular in cross section. That is to say, it is continuous, comprising the upper portion *y'*, of which the top portion *f* of the barrel forms the bottom, and the circular portion *y*, of which the shell forms the outer walls and bottom, and which forms a passage uniting the opposite sides of the portion *y'*. The feed checks J, J, communicate with this passage on opposite sides of the boiler, and ordinarily only one of them is open at a time, so that the water entering will pass from the open check downward through one side of the passage, and then upward through the other side and into the portion *y'* from which it flows through a pipe K to the main chamber X of the boiler, entering it at a point below the water line, and preferably quite near the bottom. The drawing shows two of these pipes, and it shows them located in front of the flue sheet, but the generic features of my invention are not limited in either of these respects. I prefer, however, to locate it (or them) as shown and provide it with an upward extension *k*, which extends through the top of the shell and is provided with a screw cap which may be removed for the attaching of a hose whereby water may be forced through the pipe and into the boiler, so that by opening a hand hole or mud cock at the other end of the boiler a strong stream of water may be forced through it for dislodging sediment from its bottom and discharging it.

As the water passes through the auxiliary chamber, and especially through its portion *y*, the impurities are precipitated, and a large percentage of the precipitated matter falls through an opening L into a mud drum M, provided with a blow-off cock *m*. With this arrangement, if the blow-off cock and one or both checks be opened, a strong current of water will flow downward through one or both sides of the passage *y*, thence through opening L into the drum M, and thence out through the cock, whereby these parts are thoroughly cleansed of all sediment that may have accumulated in them. This may be done without in any way affecting the generation of steam or the level of the water in the main chamber of the boiler. In like manner if only the blow-off cock be opened, the pressure of the steam will expel all of the water from the auxiliary chamber, after which, if the cock be kept open, steam will flow through the chamber and sweep it. Neither of these operations will, however, clean the bottom of the portion *y'* of the chamber, and in order to enable this to be done I place at the top of the boiler one or more (preferably two) washout plugs N, which are normally closed by a screw cap. When there is no steam a hose may be inserted through these washout plugs and a stream of water brought to play directly upon all of the parts above the barrel F.

Where a dry pipe is used, in order to accommodate it a U-shaped notch is cut in the top of the plate E, and a plate O bent to a corresponding U-shaped cross section is placed therein and secured to the plate E and to the flue-sheet in any suitable manner, as for example, by angle plates E' and D', to which the plate O is riveted and which in turn are riveted to the plate E and flue sheet D, respectively.

The end wall of the auxiliary chamber slopes toward the mud hole L, the object being to cause matter that is precipitated to be brought as near said hole as possible, and avoid the formation of a corner so far away from said hole that the cleansing currents cannot reach and clean it.

What I claim as new, and desire to secure by Letters Patent, is—

1. The combination with a boiler shell, of an auxiliary chamber located therein, means for supplying said auxiliary chamber with water, a passage communicating with the upper part of the auxiliary chamber and with the main chamber of the boiler below the water line, so that water flows from the upper part of the auxiliary chamber through said passage, and enters the main chamber of the boiler below the surface of the water therein and an open mud hole located at the bottom of the auxiliary chamber, substantially as set forth.

2. The combination with a boiler shell, of an auxiliary chamber located therein, a feed check opening into the auxiliary chamber above its bottom, an open mud hole located below the check, and an open water-passage communicating with the auxiliary chamber above the check and with the main chamber of the boiler below the water line, so that the feed water flows from the auxiliary chamber through said passage and enters the main chamber of the boiler below the surface of the water therein substantially as set forth.

3. The combination with the boiler shell, of an annular chamber located therein, the upper portion of said chamber being in direct open communication with the steam space of the boiler, so that steam may pass into the chamber and into direct contact with the water therein, means for supplying said chamber with water, a mud hole located at the bottom thereof, and an open passage connecting the upper part of the auxiliary chamber with the main chamber of the boiler, below the water line thereof, so that the feed water flows from the auxiliary chamber through said pas-

sage, and enters the main chamber of the boiler below the surface of the water therein substantially as set forth.

4. The combination with the boiler shell A, of the barrel F located therein, bar H, and plate E extending from said barrel to the shell, forming an annular chamber, a feed check J communicating with said chamber about its mid-height, so that the colder water entering will pass down on one side of the chamber under the barrel and up on the other side, a mud hole located at the bottom of the chamber, and a water-passage leading from the upper part of said chamber to the main chamber of the boiler, substantially as set forth.

5. The combination with a boiler shell, of an auxiliary chamber located therein and a mud hole located at the bottom of the auxiliary chamber, means for supplying said chamber with water, and an open passage from said chamber to the main chamber of the boiler, the end of the auxiliary chamber being sloped toward the mud hole, substantially as set forth.

6. The combination with the boiler shell, of the barrel F located therein, bar H, and plate E extending from said barrel to the shell so as to form a continuous or annular auxiliary chamber, a passage Z through which the auxiliary chamber and main chamber communicate at top, means for supplying the auxiliary chamber with water, and a pipe communicating with the upper part of the auxiliary chamber and with the main chamber of the boiler below the water line, substantially as set forth.

7. The combination with the boiler shell, of the barrel F, located therein, bar H, and plate E extending from said barrel to the shell so as to form an annular auxiliary chamber, a passage connecting the auxiliary chamber with the main chamber, means for supplying the auxiliary chamber with water, and the washout plug N located over the auxiliary chamber, substantially as set forth.

8. The combination with a boiler shell and the dry pipe, of an auxiliary chamber located within the shell and having a portion removed from its end to receive the dry pipe, and a plate embracing the dry pipe and secured water tight to the ends of the auxiliary chamber, substantially as set forth.

9. The combination with the boiler shell, of an auxiliary chamber located therein, means for supplying it with water, and the pipe K communicating with the main chamber of the boiler near its bottom and with the auxiliary chamber near its top, said pipe having the extension *k* and means for closing it, substantially as set forth.

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