

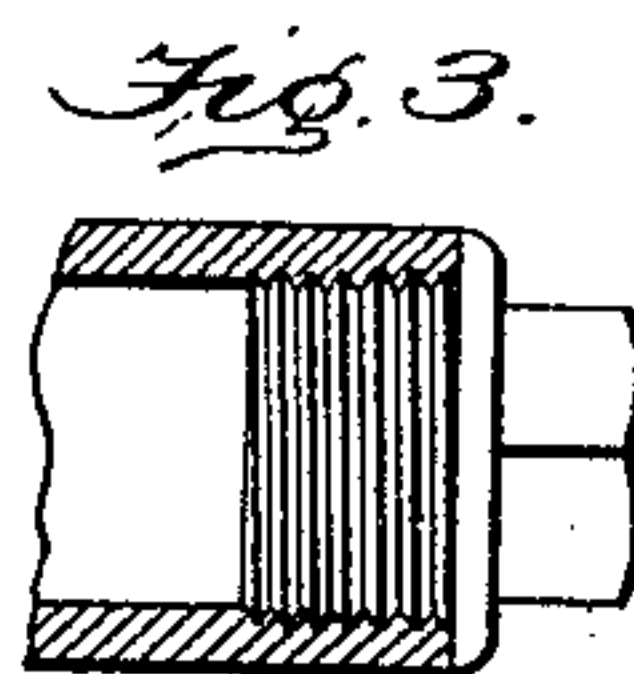
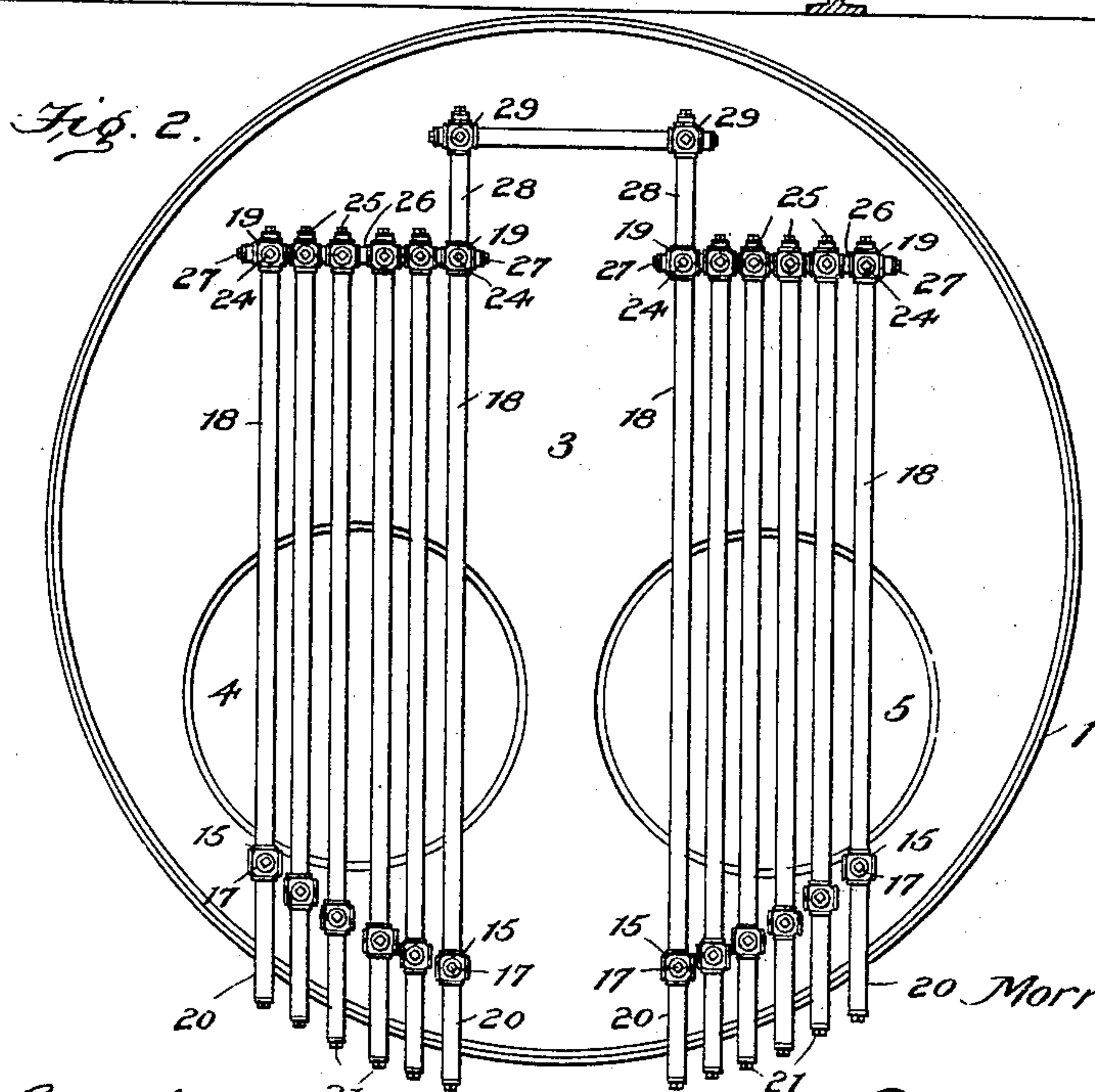
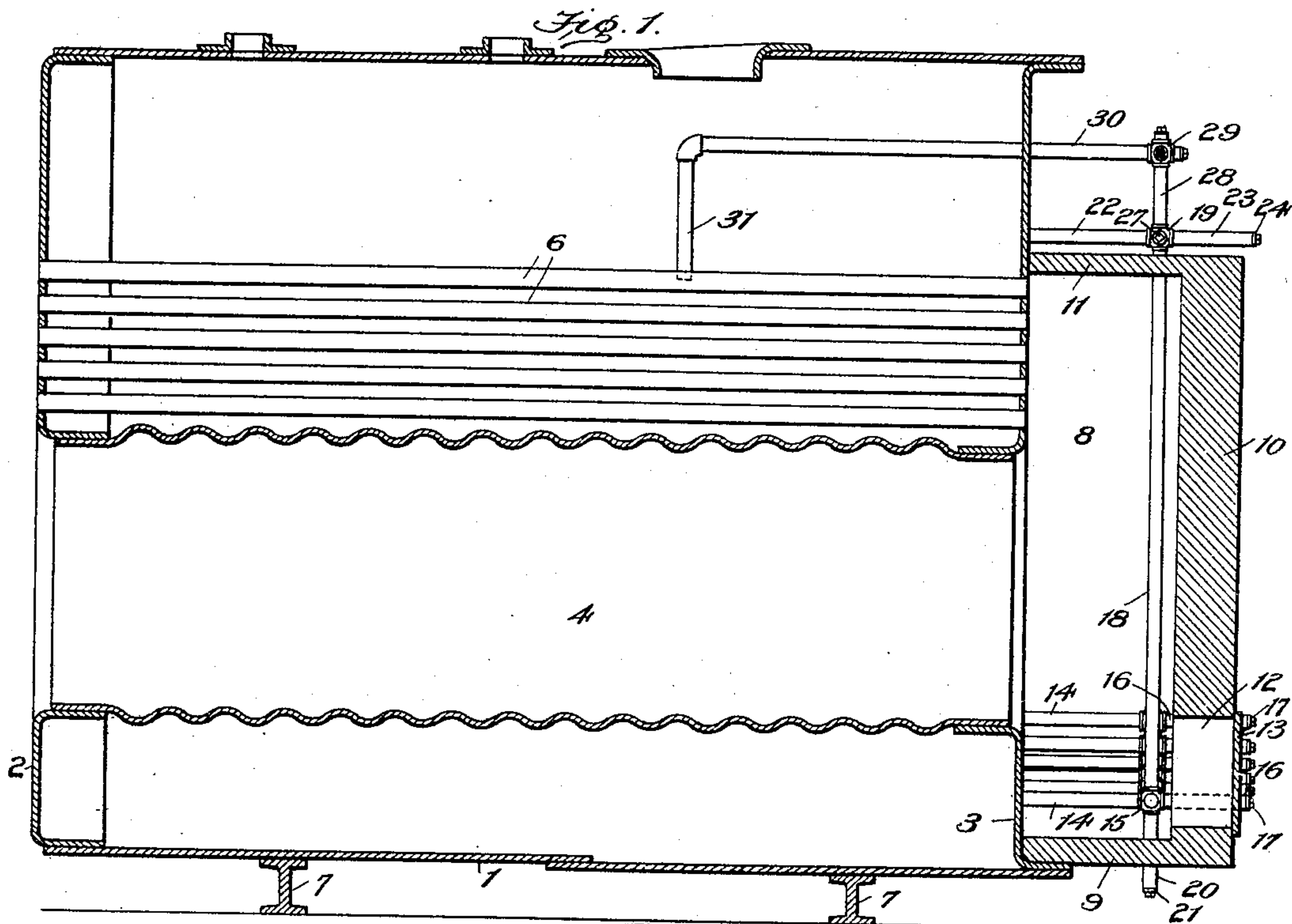
No. 774,400.

PATENTED NOV. 8, 1904.

M. SHERMAN.  
STEAM BOILER.

APPLICATION FILED MAR. 10, 1904.

NO MODEL.



Witnesses

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# UNITED STATES PATENT OFFICE.

MORRIS SHERMAN, OF CHATTANOOGA, TENNESSEE.

## STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 774,400, dated November 8, 1904.

Application filed March 10, 1904. Serial No. 197,435. (No model.)

*To all whom it may concern:*

Be it known that I, MORRIS SHERMAN, a citizen of the United States, residing at Chattanooga, in the county of Hamilton and State of Tennessee, have invented new and useful Improvements in Steam-Boilers, of which the following is a specification.

My invention has relation to new and useful improvements in steam-boilers, and more especially to that character or type of boiler in which means is provided or included in the structure of the boiler to establish a circulation of the water through the boiler in order to better facilitate the heating of the water and the generation of steam.

The primary object of the invention is to construct a boiler of the type mentioned with an improved and simplified means for creating the circulation of the water within the boiler in order that the heated water may be evenly distributed within the boiler to bring substantially all the water into direct contact with the portions of the boiler having the greatest heat.

Another object is to so construct the circulatory means or system that it may be easily and thoroughly cleaned without disconnecting or removing any of the parts from their operative relation to the boiler.

The invention consists in providing, in combination with an internally-fired fire-tube boiler of the dry-back type, a circulatory system consisting of a plurality of water-tubes arranged in the combustion-chamber in rear of the boiler and communicating with the interior of the boiler at points above and below the furnace or furnace-flue, the arrangement being such that the tubes being subjected to the heated gases will cause a circulation of the water therein, so that the water will be constantly elevated from beneath the furnace and discharged into the upper portion of the boiler to be decomposed into steam.

The invention consists, further, in the improved arrangement and aggroupment of the various elements to be more fully described hereinafter and the novelty of which will be particularly pointed out and distinctly claimed.

I have fully and clearly illustrated my invention in the accompanying drawings, to be taken as a part of this specification, and wherein—

Figure 1 is a vertical longitudinal central section through a boiler embodying my invention in its structure. Fig. 2 is a rear elevation of the invention, the rear fire-wall of the boiler-furnace being removed to disclose the arrangement of the pipes in the circulatory system. Fig. 3 is a detail view of the ends of one of the water-tubes, partly in section, showing the structure of the removable plugs to permit access to the tubes.

Referring to the drawings, the reference-numeral 1 designates the outer shell of a boiler, which is substantially cylindrical in form and which is closed at its opposite ends by means of heads 2 3. Extending longitudinally through the boiler and arranged at a point below the horizontal diameter thereof are a pair of furnace-tubes 4 5, the respective ends of which are rigidly secured to the heads 2 and 3, through which they open. In the upper portion of the boiler-shell above the furnace-flues 4 5 are a plurality of fire-tubes 6, which extend lengthwise of the boiler and are secured at their ends in the boiler-heads, substantially as shown in the drawings, and through which the furnace-gases pass from the furnace-flue on their way to the stack, the heating of the tubes by the gases serving to decompose the water in contact with said fire-tubes and generate the steam. This boiler, as briefly described above, is of a common and well-known type and forms, specifically, no part of my invention, which consists in the additions or improvements made to said boiler to be described hereinafter.

The boiler is supported upon any suitable foundation, the construction of which is immaterial, but which is shown in the drawings as consisting of I-beams 7, upon which the boiler sets, as clearly shown in Fig. 1. At the rear of the boiler is constructed a chamber 8, built up of a horizontal wall 9, adjacent the bottom of the boiler, a vertical wall 10, rising from said horizontal wall, and a second horizontal wall 11, connected to the upper



end of the vertical wall and abutting the rear boiler-head at a point above the uppermost of the fire-tubes in said boiler. In the rear or vertical wall is an opening 12, communicating  
5 with the interior chamber for a purpose to be hereinafter more fully set forth. This opening is closed by means of a door 13, suitably mounted on the outside of the vertical wall.

It will be seen that the products of combustion and the furnace-gases will pass through  
10 the furnace-flues 4 5 into the chamber 8 and be directed by the walls of said chamber thence into the rear open ends of the fire-tubes 6 and through said fire-tubes to the stack.  
15 The boiler being supplied with a proper quantity of water it is apparent that the water directly over the furnaces and furnace-flues will be subjected to a greater heat than that water below the flues, owing to the fact that the  
20 heated fire-tubes add to the heat supplied by the furnace-flues, while that water at the sides and bottom of the boiler is heated by the flues alone. The result of the circumstances just stated is that the water in the boiler is not  
25 evenly heated and a greater time and excess of fuel is required to generate the steam, which objections are satisfactorily overcome by the means to be now described for maintaining a constant and rapid circulation of  
30 the water from the bottom to the top of the boiler, so that the entire contents of the boiler will be subjected to the heat of the fire-tubes at one time or another.

At a point directly beneath the rear open  
35 ends of the furnace-flues in the head of the boiler are tapped two rows of holes, into which are secured in any suitable manner a plurality of rearwardly-extending horizontal pipes or water-tubes 14, said pipes being arranged in  
40 a curved line substantially coincident with the curve of the boiler-shell, said line being arranged closely adjacent the periphery of the head in order to bring the inner ends of said pipes in proper position to receive the water  
45 from substantially all depths in the boiler below the furnaces, so that when the circulation is created, as hereinafter set forth, there will be no dead water left at the bottom of the boiler. Each of these tubes 14 at its rear end  
50 portion is connected to one arm of a double-elbow pipe-coupling 15, and to the opposite arm is secured a horizontally-disposed pipe 16 in line with the tube 14, extending into the opening in the rear wall of the chamber 7  
55 and provided with a screw-cap 17, which normally closes the rear end of the tube, but is removable when it is desired to clean the tube to which it is attached.

Secured to and communicating with the interior of each of the couplings 15 is a vertical tube 18, arranged closely adjacent the rear wall of the chamber 7 and extending upwardly for the whole height of said chamber and through the wall 11 to communicate with a

double-elbow coupling 19, as clearly shown  
65 in Fig. 1 of the drawings. From the lower arm of the coupling 15, or that opposite the one connected to the pipe 18, is a depending short pipe 20 in longitudinal alinement with the tube 18 and provided with a closure 21,  
70 the removal of which permits the water in the tubes 18 to be drawn off and the tubes to be cleaned. Secured to each of the couplings 19 and projecting laterally and forwardly therefrom is a tube 22, the end opposite to  
75 that connected to the coupling being connected to the rear head of the boiler and opening into the boiler at a point just above and closely adjacent the bank of fire-tubes in order that the comparatively cool water will be dis-  
80 charged directly onto the fire-tubes and be quickly decomposed into steam. Each of the couplings 19 is provided with a short pipe 23 in line with the tubes 22 and provided with a closure 24, the removal of which permits the  
85 clearing of the interior of the pipes 22.

The upper vertical arm of each of the couplings 19 is closed by a cap 25, which is removable to permit cleaning. By referring to Fig. 2 it will be noticed that the couplings 19 are  
90 arranged side by side in a horizontal line and are connected to each other by means of short pipe-sections 26, and the side couplings are provided with removable caps 27, so that the interiors of the couplings might be easily ac-  
95 cessible for cleaning purposes.

The innermost tube of each set or series, or the one nearest the center of the boiler, instead of terminating in a line with the other tubes is carried vertically for a distance above  
100 the upper terminals of the remaining tubes, as at 28, and is provided with a double-elbow coupling 29, from one side arm or branch of which extends a laterally-projecting horizontal pipe 30, which is projected through the  
105 rear head of the boiler and carried to a point well within the shell, where it is provided with a downwardly-directed outlet 31, the lower end of which terminates at a point below the water-line of the boiler and directly  
110 over, or, if desired, among the horizontal fire-tubes. It will be noticed that the lower ends of the innermost tubes are at the lowest point in the boiler, where the water is coolest, so that the water from the coolest part of the  
115 boiler will be discharged directly onto the highly-heated fire-tubes and rapidly transformed into steam.

The operation of the boiler, or rather the actions created in the water by the structure  
120 just described, it is believed, will be apparent from the above description, taken in connection with the drawings; but it may be stated as follows: The fire being built within the furnace, the draft created carries the gases and  
125 products of combustion rearwardly through the furnace-flues 4 and 5 into the chamber 8 into direct contact with the vertical tubes 18,



serving to heat the same and cause the water therein, owing to its consequent heated condition, to flow upwardly through said tubes and the pipes 22 into the boiler at a point  
 5 above the fire-tubes. The rising of the heated water and its flow into the upper portion of the boiler causes the water from the bottom of the boiler, or that water subjected to less heat, to flow upwardly into the pipes 18 and  
 10 thence to the top of the boiler. It will thus be seen that a steady, rapid, and continuous circulation will be created within the boiler, so that all the water within the boiler is brought to the point of greatest heat, resulting in the  
 15 more economical and rapid generation of the steam.

The innermost pipes of the series, as above described, by virtue of being carried above the remaining pipes and discharging at a point  
 20 approximately the center of the boiler serve a purpose which is important in the successful operation of the boiler. They provide, in the first place, for a more even distribution of the water in that they take the water from  
 25 the coolest part of the boiler and discharge it at the hottest point, so that the average heat of the water in the boiler is quickly reached. A second important result attained by the tubes mentioned is that they prevent siphon-  
 30 ing of the water from the upper part of the boiler, and a third result attained is that these tubes accelerate the circulation of the water through the other tubes, owing to the fact that the water flows more rapidly through  
 35 the innermost tubes incident to being subjected to the additional heat of the dry steam within the boiler, and said tubes communicating with the receiving-tubes in the series through the couplings 19 and short pipes 26  
 40 creates more rapid circulation in all of the tubes.

Having thus described my invention, what

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

1. The combination with a steam-boiler hav- 45  
 ing an internal furnace-flue, of a plurality of water-tubes arranged at the rear of the boiler and exterior thereto, the respective ends of the tubes communicating with the boiler at points above and below the furnace-flue, and 50  
 an additional tube communicating with all the water-tubes and extending to a point within the boiler.

2. The combination with a steam-boiler hav-  
 ing an internal furnace-flue, of a plurality of 55  
 water-tubes arranged at the rear of the boiler and exterior thereto, the respective ends of the tubes communicating with the boiler at points above and below the furnace-flue, and one or more additional water-tubes communi- 60  
 cating with all the water-tubes projecting a distance above said tubes, said additional tube or tubes opening into the boiler above the other tubes.

3. The combination with a steam-boiler hav- 65  
 ing an internal furnace-flue, of a plurality of horizontally-disposed pipes arranged at different heights below the furnace-flue, couplings carried by said pipes, vertical tubes con-  
 nected to said couplings and extending to a 70  
 point above the furnace-flues, couplings at the upper ends of the vertical tubes, and horizontal pipes connected to said couplings and opening into the boiler, all of said couplings being provided with removable caps to per- 75  
 mit access to both the vertical and horizontal water-tubes for the purpose of cleaning.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

MORRIS SHERMAN.

Witnesses:

FRANKLIN HARRIS,  
 T. S. LYON.