

No. 718,525.

PATENTED JAN. 13, 1903.

A. E. ROBERTS.

COMBINATION SCOTCH AND WATER TUBE MARINE BOILER.

APPLICATION FILED MAR. 18, 1901.

NO MODEL.

Fig. 2.

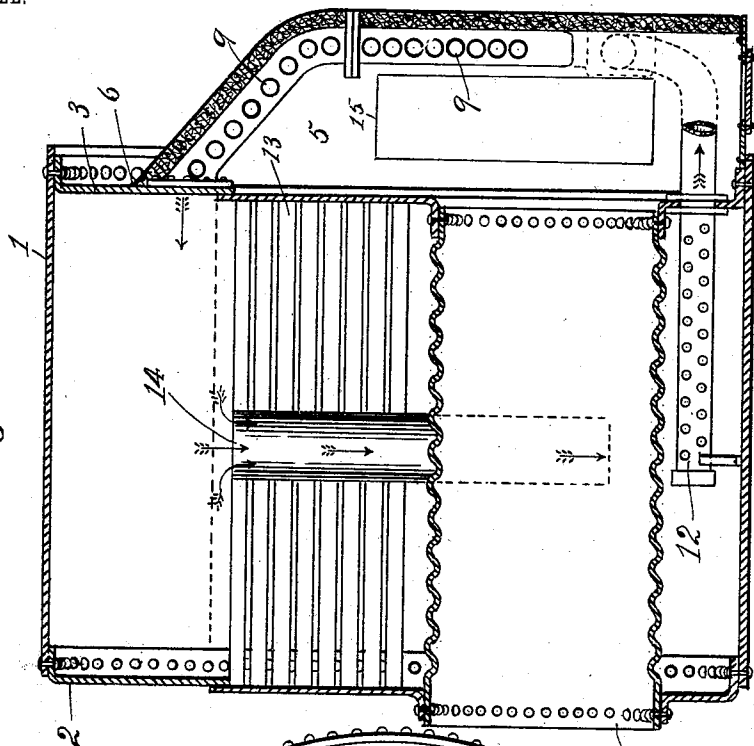
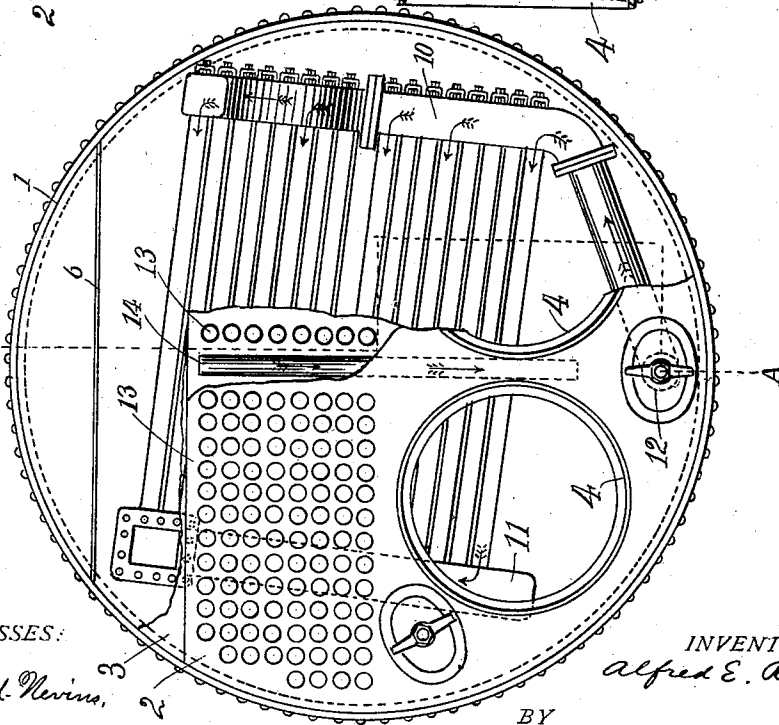


Fig. 1.



WITNESSES:

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COMBINATION SCOTCH AND WATER-TUBE MARINE BOILER.

SPECIFICATION forming part of Letters Patent No. 718,525, dated January 13, 1903.

Application filed March 18, 1901. Serial No. 51,773. (No model.)

To all whom it may concern:

Be it known that I, ALFRED E. ROBERTS, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented certain new and useful Improvements in Combination Scotch and Water-Tube Marine Boilers, of which the following is a specification.

My invention relates to improvements in marine boilers, the object of my invention being to provide a boiler of a construction which will include the advantageous features of both what is known as the "Scotch" marine boiler and the water-tube marine boiler.

The advantages of the water-tube marine boiler are its rapid circulation and that steam can be gotten up in a very short time. Its disadvantages are its fluctuation in pressure and water-line. From the latter cause the marine boiler known as the "Scotch" or return tubular marine boiler is generally preferred, notwithstanding its poor circulation and other disadvantages.

The object of my invention is to provide a marine boiler which will have excellent circulating ability, and therefore increased efficiency and economy, while at the same time having stability in pressure and water-line and simplicity of construction, being therefore easy to keep in repair, easy to manage, and cheap to manufacture. In other words, the invention is such as to provide economy in fuel consumption, economy in weight of boiler, economy in first cost of manufacture, economy in maintenance and repair, economy in ship-space. This is in addition to other advantages already referred to and hereinafter in detail more particularly pointed out.

My invention therefore resides in the novel construction, combination, and arrangement of parts for the above ends, hereinafter fully specified, and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a broken end view of the boiler, the rear wall thereof being broken away to show the water-tubes in the combustion-chamber; and Fig. 2 is a longitudinal section of the boiler on the line A A of Fig. 1.

Referring to the drawings, 1 represents the cylindrical casing of the boiler of the width of a single plate from front to rear.

Herein is gained an important advantage over the ordinary form of Scotch boiler, having a rear combustion-chamber inclosed within the boiler-casing and subject to the steam-pressure. Such boilers of no greater capacity than my improved boiler are of such length as to require two cylindrical plates joined by a circumferential seam midway of the length of the boiler, which costs more and leaks a great deal below the furnace-line. In my improved form the boiler-casing proper is considerably shortened, so that plates of a single width can be used.

The front head 2 of the boiler is made precisely like that of the Scotch boiler—that is to say, with a peripheral flange riveted to the end of the cylindrical boiler-casing—and I construct the rear head 3 in a similar manner, except that in this case the peripheral flange of the head extends outwardly instead of inwardly, thereby allowing machine-riveting with no increased total length of the boiler. Said cylindrical casing and heads form the boiler-casing proper. Entirely through said casing are passed two furnaces 4, opening at the rear end into the combustion-chamber 5, said combustion-chamber following in its lower portion the cylindrical outline of the boiler-casing and having a straight top 6, secured to the rear head 3 of the boiler proper. The rear wall of the combustion-chamber 5 is inclined forwardly at the top to connect with the rear wall of the boiler-casing and is packed with asbestos or other suitable material. Against said wall are supported inclined water-tubes 9, the ends of said water-tubes being fitted into the wrought-steel tube headers or legs 10 11, which can be bull-riveted, as shown, the lower header 10 receiving the water from the water-space by means of the pipe 12, while the upper header 11 discharges into the upper portion of the steam and water chamber at about the height of the water-line.

For easy removal the headers 10 11 may be divided into sections attached to each other by flanges, and I have herein shown the same so divided, although this is not a necessary part of the invention.

From the combustion-chamber 5 the hot gases pass through the water-chamber by means of fire-tubes 13 in the same manner as

in the Scotch boiler. In order to assist in the rapid circulation of the water, a downcast-pipe 14 is provided, passing between the two furnaces, as shown.

- 5 The advantages of the above construction are as follows: The screw-stays which are necessary in the Scotch boiler to connect the rear wall of the combustion-chamber with the outer casing of the boiler are no longer needed.
- 10 These screw-stays were a source of continual trouble, owing to the strain on the plates due to the change of temperature, and leaks were continually arising. The girders or bracket-plates over the combustion-chamber required
- 15 in the Scotch boiler are now not needed, as said combustion-chamber is no longer subject to the water-pressure. The expensive flanging that is necessary with the internal combustion-chamber in the Scotch boiler is also
- 20 avoided. It has already been remarked that the central circumferential seam necessary in the Scotch boiler on account of the difficulty of getting plates of the required width is now not necessary, as the boiler-casing is
- 25 shortened, and plates can be obtained wide enough to extend the whole length of said boiler-casing.

- In the Scotch boiler in order to get at the combustion-chamber to make repairs therein
- 30 it was necessary for the engineer to crawl through the furnaces into said combustion-chamber. This is now no longer necessary, as a door 15 is provided at the side or bottom of the combustion-chamber, giving easy access thereto. With the Scotch boiler it was
- 35 necessary to leave sufficient room behind the rear end of the boiler to get at the screw-stays. This is now no longer necessary, and that space is now saved for the ship's use.
- 40 This boiler is also of desirable construction, as it can readily be substituted for the ordinary Scotch boiler without material alteration of the shipwork. Excellent circulation of the water is now secured with less expense in
- 45 fuel, and thus the efficiency and economy of the boiler are increased, and the steam can be gotten up quickly, as the combustion-chamber is now no longer under boiler-pressure, and therefore the boiler is not strained when the
- 50 steam is being generated. A further advantage is that the boiler is well adapted for forced draft, owing to the fact that the flame is forced against the water-tubes 9 instead of against a stayed surface, as in the Scotch marine boiler. This boiler can also be used for
- 55 high pressures, as there are no surfaces stayed by screw-stays, which in previous constructions practically placed a limitation on the pressures. The loss of heating-surface of the combustion-chamber is more than compensated for by the surface of the water-tubes. This construction also admits of providing a separate combustion-chamber to each
- 60 furnace with no diminution in the number of fire-tubes, with little cost, and with greater cubic capacity of combustion-chamber for the same depth, this being rendered possible by

placing a vertical sheet of asbestos in the combustion-chamber between two furnaces. The number of fire-tubes is increased for a given diameter of boiler without reducing the height of the steam-space, owing to the fact that the combustion-chamber, now no longer being surrounded by water, may be expanded to the extreme edge of the boiler proper, thus permitting a greater number of fire-tubes at the sides. A further advantage is that owing to the shortening of the boiler-casing small hatches may be permitted in ships, so that the ship is not cut to pieces to get the boiler into position therein. This construction also admits of ready provision for double-ended boilers, which in this case are two single-ended boilers back to back, and such double-ended boilers may be easily put in place on board ship.

A modified inferior form of my invention may be obtained by placing the water-tubes 9 within the combustion-chamber of the ordinary Scotch boiler. This construction, although losing most of the advantages attendant upon the form of the invention shown in the drawings, is yet an improvement in some respects upon the ordinary Scotch boiler, and I desire to include the same as within the scope of my invention.

The water-tubes can be cleaned when required by means of chains passed there-through.

I am aware that it has been proposed to provide a marine boiler comprising upper and lower separate cylinders, the lower cylinder having a furnace therethrough and the upper cylinder having fire-tubes therethrough, said cylinders being connected by short vertical tubes running from the top of the lower cylinder to the bottom of the upper cylinder and also by long vertical tubes at the rear ends of both cylinders, the latter tubes forming, with the cylinders, a combustion-chamber. My construction differs from this in providing a single large cylinder, thus dispensing with the short vertical tubes aforesaid.

The advantages of my construction over the prior construction referred to are as follows: The height between decks being necessarily limited, said prior construction does not stow well in the ship in proportion to the steaming ability. There is too much loss of space in the design and too much space occupied in proportion to the steaming ability. Moreover, by reason of the space extending between the two cylinders the bottom of the upper cylinder will be comparatively cold, and since there is thus a great deal of space exposed to radiation of heat from the cylinders the very object of providing circulation ability will be defeated, this object being to get rid of the cold water. Another disadvantage is that by reason of the exposure to cold of the bottom of the upper cylinder there will be extreme straining of the material of said cylinder and of the top of the lower cylinder, and the joints between the

two cylinders will leak, owing to this straining. These short openings also will cause "priming," on account of the sudden inrush of the water from the lower cylinder into the upper cylinder, making the steam wet.

Another advantage residing in my construction is that I am able to use two, three, four, or more furnaces through the same cylinder, thus permitting cylinders of any size to be used. This is not possible in the prior construction referred to, which is only capable of being used to any advantage with a single furnace. The largest economical furnace is of forty inches diameter. A furnace fifty-four inches in diameter, the largest made, withstanding a pressure of two hundred pounds, would have to be three-fourths of an inch thick. This would be so thick that the heat could not pass through economically to heat the water. Any larger size than this would be impractical. This would limit the size of the unit boiler, and it would be necessary to put in a very large number of boilers in an ordinary merchant ship to obtain the proper amount of steam and there would not be floor-space enough for such boilers. My construction avoids these disadvantages, since it is permissible to put any number of furnaces in the same boiler-casing.

Another advantage is that the present construction of the boiler can be readily substituted for the Scotch boilers now generally in use, being of the same general form, whereas the prior construction referred to could not be so substituted with advantage, if at all.

I claim—

1. In a marine boiler, the combination of a single cylindrical boiler-casing, a combustion-chamber in the rear of and outside of the

boiler-casing, a furnace extending through the lower part of the boiler-casing and opening into the said combustion-chamber, return fire-tubes through the upper part of the boiler-casing opening from the upper part of the said combustion-chamber, a main water-tube or header connected with the lower part of the boiler-casing, a main water-tube or header connected with the upper part of the boiler-casing, and water-tubes leading upward from the header connected with the lower part of the boiler-casing to the header connected with the upper part of the boiler-casing, substantially as described.

2. In a marine boiler, the combination of a single cylindrical boiler-casing, a combustion-chamber in the rear of and outside of the boiler-casing, a plurality of furnaces extending through the lower part of the boiler-casing and opening into the said combustion-chamber, return fire-tubes through the upper part of the boiler-casing opening from the upper part of the said combustion-chamber, a main water-tube or header connected with the lower part of the boiler-casing, a main water-tube or header connected with the upper part of the boiler-casing, and water-tubes leading upward from the header connected with the lower part of the boiler-casing to the header connected with the upper part of the boiler-casing, substantially as described.

In witness whereof I have hereunto set my hand in the presence of two subscribing witnesses.

ALFRED E. ROBERTS.

Witnesses:

FRANCIS M. WRIGHT,
Z. A. DANIELS.