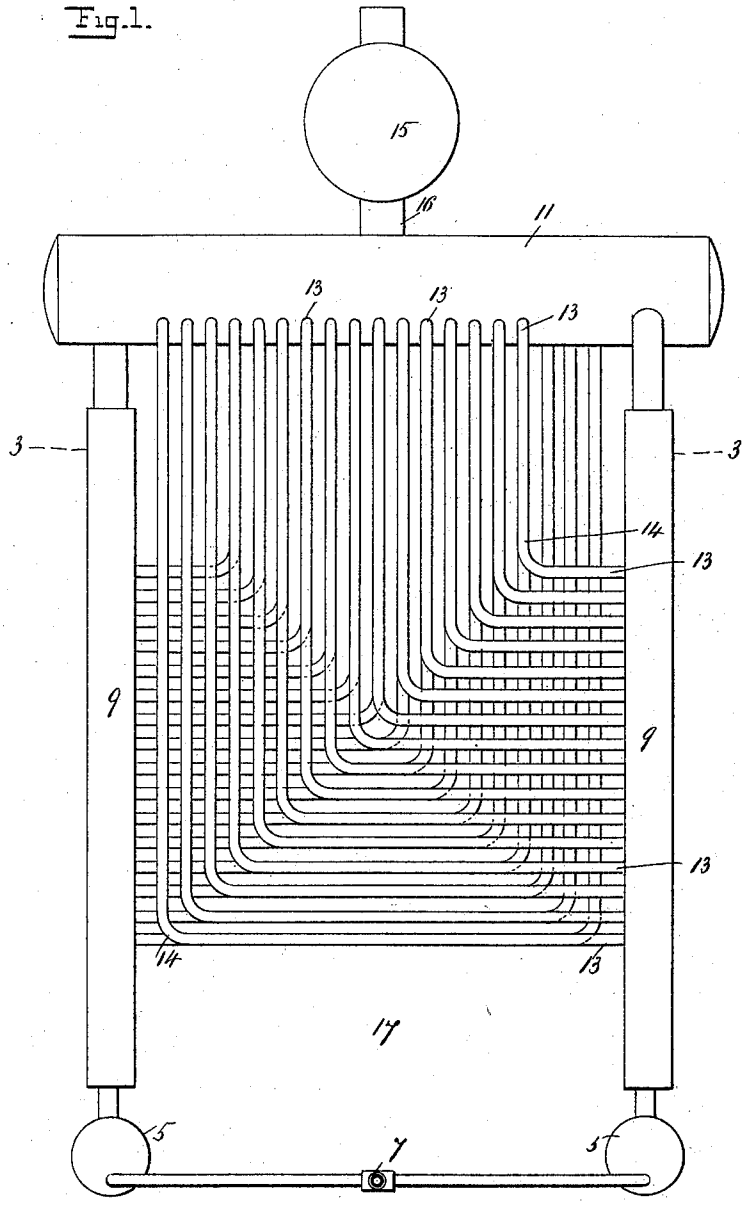
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F. A. GARDINER.

BOILER.

No. 603,877. Patented May 10, 1898.

Fig. 1.



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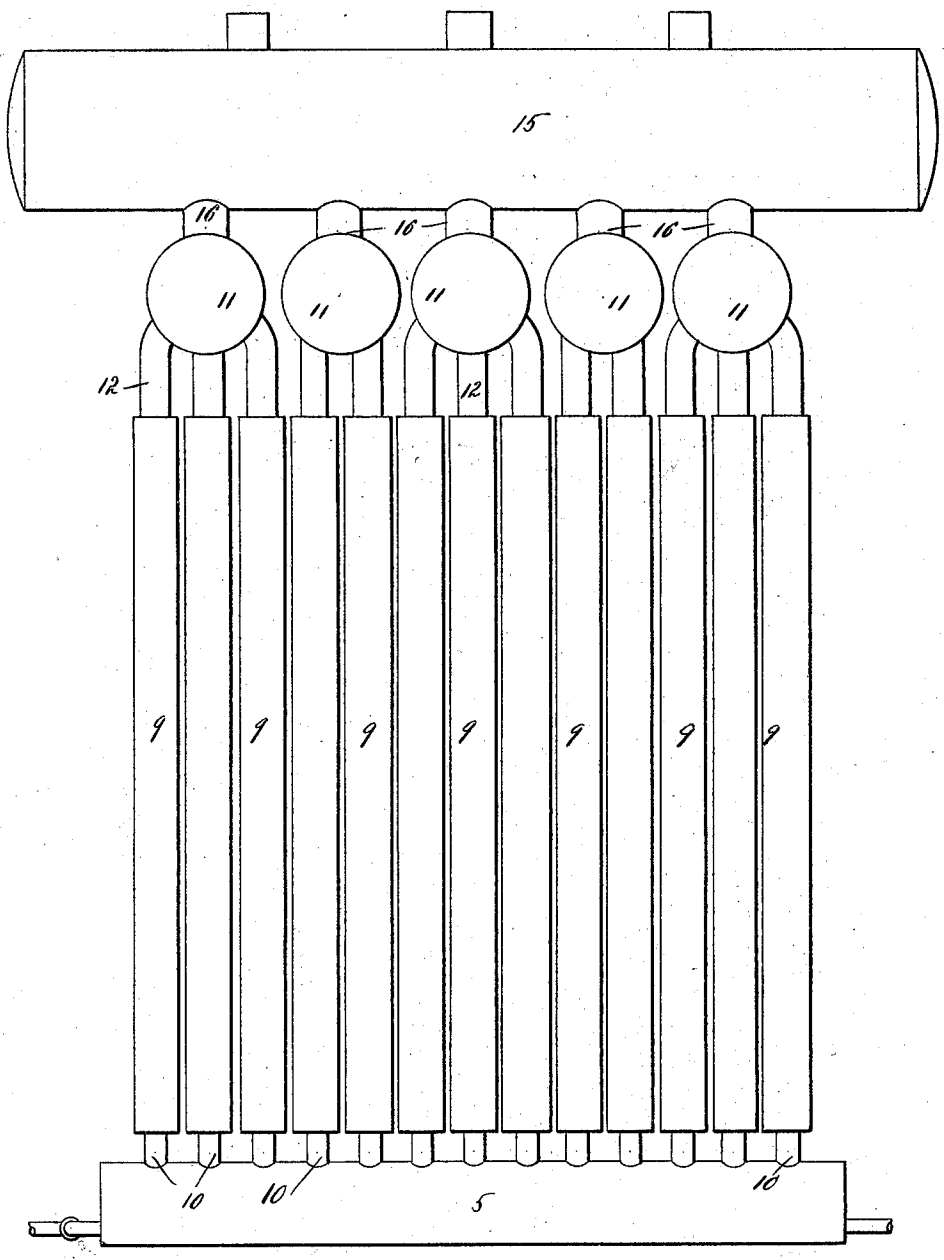
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Fig. 2.



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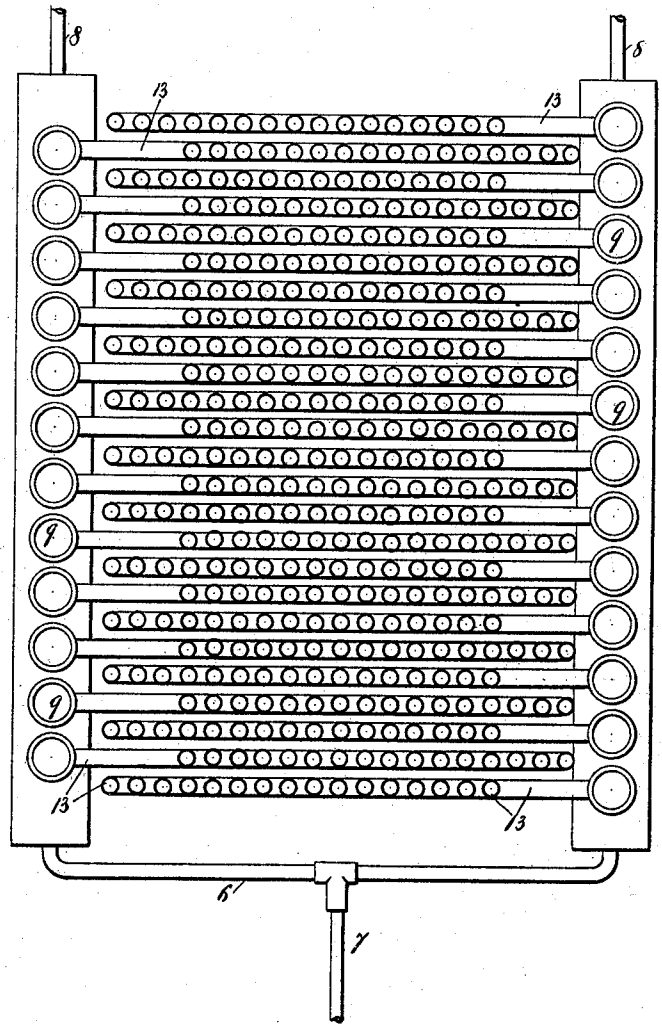
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Fig. 3.



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UNITED STATES PATENT OFFICE.

FRED ADELBERT GARDINER, OF DEDHAM, MASSACHUSETTS.

BOILER.

SPECIFICATION forming part of Letters Patent No. 603,877, dated May 10, 1898.

Application filed December 31, 1897. Serial No. 665,075. (No model.)

To all whom it may concern:

Be it known that I, FRED ADELBERT GARDINER, a citizen of the United States, residing at Dedham, in the county of Norfolk and State of Massachusetts, have invented certain new and useful Improvements in Boilers, of which the following is a full and complete specification, such as will enable those skilled in the art to which it appertains to make and use the same.

My invention relates to boilers in general, and more particularly to that class known as "water-tube" boilers, and is especially designed for marine use and for other purposes where a small and compact boiler with high efficiency is required, the particular object of my invention being to provide a boiler of this nature which will economize floor-space and which will, moreover, present a maximum pipe-surface to the action of the heat from the fire-box and will insure a perfect circulation.

In the drawings forming a portion of this specification, and in which similar figures indicate similar parts in the several views, Figure 1 is a front view of my improved boiler. Fig. 2 is a side view thereof, and Fig. 3 is a section on line 3 3 of Figs. 1 and 2 and showing the overlapping arrangement of the series of water-tubes.

Referring now to the drawings, in operating in accordance with my invention I provide two drums 5, arranged parallel at the base of the boiler and forming mud or water drums, said drums having a mutual pipe connection 6, comprising a T 7, through the medium of which connection may be had with an inspirator, donkey-pump, or other boiler-feeding device. Blow-outs 8 are tapped into the drums 5 and form means for blowing off, when desired.

Connected with each drum 5, through the medium of nipples 10 or by other desired means, is a series of vertical water-columns 9, the columns of each series being connected alternately in pairs and trios with separating-drums 11, extending above the columns and transversely of the boiler, the columns of one series standing opposite the interspaces between the columns of the other series.

The connections of the columns 9 with the drums 11 are made through nipples 12, the system of connection being such that each pair of columns of one series will be connected to one end of a drum, while each trio of the other series will have connection with the opposite end, the result being that one end of each drum will have connection with three columns, while the other end will have connection with but two columns. Further connection between each column 9 and its respective separating-drum is made by means of a series of water-tubes 13, the lowermost tube extending from a point adjacent the lower end of its column transversely of the boiler and horizontally to a point adjacent the opposite column, where it is bent upwardly at 14 and extended upwardly to its respective drum, the upward extension continuing in the planes of its column and nipple connection with the drum. A succession of similar tubes 13 are arranged above the lowermost tube and equally distanced in the same plane therewith and connect with the same drum, the horizontal and vertical extensions of said tubes gradually diminishing in length, as shown in Fig. 1 of the drawings. The result of this arrangement, as shown in Figs. 1 and 3 of the drawings, is to secure a succession of series of overlapping pipes or water-tubes, the series, as also the tubes of each series, being separated by slight interspaces completely filling the area above the fire-box 17, except for sufficient space to allow the passage of heat between the tubes. A further result, and an extremely desirable one, is that with this arrangement I am enabled to use a small gage of water-tube with the maximum gage of water-column, insuring an extremely rapid and a complete circulation of water throughout the boiler, at the same time securing the maximum exposure of water-tube surface to the action of heat from the fire-box.

Arranged transversely and centrally of the separating-drums 11 is a steam-drum 15, connected successively with the separating-drums by means of nipples 16, whereby the dry steam may rise from the drums 11 into the steam-drum, from which latter it may be conducted in any desired manner to the proper point.

It will be noted that the central column of each trio is connected with its respective drum at the lowest point thereof, whereby said drum may be completely drained.

The operation of my boiler will be fully understood upon a reference to the drawings and the specification, and is as follows: The boiler being filled with water to a proper height and fire being in the box 17, the heated water in the pipes 13 will rise, and the vapor therefrom, together with portions of the water, will enter drums 11, the steam leaving the water and passing upwardly through connections 16 into the steam-drum 15. Meanwhile the water thus entering the drums 11 will pass longitudinally thereof, and, entering the columns 9, which are of larger diameters and lower temperature, will fall thereinto and will descend therein, until, entering one of the pipes or tubes 13, it will again pass upwardly, maintaining the course and passing from one portion of the boiler to another so long as heat may be applied and water supplied thereto.

It will be readily understood that I may vary the specific arrangement herein shown and described without departing from the spirit of my invention.

Having thus described my invention, what I claim is—

1. In a boiler, the combination with a plurality of water-drums of a series of vertical columns connected with each drum in a common plane, a plurality of separating-drums arranged above and transversely of the said columns and water-drums, the columns of each series being connected alternately in pairs and trios with the adjacent ends of their respective separating-drums, the middle column of each trio having vertical connection with the lowest point of the drum to drain the latter, the remaining columns of each trio having bent connections with the sides of their respective drums, the columns of each pair having vertical connection with the adjacent ends of their respective drums, a plurality of angular tubes extending outwardly from each column and upwardly in the plane of its column, the tubes from the columns of one series extending between the tubes of the other series.

2. In a boiler, the combination with a plurality of water-drums, of a series of columns connected with each drum, a plurality of separating-drums arranged above and transversely of the water-drums, the columns of each series being connected alternately in pairs and trios with their respective separating-drums, a series of water-tubes extending from each column and connected with the separating-drum of its respective column, and a steam-drum connected with the separating-drums.

3. In a boiler, the combination with a plurality of water-drums, of a series of water-columns connected with each drum, a plurality of separating-drums arranged above and transversely of the water-drums, the columns of each series being connected in pairs and trios with their respective separating-drums, each separating-drum having a trio of one series connected with one end thereof and a pair of the opposite series connected with the other end, a series of tubes leading from each column to the separating-drum to which said column is connected, and a steam-drum connected with the separating-drums.

4. In a boiler the combination with a plurality of water-drums, of a series of water-columns connected with each drum, a plurality of separating-drums arranged above and transversely of the water-drums, the columns of each series being connected in groups with their respective separating-drums, said groups being alternately equal and successively different in number, each separating-drum having a larger group of one series connected with one end and a smaller group of the other series connected with the other end thereof and a series of tubes leading from each column and connected with the separating-drum with which its column is connected.

5. In a boiler the combination with a plurality of water-drums, of a plurality of separating-drums, water-columns connected with each water-drum and connected in groups with the separating-drums, water-tubes leading from the columns to the separating-drums with which their respective columns are connected, and a steam-drum connected with the separating-drums.

6. In a boiler, the combination with a plurality of water-drums, of a plurality of separating-drums, a series of water-columns connected with each water-drum and connected in groups with the separating-drums, said groups being alternately equal and successively different in number, each drum having a larger group of one series connected with one end and a smaller group of the other series with the other end thereof, water-tubes leading from the columns and connected with the separating-drums with which their respective columns are connected, and a steam-drum connected with the separating-drums.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of the subscribing witnesses, this 27th day of December, 1897.

FRED ADELBERT GARDINER.

Witnesses:

JAMES F. WARD,

FRANK W. HERRICK.