

(No Model.)

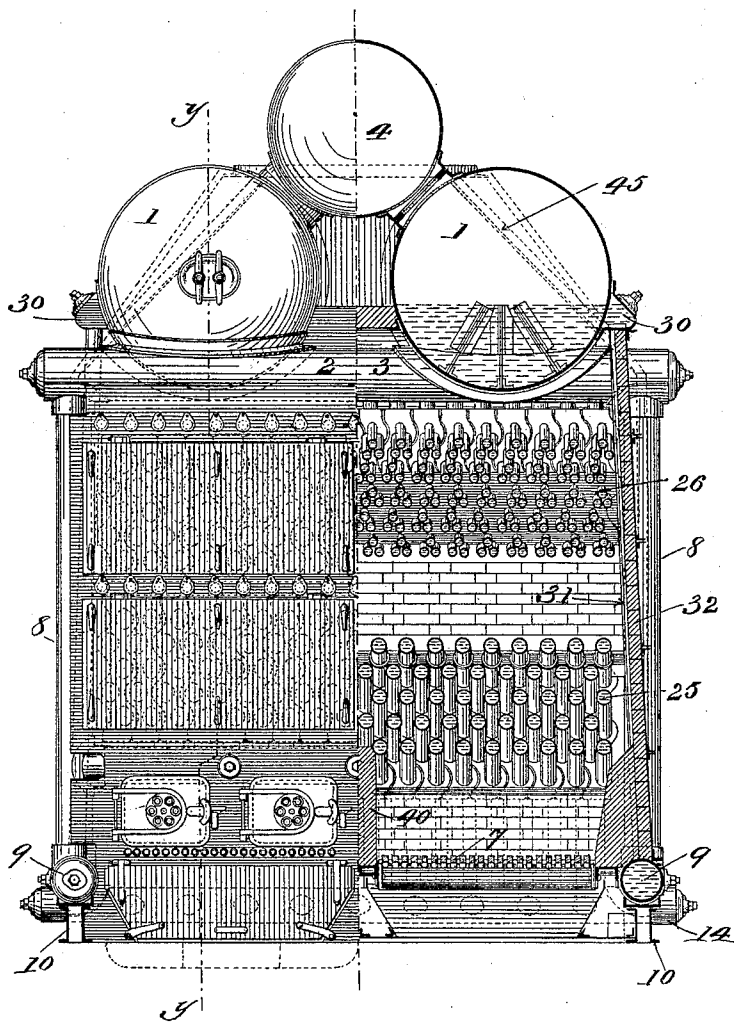
2 Sheets—Sheet 1.

N. W. PRATT.  
SECTIONAL STEAM BOILER.

No. 439,684.

Patented Nov. 4, 1890.

*Fig. 1.*



WITNESSES:

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## SECTIONAL STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 439,684, dated November 4, 1890.

Application filed December 23, 1889. Serial No. 334,725. (No model.)

*To all whom it may concern:*

Be it known that I, NAT. W. PRATT, a citizen of the United States, residing at Brooklyn, Kings county, State of New York, have invented certain new and useful Improvements in Sectional Steam-Boilers, of which the following is a specification.

The herein-described water-tube boiler is especially adapted for marine service. The construction of the same embodies a supporting structure composed as far as possible of the pipes forming the water-spaces of the boiler—such as the vertical downflow-pipes, the horizontal distributing-pipes, or the transverse pipes connecting the steam and water drums and the headers; also, an improved arrangement of the water-tubes, whereby the water is circulated repeatedly through the current of hot gases through successive groups of tubes, between which there are intervals or combustion-spaces; also, an improved arrangement of the upper groups of water-tubes in sub-groups, whereby the heating-surface is increased, as well as other details of improvement, such as will be hereinafter described, and pointed out in the claims.

Referring to the drawings, Figure 1 is a front elevation, partly in section, on the line *xx*, Fig. 2; and Fig. 2, a side elevation, partly in section, on the line *yy*, Fig. 1, the fire-brick filling between the vertical tubes being omitted.

The drawings represent a double boiler, each having two independent grate-surfaces 7. The steam-drums that are side by side have communication established between them through the transverse water-pipes 2 and 3, forming girders for the structure, and through the common steam-drums 4. There is no circulating communication between the generators lying end to end; but the smoke-flue 5, conducting to the funnel 6, is common to all the furnaces, and the furnaces that are side by side communicate above the wall 40. 8 8 are the vertical downflow-pipes, forming pillars for and communicating with the tubular girders 2 and 3, and 9 the longitudinal distributors, to which the downflow-pipes also communicate and rest upon. The distributors 9 lie upon the framing 10, composed of channel-beams, which form the foundation of the structure. The headers 11 are sus-

pended from the tubular girders 3, with which they communicate by nipples 12. The headers 13 are supported by the transverse distributing-pipes 14, extending between and communicating with the distributors 9, and with which transverse pipes the said headers 13 communicate by the uptake-tubes 15. The headers 16 and 17 are connected together by nipples 18, and are supported by the transverse tubular beam 19, secured to the columns 8, and which serve as a water-space, but not essentially as a circulating medium. The headers 17 are nipped to the pipe 19, supplying water thereto, and the pipe also communicates with the water-space in the columns 8 through holes 20. The headers are serpentine in form, connecting the water-tubes 25 in single vertical series in staggered succession, or connecting the water-tubes 26 in single vertical series of sub-groups or clusters in a similar staggered relation.

30 are connecting-boxes forming saddles on the sides of the drums 11, contributing to support them by means of the vertical water-tubes 31, which are expanded into said connecting-boxes, and also expanded into the distributors 9. These vertical tubes form the frame-work of the side walls of the furnaces, being filled in with fire-brick sections or blocks 32 between them, and they act as generating-tubes, promoting circulation. The side walls thus formed incline toward the top to increase the grate-surface, allowing for the thickness of the fire-brick 50. The connecting-boxes 30 communicate with the interior of the drum 1 only through the openings 35 near the rear ends of said drums, so as to deliver the steam and water near the delivering-point from the tubes 26, and thereby co-operate as to the direction of circulation indicated by the arrow, Fig. 2. The water-tubes 25, being exposed to greatest heat, are of heavier quality and large diameter to withstand the same, the tubes 26, exposed to less intensity, being constructed of lighter material, smaller diameter, and greater plurality, in order to increase their heating-surface. The dividing-wall 40 separates the fuel-spaces, but after passing above the same the hot gases mingle in the common combustion-spaces 41 42, passing thence a second time through the group of tubes 26 into the space 43, separated by the wall 44, thence

to the flue 5, surmounted by a hood 45, Fig. 1, between the adjacent ends of the drums 1.

In operation the circulation is passed upward from the transverse distributors 14 through the uptake-tubes 15 and generating-tubes 25 first, the same body of water thence circulating a second time under exposure to the hot gases through the tubes 26, where the heating-surface is furthermore increased. The opposite inclinations of the successive groups of tubes promote the reverse circulation, the steam and water being finally delivered through the transverse pipe 3 to the drums 1. The circulation also occurring upward from the pipes 9 through the wall-tubes 31 and discharging through the openings 30 at the water-level in the drums, the currents are thrown forward in a common direction into the cross-pipe 2, and thence downward through the downtake-pipes 8, chiefly at the fronts of the boilers. It is to be noted that the tube-groups may be employed in any number in vertical succession other than that shown.

I claim as my invention—

1. In a sectional steam-boiler, the combination of transverse connecting-pipes supporting the steam and water drum or drums, vertical downflow-pipes forming pillars for the transverse connecting-pipes, longitudinal distributors connecting with and forming the base of the pillars, and vertical upflow-tubes communicating therefrom with the sides of the steam and water drum or drums and forming the walls of the furnace.

2. In a sectional steam-boiler, the combination, with the steam and water drum or drums, the downflow-pipes, and longitudinal distributors, of a transverse distributor connecting between the longitudinal distributors and the generating-tubes arranged in groups oppositely inclined and connected at alternate ends in vertical succession, with combustion-spaces between them, having headers that connect the uppermost and lowermost extremities of said groups with the steam and water drum or drums and with the transverse distributor, respectively.

3. In a sectional steam-boiler, the herein-described arrangement of generating-tubes in groups oppositely inclined and connected at alternate ends in vertical succession, having combustion-spaces between them, the headers at the upper end of one group connecting with the adjacent headers at the lower end of the succeeding group above.

4. In a water-tube boiler, the herein-described arrangement of inclined generating-tubes in sub-groups or clusters staggered in vertical succession, and serpentine headers receiving all the members of each cluster severally in said vertical succession.

5. In a sectional steam-boiler, the combination of the furnace, the groups of inclined generating-tubes in vertical succession, hav-

ing combustion-spaces between them, the group or groups adjacent the furnace being composed of tubes of comparatively large diameter located at uniform distances apart, the succeeding group or groups being composed of tubes of comparatively small diameter arranged in sub-groups or clusters, the intervening spaces of which are greater than the intervening spaces between the constituents of the clusters.

6. In a sectional steam-boiler, the combination of the steam and water drum or drums, the downflow-pipes, the horizontal distributors, the inclined generating-tubes connecting with the distributors and the drums, and the vertical upflow-tubes, likewise connecting, forming the side walls of the furnace and converging from the lower portion toward the upper portion of the structure.

7. The combination, with the steam and water drum or drums, of the generating-tubes connecting with one end thereof, the longitudinal water-boxes fastened to the sides of the drum and upflow-tubes connecting therewith, and openings through the shell of the drum into the water-boxes adjacent the openings of the generating-tubes, for the purposes described.

8. In combination with the furnace of a water-tube boiler, a group of inclined generating-tubes above the furnace, receiving a single exposure to hot gases, a second inclined group above the first group, having a transverse flame-plate, and a draft-exit beneath one end of said second group, whereby the latter receives two successive exposures to the said hot gases.

9. In a sectional steam-boiler, the combination, with the furnace, of generating-tubes in groups oppositely inclined in vertical succession, the ends of said groups being alternately connected, and a flame-plate transverse to the tubes, whereby an upward draft is directed across one end thereof and a downward draft directed across the other end, the same body of water being subjected to repeated circulation and repeated exposure to the hot gases.

10. In a sectional steam-boiler, the combination, with the furnace, of an inclined group of generating-tubes above the same exposed to the fire throughout their length, an oppositely inclined group connected as described, an intervening combustion-space, a bridge-wall and flame-plate dividing the said space and second group transversely, a combustion-space above the second group, and a draft-outlet between the groups on the side of the bridge-wall opposite the said intervening combustion-space.

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