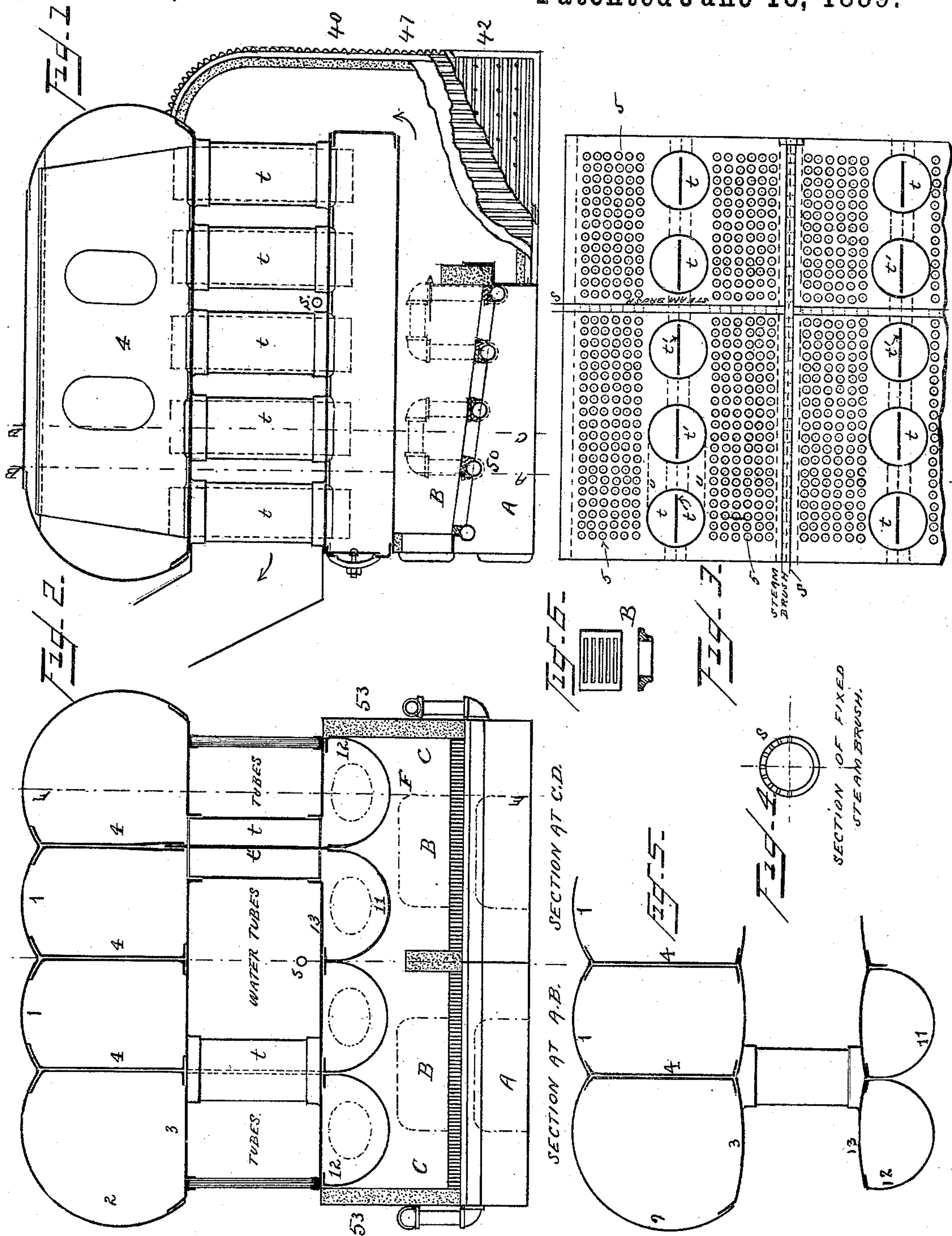


Patented June 18, 1889.



WITNESSES:

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UNITED STATES PATENT OFFICE.

NATHAN B. CLARK, OF THE UNITED STATES NAVY, AND FRANK B. KING, OF
BALTIMORE, MARYLAND.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 405,344, dated June 18, 1889.

Application filed December 6, 1888. Serial No. 292,854. (No model.)

To all whom it may concern:

Be it known that we, NATHAN B. CLARK, chief engineer United States Navy, (retired,) of Washington, in the District of Columbia, and FRANK B. KING, residing at Baltimore, in the State of Maryland, have invented certain new and useful Improvements in Steam-Boilers, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to steam-boilers of the class having an upper member composed of arches secured to a tube-plate, a lower member composed of reversed arches secured to a tube-plate, and water-tubes connecting the same, said boiler having some general features in common with the boiler patented to us July 24, 1888, No. 386,526, and with the application filed June 27, 1888, Serial No. 278,381.

The object of the invention is to simplify and strengthen the construction of boilers.

Figure 1 is a longitudinal section on line E F of a boiler of the character described. Fig. 2 is a cross-section of Fig. 1 on lines A B and C D, as will be readily understood. Fig. 3 is a horizontal section through the water-tubes; Fig. 4, a cross-section of steam pipe cleaner or brush. Fig. 5 is a diagram of a modification. Fig. 6 is a plan and section of grate-bar casting.

A indicates the ash-pit, B the fire-grate, and C the walls, of the furnace and casing.

The direction of the draft is from the grate backward under the bottom member of the boiler, then up and forward between the bottom and top members of the boiler, and so out at the front, as indicated by the arrows, Fig. 1.

The numeral 1 designates the top plates of the boiler, which plates form arches extending lengthwise of the boiler. The sides of the top member are formed by curved plates 2 and the bottom by tube-plates 3, which extend from side to side of the boiler. The edges of the arches are connected by perforated tie-plates 4 to the plates 3 and also to the bottom member of the boiler, preferably by riveting, or in other suitable manner.

The bottom member of the boiler has curved bottom plates 11 and side plates 12, which

are joined to the tube-plate 13, extending across the boiler, forming arches equal in number and parallel with the top arches of the boiler. Large downcast tubes *t* extend between the two boiler members, opening through the plates 3 13 in such position as to straddle the plates forming the sides of the lower arches, thus forming communication to both lower arches. The edges of the arched plates are tied through the tubes by tie-plates *t'*, which connect the edges of the lower arches to the tie-plates 4 of the top member. The plates 1 and 11 are thus connected to each other, and also to the plates 3 and 13, by the same sets of ties or braces. The downcast conduits *t* are in rows extending lengthwise of the arches or segments of the boiler. The space between these downcasts *t* is filled with vertical tubes 5, extending from the bottom to the top member. By a well-known law the water-circulation in the boiler will be down through the conduits *t* and up through the tubes 5.

The ties 4 may be flanged or may be angle-plates placed side by side, and may be made to straddle the ties *t'*, as shown at the right hand in Fig. 2.

A suitable number of fixed steam-pipes *s* may extend from side to side or from end to end of the boiler in proximity to the water-tubes. These pipes *s* are perforated with small holes, which serve to throw jets of steam among the tubes 5. The pipes *s* we call a "steam-brush," the object being to direct a jet of steam (or compressed air or water) onto the water-tubes, and thus clean them by blowing off the soot, &c. The pipes *s* are suitably connected with the boiler or with any other boiler or source of steam or air supply. If the fixed pipes *s* are made of an L or T shape, they can be inserted from the front of boiler and then fixed so as to discharge jets between tubes in both directions.

In our application filed June 27, 1888, Serial No. 278,381, we claim a movable jet-pipe for the purpose of a steam-brush, but not a fixed pipe. In the present device we use a fixed pipe, and provide for cleaning all the tubes by spraying the steam in all directions between the tubes.

As many rows of downcast conduits may

be used as there are adjoining arches in the boiler. The spaces between these conduits, which are occupied by water-tubes, can be reached from the ends of the boiler or from the sides, which are preferably removable. The downcast pipes may be flattened instead of round, (see dotted lines, Fig. 3,) and may be of size to correspond with the number employed. In the diagram, Fig. 5, the tube-plates 3 are shown as curved in reverse direction to the outer shell-plates. This construction will be desirable where the water-tubes are of great length in proportion to their diameter, and where it is not desirable to throw the work of supporting the tube-plates largely on the water-tubes.

As the tube-plates 3 are in part cut away for the passage of the water-tubes and conduits, the internal pressure on them is less than on the shell-plates 1 and 11. Consequently the tube-plates can be given a less curvature in the arches than the shell-plates with the same proportionate strength.

The grates are supported on water-tubes 50, arranged in parallel sections and connected to the feed-pump, so that all the feed-water passes in a continuous stream through each section, and the bars are thereby kept comparatively cool. The grate-bars B are cast in short lengths with large bearings on the water-tubes 50.

If subjected to inordinate pressure, the arched sections would tend to assume the form of cylinders, and the tubes at the edges of the sheet of each section would be subjected to a tensile strain, while those at and near the center of the width of the section would receive a compressive strain from the bulging of the tube-sheet. Therefore in boilers intended for high pressures the outer rows of tubes in each section may be screwed into the tube-sheet or secured with nuts, and if tubes are used of such great length in proportion to their diameter as to impair their efficiency as struts for bracing the tube-sheets apart, then the tube-sheet should be slightly curved across the width of each arched section, as shown by Fig. 5, Sheet 1, as the slightly-curved sheet would bear much more pressure without distortion than a flat one.

The sides of the furnace are lined with

soapstone slabs 53, which are sawed to present the end grain of the stone to the fire.

The boiler-casing 40 has corrugated metallic plates 41 and 42 joined together to form the outer shell.

We claim—

1. In a steam-boiler, the combination of the top and bottom members composed of arches, and downcast conduits overlapping the edges of said arches and forming passages from one arch to another, as well as a connection between top and bottom members.

2. In a steam-boiler, the combination of top and bottom members composed of arches united by conduits overlapping the edges of the adjacent arches, and ties or braces passing through said conduits, uniting the edges of the arches in the two members.

3. In a steam-boiler having top and bottom members composed of arches, as described, and connecting - conduits overlapping the edges of adjacent arches, the combination, with the arches, of ties passing through the conduits and also fastened to the tube-plates of the arches, substantially as described.

4. The combination, with a steam-boiler having top and bottom members and connecting water-tubes, as described, of fixed perforated pipes in proximity to said water-tubes, whereby steam may be thrown on the exterior of the tubes and into the passages between them.

5. The combination, with a steam-boiler having water-tubes, of a fixed pipe in proximity to said tubes, said steam-pipe having perforations leading in many directions, so as to direct a current of steam or air onto and between the water-tubes, substantially as described.

6. A steam-boiler consisting, essentially, of a top member and a bottom member and vertical water-tubes connecting the same, the members being composed of arches of less curvature in the tube-plates than in the outer plates, substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

NATHAN B. CLARK.
FRANK B. KING.

Witnesses:

JOHN R. FARNUM,
GEORGE P. MORGAN.