(No Model.) 3 Sheets—Sheet 1.

W. KENT.

STEAM BOILER.

No. 330,126. Patented Nov. 10, 1885.

Fig. 1

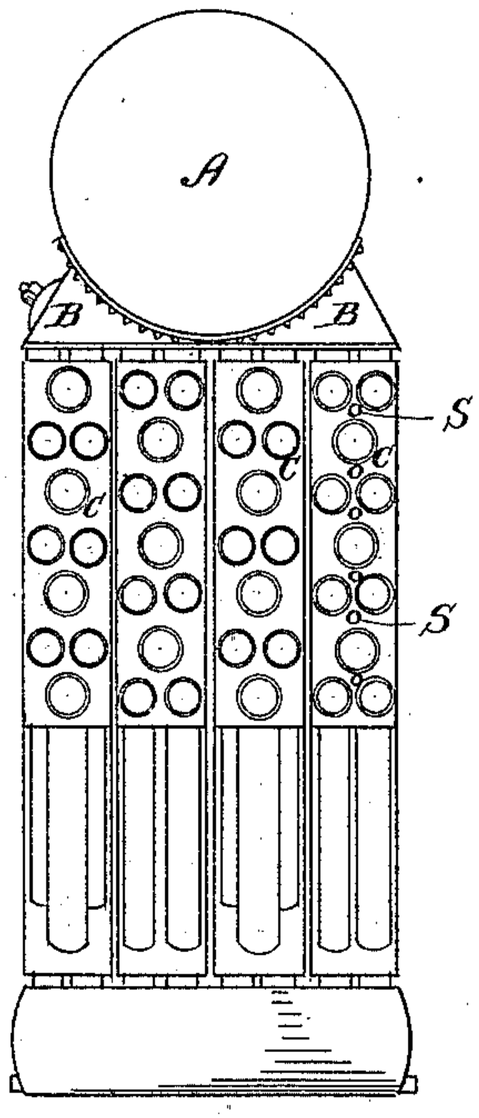
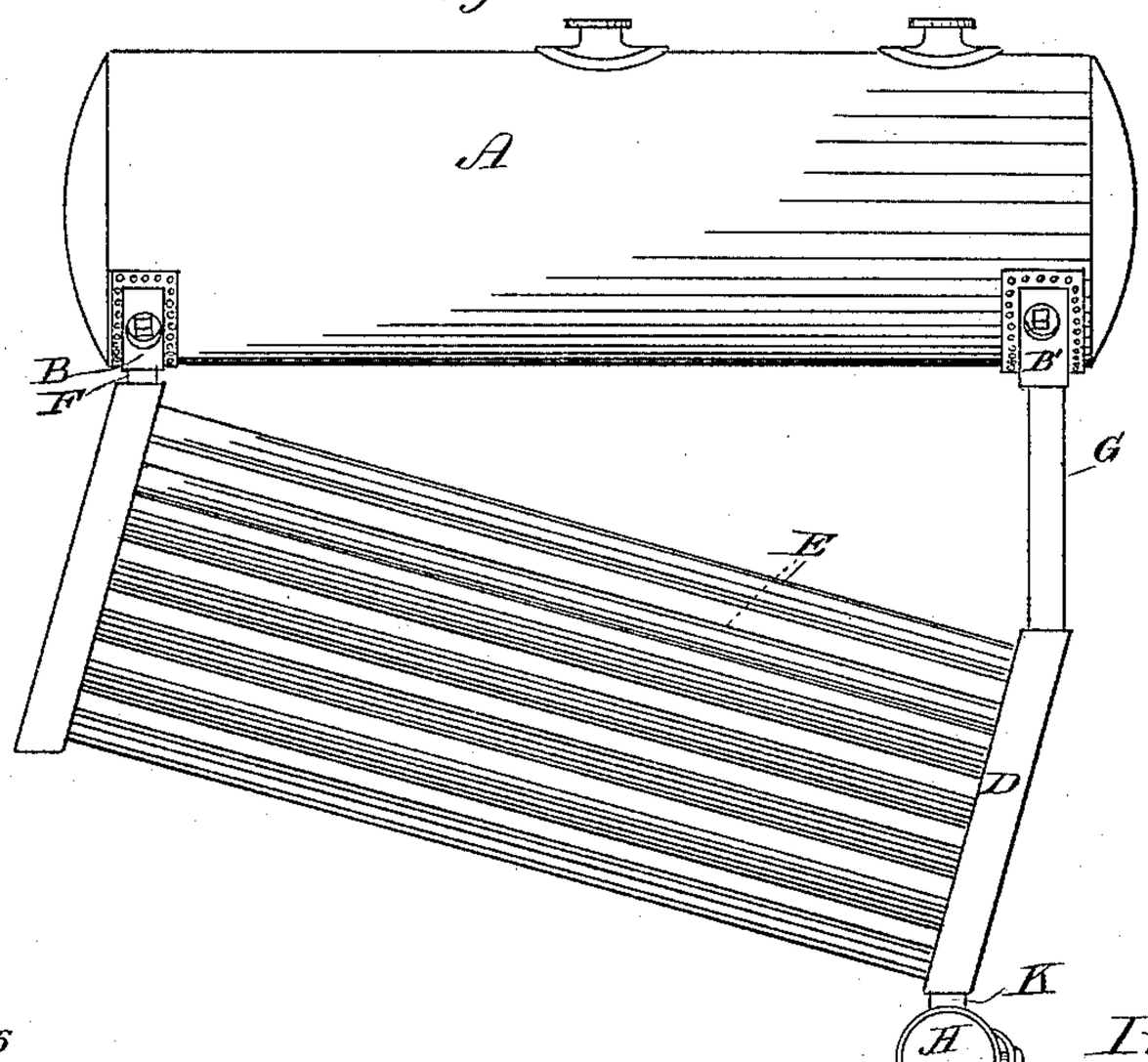


Fig. 2



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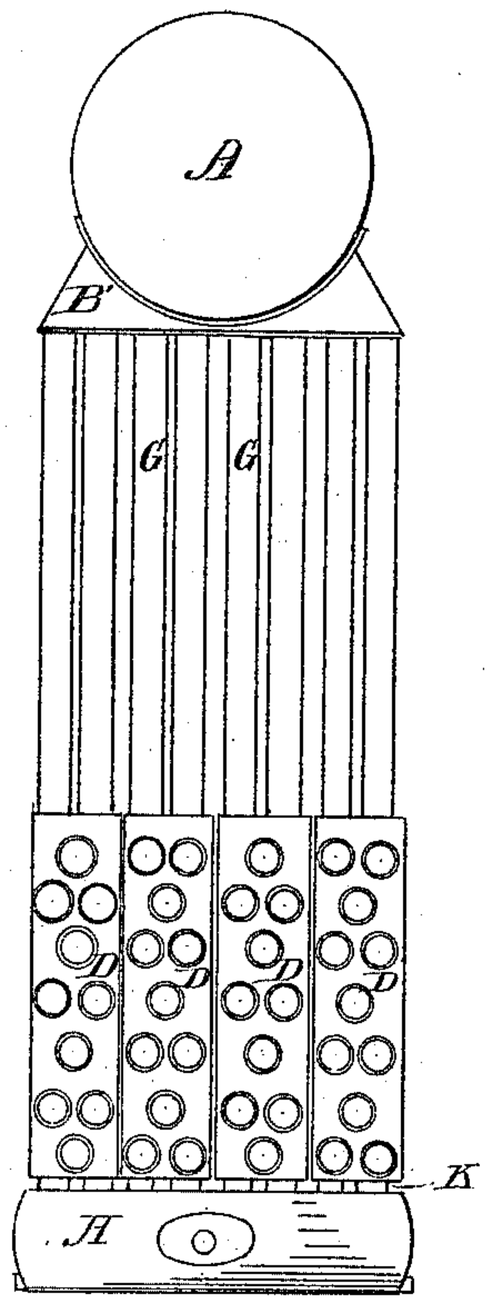

Fig. 3

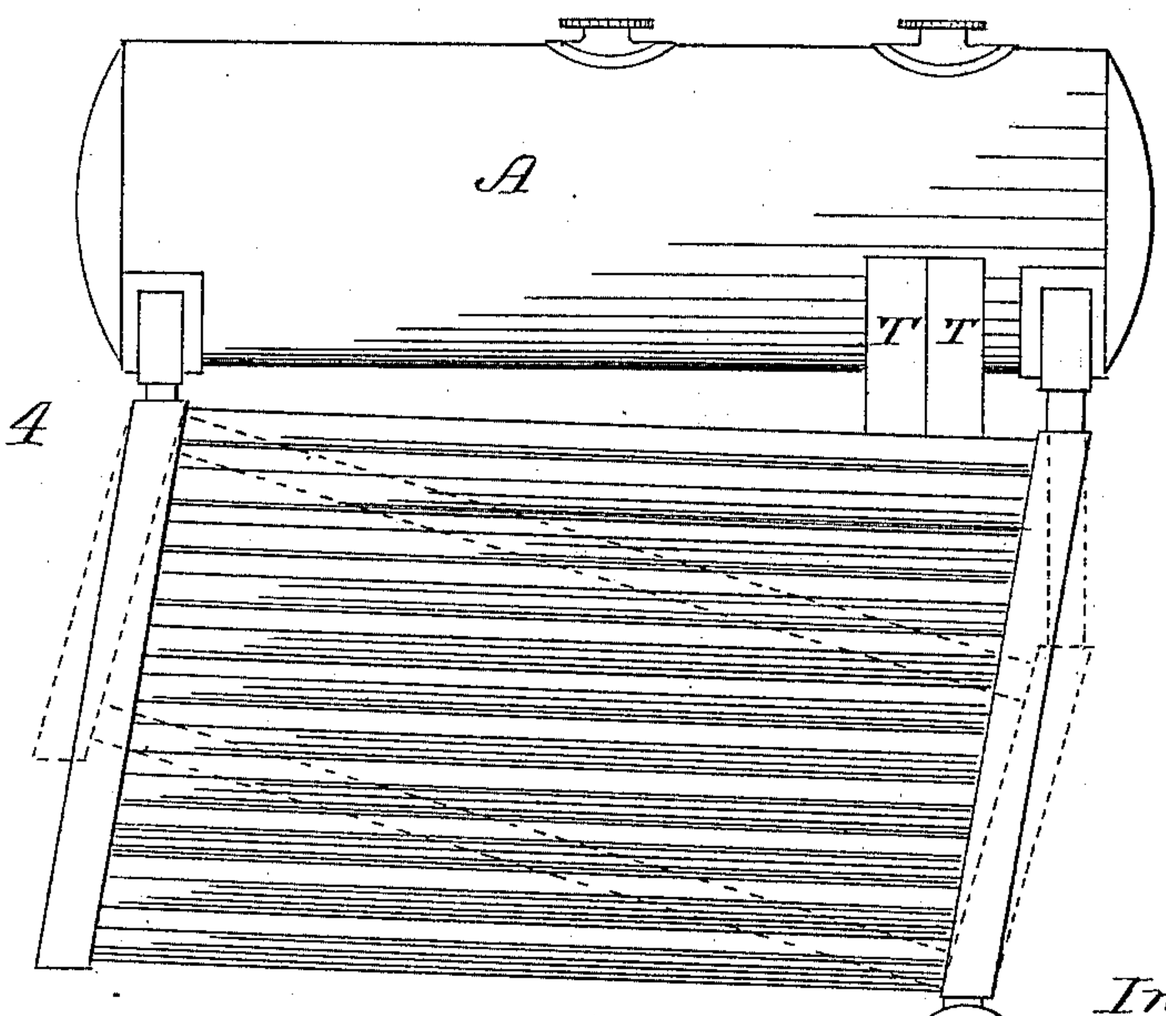

Fig. 4

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3 Sheets—Sheet 3.

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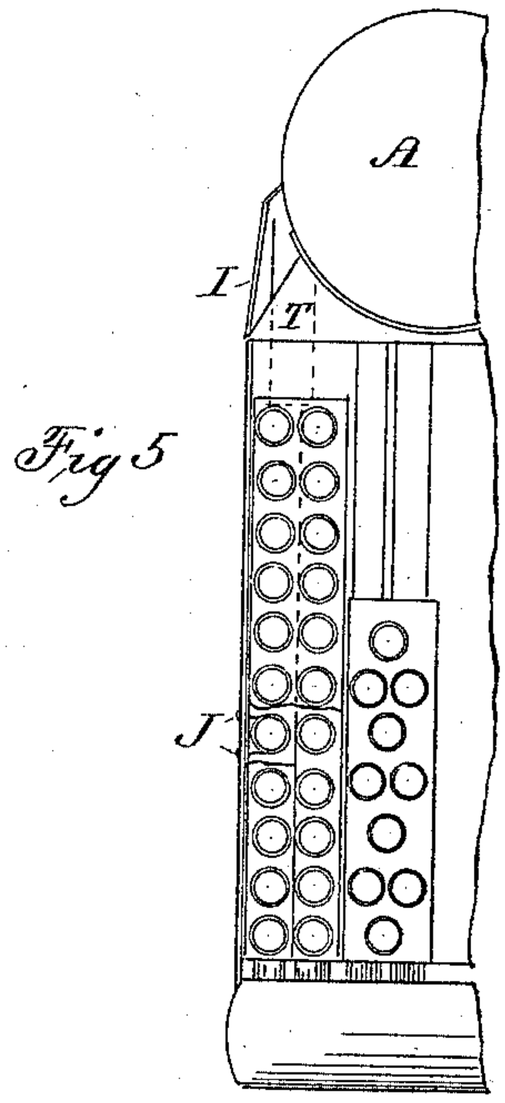

Fig 5

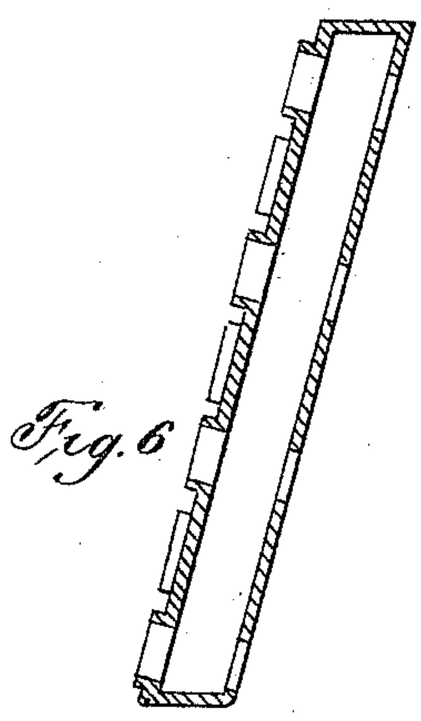

Fig. 6

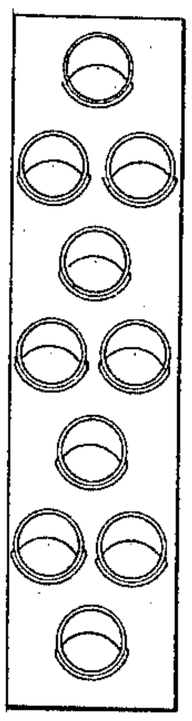

Fig. 7

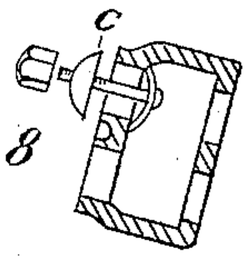

Fig. 8

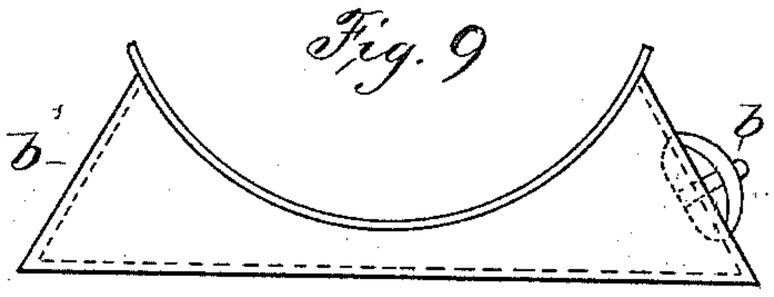

Fig. 9

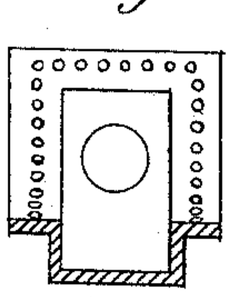

Fig. 10

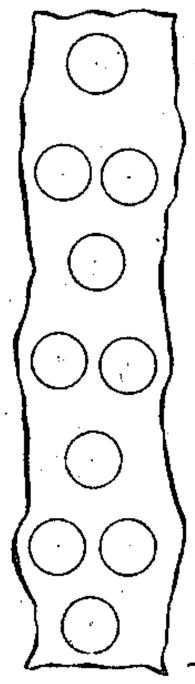

Fig. 11

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UNITED STATES PATENT OFFICE.

WILLIAM KENT, OF JERSEY CITY, NEW JERSEY.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 330,126, dated November 10, 1885.

Application filed April 18, 1884. Serial No. 128,356. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM KENT, a citizen of the United States, residing at Jersey City, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Steam-Boilers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to that class of steam-boilers known as "water-tube" or "sectional" boilers; and it consists of an improved method of constructing certain parts of these boilers with the object of making certain parts out of wrought-iron or steel which have hitherto been made only of cast-iron, thus avoiding breakages which are consequent upon the use of cast-iron, and also lightening the weight and simplifying the construction of the boiler.

Referring to the drawings, Figure 1 shows a front view; Fig. 2, a side elevation; Fig. 3, a rear view of one style of my improved boiler; Fig. 4, a side elevation of a boiler having a modified form of header; Fig. 5, a front view of the same; Fig. 6, a detail vertical sectional view of a rear header; Fig. 7, a front elevation of the same; Fig. 8, a detail view of the preferred style of header, and showing the larger sides slightly swelled; Fig. 9, a detail front elevation of the connection-box; Fig. 10, a detail side elevation of the same; Fig. 11, a modification showing the flat sides of the headers corrugated.

Similar letters denote like parts in the several figures of the drawings.

A represents a steam or water drum; B and B′, front and rear connecting-boxes; C C, front headers; D D, rear headers; E E, water-tubes; F and G front and rear circulating-tubes; H, mud-drum, and K mud-drum connections. The parts thus named constitute all the principal working or pressure parts of the boiler.

No furnace, brick-work, or other setting is shown in the drawings, since the boiler may be adapted to any style of furnace or any method of setting which may be suitable.

The fire is placed either under the front end of the setting or inclined tubes E or under the whole length of inclined tubes, according to the length of these tubes, and the flame or heated gases of combustion pass either directly up through these tubes and thence out between the circulating-tubes G, or by means of baffle-plates or flame-walls, (not shown in the drawings,) they may be made to circulate around or across these tubes in different directions, as is customary in boilers known as "Babcock & Wilcox," before making their escape between the circulating-tubes G.

The water-level is kept at any convenient depth in the steam or water drum A, and while the boiler is being fired it circulates in this drum from front to rear down through the circulating-tubes G and headers D, up through the inclined tubes E, headers C, and circulating-tubes F into the steam or water drum A.

In boilers of the general type herein described it has hitherto been customary to make the connections between the inclined tubes E and the steam and water drum A either by means of water legs or boxes made of wrought-iron and thoroughly stayed, or else of staggered cast-iron headers, as in the Babcock & Wilcox boiler. The first method is objectionable on account of the bulk of the wrought-iron water-leg being so large as to prevent the boiler from having the advantages of small parts easy of duplication and of transportation, which constitute one of the chief advantages of sectional boilers. The latter plan of cast-iron headers had the disadvantage of considerable weight and consequent cost, and also of frequent breakages, due to the use of such a treacherous material as cast-iron for this purpose.

Prior to my invention it has not been found practicable to make these headers by any other method than by casting them.

In my invention an improved form of header is used which preserves all the advantages of the sectional system, and at the same time has none of the disadvantages entailed by the use of cast-iron. I make these headers, as shown in Figs. 1, 2, 3, 6, and 7, of wrought-iron or steel plates or tubes, and square or oblong in section. These headers may be made either by bending wrought-iron or steel plates to the required shape, and then welding the edges, or by bending and riveting the edges, or preferably by taking a lap-welded wrought-iron

or steel tube and pressing it into the form of the header, or else by special machinery rolling the square tube direct without first making round tubes. The ends of these headers I prefer to make by welding in a piece of wrought-iron of proper size. The larger sides are preferably slightly swelled, as in Fig. 8, in order to give the header sufficient strength without the necessity of staying it; but for high pressures they may be stayed, if desired, as shown at S, Fig. 1, the stay S being preferably a hollow stay. Holes are cut into one side of these headers for the reception of the inclined tubes E, which are expanded into them, and I prefer to arrange these holes, as shown in Figs. 1 and 3, in such a way as to stagger the tubes. Thus in one header two holes are placed in line with each other horizontally, and on the next horizontal line there is but one hole in the middle of the header, and in the header next adjoining, in line with the two holes in the first header, there is one hole occupying the center position in the header, and opposite the one hole in the first header there are two holes in the second header. By this arrangement all the holes in headers, and consequently all the tubes expanded into these headers, are staggered, so as to compel the heated gases to take a tortuous course between the tubes. On the side of the header opposite the holes into which the tubes are expanded—that is, on the front side of the front headers and on the rear side of the rear headers—I either cut or press a number of holes immediately opposite the expanded holes. These are for the purpose of receiving caps or hand-hole plates *c*, Fig. 8. Instead of the hand-hole plate *c*, there may be used plugs; or any other convenient method of making these holes steam-tight may be adapted.

Another form of my header is shown in Figs. 4 and 5. In this case the oblong header, similar to that shown in Fig. 1, is used; but there are two vertical rows of holes in it, and adjacent holes of the two rows are on the same horizontal line. I prefer this style of header as the outside header in a battery of boilers, as shown in Fig. 5, for the purpose of diminishing the amount of brick-work required to set the boiler. This feature is especially valuable in boilers for marine purposes. For this purpose I would fill the spaces between the tubes embraced by these headers with fire-brick or other refractory material, the tubes acting as supports to the fire-brick, and the water passing through the tubes cooling the fire-brick and preventing its burning out. This combination of tubes and fire-brick makes a very effective wall for the boiler-setting, preventing radiation and at the same time being very strong and durable. For marine purposes such as I have described I would use these headers and other tubes, and the spaces between them I would fill with fire-brick as side walls to the furnaces, and the inclined tubes between these side walls I would attach to the style of headers shown in Figs. 1, 2, and 3, such a combination being shown in Fig. 5. To complete the side wall, I use a sheet of iron, I, clamped to the tubes by straps J or other means, and I close the opening between the side wall of tubes and brick combined by a number of tiles, T T, two of which are shown in Fig. 4 and one partly in dotted lines in Fig. 5.

In addition to the improved form of headers above described, another important portion of my invention is the wrought-iron connection-box B, which connects the steam and water drum A with the front and rear headers by means of the circulating-tubes F and G. This box, in the form in which I prefer to make it, is shown in detail in Figs. 9 and 10, and consists of a plate of wrought-iron or steel bent and flanged into the required shape. The ends of this box I prefer to weld into the plate of which the box is mainly formed; but, if more convenient, these may be riveted in, and I place a hand-hole, *b'*, in one or both ends to facilitate cleaning.

It is evident that the wrought-iron or steel headers which I have above described are applicable to other forms of sectional boilers than those which are provided with steam or water drums, as shown in the drawings. The flat sides of the headers, Fig. 7, may be slightly corrugated, as shown in Fig. 11, if desired. The rectangular header may be made by riveting, if desired, instead of welding or pressing a round tube into shape, and the outside head of the rivet may be countersunk.

It is also evident that the connecting-box B is applicable to boilers having either steam or water drums, but with headers and circulating-tubes of differents forms than those I have shown, and I therefore do not confine myself simply to the combination of the connecting-boxes with the headers which I have described. I do not claim, broadly, the combination of the steam and water drum with inclined water-tubes and vertical headers or circulating-tubes; but

What I do claim is—

1. A sectional or water-tube steam-boiler provided with vertical wrought-metal headers having parallel rectangular sides, and perforated, substantially as described, to receive the ends of three rows of water-pipes in three vertical and parallel planes, as set forth.

2. In a water-tube steam-boiler, the combination of the steam and water drum supported in connecting-boxes, a series of inclined water-tubes, headers for the tubes, said headers being of wrought metal and connected to three rows of water-tubes arranged in three vertical rows, as described, and circulating-tubes connecting said headers with the connecting-boxes, substantially as described.

3. In a water-tube steam-boiler, the combination of two headers, each provided with perforations for three rows of water-pipes arranged substantially as described, the two horizontal perforations in one header being

arranged opposite the single perforations in the other, whereby all the pipes are staggered, as set forth.

4. A sectional or water-tube steam-boiler composed of a horizontal steam and water drum, A, inclined water-tubes E, and connecting-tubes F G, in combination with headers C, approximately oblong in cross-section, and into which the tubes E are expanded, and connecting-boxes B, substantially as shown and set forth.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM KENT.

Witnesses:
CHAS. A. HESS,
W. J. TOWNSEND.