May 9, 1933. W. HEAGERTY 1,908,605

BOILER

Filed Sept. 5, 1930 2 Sheets-Sheet 1

Fig. 1.

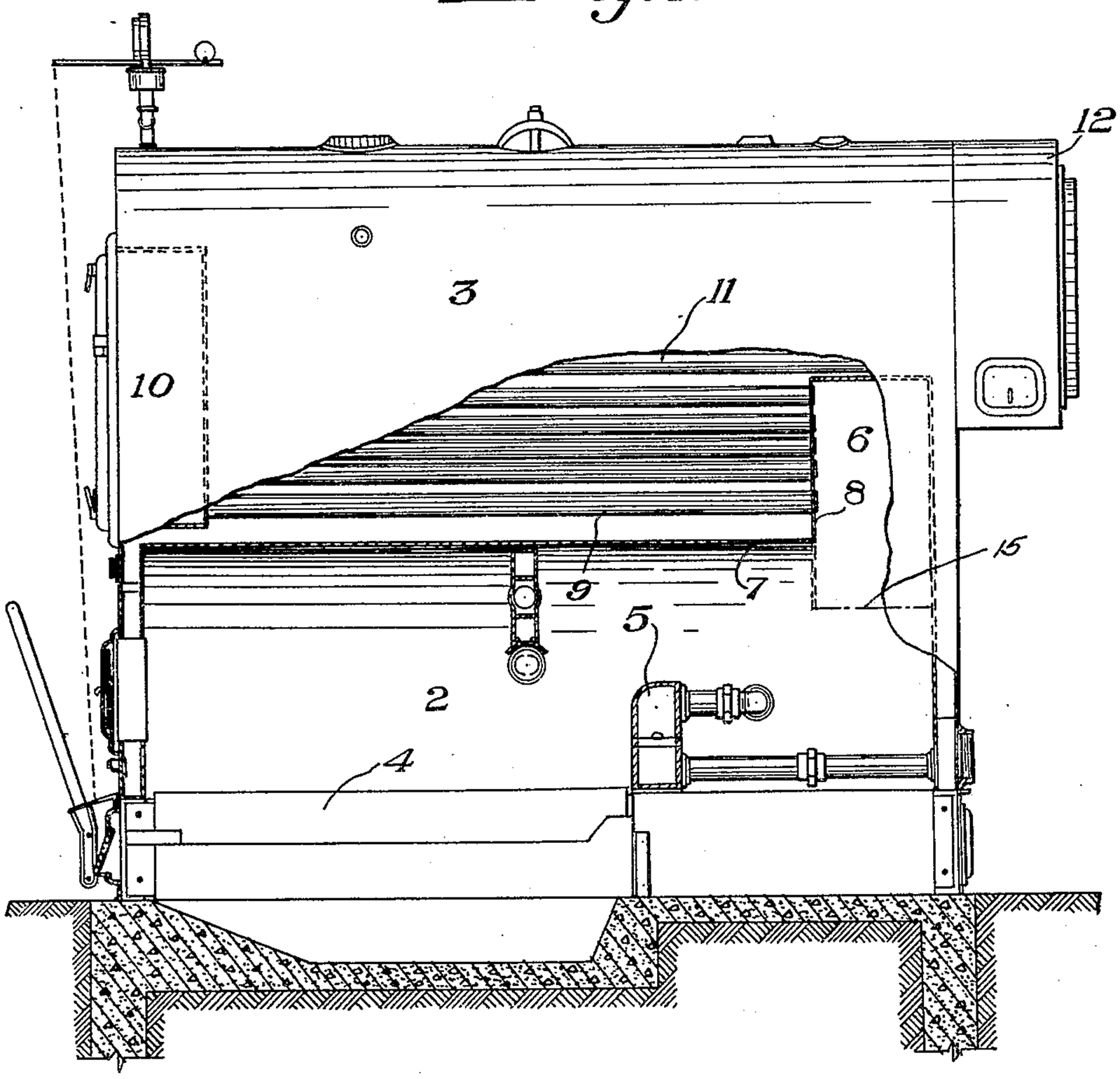
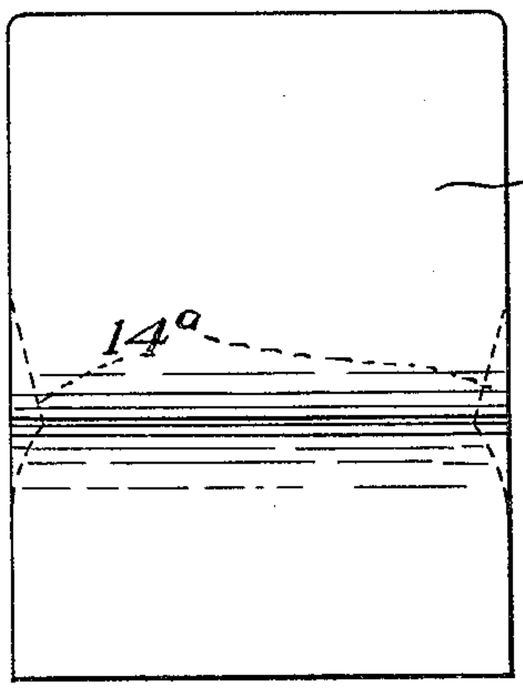


Fig. 2.



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BOILER

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Fig. 3.

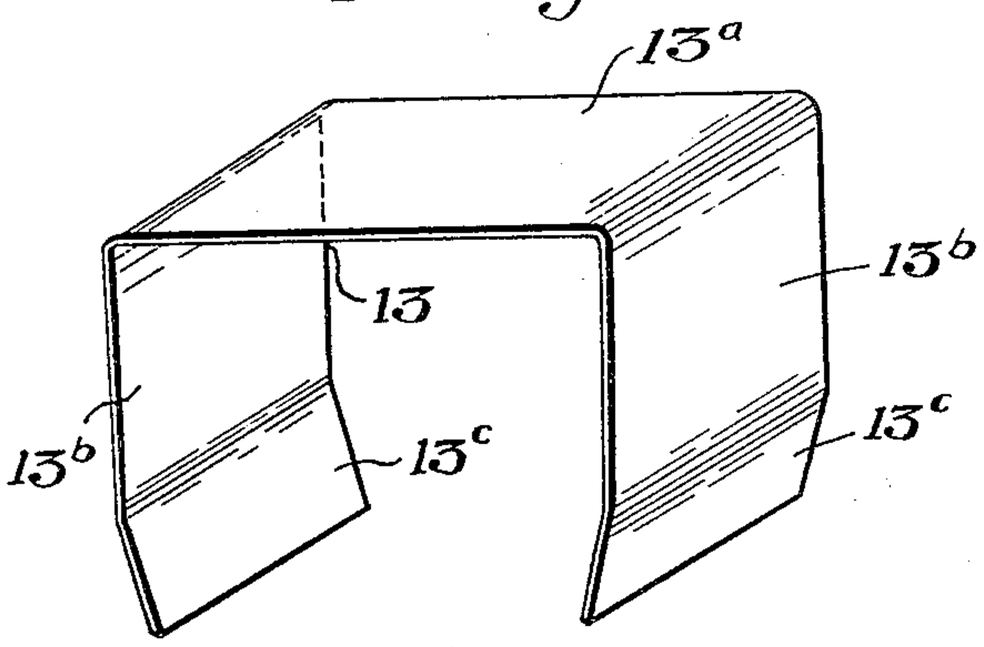

Fig. 4.

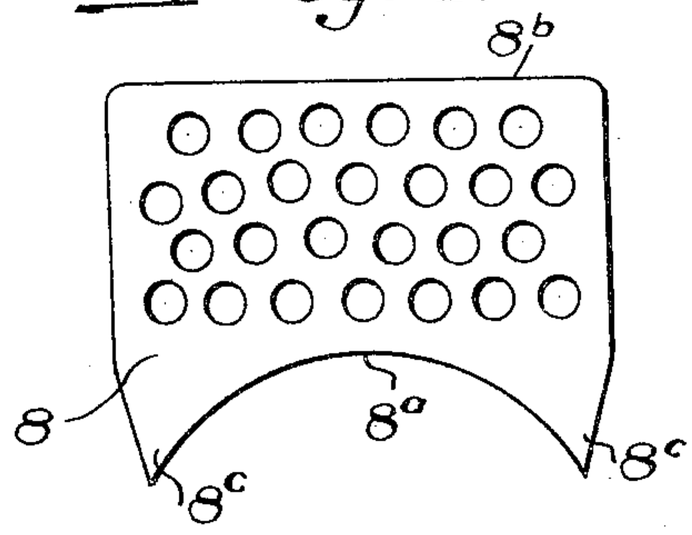

Fig. 5.

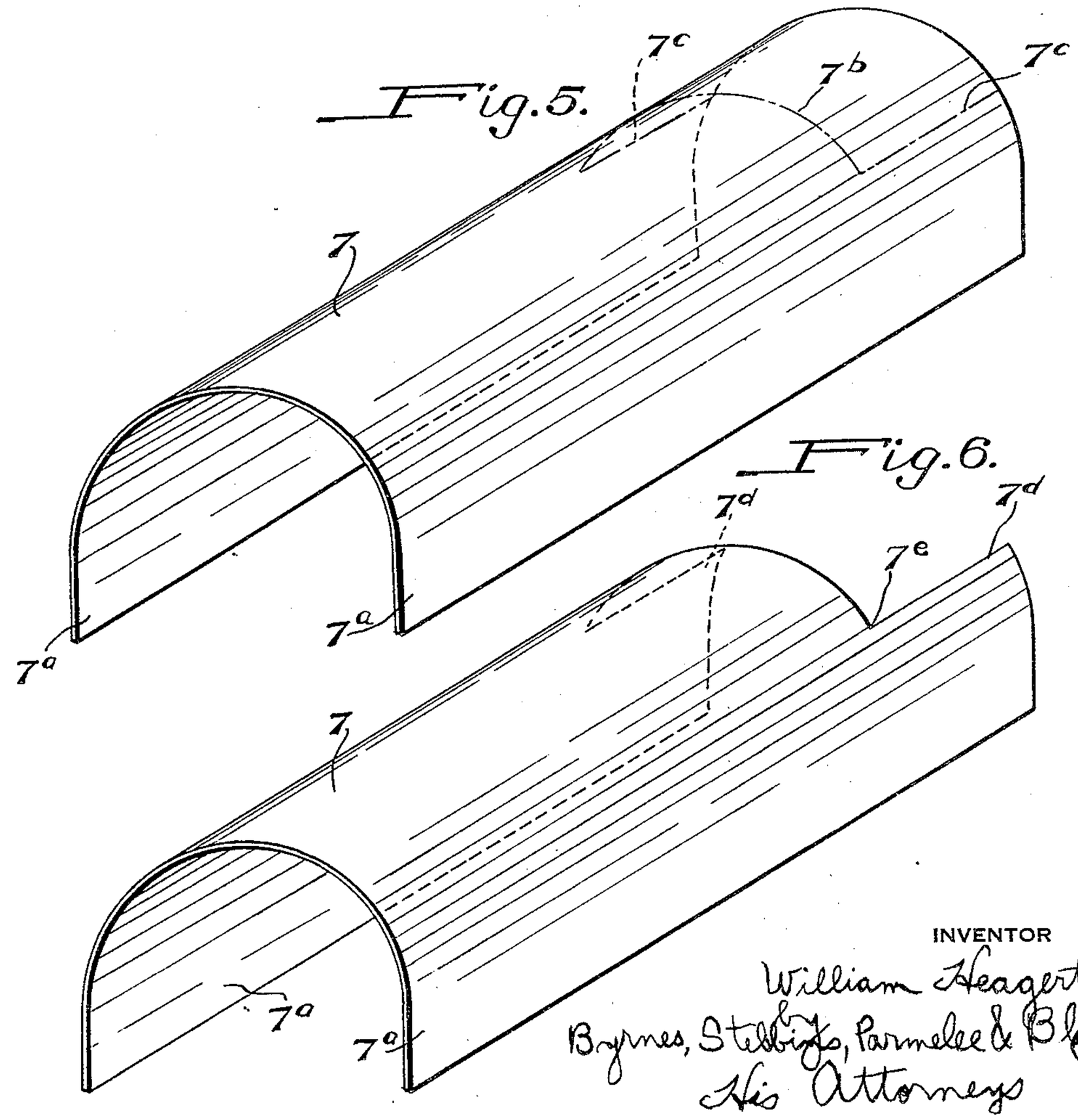

Fig. 6.

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UNITED STATES PATENT OFFICE

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BOILER

Application filed September 5, 1930. Serial No. 479,871.

This invention relates to boilers, and more particularly low pressure boilers of the type employed for heating purposes.

Boilers of the so-called "compact" type are provided with a combustion chamber which extends substantially the entire length of the furnace. At the rear end of the combustion chamber there is a vertical chamber commonly referred to as the auxiliary combustion chamber. Leading forwardly through the boiler from the auxiliary combustion chamber are a plurality of fire tubes, the forward ends of which terminate in a smoke box. Other tubes above these first tubes extend rearwardly from the smoke box to the back of the furnace into the rear smoke box.

As heretofore commonly constructed, the auxiliary combustion chamber has been formed by providing a plate at the back of the combustion chamber which curves inwardly at the top of the auxiliary combustion chamber and contacts with the furnace tube sheet which sheet supports those fire tubes that extend from the auxiliary combustion chamber forwardly to the smoke box. The special advantages of this type of boiler is that it is extremely compact.

In order that it may be compact, the maximum length of the auxiliary combustion chamber should not exceed eighteen inches. Where the top of the combustion chamber is curved inwardly, as has heretofore been the practice the length of the upper part of the auxiliary combustion chamber is considerably less than eighteen inches.

The furnace or fire tubes have to have a water-tight connection with the furnace tube sheet in which they are supported, and this is done by upsetting the ends of the tubes against the outside of the furnace tube sheet in the auxiliary combustion chamber. Where the auxiliary combustion chamber has been formed with a curvature at the top thereof, it has been necessary to set the tubes before the combustion chamber structure has been completely assembled, inasmuch as tools for effectively upsetting the ends of the tubes cannot be conveniently used in a space of less than eighteen inches and cannot be used at all in the limited space provided where the top of the auxiliary combustion chamber curves inwardly.

It frequently happens that after a boiler has been assembled and has been set up for testing, leaks are found between the fire tubes and the furnace tube sheet. In boilers of this type as heretofore constructed with a rounded top in the auxiliary combustion chamber, the usual tools for expanding the tubes to stop the leaks cannot be used. These leaks must, therefore, be stopped either by a workman getting into the furnace structure and using a hammer and chisel or like implement, or in many cases by welding. If the leaks have to be stopped by welding, the tubes cannot be replaced when they are burned out and they must, therefore, be plugged off. If they are plugged off, the effective heat transfer surface of the furnace is reduced, decreasing the efficiency of the boiler.

According to the present invention, there is provided a compact boiler wherein the auxiliary combustion chamber can be more cheaply constructed than has heretofore been possible, and wherein the auxiliary combustion chamber has a constant depth throughout its entire height, so that access may be had to the upper tubes in the furnace tube sheet as readily as to the other tubes, and the usual tools for the setting the tubes can be used in the auxiliary combustion chamber even after the furnace has been assembled, without difficulty at all. Consequently, tubes can be very easily replaced when necessary, leaks can be stopped either in the factory or when they subsequently develop in use, without trouble, and it is not necessary to resort to welding of the tubes or to plugging them off in order to stop leaks or keep the boiler in an efficient operating condition.

According to the present invention, there is also provided a novel method of constructing and assembling sheet metal boilers of this type. The usual method of assembling boilers of this type as heretofore constructed is disclosed in patent to Burchfield No. 1,481,408 dated Jan. 22, 1924.

The invention may be readily understood

by reference to the accompanying drawings in which

Figure 1 is a side elevation of a complete boiler of the compact type, part of the structure being broken away to show the inner construction of the boiler;

Fig. 2 is a front elevation of the combustion chamber rear plate;

Fig. 3 is a perspective view of the auxiliary combustion chamber top and side sheet;

Fig. 4 is a front elevation of the furnace tube sheet;

Fig. 5 is a perspective view of the crown sheet in a partially completed state; and

Fig. 6 is a similar view of the completed crown sheet.

Referring to Figure 1, 2 designates the main combustion chamber beneath the boiler 3, and 4 indicates more or less conventionally the grate at the bottom of the combustion chamber. At 5 is a bridge wall.

At the rear of the furnace structure is an upwardly extending extension of the combustion chamber, this extension being designated 6. This upwardly extending extension is commonly referred to as the auxiliary combustion chamber. The crown sheet of the furnace is designated 7 and the top of this crown sheet terminates at the auxiliary combustion chamber 6. At 8 is a furnace tube sheet which supports several banks of tubes 9, these tubes 9 leading forwardly through the boiler to a smoke box 10. Other banks of tubes 11 lead from the smoke box 10 to the rear smoke box or flue outlet 12. It will be noted that the auxiliary combustion chamber is of uniform length or depth throughout its height and that it has a substantially flat top and substantially straight sides.

In the construction of the furnace, a sheet of metal of the proper size to form the crown sheet is bent to the shape shown in Figure 5, so as to have substantially vertical sides and an arched top which curves on a true radius. This crown sheet is designated 7 in Figure 5, and 7*a* designates the vertical side portions of the sheet. After the sheet has been formed in this manner, it is cut along the dot and dash lines 7*b* and 7*c* so that a portion of the top of the crown sheet is removed at the rear of the sheet. When this portion of metal has been cut out, the crown sheet has the shape shown in Figure 6. It will be seen that the sheet 7 with its vertical sides 7*a* has rearwardly projecting extensions 7*d*, the upper portions of which curve inwardly to a slight extent about a true radius.

When the crown sheet has been completed, as shown in Figure 6, a furnace tube sheet of the shape shown in Figure 4, and designated 8, is welded in place against the rear end of the top of the crown sheet. This sheet 8 has a curved bottom edge 8*a* conforming to the curvature of the top of the crown sheet and a substantially straight upper edge 8*b*. The pointed extensions 8*c* set into the corners 7*e* of the crown sheet.

Next the auxiliary combustion chamber sheet is welded to the crown sheet and the furnace tube sheet. This auxiliary combustion chamber sheet is shown in Figure 3 and comprises an integral sheet of metal 13 which has been bent to a substantially inverted U-shape, it having a flat top portion 13*a* and flat sides 13*b*, the sides having lower end portions 13*c* which bend inwardly to a very slight extent. This member 13 is set in place on the extensions 7*d* of the crown sheet, and the lower edges of the portions 13*c* are welded to the upper edges of the extensions 7*d*. The shape of the member 13 corresponds to the shape of the plate 8 and the forward edges of the member 13 are welded to the side and top edges of the member 8. When the boiler has been assembled to this extent, the tubes 9 would ordinarily be set in the furnace tube sheet 8. After this has been done, the combustion chamber rear plate 14 shown in Figure 2 is welded to the rear end of the assembled structure. This plate is merely a flat sheet of metal which has substantially the contour of the rear end of the combustion chamber and auxiliary combustion chamber, except that the combustion chamber curves inwardly to a slight extent, as indicated by the dotted lines 14*a* in Figure 2, whereas the plate 14 is substantially a rectangle. The plate 14 sets against the end of the cumbustion chamber structure and is welded, the weld being around the edges of the plate 14, except at the places indicated by the dotted lines 14*a* where the plate projects slightly beyond the borders of the combustion chamber. In Figure 1, the dotted line 15 designates the line of weld between the edge of the member 13 and the upper edge of one of the extensions 7*d*.

According to this method of assembling the furnaces, the combustion chamber and auxiliary cumbustion chamber are completely formed of four pieces of metal. The points of welding occur at places which are readily accessible. The manner of shaping and bending the metal is quite simple. At the same time, a structure is provided wherein the auxiliary combustion chamber has the full length or depth throughout its height, giving ample room for a workman to have access to the ends of all of the furnace tubes 9. The workman can use standard repair tools or expanding tools against the ends of all of these tubes with equal facility. Leaks developing around the tubes 9 and the tube sheet 8 can be repaired easily either in the factory before the boiler is shipped out and after it has been tested, or in the field after the boiler has been put into service. Moreover, where tubes are to be replaced, there is

ample clearance for the use of tools for removing the old tubes and expanding the ends of the new tubes.

A further advantage of the present invention resides in the arrangement of the smoke box 10. As shown in Figure 1, this smoke box is recessed with respect to the front of the boiler so that it extends into the water chamber of the boiler and is entirely surrounded by the water chamber, except at the front where it is closed by means of doors on the front plate of the boiler. It has heretofore been common practice in the art to extend the smoke box forwardly of the front wall of the boiler, making a projection at the front of the boiler which both radiates heat into the boiler room and which also is in the way in firing the boiler. By recessing the smoke box it is water-cooled and thus protected from burning out. It cannot radiate heat, and heat is conserved in the boiler by the transfer of the heat from the smoke box directly to the boiler. The entire structure of the front part of the boiler, incidentally, is made cheaper by reason of this arrangement.

While I have shown my invention as applied to a boiler of a particular contour and type, it will be understood that the invention is not restricted to the particular combustion chamber is of a different shape than the one specifically shown.

I claim as my invention:

1. A furnace structure having an auxiliary combustion chamber portion comprising four elements welded together, one of said elements being a crown sheet having rear side wall extensions, a second element being an auxiliary combustion chamber sheet having a top and depending sides, the depending sides being welded to the extensions of the crown sheet, the third element being a furnace tube sheet welded along its lower edge to the crown sheet and along its other edges to the auxiliary combustion chamber sheet, the fourth element being a single plate welded against the ends of said extensions and the end of the auxiliary combustion chamber sheet and closing the end of the main and auxiliary combustion chambers.

2. In a furnace structure, a crown sheet having an arched top and vertical sides having rearwardly projecting extensions at the sides thereof, a furnace tube sheet welded to the rear end of the top portion of the crown sheet, an auxiliary combustion chamber member having a top and depending sides, the edges of the sides being welded to the tops of the projections on the crown sheet, the front edges of the auxiliary combustion chamber member being welded to the tube sheet, and a rear plate lying within a single plane welded against the end of the auxiliary combustion chamber member and the ends of the extensions of the crown sheet.

3. In a boiler furnace, a boiler, a combustion chamber under the boiler, and an auxiliary combustion chamber above and at the top of the rear end of the combustion chamber, said auxiliary combustion chamber being of uniform length from top to bottom, a crown sheet having a top portion and side portions which project beyond the top portion at the rear end of the sheet, vertical side members welded onto said projecting side portions of the crown sheet and forming the sides of the auxiliary combustion chamber, a cross piece connecting the side members and forming the top of the auxiliary combustion chamber, a single rear plate lying within a single plane welded to the ends of the projecting side portions of the crown sheet and to the rear edges of the said side members and cross piece, and a fire tube sheet welded to the crown sheet, to the side members and the cross piece.

In testimony whereof I have hereunto set my hand.

WILLIAM HEAGERTY.