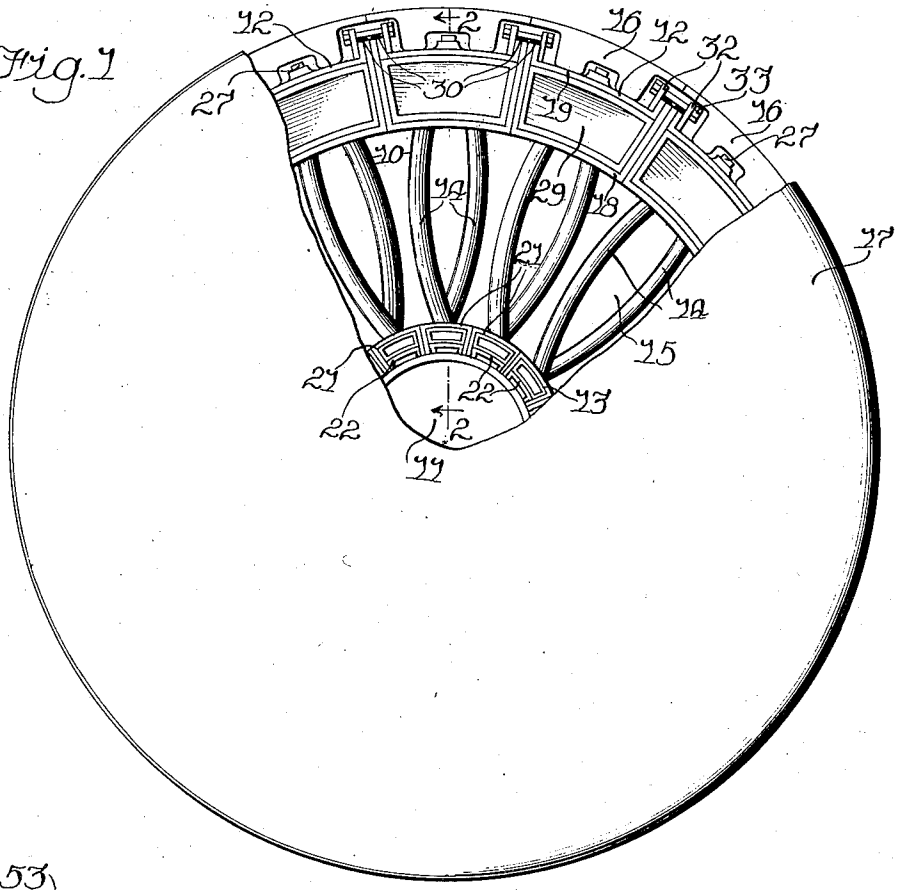
Aug. 31, 1926. 1,598,062

J. A. DIENNER ET AL

BOILER CONSTRUCTION

Filed Dec. 12, 1919 4 Sheets-Sheet 1

Fig. 1



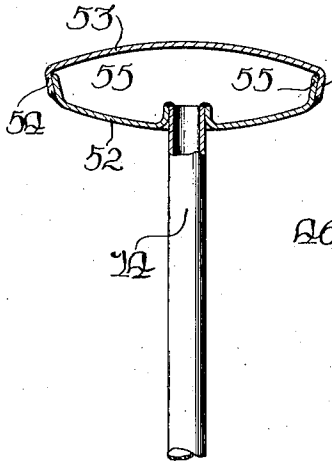


Fig 8

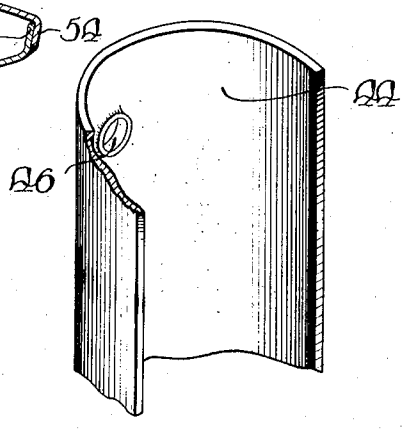
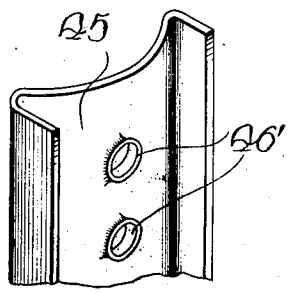


Fig. 7

Fig. 6



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BOILER CONSTRUCTION

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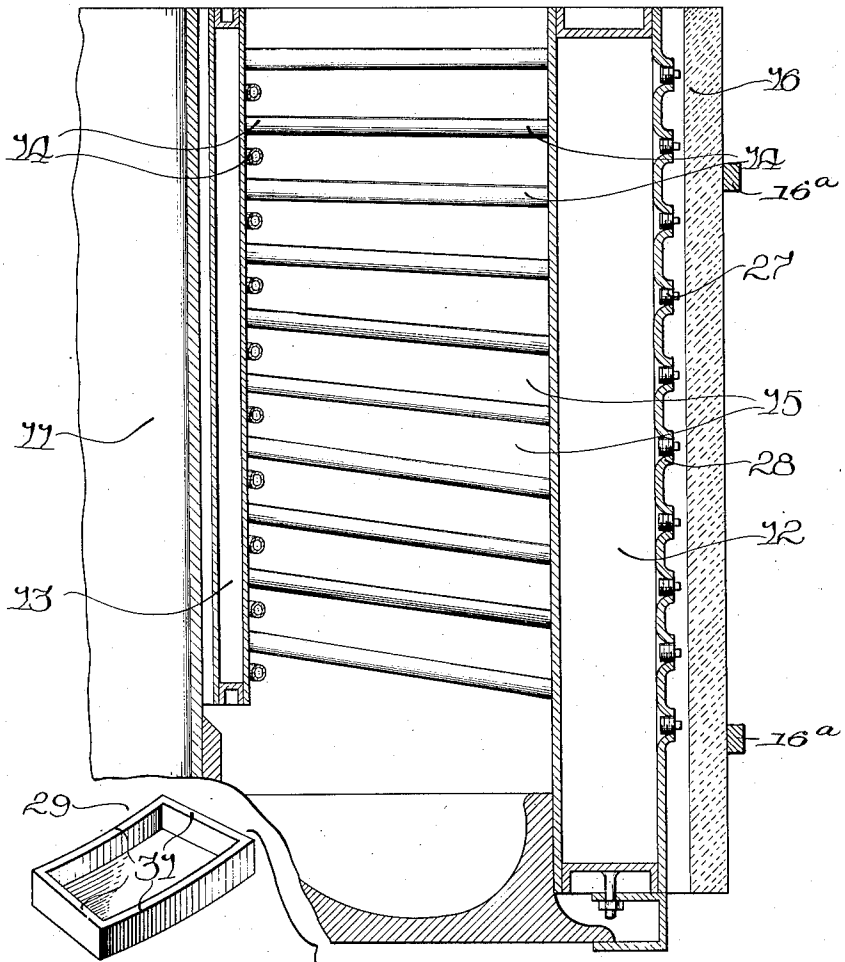


Fig. 2

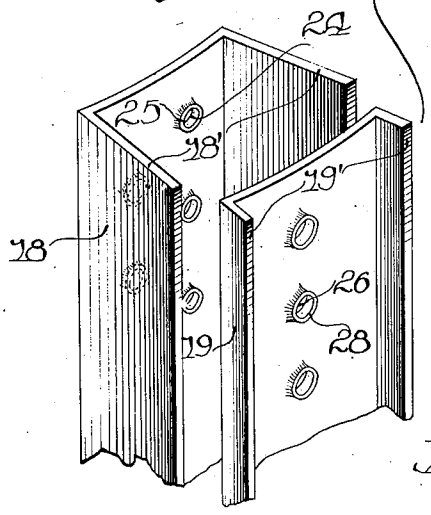


Fig. 3

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BOILER CONSTRUCTION

Filed Dec. 12, 1919 4 Sheets-Sheet 3

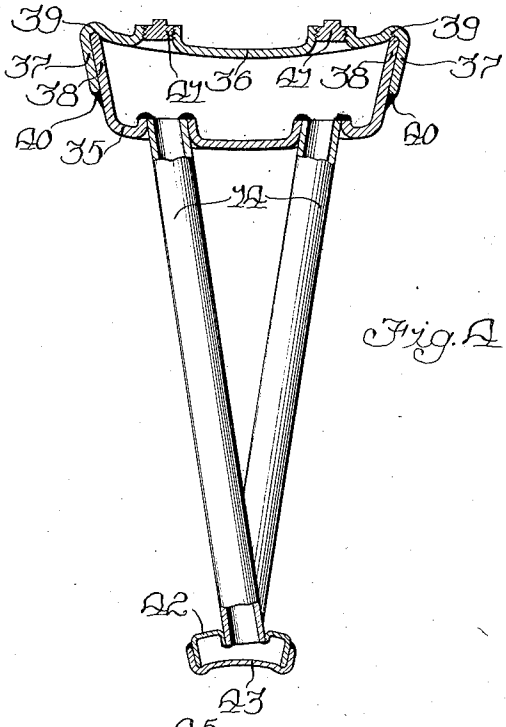


Fig. 4

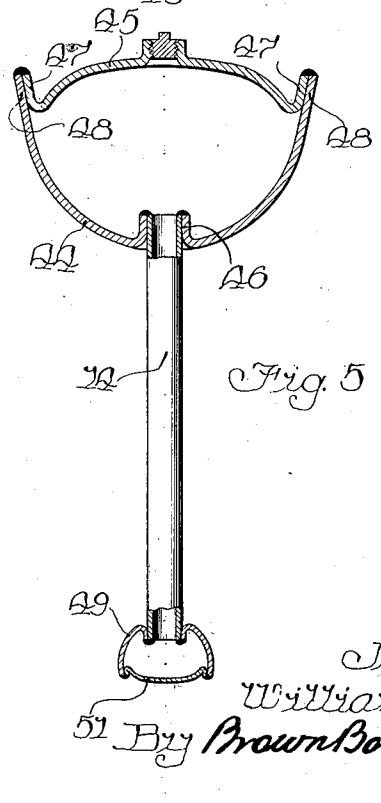


Fig. 5

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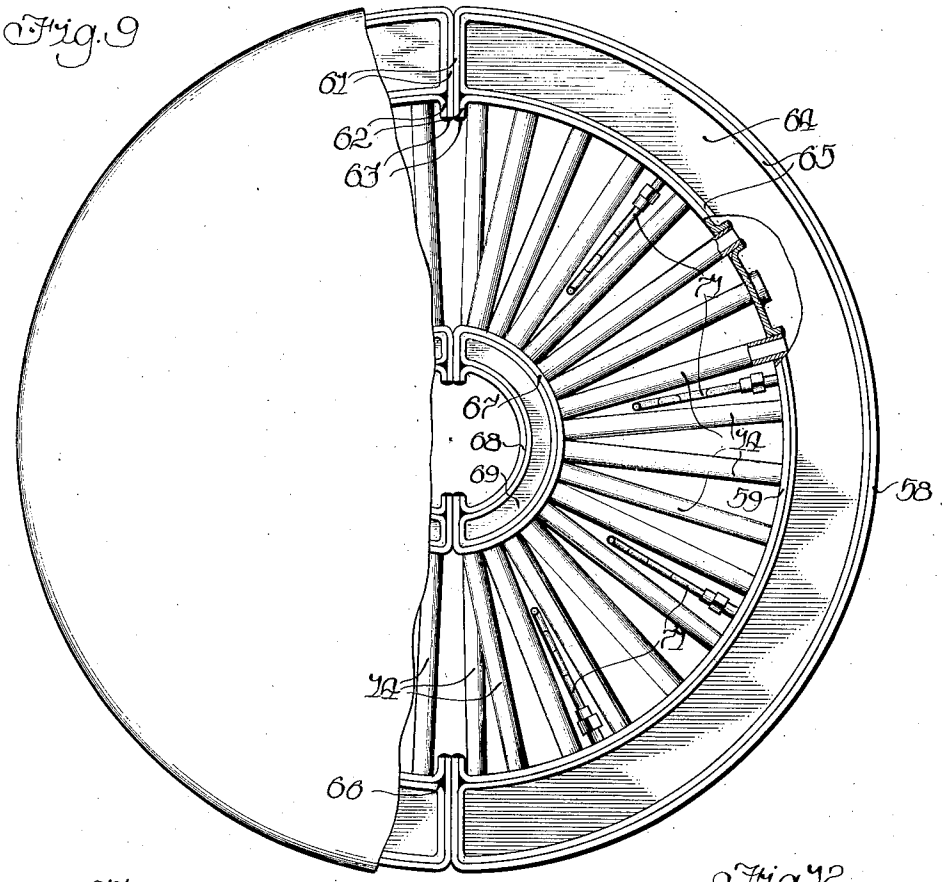
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J. A. DIENNER ET AL

BOILER CONSTRUCTION

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Fig. 9



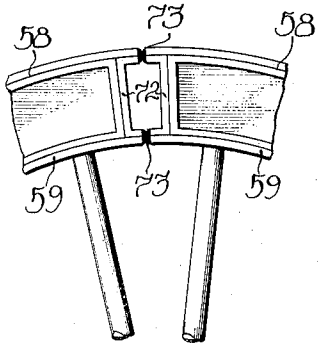


Fig. 10

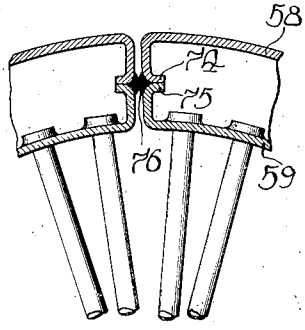
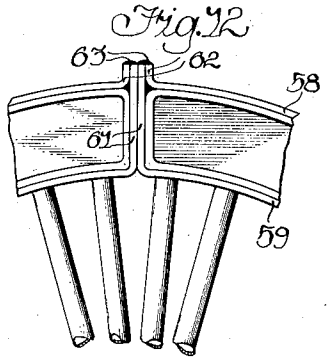


Fig. 11

Fig. 12



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Patented Aug. 31, 1926. 1,598,062

UNITED STATES PATENT OFFICE.

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BOILER CONSTRUCTION.

Application filed December 12, 1919. Serial No. 344,404.

The present invention relates to boilers, more particularly of the sectional water tube type, and is generally concerned with improvements in the construction of the boiler sections.

More specifically, the invention pertains to an improved construction of header or riser for these boiler sections and has as its primary object to provide an improved method of constructing these headers of sheet metal, such as wrought metal plates.

The secondary object of the invention is to provide an improved construction of sectional header formed of a plurality of independent sections.

The more particular objects contemplated in devising the above construction of header are: To reduce the cost of manufacture by utilizing sheet material instead of tubular stock; to facilitate the operation of welding the circulating tubes in the headers and also obtain a more efficient weld by providing a sectional construction of header which will permit access to the interior thereof; and to provide a construction of header which is adaptable to shaping and forming to secure any desired formation of header. The latter object is of particular advantage in many situations as it allows of a relative proportioning of, (1) the volumetric capacity of the headers, (2) the area of heating surface exposed to the fire gases, (3) the relative location and extent of physical contact between the adjacent headers.

The present method of constructing headers has particular utility in a circular type of sectional water-tube boiler, such as is disclosed in the copending application of W. H. Winslow, Serial No. 344,355, filed December 12, 1919. In the following description, we shall, therefore, describe the invention with specific reference to its utility and advantages in this particular class of boiler, but it is to be understood that the scope of the invention is not confined to this particular class of boiler, but may be extended to other classes and types of boilers as well.

In the accompanying drawings:—

Figure 1 is a plan view of a circular boiler of the general arrangement disclosed in said copending application, the casing of the boiler being broken away to show the radial disposal of the boiler sections;

Figure 2 is a vertical sectional view taken on the line 2—2 of Figure 1;

Figure 3 is a fragmentary perspective view of the several parts of one of the headers before assembling;

Figure 4 is a plan view partly in elevation and partly in section of a modified construction of header;

Figure 5 is a similar view of another modified construction;

Figures 6 and 7 are fragmentary perspective views of the header sections employed in constructing the form of header illustrated in Figure 5;

Figure 8 is a plan view, partly in section, of another modified construction of header;

Figure 9 is a view similar to Figure 1, showing a modified arrangement and construction of the headers and the boiler sections; and

Figures 10, 11 and 12 are fragmentary detail views of modified methods of joining the inner and outer plates of the above construction of header.

The boiler illustrated in Figure 1 is composed of a plurality of vertical boiler sections, each designated 10 in its entirety, which are arranged in circular formation, each section radiating from a central exhaust flue 11. The boiler sections are all substantially identical and comprise a long outer header 12 of relatively large cross sectional area, and a short inner header 13 of relatively small cross sectional area, these headers being jointed by a plurality of relatively short cross tubes 14. The outer headers 12 are placed in contact so as to form a substantially closed ring of headers, which constitutes a circular outer water wall for the boiler. The inner headers 13 are also placed in contact to form a substantially closed inner ring of headers, which constitutes an inner circular water wall, defining the central exhaust flue 11. Between the inner and outer water walls is defined a vertical flue space 15 of ring shaped conformation through which pass the products of combustion from the annular fire box below. The circulating tubes 14 are interspersed across this flue space 15, the tubes of each section extending substantially radially across this flue space, between the inner and outer water walls. The outer water wall is insulated against external heat losses by a series of slabs 16 of heat insulating material. The insulating slabs are preferably arranged so that there is one slab for each boiler section, whereby

any particular boiler section may be removed and replaced without disturbing the heat insulation of the remaining boiler sections. The series of heat insulating slabs are preferably held in place by one or more retaining bands encircling the boiler. A removable metallic shell or casing 17 completely encloses the top and sides of the boiler.

Referring now to the improved construction of the headers 12 and 13, and referring particularly to Figures 1 and 3, it will be seen that the outer header 12 is constructed of two independent channel sections 18 and 19, and that the inner header 13 is likewise constructed of two independent channel sections 21 and 22. As will be observed from Figure 3, the channel section 18 of the outer header is provided with relatively long side flanges 18′, and the channel section 19 is provided with relatively short flanges 19′. The flanges of both channel sections are flared outwardly to a small degree so that the lateral faces of the completed header will lie in radial planes in the assembled boiler. The web portions of the channel sections may be formed straight or may be curved concentrically with the circular form of the outer water wall.

These channel sections are preferably made out of wrought metal plates, preferably of soft steel, from which the sections are punched and shaped. It is also practicable to construct these channel sections out of stock channel bar if desired. Each rear channel section 18 is provided with a plurality of holes 24 for receiving the circulating tubes, these holes being preferably disposed in staggered relation to receive the staggered outer ends of the circulating tubes 14. The purpose of this staggered relation of the tubes is to distribute the tubes uniformly across the flue space 15, and eliminate large flue spaces between the tubes. The holes 24 are punched or drilled, and the surounding metal is then flared inwardly into the channel formation by the insertion of a suitable flaring tool so as to provide the inwardly projecting nipple flange 25. The operation of punching or drilling these holes and then flaring the same can be accomplished simultaneously with the operation of cutting and shaping the blank header section or at any other preferred time in the formation of these sections. The nipples 25 afford a more suitable welding surface for welding the tubes in the channel section. The provision of these nipples furthermore dispenses with the necessity of flowing any, or very little extra metal between the tube and the channel section to obtain an efficient weld. The weld can be confined entirely to the inside of the channel section or an additional weld can be performed between the outside of the channel section and the circulating tube if desired.

The front channel section 19 may be provided with an aligned series of holes 26 of longer size than the holes 24, for accommodating the removable plugs 27, which permit entrance to the tubes 14 for scaling the same. The holes 26 are formed in the same manner as the holes 24, so as to provide the projecting flanges 28 which are internally threaded for the reception of the plugs 27. It will be noted that there is only one plug 27 provided for every pair of cross tubes, which is located at a point intermediate these tubes, and that these cross tubes are bowed on arcs extending through the plane of the holes 26. By this arrangement only one plug opening is required for the insertion of the scaling or cleaning tool into either of these two cross tubes. This may be modified, however, to provide separate plugs for each tube, in which case the holes for the plugs would be staggered similarly to the holes for the tubes.

After all of the circulating tubes have been welded in the rear channel section 18, the front channel section 19 is inserted in the rear section with its flanges 19′ nested between the flanges 18′ and with the ends and edges of these flanges substantially flush. The two sets of flanges are then welded together from top to bottom of the header along the edges, so that the two header sections form an integral header unit. The ends of this header unit are then closed by the insertion of end heads or caps 29, which are welded in the ends of the header. These end heads each consist of a wrought metal stamping or a steel casting formed in the shape of a polygonal cup having upstanding marginal flanges 31 around its four sides. The inner and outer edges of this cup member are curved concentric with the curvature of the web portions of the channel sections and the lateral edges are flared similarly to the flanges 18′. These end heads are welded in the ends of the header by welding the flanges 31 around the upper edges or margins of the header. The lower end heads 29 may be provided with an integral stud or other similar means for mounting the boiler sections on the boiler setting and may be provided with a feed-water inlet for admitting feed water to the boiler sections, as illustrated in the copending application previously referred to. We have not described or illustrated these particular details as they are not related to the present invention.

It will be observed that in each of the preceding welding operations free and open access is had to the two edges to be welded, so that the weld can be preformed efficiently and with facility. The weld between the two channel sections 18 and 19 is made along the aligned edges of the flanges 18′—19′ as indicated at 30 in Figure 1. Both flanges are of substantially the same thickness so

that the heat absorption and conduction of the two parts of the weld is substantially the same, thereby facilitating the weld. In welding the tubes 14 in the channel section 18 the weld is similarly performed between the coextensive edges of the tube and the nipple or flange 25. Here again both parts of the weld are of the same sectional area and the heat conduction is substantially even. A notable feature of the welds between the tubes and the nipples 25 is the fact that these welds are entirely removed from the temperature of the combustion zone and are exposed only to the temperatures in the headers. The uniformity of heat conduction of these aforesaid welds is also true of the flanges 31 on the end heads 29 and the cooperating upper edges of the channel sections. The weld between these flanges 31 and the upper edges of the channels is also performed along these contiguous edges, as previously described.

The inner headers 13 of the inner water wall are constructed in precisely the same manner just described, with the exception that the holes for receiving the circulating tubes 14 are substantially aligned and there is no provision for removable plugs in these headers. The two channel sections 21 and 22, which are of relatively small size, are arranged with the welded flanges facing inwardly so as to present the web of the larger channel section 21 to the flue space 15. These inner headers 13 are somewhat shorter than the outer headers 12, as will be seen from Figure 2, and the lowermost circulating tubes 14 are inclined upwardly to secure an upward circulation through the inner headers 13. As fully described in the Winslow copending application, the great difference in sectional areas between the two headers 12 and 13 is designed to obtain violent agitation in the inner header 13, and a relatively quiescent circulation in the outer header 12. The burner, which is of annular formation, is situated below the boiler sections 10 and is arranged to circulate the products of combustion up through the annular flue 15 and down and out of the boiler through the central exhaust flue 11.

Referring particularly to Figure 1, the several boiler sections 10 are preferably interconnected by the provision of clamping strips 32 engaging within the projecting flanges of the outer headers 12. These clamping strips preferably extend the full length of the header and at intervals are provided with holes for the reception of the clamping bolts 33. By contracting these clamping bolts 33 it will be seen that the joints between the adjacent boiler sections can be tightly compressed to prevent any heat loss through these joints. In removing a boiler section the outer slab of insulation 16 is removed and the bolts 33 are then disengaged, whereupon that particular section can be freely removed without disturbing the remaining sections.

It should be noted that the general rectangular formation of the inner and outer headers results in a uniform depth of water wall throughout each ring of headers, and because of this and the extended area and intimacy of contact between the headers there is a minimum heat loss through the water wall. This rectangular formation of the headers furthermore affords a maximum cross sectional area and a maximum capacity to the header.

In Figure 4 we have illustrated a modified construction of inner and outer headers. In this embodiment, the inner or rear channel section 35 is similar in formation to the previous channel section 18, but the front or outer channel section 36 is modified by the provision of the inwardly bending flanges 38 of the inner channel section 35. These flanges diverge radially similarly to the previous channel sections. In forming the flanges 37 on the outer channel section 36 the angle or bend of the flange is beaded outwardly to form an internal locking groove or recess 39. The edges of the flanges 38 are adapted to be forced into these locking grooves when the flanges 37 and 38 are welded, so that the ends of the flanges 38 will be locked against any tendency of the flanges 37 tending to cam the flanges 38 inwardly under the action of the pressure tending to separate the two channel sections. The web of the outer channel section 36 is made of concave form to obtain greater strength against outward bending and deformation of this wall under high steam pressures. This concave formation of the outer channel section 36 furthermore accommodates the spaced removable plugs 41 and avoids their projecting beyond the circular confine of the outer header. In this instance the plugs 41 are aligned directly with the tubes 14, there being one plug for each tube, and these tubes are extended in a straight line between the headers instead of being curved. The end heads for closing off the ends of the header are provided with marginal flanges and are welded within the open ends of the channel sections substantially the same as described of the other embodiment. The two channel sections may be assembled by shaping the outer channel section over the inner, or the two sections may be assembled by sliding the sections lengthwise into engagement with each other. The weld is performed along the edge of the outer flange 37, as indicated in solid black at 40. It will be noted that, as in the previous embodiment, the sectional thicknesses are substantially the same and therefore the two flanges can be welded with facility. The inner header is constructed of the two chan-

nel sections 42 and 43 which are shaped similarly to the channel sections 35 and 36 of the outer header. These inner channel sections 42 and 43 are assembled and welded in practically the same manner as the outer channel sections, and we shall therefore, not describe these again in detail.

In Figure 5, we have illustrated another modified construction of outer and inner header. In this embodiment the rear channel section of the outer header is of semi-cylindrical formation as shown in perspective in Figure 7. This semi-cylindrical formation is preferably constructed with the tube openings 46 aligned so as to enter the channel section radially to receive a radial disposal of the cross tubes 14, although it will be apparent that these openings can be staggered to receive a staggered relation of circulating tubes 14 if desired. The outer section 45 is bowed outwardly as clearly shown in Figure 6 and is formed with reversely curved flanges 47 which are adapted to engage contiguous to the flanges 48 of the section 44. The manner of welding these flanges, and welding the end heads in the ends of the header will be obvious from the foregoing description. The semi-cylindrical formation of this construction of header forms a corrugated interior surface on the circular water wall of the boiler, and hence exposes a large area of heat absorbing surface to the influence of the fire gases. This semi-circular formation of header, however, possesses the advantage over a header of purely circular formation of affording an extensive area of contact between adjacent headers, considerably larger than that of purely tangential contact. The circular conformation of the header also has the obvious advantage of possessing a higher factor of strength against distortion or disruption of the header under high steam pressure. The inner header is constructed in precisely the same manner, of the two header sections 44 and 45.

In Figure 8, we have illustrated still another modified construction of header. The two channel sections 52 and 53 are curved so that they combine to form a header of generally elliptical formation. The flanges 54 of the outer channel section are lapped over and welded to the diverging flanges 55 of the inner channel sections 52, so as to form radial lateral walls.

By reason of the sectional construction of the headers the same can be constructed in relatively large units for a given size of boiler. For example, in Figure 9, we have shown the inner and outer headers as embracing one-half of the boiler. In this particular form, the outer header is constructed of two semi-circular plates 58—59 the ends of which are bent inwardly to form end flanges 61 and 62, which are welded together along their adjoining edges, as indicated at 63. A semi-circular top head or plate 64, having a marginal flange 65 is welded in the top of the header in substantially the manner previously described. A similar head is, of course, also welded in the bottom of the header. Any small openings at the upper corners of the headers can be suitably plugged by a welding operation, as indicated at 66.

The inner headers are constructed in the same manner of arched plates 67 and 68 and semi-circular heads 69. The tubes 14 connecting the headers are arranged in any preferred relation, preferably, however, in staggered horizontal rows so as to break up the vertical flue spaces. The superheating coils 71 which lead from the outer header to the steam manifold, (as disclosed in the aforementioned copending application) are disposed in these vertical flue spaces, there being a plurality of such superheating coils for each outer header. The inner and outer walls of each header may be reenforced against distortion by transverse stay bolts or the like.

In Figures 10, 11, and 12 are shown modified methods of joining the inner and outer curved plates of the above construction of header. In Figure 10 the two plates are joined by vertical channel sections 72, the flanges of which are welded to the adjoining edges of the plates as indicated at 73. In Figure 11 the vertical edges of the plates are bent inward and are formed with small reentrant flanges 74 and 75. These reentrant flanges are placed in engagement and the weld is performed along their line of juncture, as indicated at 76. In Figure 12 the inner and outer plates are formed with the end flanges 61 and 62 bent outwardly instead of inwardly so as to expose the welds to the outside.

It will be obvious that the foregoing construction of boiler can be manufactured at a much lower cost than one constructed of a large number of small headers. There is, furthermore, a much reduced heat radiation loss accruing to this construction by reason of the minimum number of spaces and joints between the headers. Obviously, this construction can be embodied in headers of quarter circle formation or in headers of even smaller angular extent.

We do not intend to be limited to the specific details and arrangements herein shown and described.

We claim:—

1. A sectional unit of a boiler comprising two headers, and a plurality of tubes joining said headers, one of said headers comprising an inner header section, an outer header section, both of said header sections extending longitudinally throughout the entire length of the header, one of said header sections

having lateral flanges adapted to embrace the lateral edges of said other header section and to be welded thereto, and nipples struck up from the body of one of said header sections, said tubes being welded integrally to said nipples.

2. A sectional unit of a boiler comprising two vertical headers and a plurality of tubes extending between said headers, each of said headers being built up of inner and outer straight-sided sections extending longitudinally throughout the entire length of the header, each of said header sections being constructed of sheet metal shaped into general channel formation with lateral flanges, the inner and outer header sections of each header being nested with the corresponding flanges of both sections aligned coextensively, said coextensive flanges being welded together, flanged end heads set in the ends of each of said headers and welded therein, and flanged nipples struck inwardly into each header from the body of the inner header section thereof, said tubes extending into said nipples and being welded therein within each header prior to the assembly of the header sections.

3. In a boiler, the combination of a plurality of independent vertical sections, each of said sections comprising a relatively large outer header and a relatively small inner header joined by a plurality of connecting tubes, said sections being arranged in circular formation with each section extending radially from the center of the boiler, said outer headers being placed in contact to form a circular outer water wall, said inner headers being placed in contact to form a circular inner water wall, each of said headers comprising an inner header section, an outer header section, both of said header sections extending longitudinally throughout the entire length of the header, said inner header section comprising flanged nipples extending inwardly into the header, the ends of said connecting tubes being welded in said flanged nipples from the interior of said headers, said header sections having lateral flanges adapted to be welded together after said connecting tubes have been welded in said nipples, said rings of inner and outer headers defining an annular heating flue therebetween, said ring of inner headers defining a secondary central heating flue.

4. In a boiler, a plurality of sectional boiler units, each of said boiler units comprising a relatively large outer header and a relatively small inner header joined by a plurality of connecting tubes, each of said headers comprising an inner header section, an outer header section, both of said header sections extending longitudinally throughout the entire length of the header, both of said header sections being constructed of sheet metal shaped into channel formation, the outer header section being nested within the inner header section and having its flanges coextensive with the flanges on said inner header section, said flanges being welded together, flanged nipples projecting from the body of each inner header section, said tubes being welded in said nipples, said boiler units being arranged in circular formation with each unit extending radially from the center of the boiler, said outer headers being placed in contact to form a circular outer wall, said inner headers being placed in contact to form a circular inner water wall, an annular heating flue between said water walls, and a central heating flue defined by said inner water wall.

5. In a boiler, a plurality of sectional boiler units, said boiler units being arranged in circular formation with each of said units extending substantially radially, each of said units comprising a pair of headers and a plurality of substantially horizontal circulating tubes joining said headers, said headers comprising a pair of vertical channel sections, one of said channel sections having holes formed therein in which are welded said tubes, said channel sections being assembled with the flanges thereof engaging each other, said flanges being welded together to form an integral header unit, the flanges on each series of headers contacting to form a closed circular water wall and defining an annular flue between the several pairs of headers, said circulating tubes being interspersed across said flue upwardly along the lengths of said headers.

6. A high pressure water-tube boiler, comprising a plurality of sections, each section comprising an inner header and an outer header, said headers having flat side faces being built up of longitudinally extending plates, welded together adjacent their edges, the welded edges of said outer header projecting outwardly away from the fire, said headers being non-circular in cross section with flat side faces in abutment, and water tubes communicating with said headers.

7. In a circular high pressure water-tube boiler, two concentric shells each formed of a plurality of abutting headers, water-tubes extending across the annular space between said shells, certain of the tubes being inclined to establish circulation by the ebullition of the liquid therein, said tubes taking water from the outer headers and delivering it to the inner headers, said outer headers being larger than the inner ones and having radial faces in abutment to form a continuous outer wall.

8. A high pressure water-tube boiler, comprising headers, and tubes interconnecting said headers, said tubes being welded to said headers inside the same, certain of said headers having flat faces in abutment to

form a continuous wall, and being formed of a plurality of longitudinal sections to facilitate forming said inside welds.

9. In a high pressure water-tube boiler, two concentric rings of vertical headers, the headers of both rings having radial faces in abutment to form substantially continuous walls, and water-tubes connecting said headers, certain of said tubes being inclined to produce automatic circulation by ebullition of the liquid in the tubes.

10. A high pressure water-tube boiler, comprising two concentric rings of vertical headers, the outer ring made up of headers both larger and longer than those of the inner ring, the headers of both rings having radial faces in abutment to form substantially continuous walls, and water-tubes connecting said headers, the lower tubes being inclined to produce automatic circulation by ebullition of the liquid in the tubes, and the upper tubes being relatively level to provide large volume up to the top of the boiler.

In witness whereof we hereunto subscribe our names this 29th day of November, A. D. 1919.

JOHN A. DIENNER.
WILLIAM H. WINSLOW.