Aug. 16, 1955 H. H. GARY, JR 2,715,377

METHOD OF FORMING HEADS FOR BOILERS, PRESSURE VESSELS, TANKS, AND THE LIKE

Filed March 23, 1954

Fig. 1.

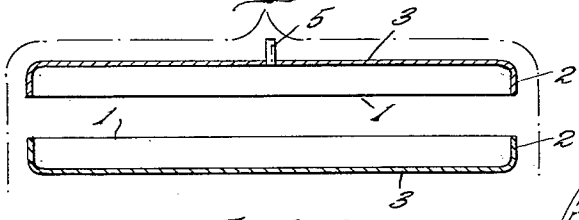


Fig. 2.

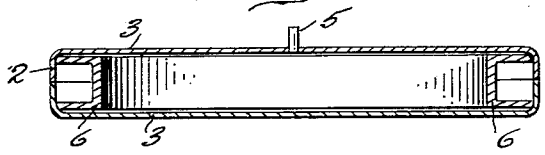


Fig. 3.

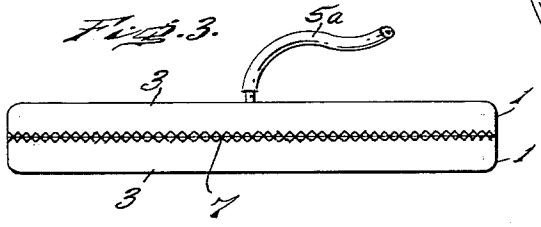


Fig. 4.

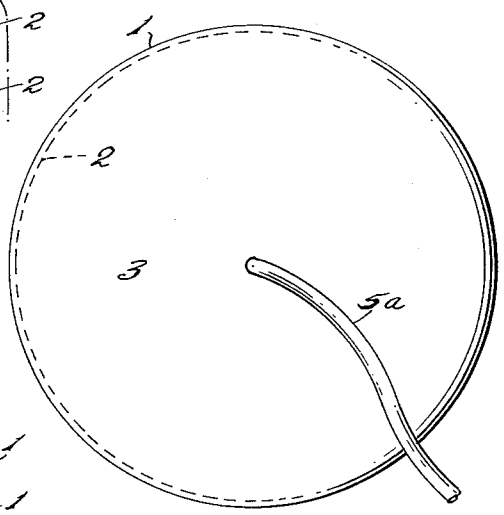


Fig. 5.

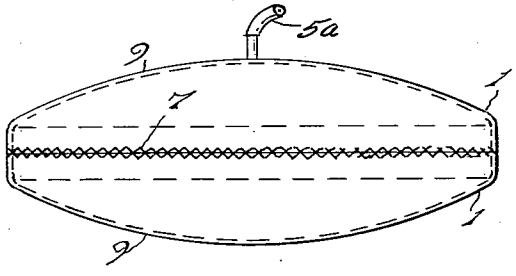


Fig. 7.

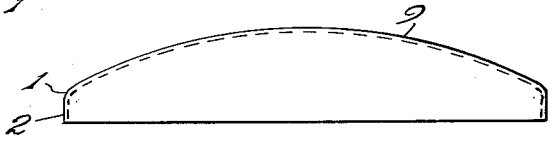
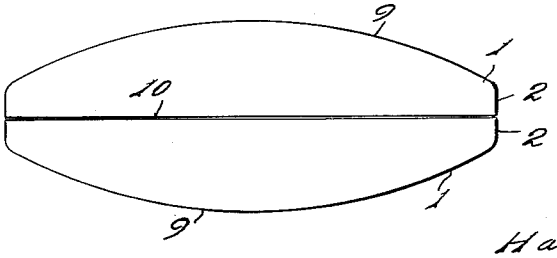


Fig. 6.



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METHOD OF FORMING HEADS FOR BOILERS, PRESSURE VESSELS, TANKS, AND THE LIKE

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4 Claims. (Cl. 113—121)

My invention relates to improvement in method of forming heads for boilers, pressure vessels, tanks, and the like, and more particularly to a method of forming head closures which have a circular convexly curved head portion with an integral depending circumferential flange.

It is customary practice at present to form such circular convexly curved head closures having an integral depending flange from flat sheets of steel, or other metal, by the use of dies, or by spinning operations. The manufacturing cost of forming circular convexly curved head closures with an integral depending flange by spinning operations is rather prohibitive. When only small quantities of such circular convexly curved head closures of a certain diameter are required, the cost of the necessary dies and the cost of setting up the dies in presses for the production of only a small quantity of heads is also practically prohibitive. In addition, such head closures when formed in dies have certain inherent residual stresses set up in the metal, and such heads, preferably, after formation should be subjected to annealing processes to relieve the residual stresses.

One object of my invention is to provide a method by the use of which circular convexly curved head closures for boilers, tanks, etc. may be formed very economically in various desired diameter sizes without the incurring of the very substantial costs involved when dies and presses are used to form such heads.

Another object of my invention is to provide a method by the use of which residual stresses in the metal of which the head closure is formed are relieved contemporaneously with the forming of the convexly curved portion of the head closure.

Another object of my invention is to provide a method by the use of which the convexly curved portion of the head closure is formed by stretching of the metal itself, and without any shortening of the diameter of the head closure.

Another object of my invention is to provide a method by the use of which the convexly curved portion will be formed simultaneously in two head closures.

The accompanying drawings show somewhat diagrammatically the progressive steps in my improved method, which has proven to be very satisfactory in commercial use.

In said drawings, Fig. 1 is a somewhat diagrammatic sectional view of two separated plane head closures provided with integral circumferential flanges.

Fig. 2 is a sectional view similar to Fig. 1 and with the opposed flanges of the heads in engagement with each other and a circular support ring interposed between the two head closures.

Fig. 3 is a somewhat diagrammatic elevation of the structure shown in Fig. 2, and with the two head closures welded together circumferentially at the point of contact of their respective flanges.

Fig. 4 is a top plan of the structure shown in Fig. 3.

Fig. 5 is a side elevation of the structure shown in Fig. 3 and with the plane surfaces of the heads expanded to convexly curved configuration by internally applied fluid pressure.

Fig. 6 is an elevation of the structure shown in Fig. 5 and with the two head closures shown cut apart at the weld which connected the respective flanges together, and with the support ring removed.

Fig. 7 is an elevation of a convexly curved head closure made with the use of my improved method.

Referring to said drawings, Fig. 1 shows somewhat diagrammatically two circular head closures **1** formed from flat sheet steel, or other metal, and which are provided with integral depending flanges **2** which are formed by any of the methods well known in the art. Of course, said flanges **2** may be formed by welding a circumferential depending strip of the proper width to the plane head portion **3** of the head closure.

One of the pair of head closures **1** is provided with an axial opening in which a fluid conduit means **5** is mounted in fluid tight relationship with the plane head portion **3**. The fluid conduit means **5** is connected with a fluid conduit **5***a* which is connected to a convenient source of fluid under pressure sufficient to bulge the plane head portion **3** to convex configuration, as hereinafter described.

As shown in Fig. 2, a circular metal ring **6** of substantially the same diameter as the internal diameter of the flange **2** is inserted between the two head closures **1**. The ring member **6** is, conveniently, of general block **C** shape in cross section, and is of sufficient section to withstand, without deformation, the radial stresses resultant from the introduction of fluid under pressure to the space inside of two welded together head closures through the fluid conduit means **5**, as heerinafter described. As shown in Fig. 2, the ring member **6** engages the flanges **2** of both head closures **1** in substantially fluid-tight relationship to prevent the fluid under pressure, when introduced through the fluid conduit means **5**, from bulging the flanges **2** when the plane head portions **3** are being bulged, as hereinafter described. Unless a ring member, as indicated at **6**, be placed between the heads, the radial stresses of the fluid pressure would cause extreme buckling of the heads and the flanges.

As shown in Fig. 2, the width of the ring member **6** is slightly less than the distance between the inside surfaces of the two plane head portions **3** when the flanges **2** thereof are positioned together, as indicated in Fig. 2.

As shown in Fig. 3, the two heads **1** are welded together circumferentially at the abutting portions of their flanges **2**, as indicated at **7**. Fluid under pressure is then introduced into the two welded together head closures through the fluid conduit means **5** from the source of fluid under desired pressure. The member **6** being of ring form, the forces of the fluid under pressure will be exerted uniformly on the inside faces of both plane head portions **3**, and will cause the plane surfaces **3** of each head closure to be bulged uniformly from a plane form as shown at **3** in Figs. 1, 2 and 3 to the convexly curved configuration **9**, as shown in Figs. 5, 6 and 7.

Fluid pressure applied through the fluid conduit means **5** will cause the plane surfaces **3** to bulge in an even or uniform manner, and the fluid pressure is increased in value until the head portions have bulged to the required radius of dish. When the head portions have been bulged to the desired radius, the fluid pressure is relieved from within the welded together head closures **1**.

The two head closures **1** are then cut apart at the circumferential point of weld as indicated at **10** in Fig. 6, and the ring **6** is removed from within the heads, leaving 2 circular convexly curved head closures of the desired

radius of dish and with integral depending flanges of the desired diameter.

The head closures may then be inserted in the opposite ends of the preformed cylindrical body portion of the boiler, pressure vessel, tank, and the like, and the heads integrally connected with the body portion of the boiler, etc., in any well known manner, such as by welding.

It is obvious that various modifications may be made in my improved method without departing from the essential features thereof, and, I do not desire to limit myself to the precise details of the method as herein described.

I claim:

1. The method of making head closures for boilers, pressure vessels, tanks, and the like consisting in forming circular head closures with a plane head portion and a depending circumferential flange from flat sheet metal; providing a plane head portion with axial fluid conduit means in communication at its inner portion with the interior of said head closure and adapted to be connected at its outer portion to a source of fluid under pressure; positioning two of said head closures together, one of which being provided with a said fluid conduit means, in axial alignment and with their respective circumferential flanges in abutting relationship and with a circular metal ring member, having substantially the same outside diameter as the internal diameter of said flanges, positioned within said pair of head closures, with said ring member in substantially fluid-tight circumferential contact with the respective flanges of each head closure near the junction of the flange and plane head portion; circumferentially welding the flanges of said head closures together at their abutting surfaces; subjecting the plane head portions of said two welded together head closures to internal pressure by means of fluid under pressure introduced through said fluid conduit means, said fluid under pressure being of a value sufficient to bulge convexly the plane head portions of said welded together head closures to the desired radius of dish; relieving said internal fluid pressure when said head portions have been bulged convexly to the desired radius of dish; cutting the two head closures apart at their side flange portions; and removing said ring member from within said head closures.

2. The method of making head closures for boilers, pressure vessels, tanks, and the like consisting in forming circular head closures with a plane head portion and a depending circumferential flange from flat sheet metal; providing a plane head portion with fluid conduit means in comunication at its inner portion with the interior of said head closure and adapted to be connected at its outer portion to a source of fluid under pressure; positioning two of said head closures together, one of which being provided with a said fluid conduit means, in axial alignment and with their respective circumferential flanges in abutting relationship and with a circular metal ring member, of general channel cross section and having substantially the same outside diameter as the internal diameter of said flanges, positioned within said pair of head closures, with the flange portions of said channel shaped ring member in substantially fluid-tight circumferential contact with the respective flanges of each head closure near the junction of their flange and plane head portion; circumferentially welding the flanges of said head closures together at their abutting surfaces; subjecting the plane head portions of said two welded together head closures to internal pressure by means of fluid under pressure introduced through said fluid conduit means, said fluid under pressure being of a value sufficient to bulge convexly the plane head portions of said welded together head closures to the desired radius of dish; relieving said internal fluid pressure when said head portions have been bulged convexly to the desired radius of dish; cutting the two head closures apart at their side flange portions; and removing said ring member from within said head closures.

3. The method of making head closures for boilers, pressure vessels, tanks, and the like consisting in forming circular head closures with a plane head portion and a depending circumferential flange from flat metal; providing a plane head portion with fluid conduit means in communication at its inner portion with the interior of said head closure and adapted to be connected at its outer portion to a source of fluid under pressure; positioning two of said head closures together, one of which being provided with a said fluid conduit means, in axial alignment and with their respective circumferential flanges in abutting relationship and with a circular metal ring member, of general block C configuration in cross section and having substantially the same outside diameter as the internal diameter of said flanges, positioned within said pair of head closures, with said block C shaped ring member in substantially fluid-tight circumferential contact with the respective flanges of each head closure near the junction of their flange and plane head portion; circumferentially welding the flanges of said head closures together at their abutting surfaces; subjecting the plane head portions of said two welded together head closures to internal pressure by means of fluid under pressure introduced through said fluid conduit means, said fluid under pressure being of a value sufficient to convexly bulge the plane head portions of said welded together head closures to the desired radius of dish; relieving said internal fluid pressure when said head portions have been bulged convexly to the desired radius of dish; cutting the two head closures apart at their side flange portions; and removing said ring member from within said head closures.

4. The method of making head closures for boilers, pressure vessels, tanks, and the like consisting in forming circular head closures with a plane head portion and a depending circumferential flange from flat metal; providing a plane head portion with fluid conduit means in communication at its inner portion with the interior of said head closure and adapted to be connected at its outer portion to a source of fluid under pressure; positioning two of said head closures together, one of which being provided with a said fluid conduit means, in axial alignment and with their respective circumferential flanges in abutting relationship and with a circular metal ring member, provided with an intermediate circumferential recess portion and having substantially the same outside diameter as the internal diameter of said flanges, positioned within said pair of head closures, with said ring member in substantially fluid-tight circumferential contact with the respective flanges of each head closure near the junction of their flange and plane head portion; circumferentially welding the flanges of said head closures together at their abutting surfaces; subjecting the plane head portions of said two welded together head closures to internal pressure by means of fluid under pressure introduced through said fluid conduit means, said fluid under pressure being of a value sufficient to convexly bulge the plane head portions of said welded together head closures to the desired radius of dish; relieving said internal fluid pressure when said head portions have been bulged convexly to the desired radius of dish; cutting the two head closures apart at their side flange portions; and removing said ring member from within said head closures; whereby, the residual stresses in the metal of which said head closure is formed are relieved contemporaneously with the forming of the convexly curved portion of said head closure.

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