Oct. 24, 1933. J. PRICE 1,931,679

CLOSURE MEANS FOR PRESSURE CONTAINERS

Filed April 27, 1931

Fig. 1.

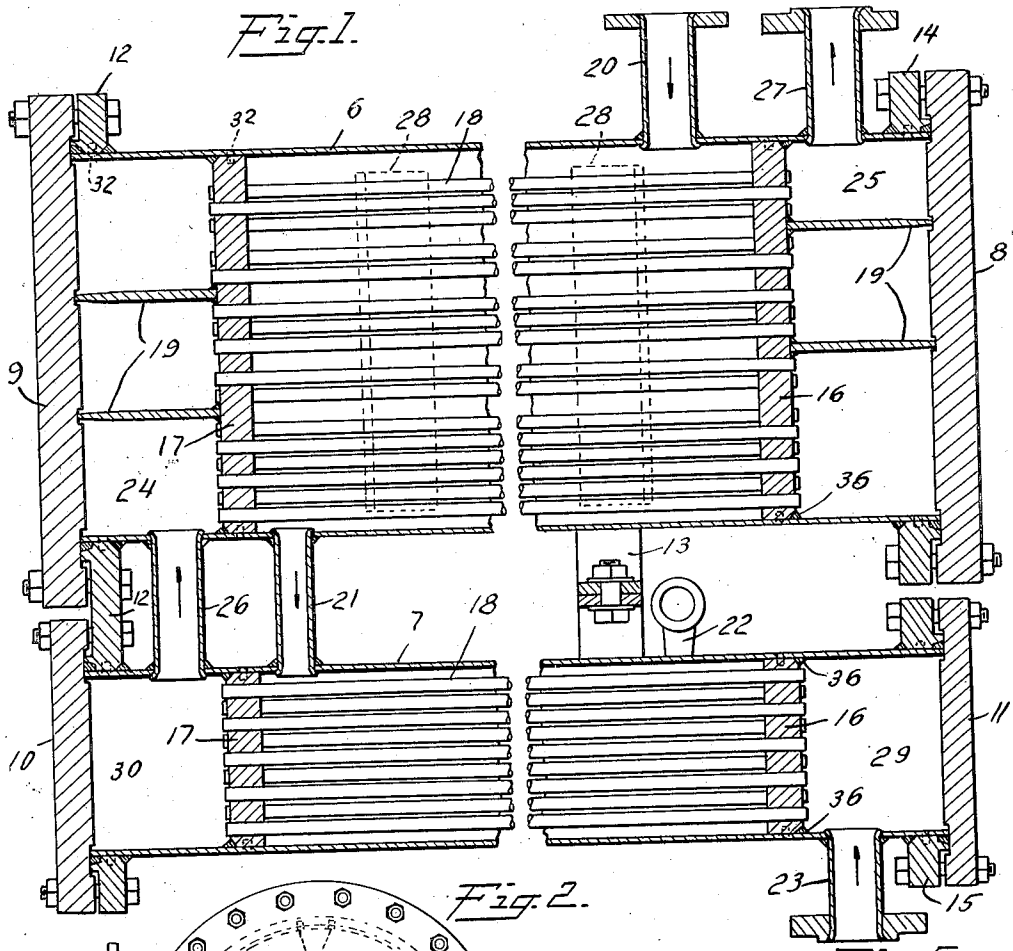


Fig. 2.

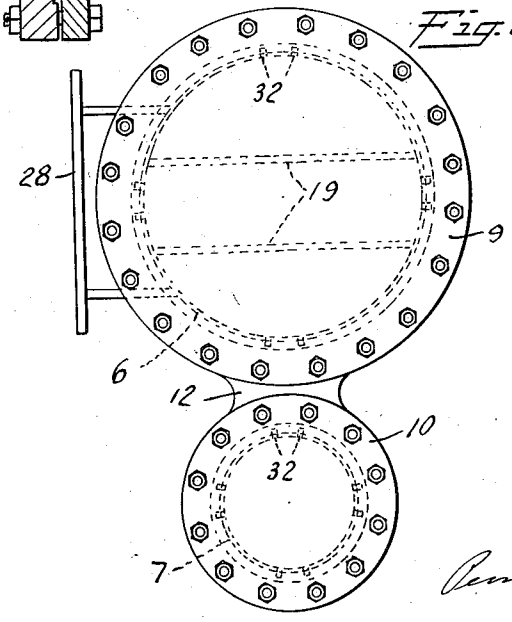


Fig. 3.

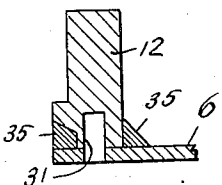


Fig. 5.

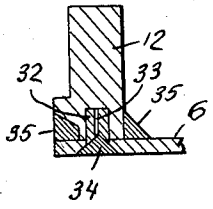
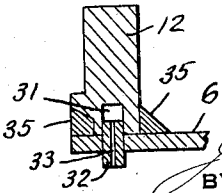


Fig. 4.



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CLOSURE MEANS FOR PRESSURE CONTAINERS

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8 Claims. (Cl. 220—75)

This invention relates to pressure containers and more particularly concerns improved means for permanently connecting and sealing transverse members such as head flanges, tube sheets and the like to the shells of pressure vessels such as heat exchangers, tanks, etc.

Many forms of vessels or containers for carrying fluids under pressure comprise shells of circular or other section with suitable heads removably secured to the ends thereof. In the case of heat exchangers of certain types, suitable transverse tube sheets are secured within the shells between their ends. The heads of containers of this type are usually bolted or otherwise removably secured to exterior flanges permanently secured to the container shell. In the containers of the type described, it is always desirable and often essential that the head retaining flanges, tube sheets and other transverse pressure members be securely connected in fluid-tight union with the shell.

With the above and other considerations in mind, it is proposed in accordance with the present invention to provide improved means for both locking and sealing pressure retaining members such as tube sheets, head flanges, heads, etc. to the shells of pressure containers. A further object of the invention resides in the provision of improved means for sealing the locking means in place. Various other specific objects, advantages and characteristic features of the invention will become apparent as the description thereof progresses.

In general, the objects of my invention are carried out by inserting locking elements in cooperating openings in a container shell and a transverse pressure retaining element, and by further forming a separate fluid-tight joint between the shell and the member. The pressure retaining member usually extends transversely of the shell and is disposed to fit in close engagement with the inner or outer surface of the shell or with both such surfaces. The locking elements preferably comprise dowel pins or equivalent means having a driven fit with cooperating transverse opening in the shell and the member, these pins being placed in shear by pressure acting on the transverse member. The separate sealing joint between the member and the shell is preferably formed by welding these elements together along their line of juncture.

The invention will be best understood by reference to the accompanying drawing in which one embodiment thereof has been illustrated. In the drawing;

Figure 1 is a sectional side elevation of a heat exchanger having tube sheets and head flanges secured to the shells thereof by means embodying the present invention;

Fig. 2 is an end elevation of the exchanger shown in Fig. 1; and

Figs. 3, 4 and 5 are sectional views showing the joint between a head flange and a shell in several successive stages of manufacture.

Referring to the drawing, the pressure container shown to illustrate the invention comprises a heat exchanger for heating fluids such as fuel oil by means of hot fluids. Either or both of the fluids passing through a heat exchanger of this type may be under considerable pressure.

The exchanger shown comprises generally a pair of parallel elongated cylindrical shells 6 and 7 having removable heads 8, 9, 10 and 11 respectively fixed to the opposite ends thereof. The shells 6 and 7 may be united by a double head flange 12 which fits snugly about the outer surfaces of the two shells adjacent one end thereof and by a bracket 13 disposed directly between the shell surfaces. In the disclosed embodiment, two separate head flanges 14 and 15 are respectively fitted on the shells 6 and 7 at the opposite ends thereof from the double head flange 12.

Each shell 6 and 7 is provided with two spaced tube sheets 16 and 17, these sheets fitting snugly against the inner surfaces of the shells and being spaced from the shell heads as shown. Suitable tubes 18 extend between the tube sheets 16 and 17 of each shell and are sealed in openings in the tube sheets in accordance with usual practice. A plurality of partitions or baffles 19 are preferably disposed between each tube sheet 16 and 17 and the adjacent heads 8 and 9 of the upper shell 6 to direct the fluid in reverse paths through the tubes 18 of this shell. A fluid inlet fitting 20 is sealed in an opening in the upper shell 6 between the tube sheets 16 and 17 thereof and the space between these sheets is connected to the space between the tube sheets of the lower shell 7 by a duct 21. An outlet fitting 22 is provided in the lower shell between the tube sheets thereof. An inlet fitting 23 communicates with one end of the lower shell 7 outside of the tube sheet 16 thereof and the other end of this shell is connected to the end chamber 24 of the upper shell 6 by a duct 26. The end chamber 25 of the upper shell 6 is provided with an outlet fitting 27. The heat exchanger may be supported on any fixed structure by suitable means such as the brackets 28.

In accordance with usual practice, one of the

fluids between which an exchange of heat is desired, say the hotter fluid, is introduced through the inlet fitting 20, flows around the tubes 18 of the upper shell 6, passes through the duct 21, flows around the tubes 18 of the shell 7 and is discharged through the fitting 22. The other fluid, say the cooler fluid, enters the end chamber 29 of the lower shell 7 through the fitting 23, passes through the tubes 18 of the lower shell to the end chamber 30 thereof, passes through the duct 26 to the end chamber 24 of the shell 6, flows in a tortuous path back and forth through the tubes 18 of the upper shell 6 and finally passes out through the end chamber 25 and the fitting 27.

Referring now more particularly to the improved connecting and sealing means of the invention, a plurality of cooperating transverse openings 31 are formed in the shells and the tube sheets and head flanges at a number of spaced points. As shown in Fig. 2, eight such sets of openings may be used for each tube sheet and head flange, but obviously, other numbers of openings may be employed. A dowel pin 32 having a driven fit with the openings 31 is forced into each of these openings as shown in Fig. 4. It is preferred to provide a longitudinal vent or opening 33 through each dowel pin 32 to permit the escape of air from the pocket formed in the opening 31 as the pin is driven into place. After being fully inserted in the opening, each dowel pin is preferably tightly secured in place, and this may be accomplished by welding the outer end of each pin to the shell 6, as indicated at 34 in Fig. 5.

Each tube sheet and head flange is sealed in fluid-tight engagement with the shell by means in addition to the dowel pin connection described above. This may be conveniently accomplished by forming a continuous welded joint, indicated at 35, between the transverse member and the shell at one or both sides of such member. In the disclosed embodiment, the head flanges 12, 14 and 15 are welded to the shells 6 and 7 on both sides of these flanges as shown at 35, while a single line of welding 36 is employed to seal each tube sheet 16 and 17 to its corresponding shell 6 or 7.

Obviously, the openings 31 may be drilled in the shell and the cooperating transverse pressure retaining member either before or after the welded sealing joint is formed between these elements, and the insertion of the dowel pins may either precede or follow the formation of the sealing weld.

The connecting and sealing means of the present invention presents several advantageous features. Although a welded joint between elements of a pressure container produces a fluid-tight construction, the ability of such a joint to retain a transverse pressure retaining member such as a tube sheet or head in place against high pressures is limited. In the joints of the present invention, the tube sheet or head is securely locked to the shell by the dowel pins, and this locking engagement is further reinforced by the weld which also forms the desired fluid-tight seal.

I claim:

1. In a pressure fluid container of the type described, an elongated shell, a separate pressure retaining member extending transversely of said shell in close engagement with a surface of said shell, transversely extending dowel pins disposed in cooperating openings in said shell and said member for locking said member against longitudinal movement with respect to said shell, means for securing said pins in said openings and a continuous welded joint between said pressure retaining member and said shell.

2. In a pressure fluid container of the type described, an elongated shell, a separate pressure retaining member extending transversely of said shell in close engagement with a surface of said shell, transversely extending dowel pins disposed in cooperating openings in said shell and said member for locking said member against longitudinal movement with respect to said shell, a welded joint between each dowel pin and said shell for securing said pin in place and a further welded joint between said pressure retaining member and said shell.

3. In a pressure fluid container of the type described, a substantially cylindrical shell, a head flange having a circular opening therein closely engaging the outer surface of said shell, at least one radially extending dowel pin disposed in co-operating openings in said shell and said flange and a continuous welded joint between said flange and said shell.

4. In a pressure fluid container of the type described, a substantially cylindrical shell, a circular tube sheet closely engaging the inner surface of said shell, at least one radially extending dowel pin disposed in co-operating openings in said shell and said sheet and a continuous welded joint between said sheet and said shell.

5. In a pressure fluid container of the type described, a substantially cylindrical shell, a separate pressure retaining member extending transversely of said shell in close engagement with the surface thereof, transversely extending dowel pins disposed in cooperating openings in said shell and said member for locking said member against longitudinal movement with respect to said shell, and a welded joint between each dowel pin and said shell for securing said pins in place.

6. In a pressure fluid container of the type described, a shell, a head flange closely engaging the outer surface of said shell, at least one dowel pin disposed in cooperating openings in said shell and said flange and a continuous welded joint between said flange and said shell.

7. In a pressure fluid container of the type described, a shell, a tube-sheet closely engaging the inner surface of said shell, at least one dowel pin disposed in cooperating openings in said shell and said sheet and a continuous welded joint between said sheet and said shell.

8. In a pressure fluid container of the type described, a shell, a separate pressure retaining member extending transversely of said shell in close engagement with the surface thereof, transversely extending dowel pins disposed in co-operating openings in said shell and said member for locking said member against longitudinal movement with respect to said shell and means for sealing said pins in said openings.

JOSEPH PRICE.