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G. T. JACOCKS

2,223,320

HEAT EXCHANGER

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Fig. 1.

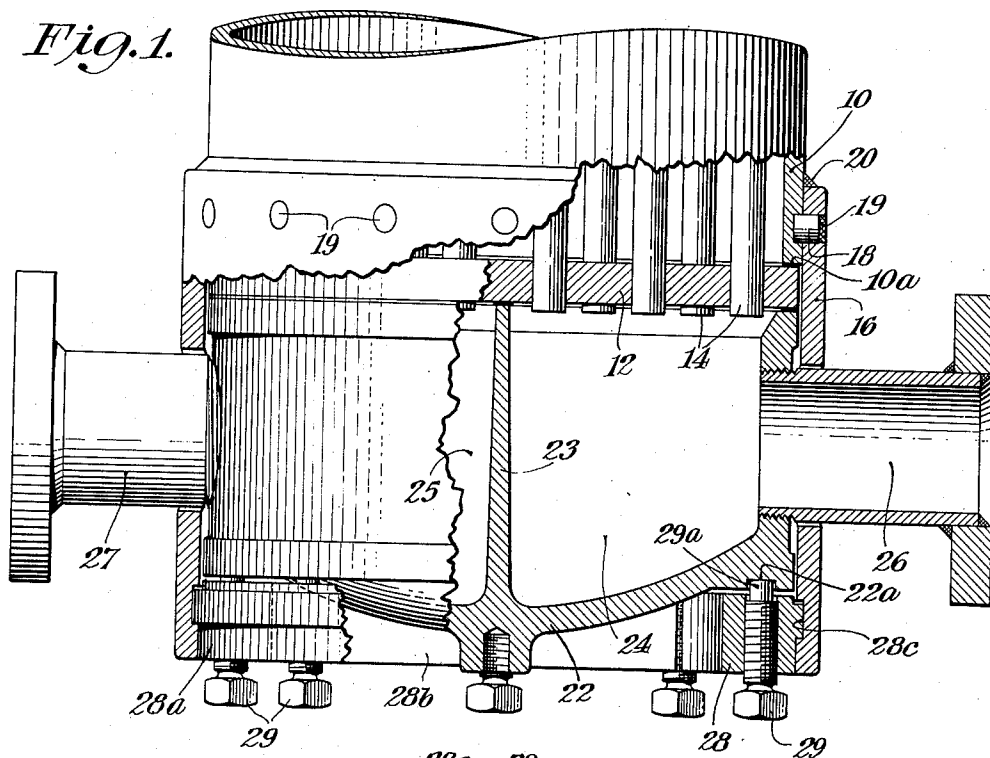
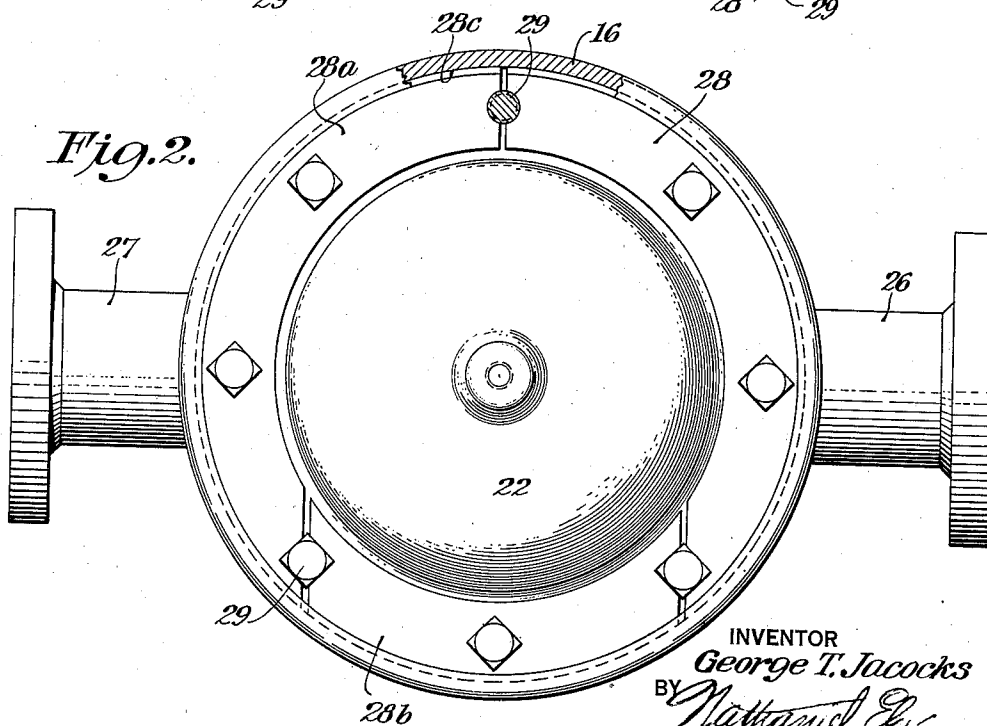


Fig. 2.



INVENTOR
George T. Jacobs
BY *Nathan S. Jacobs*
ATTORNEY

UNITED STATES PATENT OFFICE

2,223,320

HEAT EXCHANGER

George T. Jacocks, Larchmont, N. Y., assignor to
The Lummus Company, New York, N. Y., a corporation of Delaware

Application November 30, 1939, Serial No. 306,831

5 Claims. (Cl. 257—225)

This invention relates to improvements in heat exchangers of the shell and tube type and more particularly to an improved channel construction therefor.

It has heretofore been proposed that heat exchangers be provided with flanges adjacent the respective ends of the heat exchanger shell and that the fixed tube sheet, channel, and shell cover each be bolted through these external flanges. Such construction requires the provision of extra metal, which involves extra weight and extra bolts, larger gaskets, and in general embraces elements which are found extremely expensive.

It is one of the principal objects of my invention to provide a heat exchanger construction in which the fixed tube sheet of the tube bundle and the channel are of a diameter smaller than the internal diameter of the shell, whereby the tube bundle and channel may be removed from the shell for the necessary cleaning, etc.

Another and more specific object of the invention is to provide a heat exchanger construction in which the shell is of a relatively small diameter, merely sufficient to embrace the tube bundle and extends only to the fixed tube sheet, such shell having a telescopic extension portion secured thereto to provide for attachment of the channel to the fixed tube sheet.

Another and more specific object of the invention is to provide an inexpensive construction for a heat exchanger for moderate duty service, having a simplified construction for securing the channel to the shell using a minimum number of parts and being detachably secured to the shell by securing devices, all of which are within the shell.

Further objects and advantages of my invention will appear from the following description of a preferred form of embodiment thereof taken in connection with the attached drawing, in which

Fig. 1 is an elevation with parts in section of the channel end of a heat exchanger;

Fig. 2 is a bottom view with parts broken away and in section of the exchanger shown in Fig. 1.

In my copending application, Serial No. 172,567, filed Nov. 3, 1937, I have disclosed a heat exchanger in which the shell is of a substantially continuous diameter with all of the parts, including the shell cover, fixed tube sheet, and channel, secured to the internal wall thereof. Such construction is far cheaper than the

standard flanged type of construction and has many operating advantages.

In accordance with the present invention, I have availed myself of the advantage of a continuous shell which is somewhat shorter than the shell for an equivalent sized exchanger as shown in my copending application, and I have eliminated the necessity of securing internal rings as lands for attachment of the fixed tube sheet.

In accordance with this preferred form of embodiment of my invention, the heat exchanger shell 10 is conveniently of a uniform diameter, but it only extends to the tube sheet 12 from which the tubes 14 extend to form the tube bundle. Extending beyond this shell 10 and as a continuation thereof, I have provided an extension 16 which is also preferably a cylinder which telescopes over the shell 10 and overlaps the edge sufficiently to form a joint. I find that a preferred type of joint is made by drilling through the wall of this cylindrical extension portion 16 and partially into the shell 10 at spaced points on the periphery and thereafter inserting plugs 18 which may be firmly held in place by solder or other material 19. The edge of the joint between the extension 16 and the shell 10 is suitably welded as at 20 to make a permanent connection.

It will be appreciated that the primary reaction of the extension 16 with respect to the shell 10 is a longitudinal force along the axis, with the result that the pins 18 are placed in shear and will adequately anchor the extension 16 to the heat exchanger shell. It is preferable that the shell 10 be not fully perforated, thereby avoiding any leaks. The pins 18 will be of suitably hardened material to resist the combined pressure and closure load of the channel thereon.

The channel may be of a multiple or a single part type and in the present form of embodiment, I have shown a typical channel which includes a cover member 22 and a central pass baffle 23 which form the chambers 24 and 25 for the nozzles 26 and 27, whereby the fluid may pass into and out of the respective tubes 14 in the tube bundle. This channel is adapted to engage the outer surface of the fixed tube sheet 12 and to be sealed thereto as by suitable gaskets. The tube sheet 12, in turn, rests on the edge 10a of the shell 10, and sealing loads are carried directly to the main shell body in this manner.

The channel securing means may most effectively include a bull ring having a series of

segments 28, 28a, and 28b which are provided with offset portions 28c, which engage in a suitable groove near the outer end of the shell extension 16. The bull ring segments are suitably
 5 tapped to receive the hold down bolts 29, certain of the hold down bolts being placed between the split sections of the adjacent bull ring segments as shown in Fig. 2, whereby dislocation of the segments is prevented. It will be noted
 10 that the segment 28b has parallel sides so that it may be disassembled first to permit the disassembly of the parts 28 and 28a.

The hold down bolts 29 are relatively short in length and act directly on the cover 22 of the
 15 channel. Preferably these bolts have their inner ends 29a engaging in a shallow groove 22a in the channel cover whereby any outward movement of the bull ring and bolts will be resisted. Forces tending to cause such objectionable move-
 20 ment are reduced to the minimum, however, by having the bolts substantially in line with the gaskets between the channel and the fixed tube sheet, and the fixed tube sheet and the edge of the shell 10, and having the shear reactions on
 25 the pins 18 and bull ring portions 28c in alignment.

The nozzles are secured to the channel in any desired manner as by screw threading as shown in Fig. 1, or they may be integrally secured to
 30 the channel extension and provided with retractable couplings as described in my copending application, Serial No. 174,330, filed November 13, 1937, which matured into Patent No. 2,207,036, issued July 9, 1940. With an inexpen-
 35 sive construction it is preferable to screw thread the nozzles into the channel wall as this is the simplest and facilitates the removal of the nozzle when the channel is to be removed from the shell.

The construction shown would be equally suitable for securing a cover directly to the end of a shell or tank or other vessel, in which the cover is of smaller diameter than the extension, but of substantially the same diameter as the
 45 principal part of the vessel. Advantages of economy, security, and simplicity reside in such a structure.

While I have shown a preferred form of embodiment of my invention, I am aware that modifications may be made thereto and I, therefore, desire a broad interpretation of my invention within the scope and spirit of the disclosure herein and of the claims appended hereinafter.

I claim:

55 1. In a vessel of the class described having a substantially cylindrical body portion, a substantially cylindrical extension portion telescoped thereover, means to secure said extension portion to the body portion, including a plurality of shear
 60 pins projecting into said body portion, a partition member of smaller diameter than said extension portion and of substantially the same diameter as the body portion, said partition member resting on the end of said body portion,
 65 and means secured to the interior of the extension portion and engaging the partition member to seal said partition member to said body por-

tion, said means including a plurality of ring forming segmental members of larger diameter than the inner diameter of the extension portion and projecting laterally into engagement with said extension portion in axially immovable relation, and a plurality of bolts extending through the segmental members and adjustably holding said partition member against said body portion.

2. In a heat exchanger of the class described
 10 having a substantially cylindrical shell, a shell extension telescoped thereon, shear means to hold said shell extension against longitudinal movement with respect to the shell, a tube sheet within said shell extension and of a diameter to
 15 engage the end of the shell, a channel and segmental bull ring means engaging the interior of the shell extension and having adjustable means engaging the channel to hold the tube sheet in place.

3. A heat exchanger of the class described including a shell, a shell extension surrounding said shell, transversely extending plugs projecting partially through the shell extension into the shell, a channel embraced within said shell extension, a tube bundle including a fixed tube sheet engaging the end of the shell, and means to secure said channel with respect to the interior of said shell extension and to engage the fixed tube sheet in a liquid tight manner, said
 30 means including a plurality of ring forming segmental members of larger diameter than the inner diameter of the extension portion and projecting laterally into engagement with said extension portion in axially immovable relation,
 35 and a plurality of bolts extending through the segmental members and adjustably holding said channel against said body portion.

4. A heat exchanger comprising a substantially cylindrical shell, a telescoping shell extension secured thereto, a tube bundle including a fixed tube sheet engaging the end of said shell, a channel within said shell extension, removable means to secure said channel against said fixed tube sheet and to the interior of said shell extension, and nozzles screw threaded into said channel whereby said channel may be removed from said shell extension.

5. In a heat exchanger of the class described, the combination of a shell, a tube bundle including a fixed tube sheet therefor, said tube sheet engaging the end of said shell and having an outer diameter substantially the same as the outer diameter of the shell, a shell extension embracing the shell and tube sheet, shear resisting means to anchor the shell extension to the shell and means to secure the tube bundle to the shell, said tube bundle securing means being within the extension and having parts in shear engaging the shell extension, which are in longitudinal alignment with the shell extension shear resisting means, said tube bundle securing means having pressure applying parts in substantial alignment with the shell reacting part, and means to resist tendency of movement of the pressure
 65 applying parts due to any unbalance of forces.

GEORGE T. JACOCKS.