

Dec. 7, 1965

J. W. PYLE, JR
HEAT EXCHANGER HEAD

3,221,808

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2 Sheets-Sheet 1

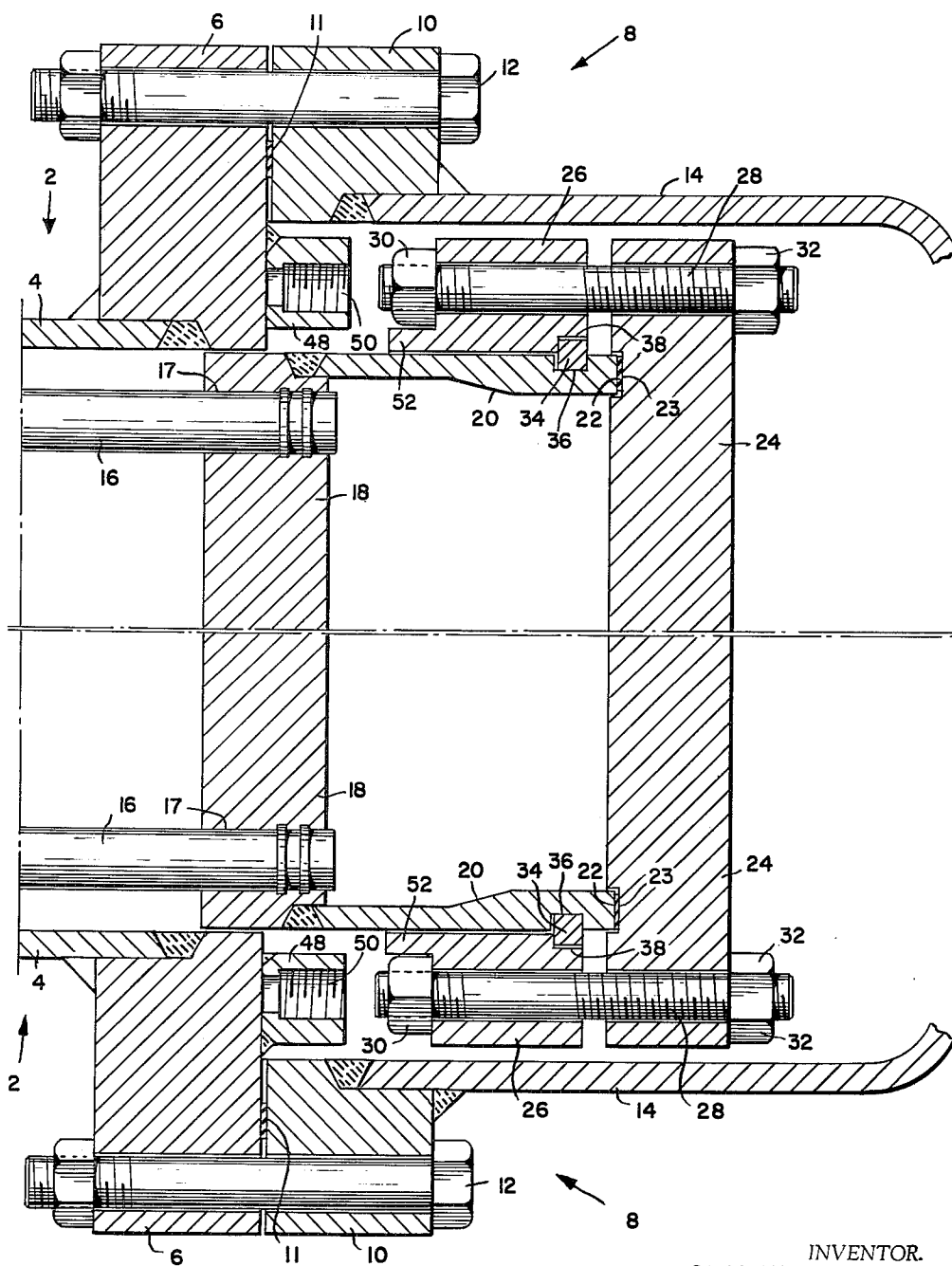


FIG. 1.

INVENTOR.
JOHN W. PYLE, Jr.
BY *Burke Jones*

ATTORNEYS

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2 Sheets-Sheet 2

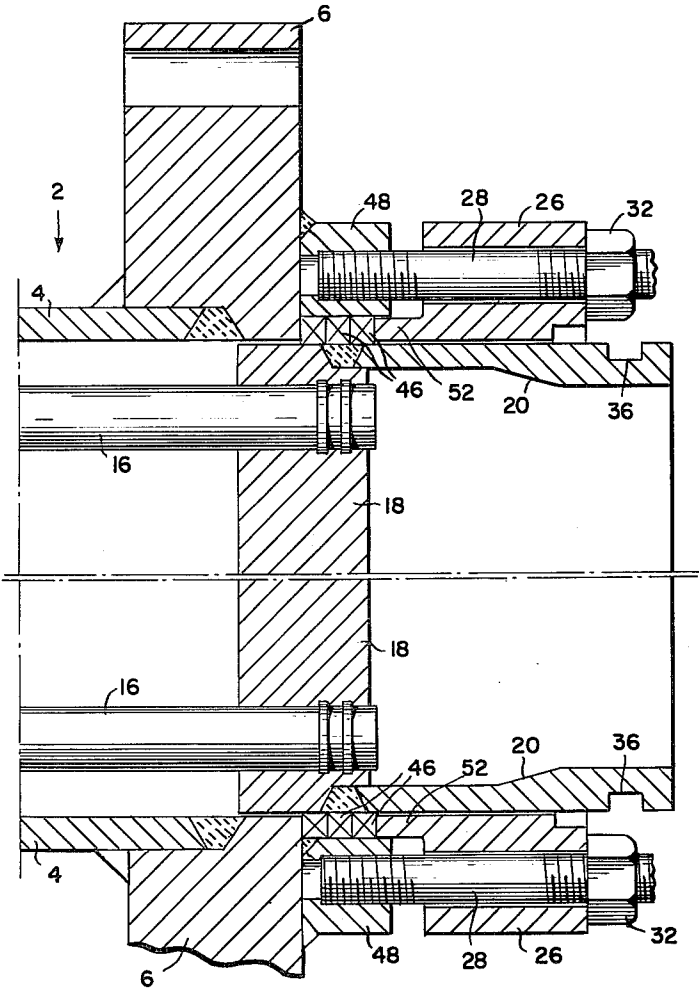


FIG. 2.

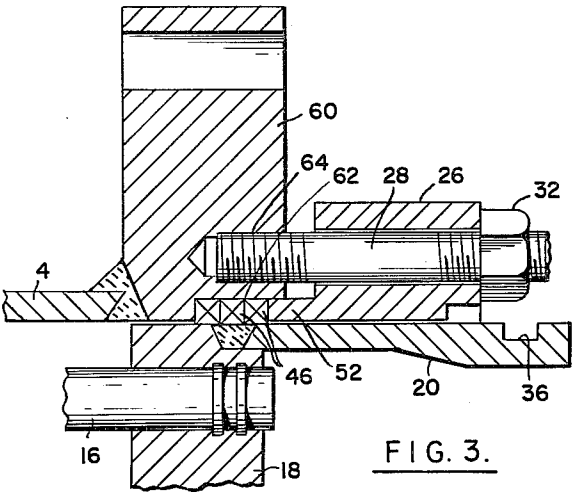


FIG. 3.

INVENTOR.
JOHN W. PYLE, Jr.
BY *Forrest Smith & Associates*

ATTORNEYS

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HEAT EXCHANGER HEAD

John W. Pyle, Jr., West Chester, Pa., assignor to Pressed Steel Tank Company, Milwaukee, Wis., a corporation of Wisconsin

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2 Claims. (Cl. 165—158)

This invention relates to a heat exchanger head and more particularly relates to such a head having a floating tube sheet.

The heat exchanger head of this invention is highly advantageous for a number of reasons. At the outset, it can be manufactured at relatively low cost due to the small number of parts, the reduced number of shop hours required for its fabrication and due to the elimination of extra parts normally required for testing. Contrary to the normal situation, the heat exchanger head of this invention provides all of the essential parts for hydrostatic or air testing of the heat exchanger shell, tubes and the tube to tube sheet joints.

The heat exchanger head of this invention is further advantageous in that it reduces the dead area normally found between a floating tube sheet extending beyond the interior surface of the shell and the consequentially employed tube support which is supported by the shell.

A further advantage is that the floating tube sheet cannot hang up on the shell and flange or any part appurtenant thereto during insertion or removal as is the case with a conventional heat exchanger head having an inside floating tube sheet.

These and other advantages of the invention will become apparent on reading the following description in conjunction with the drawings, in which:

FIGURE 1 is a vertical section through a heat exchanger head in accordance with the invention partially broken away;

FIGURE 2 is a vertical section through the heat exchanger head of FIGURE 1, partially broken away, rigged for hydrostatic testing; and

FIGURE 3 is a vertical section through a modification of the structure of FIGURE 2 partially broken away.

Referring now to FIGURE 1, a heat exchanger 2 has a conventional cylindrical shell 4 provided with a flanged end 6. A heat exchanger head 8 has a flange 10 which engages a ring gasket 11 and is bolted to flanged end 6 by bolts indicated at 12. Flange 10 is secured to a domed end cover 14.

Within shell 4 and cover 14 are heat exchanger tubes 16 which are secured in opening 17 of a floating tube sheet 18. Tube sheet 18 will be made to have a radius which is somewhat smaller than the inner radius of shell 4 and flanged end 6, for example, smaller by from $\frac{3}{32}$ to $\frac{3}{16}$ of an inch, as is illustrated in FIGURE 1. Although the clearance is illustrated in FIGURE 1, with the heat exchanger lying horizontally as illustrated in FIGURE 1, the lower periphery of floating tube sheet 18 will be supported by the inner periphery of flanged end 6 of shell 4. As viewed in FIGURE 1, tubes 16 extend to the left within shell 4 to a conventional stationary tube sheet (not shown) with the other end of heat exchanger 2 having a conventional head (not shown) for supplying and exhausting fluid to the appropriate tubes. Reference may be had to "Standards of Tubular Exchanger Manufacturers Association," fourth edition, 1959. It will be appreciated that the invention is also applicable to a single pass heat exchanger.

A cylindrical skirt 20 is secured to the exterior face of tube sheet 18 to form an open ended chamber adjacent the end of tubes 16 and abuts against a ring washer

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22 carried in a circular groove 23 of cover plate 24. Cover plate 24 is secured to removable ring 26 by threaded members 28 to which are secured nuts 30 and 32. A snap ring 34 secured in peripheral groove 36 in skirt 20 is engaged by cut out portion 38 of ring 26.

From the above description, it will be seen that floating tube sheet 18 can readily be inserted and removed from within shell 4 without hanging up on any structure appurtenant to shell 4. In view of the fact that floating tube sheet 18 is supported by the interior surface of shell 4 and does not extend beyond the latter surface, there is no necessity for a supporting structure for tubes 16 adjacent to sheet 18 as is conventionally used where the tube sheet extends beyond the surface of the shell. This eliminates a highly undesirable dead area and yet in no way impedes the free longitudinal movement of floating tube sheet 18 with respect to shell 4. Skirt 20 and cover 24, together with the associated securing parts, form the necessary fluid transfer area with a minimum of parts and provide a highly effective seal against leakage.

Referring now to both FIGURES 1 and 2, the above described structure provides all the essential elements for hydrostatic or air testing. In order to test, domed cover 14 is removed after the removal of bolts 12. Nuts 32 are then removed from threaded members 28 and cover 24 is removed. Flange 26 is then advanced to the left as viewed in FIGURE 1 until clear of snap ring 34 which is then removed. Flange 26 then moves to the right and nuts 30 are removed from threaded members 28 and removable flange 26 removed from skirt 20. Packing rings 46 are then inserted between skirt 20 and stuffing box ring 48. Flange 26 is then engaged with skirt 20 with threaded member 28 being threaded into threaded opening 50 in ring 48. Nuts 32 are then replaced on threaded member 28 and employed to urge packing gland portion 52 of flange 26 into tight engagement with packing rings 46. The heat exchanger is now all set to have a hydrostatic or air test. The results with respect to the tube to floating tube sheet joints can be observed by direct observation of the ends of tube 16.

An alternative means for holding packing 46 is illustrated in FIGURE 3. Here shell 4 has a modified flanged end 60 which has a recessed portion 62 to accommodate packing rings 46. Threaded member 28 is threaded to threaded opening 64 in flanged end 60.

The above described embodiments are illustrative and are not intended to be limiting.

What is claimed is:

1. In a heat exchanger of the type having a shell and tubes extending lengthwise of the shell, a floating tube sheet having at least a portion thereof within the shell and supported by the shell carrying the heat exchanger tubes, said floating tube sheet having a skirt forming an open ended chamber adjacent the ends of the tubes, a cover for the open end of the chamber, stuffing box means adjacent the floating tube sheet, a gland adapted to co-operate with the stuffing box, means to selectively secure the cover to the skirt and when the cover is removed, to move the gland relative to the stuffing box means to co-operate therewith including a ring slidably mounted on the skirt, means to back-up the ring secured to the skirt, and bolt means for engaging the ring and the cover and when the cover is removed, to engage the ring and the shell, and an outer end cover removably secured to the shell.
2. In a heat exchanger of the type having a shell and tubes extending lengthwise of the shell, a floating tube sheet having at least a portion thereof within the shell and supported by the shell carrying the heat exchanger tubes,

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said floating tube sheet having a skirt provided with a peripheral groove forming an open ended chamber adjacent the ends of the tubes,
 a cover for the open end of the chamber,
 stuffing box means adjacent the floating tube sheet, 5
 a gland adapted to co-operate with the stuffing box, means to selectively secure the cover to the skirt and when the cover is removed, to move the gland relative to the stuffing box means to co-operate therewith including a ring slidably mounted on the skirt, 10
 a snap ring adapted to be engaged by the first mentioned ring and carried in the groove of the skirt and bolt means for engaging the first men-

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tioned ring and the cover and when the cover is removed, for engaging the first mentioned ring and the shell, and
 an outer end cover removably secured to the shell.

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ROBERT A. O'LEARY, *Primary Examiner*.

KENNETH W. SPRAGUE, *Examiner*.