Dec. 10, 1929. T. SHIPLEY 1,739,018

DUPLICATE HEAD SHELL AND TUBE CONDENSER

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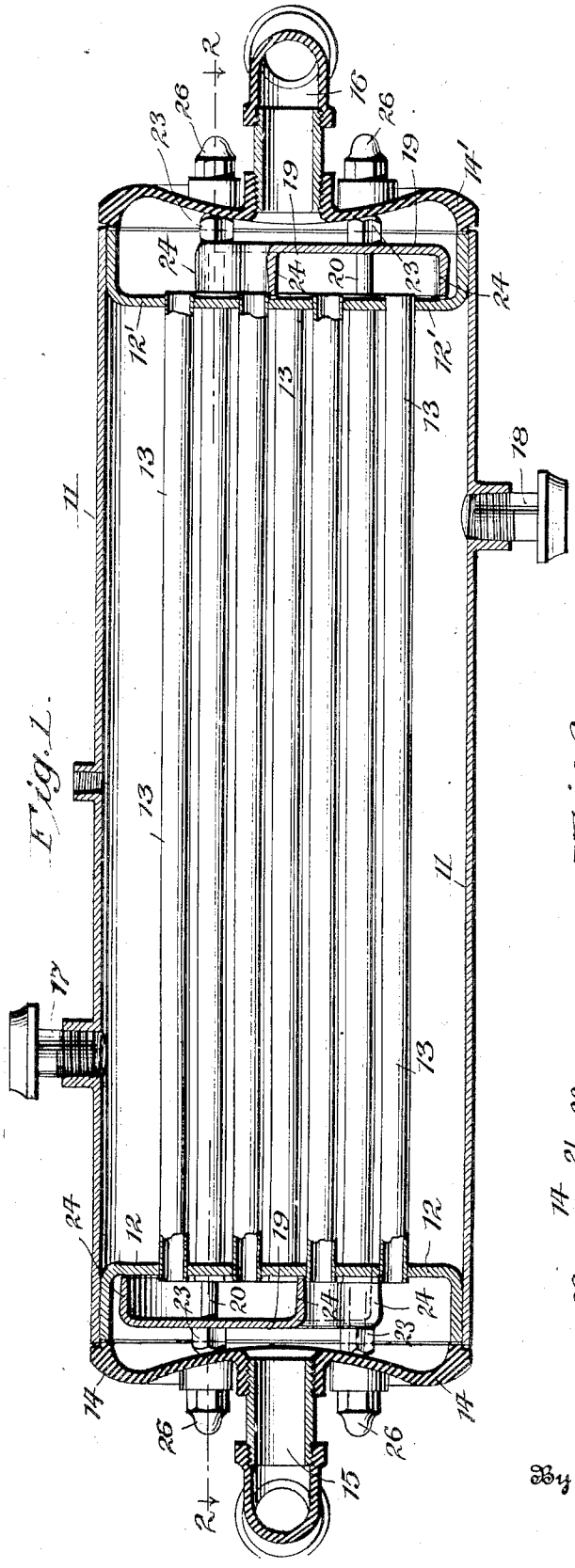


Fig. 1.

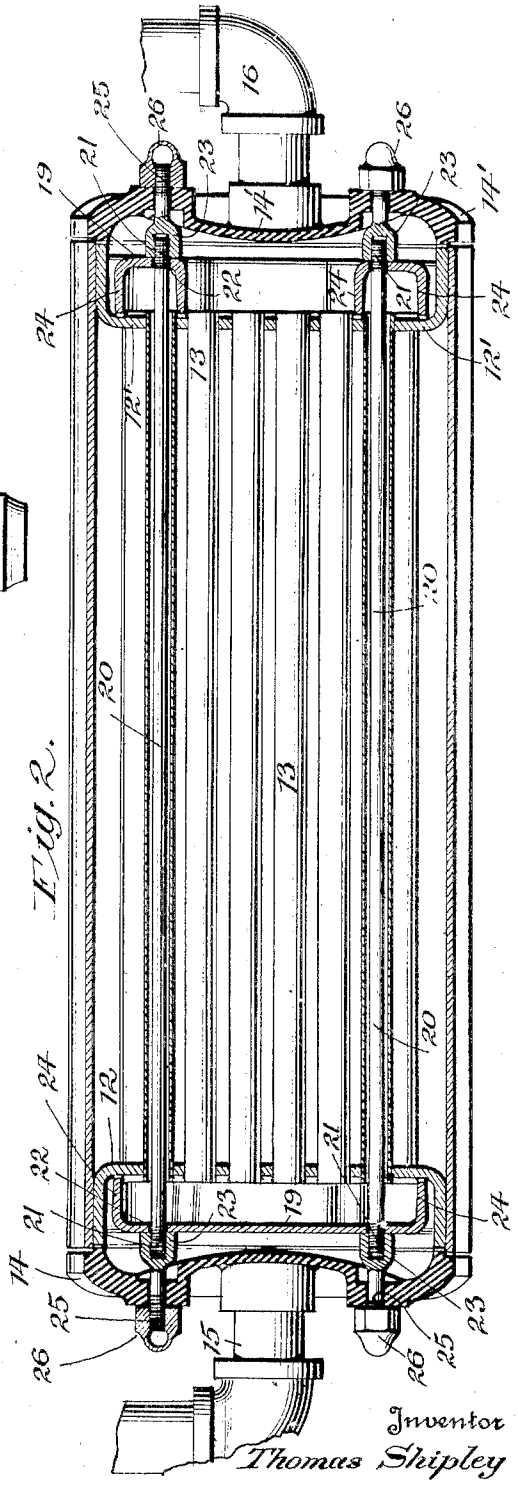


Fig. 2.

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Fig. 3.

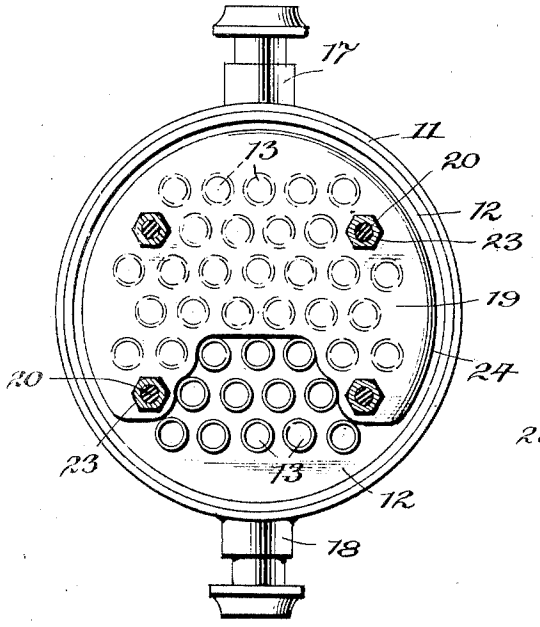
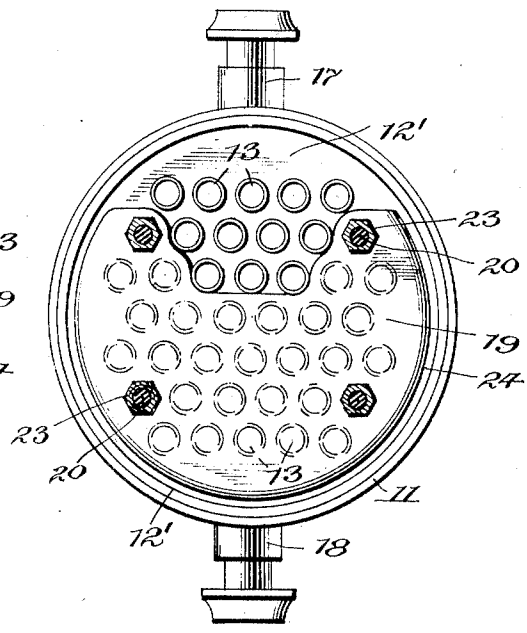


Fig. 4.



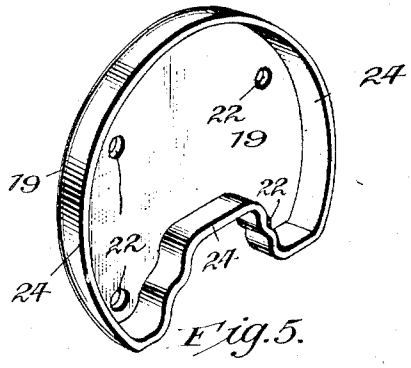


Fig. 5.

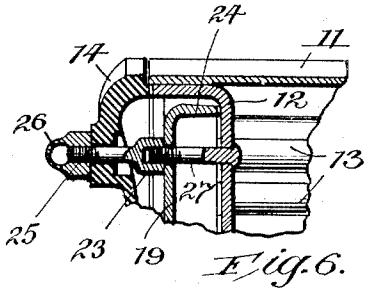


Fig. 6.

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UNITED STATES PATENT OFFICE

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DUPLICATE HEAD SHELL AND TUBE CONDENSER

Application filed March 14, 1929. Serial No. 347,000.

This invention relates to multi-pass tube condensers and more particularly to the head and water box construction for the condenser.

One well known type of multi-pass tube condenser is provided at each end with a water box formed by the ends of the condenser shell, the tube sheet and water box head and partitioned by means of lateral flanges or walls cast integrally with the water box head to reverse the direction of flow through the condenser. The partition wall segregate groups of the condenser tubes so that the liquid passing through the condenser is directed in a sinuous path, but it is frequently difficult to obtain a tight joint between each partition wall and the tube sheet as well as between the rim of the water box head and the tube sheet flange or the end of the shell. This difficulty results from distortion of the tube sheet when the tubes are expanded or welded therein, the tube sheet being bulged adjacent the tubes and having an uneven surface after the tubes have been secured in the sheet. It is evident, therefore, that the edges of the partition walls are likely to abut the tube sheet only at certain points when these partitions are cast integrally with the water box head and it is impossible to ascertain whether the joints formed between the partitions and the tube sheet are tight after the water box head has been secured in place.

It is an object of the present invention to provide an inner or false head designed to overlie the ends of the desired number and arrangement of tubes to form a partition member for one of the passes of the condenser, the flanges of the inner head supplanting the usual partition flanges on the main head of the water box.

It is a further object of the invention to provide novel fastening means to cooperate with the tie-rods of the condenser in that both the inner and outer heads are secured to the same tie-rods, thus minimizing the amount of tube space utilized for the insertion of the tie-rods.

Other objects will be apparent from the following description, taken in connection with the drawings in which

Figure 1 is a longitudinal vertical section of a condenser provided with one form of inner head showing its relation to the tubes and outer head;

Figure 2 is a section taken on the line 2—2 of Figure 1, the manner of securing the inner and outer heads to the tie-rods being shown;

Figures 3 and 4 are end views, partly in section, the outer heads being removed from the condenser;

Figure 5 is a perspective view of the inner head; and

Figure 6 is a partial sectional view illustrating a modified form of means for securing the heads to the condenser.

Referring to the drawings, it will be seen that the condenser comprises the usual shell 11, tube sheets 12, 12′, tubes 13 and main or outer heads 14, 14′. These parts of the condenser are preferably fire welded together throughout. The condenser is also provided with water inlet 15, water outlet 16, ammonia inlet 17 and ammonia outlet 18.

As is customary in multi-pass condensers, the path of the fluid through the tubes 13 is sinuous, the direction of flow in some of the tubes being opposite to that in others. For the purpose of directing the flow of fluid, which in the present instance is water, the inner heads or partition members 19 are cored to overlie a selected number or group of tubes, some of the tubes of each group discharging into the partition member while others of the tubes convey the water in the opposite direction to the other end of the condenser.

The manner of securing the partition members 19 in position with respect to the tube sheets is clearly shown in Figure 2 from which it will be seen that the tie-rods 20, each of which is provided with a threaded end portion 21, project through holes 22 in the partition members. Stud nuts 23 coact with the ends 21 of the tie-rods to clamp the flanges 24 of the partition members against the tube sheets 12. Each of the nuts 23 has a threaded stud portion 25 projecting through the outer or water box heads 14 so that cap nuts 26 may be threaded on the studs to secure the water box head 14 in position

with respect to the flanges of the tube sheet or the shell of the condenser.

In the modification illustrated in Figure 6 the partition member and water box head are fastened to the tube sheet by means of tie-bolts welded to the tube sheet, the drawing showing a single tie-bolt 27. The manner of applying the stud nuts and cap nuts to clamp the inner and outer heads in position is identical with that described above in connection with the use of tie-rods. Where a condenser of relatively great diameter, or having a large number of tubes, is employed it may be desirable to use more than one partition member at each end of the condenser. It is, of course, evident that the means for securing a single partition member to the tube are equally applicable to two or more such members applied to one tube sheet.

With the arrangement described above it has been found that the partition members may be snugly fitted to the tube sheets; at the same time the water box heads, having no internal flanges, are susceptible of close application to the tube sheet flange or shell of the condenser. It is also to be noted that the fastening means cooperate with the partition members and the tie-rods to effectively reinforce the tube sheets, the arrangement being such that a relatively small number of tie-rods may be employed without sacrificing condensing surface or strength. It is thus possible to expedite assembly, facilitate repairs and reduce leakage to a minimum.

While the example illustrated and described refers to a condenser it is obvious that the invention is applicable to brine coolers and other types of heat exchangers and it is intended that the appended claims define apparatus of this general nature.

What is claimed is:

1. An apparatus of the class described comprising a shell; a tube sheet; a water box head; an inner head interposed between said tube sheet and said water box head; fastening means for holding said inner head in engagement with said tube sheet; and means cooperating with said fastening means for securing said water box head to form a chamber at the end of said shell.

2. An apparatus of the class described comprising a shell; a tube sheet; a water box head having an aperture therein; an inner head interposed between said tube sheet and said water box head; fastening means for holding said inner head in engagement with said tube sheet, said fastening means having a threaded portion extending therefrom and projecting through the aperture in said water box head; and means cooperating with said threaded portion for securing said water box head to form a chamber at the end of said shell.

3. An apparatus of the class described comprising a shell; a tube sheet at each end of the shell; a plurality of tubes having their ends secured to said tube sheets; a water box head at each end of the shell, said water box heads having apertures therein; an inner head interposed between each tube sheet and water box head; a plurality of tie-rods extending longitudinally of the shell, each of said rods being disposed in one of said tubes, the ends of said tie-rods being threaded and projecting through said inner heads; a nut cooperating with each end of said rods to hold said inner heads in engagement with the tube sheets, each of said nuts having a threaded stud portion projecting therefrom and through said water box head; and a nut cooperating with each of said threaded stud portions for securing the water box heads to form a chamber at each end of the shell.

In testimony whereof I have signed my name to this specification.

THOMAS SHIPLEY.