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LEAKAGE CONTROL TUBE MOUNTING FOR DOUBLE TUBE PLATE HEAT EXCHANGERS

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Fig. 1.

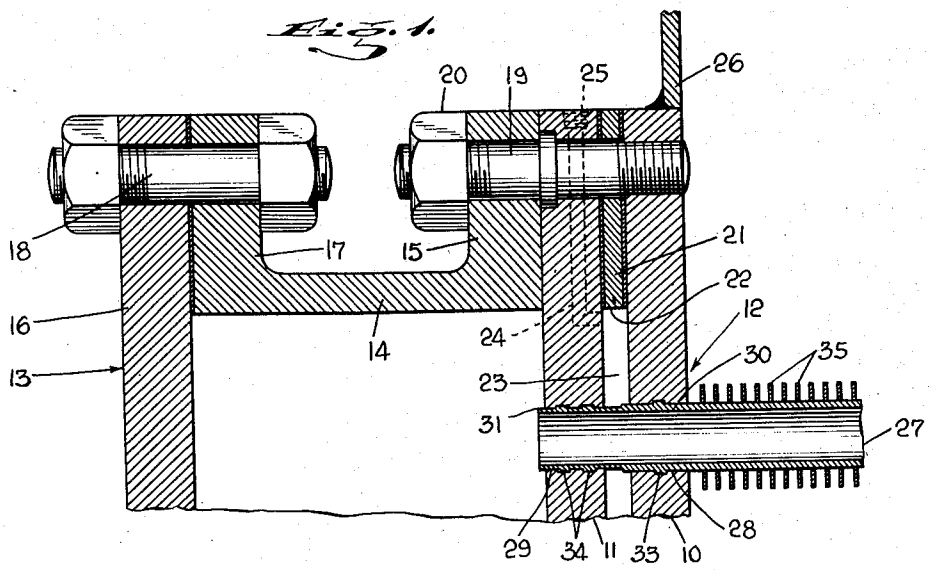
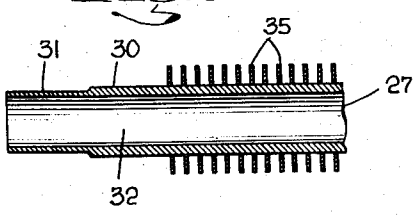


Fig. 2.



INVENTOR
NICHOLAS WEBER

BY
Howard E. Thompson
ATTORNEY

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LEAKAGE CONTROL TUBE MOUNTING FOR DOUBLE TUBE PLATE HEAT EXCHANGERS

Nicholas Weber, Teaneck, N. J., assignor to Condenser Service & Engineering Co. Inc., Hoboken, N. J., a corporation of New Jersey

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1 Claim. (Cl. 257—236)

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This invention relates to heat exchangers or surface coolers, particularly of the type for cooling air of motors on board ships and the like, where impure or salt water is utilized as a cooling medium for circulation through the cooling or heat transfer tubes of the apparatus. More particularly, the invention deals with the use of tubes having a large diameter or thick wall structure where mounted in the inner tube sheets and a thinner wall structure where mounted in the outer tube sheets, thereby providing a positive control and regulation of leakages due to corrosion, cracking or the like to avoid contamination of the circulated air circulated around the tubes inwardly of the inner tube sheets.

The novel features of the invention will be best understood from the following description, when taken together with the accompanying drawing, in which certain embodiments of the invention are disclosed and, in which, the separate parts are designated by suitable reference characters in each of the views, and in which:

Fig. 1 is a sectional view through a portion of an apparatus illustrating the mounting of one tube in a pair of tube plates at one end portion of the apparatus; and

Fig. 2 is a sectional detail view of one end portion of a tube, preparatory to assemblage in tube plates of the apparatus.

In apparatus of the type and kind under consideration used as a heat exchanger or cooler, difficulty has been experienced in providing a definite control of the cooling fluid employed to prevent contamination. Several efforts have been made to provide solutions to this problem.

It is generally known that corrosion or breakdowns usually occur in the tubes where they are mounted in the tube plates and this corrosion or breakdown usually starts at the free end portions of the tubes. The purpose of my invention is to so construct tubes in apparatus of the kind under consideration as to definitely and positively locate tube breakdowns in the outermost tube sheet, so as to facilitate plugging or sealing of the remainder of the tube until such time as repair can be made. Here it is well to keep in mind that apparatus of the type and kind under consideration are usually installed on ships where impure or salt water is utilized as the cooling medium.

Apparatus of the type and kind under consideration is generally known in the art and, for this reason, I have shown in Fig. 1 of the drawing just a portion of one end of the apparatus, it being understood that both ends of the apparatus

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are the same or substantially the same, except for the details of the header construction.

In Fig. 1 of the drawing, I have shown at 10 and 11 inner and outer tube plates of the apparatus, the inner tube plate forming one wall of an air circulating chamber 12, whereas a header 13 is mounted outwardly of the plate 11. The header in the construction shown is formed by an annular double flanged casing 14, the flange 15 of which is secured to the plates 10 and 11; whereas an outer cover plate 16 is secured to the other flange 17. The latter coupling is made through the medium of bolts 18; whereas the first coupling is made by a series of studs 19, with which nuts 20 are attached. The studs 19 are adapted to bring the plates 10 and 11 into firm engagement with a spacing ring 21, having suitable gaskets, as indicated at 22. The ring 21 forms, between adjacent surfaces of the plates 10 and 11, a chamber 23. Formed in the plate 11 is an aperture 24, which opens into the chamber 23 and out through the peripheral edge of the plate, as indicated at 25 in dotted lines. This aperture may be used as a means for drainage and also as a means for testing the tube mountings in the plates in the manners known in the art.

At 26 I have indicated part of the housing welded or otherwise secured to the plate 10 controlling the transmission of air into the apparatus around a plurality of cooling tubes, one of which is shown at 27, in Fig. 1. It will be understood that the tubes extend through the chamber 12 from one header to the other and are coupled with pairs of tube plates similar to the plates 10 and 11 at the other unshown end of the tube 27. The tube plates 10 and 11 have alined apertures 28 and 29 for the reception of large diameter circumferentially continuous solid end portions 30 and the integral smaller diameter circumferentially continuous solid weakened thin wall end portions 31 of the tubes 27, when the tubes are in their normal fabrication, as seen in Fig. 2 of the drawing.

After arranging the end portions 30, 31 in the respective tube plates 10 and 11 substantially in the position, as seen in Fig. 1, the bore 32 of the tube 27 is expanded adjacent the end portions 30, 31 to extend part of the materials of said end portions into sealing grooves 33, 34 formed in the walls of the apertures 28 and 29. Any desired number of the grooves 33, 34 can be employed in each tube plate. Each tube 27 has a series of longitudinally arranged cooling fins 35 to improve the efficiency of heat exchanging, particularly when the apparatus is utilized as an air

cooler, the fins facilitating a greater exposure of the cooling surfaces to the air circulated through the chamber 12.

In the accompanying drawing and, for purposes of illustration, the reduced or smaller outside diameter end 31 has been exaggerated to some extent in order to clearly illustrate a difference in this end, as compared with the portion 30. Keeping in mind that corrosions and breakdowns of the tube mountings usually occur in the tube plates, by providing tubes having reduced diameter ends and space between tube sheets 10 and 11, a definite control is provided to localize tube breakdowns between the inner tube sheet 10 and the end of the tube, thus keeping failures and leakage therefrom confined to chamber 23, from which it might be drained off without contamination to the air circulating chamber 12.

With cooling units or heat exchangers of the character under consideration, difficulties have been experienced in having a tube leak develop which has resulted in contamination by reason of the leak entering the circulating chamber, through which the medium to be cooled passes. Many efforts have been made to endeavor to obviate this difficulty, even to the extent of a double tube structure but, even here, the real problem has never been solved and, in this, the cost of such installations has been extremely excessive. By simply providing reduced ends on the several tubes and sealing these in the outer tube sheets in the manner here defined, a reasonably definite control is provided to locate breakdowns in the structures of the kind under consideration, thus facilitating the continuation of operation of the apparatus, particularly when on board ship, until such time as the proper repair can be made and without shutting down the operation of the apparatus. In cases of this type and kind, it is customary to plug the leaking tube, preferably within the inner tube sheet, thus dispensing with the use of the tube and cutting-down the efficiency of the apparatus only to this extent.

It will be apparent that, in illustrating one use of my invention, I have referred for the most part to utilizing air as a cooling medium and have referred to the cooling of motors and uses of motors on board ship. More generally speaking, however, the heat exchanger is adapted for use in connection with apparatus of any type or kind regardless of the location of such apparatus and the particular cooling medium employed will be such as to suit the different uses.

Having fully described my invention, what I claim as new and desire to secure by Letters Patent is:

In apparatus of the class described, employing a pair of spaced tube sheets with a chamber therebetween, one tube sheet comprising the inner sheet of the apparatus and the other the outer sheet, said tube sheets having alined bores, the bore of the outer tube sheet being of smaller diameter than the corresponding bore of the inner tube sheet, a circulating tube mounted in said tube sheets, said tube having a circumferentially continuous heavy solid wall arranged in the bore of the inner tube sheet and terminating in said chamber, an integrally reduced end portion on said tube, said end portion comprising a circumferentially continuous thin weakened wall structure arranged in the bore of the outer tube sheet and being partially disposed in said chamber, said tube having a substantially uniform diameter bore extending continuously through the small diameter weakened wall portion, the bores of said tube sheets having annular grooves, and both the heavy and thin walls of said tube having expanded parts arranged on outer surfaces only thereof and extending into said grooves in sealing the tube in the bores of both of said tube sheets and with respect to said chamber.

NICHOLAS WEBER.

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