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METHOD OF MOUNTING TUBE STRUCTURES FOR EVAPORATORS

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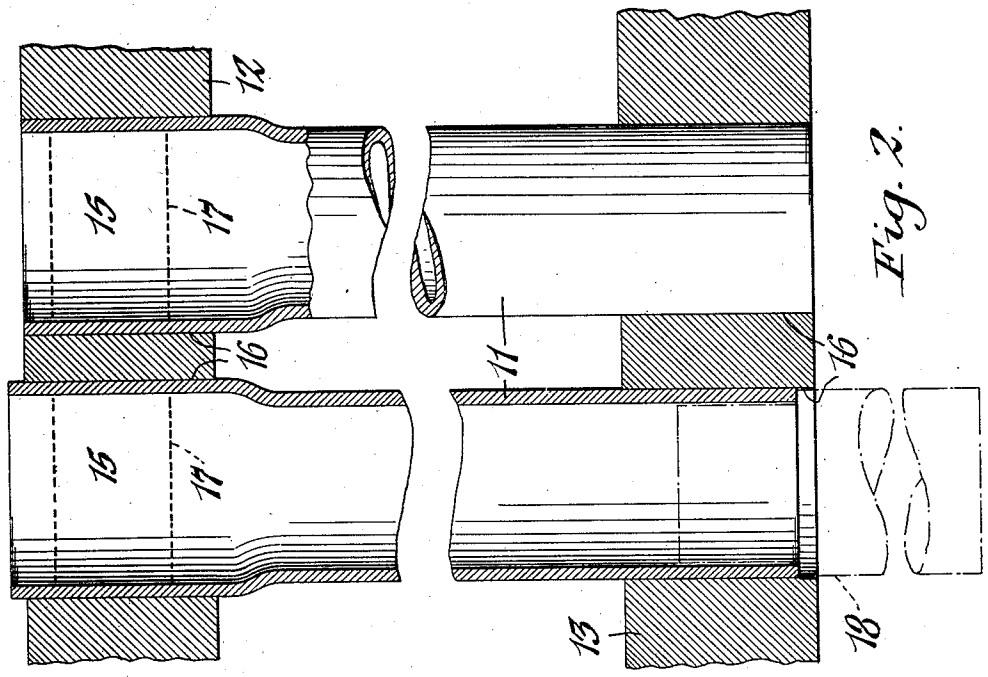


Fig. 2.

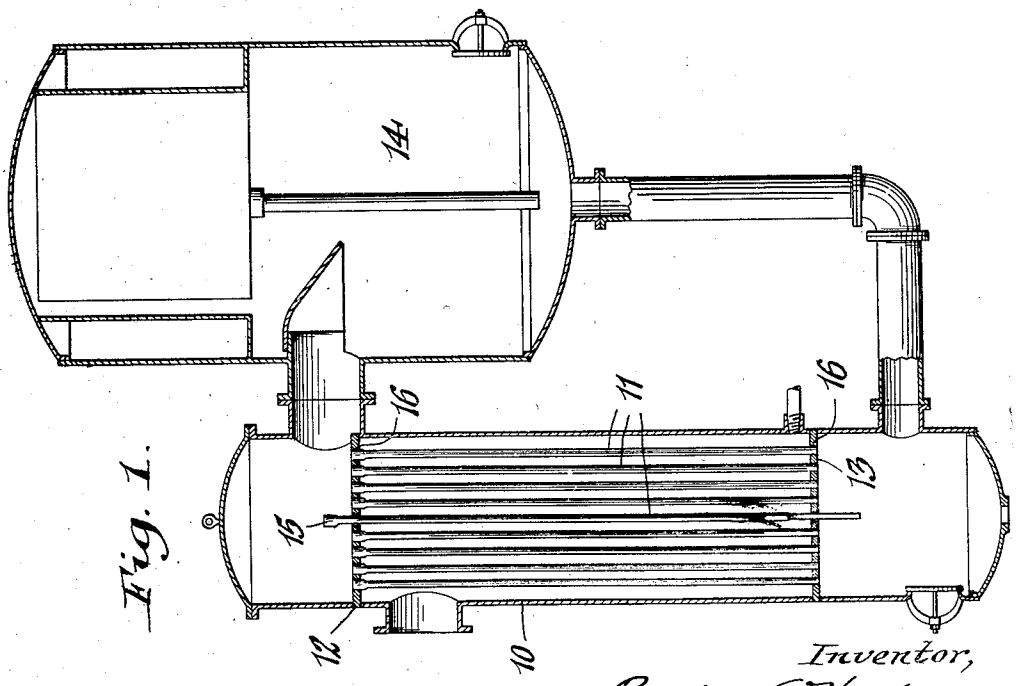


Fig. 1.

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METHOD OF MOUNTING TUBE STRUCTURES FOR EVAPORATORS

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1 Claim. (Cl. 29—157.4)

This invention relates more particularly to certain new and useful improvements in the tube structures of evaporators, heaters, condensers, etc., and to the method employed in mounting the tubes in the tube-sheets or heads.

It has for one of its objects to provide a tube structure or mounting of this character wherein the tubes are firmly and rigidly anchored in the tube-sheets by an expanding operation to effectually prevent leakage of liquid, vapor or gas and yet permit the removal of the tubes, when desired, without damaging their ends so that they may be replaced after cleaning.

Another object of the invention is the provision of a tube structure and method of expanding the tubes in their seats in the tube-sheets, which is simple and efficient, and which effectually expedites the removal of the tubes from the apparatus and affords a material saving in time over the methods heretofore employed.

Other features of the invention reside in the construction and arrangement of parts hereinafter described and particularly pointed out in the appended claim.

In the accompanying drawing—

Figure 1 is a sectional side elevation of an evaporator showing the improved tube structure, one of the tubes being shown in the act of being removed. Figure 2 is an enlarged fragmentary sectional elevation of the tube structure.

Similar characters of reference indicate corresponding parts throughout the several views.

By way of example, my invention has been shown in connection with an evaporator of known construction, the numeral 10 indicating the heating chamber having the usual tubes 11 thereof supported at their ends in upper and lower tube-sheets 12 and 13, respectively, and 14 indicating the separating chamber.

These tubes are usually expanded into the customary holes of the tube-sheets to hold the tubes firmly in place and prevent leakage of liquid, vapor or gas. In this expanding process, the metal of the tubes is likewise expanded immediately above and below the tube-sheet with the result that the outside diameter of the tubes is increased and it is impossible to remove them without cutting the tubes or slitting them at each end to contract them to allow the beads formed by the expansion to pass through the sheet-holes. Furthermore, in some industrial processes these tubes become coated with hard and firmly adherent coatings and the accumulations are such that the diameter of the tubes are increased to such an extent that they cannot be removed through the holes of the tube-sheets for cleaning purposes, thereby making it necessary to destroy the tubes to effect their removal and replace them with new ones. When the tubes are thus coated, the apparatus operates at a reduced capacity and is inefficient and it is therefore necessary that they be removed and replaced with others.

In order to eliminate the above objections and the expense entailed in the maintainance of this type of apparatus, I provide a construction which, while effectually expanding the tubes in place in the tube-sheets, permits their ready removal when desired, for cleaning or other purposes, without cutting or in any way injuring the tubes or damaging their ends, and also permits their ready replacement.

To this end, and as shown more clearly in Figure 2, the tube-sheets 12, 13 are comparatively thick and the tubes 11 are of uniform diameter except at their upper ends where they are expanded to a larger diameter as indicated at 15. This expansion of the tubes at one end is effected in the tube mill with the tubes hot, each tube being first upset to increase the thickness and then expanded, the upsetting being done to make sure that the thickness of the tube-wall after expanding will not be less than the original wall thickness. The ends of the tubes 11 are inserted in corresponding holes 16 in the tube-sheets, after which such ends are expanded with roller expanders of suitable size to force the metal of the tube against the surface of the hole in the tube-sheet and thereby hold the tube firmly in place and prevent leakage of fluid between the tubes and the tube-sheets. The expanding of the tubes is done with expanding rolls 17, shown by dotted lines in Figure 2, limited in length to a dimension somewhat less than the thickness of the tube-sheets 12, 13, whereby an increase in the diameter of the tube beyond the tube-sheets and the resulting formation of beads or ridges adjacent such sheets, which would otherwise interfere with the removal of the tubes, is effectually avoided. Removal of the tubes may be readily effected by driving against their lower ends with a suitable tool 18 shown by dotted lines in Figure 2.

By this construction and arrangement, the tubes 11 can be expeditiously removed, if unserviceable, or if still serviceable but coated on the outside, may be readily removed by driving them out of the tube-sheets and then withdrawing them from the apparatus for cleaning. When cleaned, the tubes are re-installed after

annealing their ends to soften the metal for expanding.

I claim as my invention:

The method of mounting tubes in tube-sheets having straight-walled openings therein, which consists in expanding the tubes at one end to a larger diameter, fitting the tubes in the sheet-openings, and then expanding the larger tube ends firmly in place against the straight-walled sheet-openings but not beyond the point at which the tubes may be driven out by a thrust on their smaller ends, the length of the tube-end expanded being limited to a distance less than the thickness of the tube-sheet and to an area between the opposite faces of such sheet, whereby to eliminate the formation of external ridges on the tubes adjacent the opposing faces of the tube-sheet and to provide a smooth, straight joint between the expanded tube-end and the sheet-opening to permit, when desired, the removal of the tube from the sheet by exerting a driving force axially of the tube on the smaller end thereof.

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