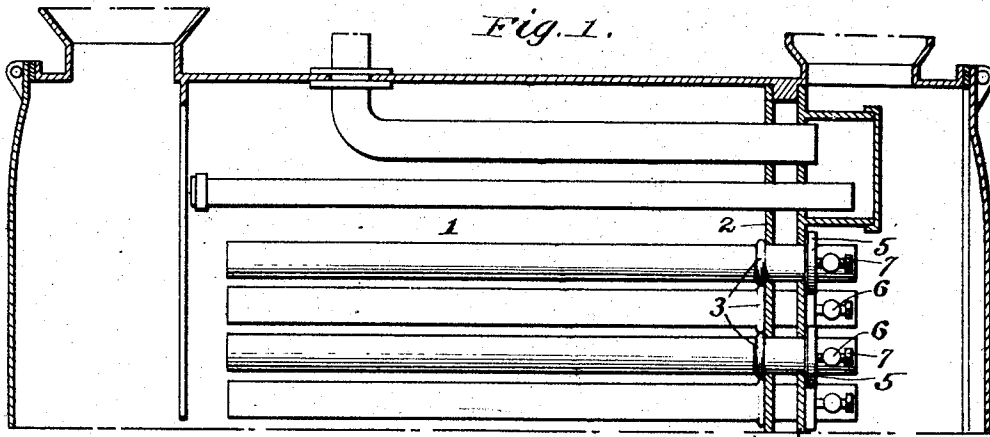
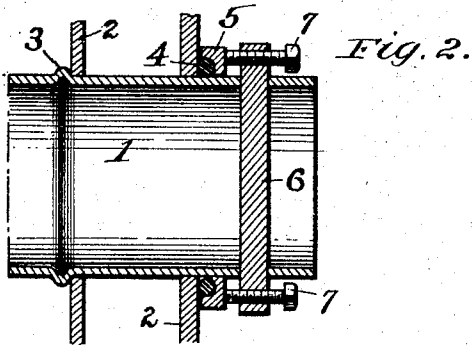
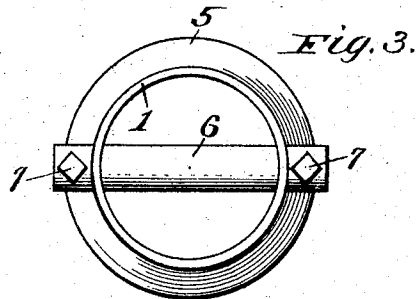
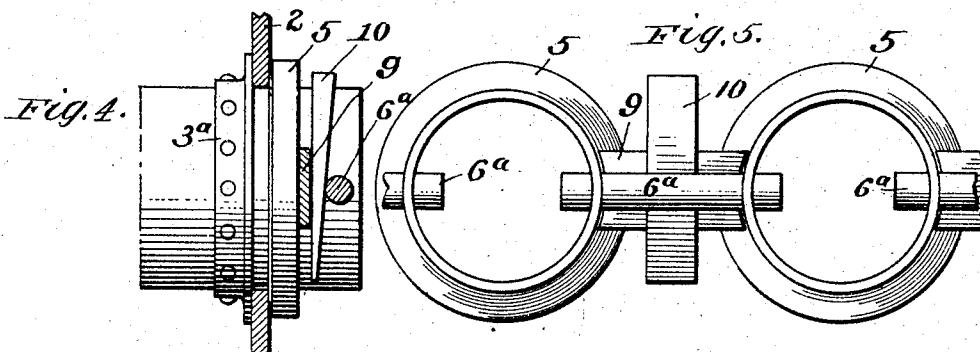
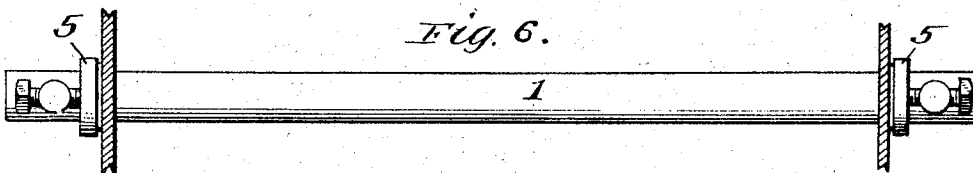


No. 772,641.

PATENTED OCT. 18, 1904.

O. CARR.
TUBE FASTENING.
APPLICATION FILED DEC. 17, 1903.

NO MODEL.



Witnesses
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UNITED STATES PATENT OFFICE.

OMA CARR, OF BUENAVISTA, VIRGINIA.

TUBE-FASTENING.

SPECIFICATION forming part of Letters Patent No. 772,641, dated October 18, 1904.

Application filed December 17, 1903. Serial No. 185,530. (No model.)

To all whom it may concern:

Be it known that I, OMA CARR, a citizen of the United States, residing at Buenavista, county of Rockbridge, State of Virginia, have invented certain new and useful Improvements in Tube-Fastenings, of which the following is a specification, reference being had therein to the accompanying drawings, in which—

Figure 1 is a longitudinal vertical sectional view of a portion of an evaporator, showing the device applied; Fig. 2, an enlarged horizontal sectional view of one end of a tube; Fig. 3, an end view thereof; Fig. 4, a detail side elevation showing a slightly different form of limiting-stop and fastening device for the tubes; Fig. 5, a detail end view of the form of the device shown in Fig. 4, and Fig. 6 a detail view showing the manner of securing both ends of a tube to the tube-sheets.

The ordinary method of fastening tubes in the tube-sheets of evaporators, heaters, condensers, &c., is to expand the tubes into the perforations of the sheet, and to thereby permanently and rigidly secure the tube in position. The result of this is that it is practically impossible to remove the tubes without damaging them beyond the possibility of reuse. Tubes thus secured in position must be cleaned while in their permanent positions, resort being had to such local mechanical treatment as conditions permit or to chemical solvent action on the incrustation, neither of which methods is at all satisfactory and frequently utterly destroy the tubes.

This invention has for its main object to provide each tube with a fastening device by which it may be removably secured to a tube-sheet either at one or both ends of the tube and which when in position will be adapted to stand a high pressure without leakage at the point of connection with the tube-sheet.

In the drawings I have shown my invention as applied to an evaporator in which the tubes are supported at one end only.

Referring to the various parts by numerals, 1 designates the tubes, and 2 the tube-sheet. Each tube at the inner face of the tube-sheet is provided with an annular enlargement or stop 3, which limits its passage through the tube-sheet. On the tube and against the outer

face of the tube-sheet is placed a packing-ring 4. Fitting closely on the outer projecting end of the tube is an undercut compression-ring 5, which is adapted to clamp the packing-ring against the tube-sheet and to make a pressure-tight joint between it and the tube. The undercut part of the pressure-ring is adapted to receive the major portion of the packing-ring. It is obvious that the packing-ring may be dispensed with, if desired, and the pressure-ring be made to bear directly against the outer face of the tube-sheet. Each tube near its outer projecting end is provided with apertures through which extends a bar or pin 6, the ends of said bar projecting beyond the outer sides of the tube, said projecting ends being provided with compression-screws 7, the inner ends of which are adapted to bear upon the compression-ring at diametrically opposite points. It will be thus seen that by forcing the compression-ring against the outer face of the tube-sheet the shoulder 3 will be drawn against the inner face of said sheet. The tube will be thereby rigidly held in position and the packing-ring will be compressed sufficiently to form a pressure-tight joint between the sheet and the tube.

It will be of course understood that any suitable means for forcing inward the compression-ring may be employed instead of the compression-screws shown in Figs. 2 and 3. In Figs. 4 and 5 said ring is forced inward by means of a wedge 10, which is driven down between the bar 6^a and the follower 9, which rests at its ends on the compression-rings. In this arrangement of parts the pin 6^a and follower 9 bridge the space between two adjoining tubes, as shown in Fig. 5. In this form of the device each device serves to simultaneously operate upon two adjacent compression-rings, and the connecting-bar 6^a need not extend across the mouth of the tubes.

It will be readily understood that the invention is applicable to such constructions in which double tube-sheets are employed, as shown in Figs. 1 and 2, as well as in that form of apparatus in which only a single tube-sheet is employed, as shown in Fig. 4. It is also obvious that instead of expanding the tube to form a shoulder 3, as shown in Fig. 2, an

annular ring 3^a may be riveted to the tube, as shown in Fig. 4, to form the stop.

Where the apparatus is provided with two tube-sheets, one for each end of the tube, the limiting-stop is omitted and a fastening device is secured to each projecting end of the tube, as shown in Fig. 6, so that each fastening device forms a limiting-stop for the other.

The advantages of this invention will be readily appreciated. It is obvious that by loosening the set-screws and removing the bar 6 the compression-ring and packing-ring may be readily removed and the tube then withdrawn from the tube-sheet. It is thus clear that the cleaning of the tubes or the replacing of a broken or worn tube with a new one may be readily accomplished.

Many changes may be made in the construction of this device within the scope of the invention and to adapt the device for use under various conditions, and I wish it understood that I do not limit myself to the specific constructions herein shown and described.

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

1. The combination of a tube-sheet, a series of tubes extending therethrough and each provided with a limiting-stop, a compression-ring on the projecting end of each tube bearing against the outer face of the tube, a bar positively connecting each adjacent pair of tubes at a point beyond the compression-ring, and means interposed between said bar and the compression-rings for simultaneously tightening the adjacent compression-rings, for the purposes set forth.

2. In a tube-fastening, the combination of a tube-sheet perforated for the passage of a series of tubes, tubes fitted therein and provided each with a limiting-stop, and a clamping device positively locked on the outer ends of each adjacent pair of tubes and bearing against the outer face of the tube-sheet and adapted to removably clamp and simultaneously adjust each adjacent pair of tubes to the tube-sheet.

3. In a tube-fastening, the combination of a tube-sheet perforated to receive a series of tubes, tubes fitted therein and provided each with a stop, a compression-ring fitted on the outer projecting end of each tube, and means locked to adjacent pairs of tubes for forcing the adjacent compression-rings against the tube-sheet to thereby simultaneously draw the limiting-stops to their seats and close the joints between the tubes and the tube-sheet.

4. In a tube-fastening, the combination of a tube-sheet perforated to receive a series of tubes, tubes fitted therein and provided each with a limiting-stop, a compression-ring on the outer projecting end of each tube, adjustable means carried by each adjacent pair of tubes for forcing the compression-ring against the outer face of the tube-sheet to simultaneously adjust and removably clamp each adjacent pair of tubes in position.

5. In a tube-fastening, the combination of a tube-sheet, a series of tubes fitted therein, a limiting-stop for each tube, a compression-ring on the outer projecting end of each tube, a packing-ring for each compression-ring, and adjustable means carried by adjacent pairs of tubes for simultaneously forcing the compression and packing rings of said adjacent pair of tubes against the adjacent face of the tube-sheet to removably secure the tubes in position and close the joints between the tubes and the sheet.

6. In an apparatus of the class described, embodying two separated tube-sheets, a tube connecting and extending through said sheets and having projecting ends, and an adjustable clamping device on each projecting end and bearing against the adjacent face of the adjacent tube-sheet.

In testimony whereof I hereunto affix my signature, in the presence of two witnesses, this 16th day of December, 1903.

OMA CARR.

Witnesses:

G. H. BAILIE,
H. T. WILSON.