

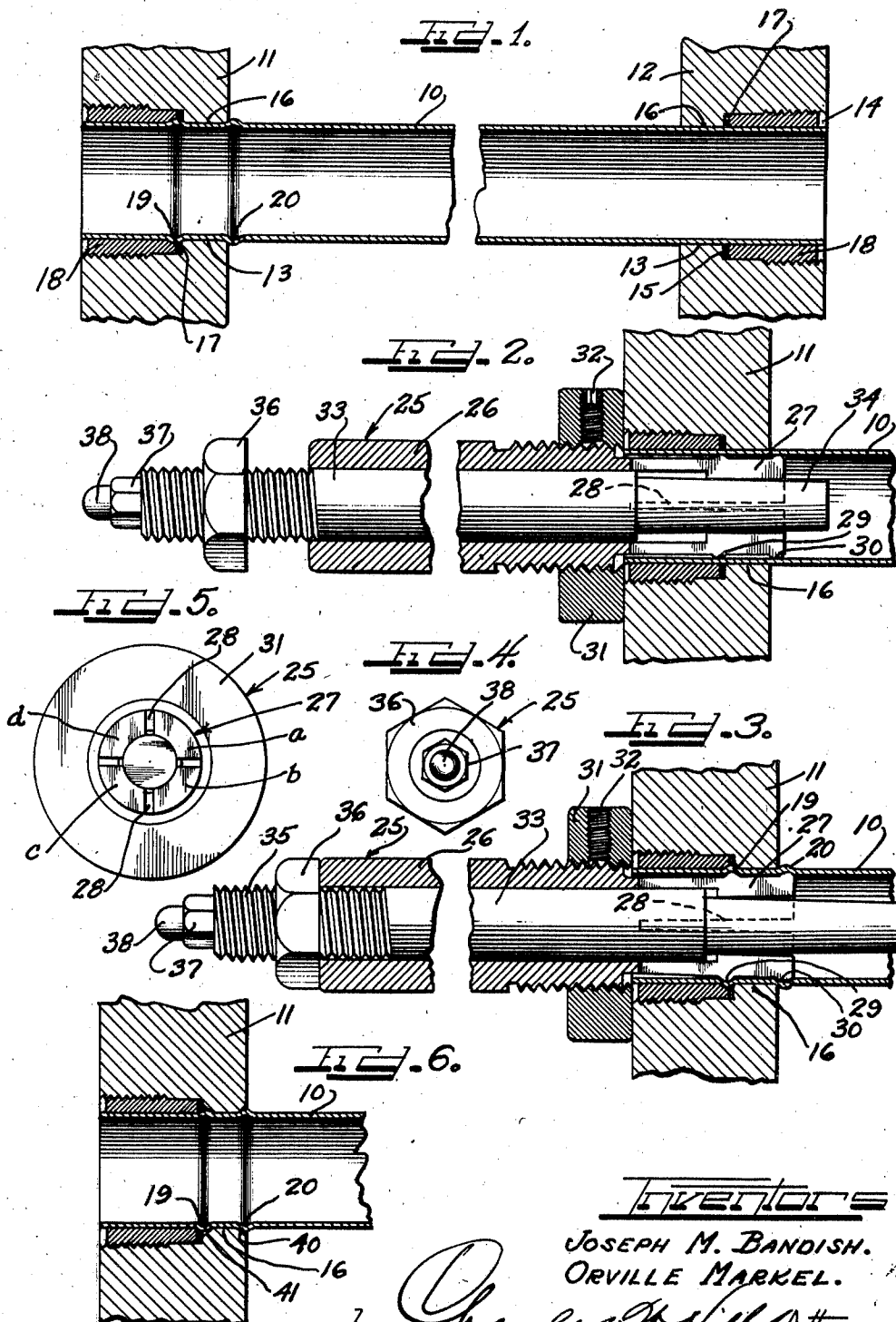
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TUBE HOLDING STRUCTURE AND LOCK

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TUBE HOLDING STRUCTURE AND LOCK

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1 Claim. (Cl. 285—56)

This invention relates to a structure for holding and locking tubes in bosses, tube sheets, or the like, and includes a method of conveniently securing tubes in mountings therefor.

More specifically, this invention relates to the formation of protruding beads on condenser tubes for abutting opposite sides of tube mounting bushings or tube sheets to lock an end of the tube against movement out of its mounting.

The invention will be hereinafter specifically described in connection with condenser tubes, but it should be understood that the invention is applicable to the mounting of all types of tubing.

It has heretofore been the practice to mount and seal condenser tubes by relatively soft packing or lead calking inserted around the ends of the tubes. This calking mounting and seal is not satisfactory, since calking alone works loose during expansion and contraction of the tubes.

It is accordingly an object of this invention to provide a tube holding structure for use in combination with calking material to hold an end of the tube securely in its mounting.

A further object of this invention is to provide a tube holding structure wherein beads are formed on the tube for abutting the tube mounting to hold the tube therein.

A further object of this invention is to provide a convenient method for securing tubes in tube mountings to hold the tubes against movement out of the mountings by expansion and contraction.

Another object of this invention is to provide a method of expanding tube ends in their mountings for locking the tubes therein.

Other and further objects of this invention will become apparent to those skilled in the art from the following detailed description of the annexed sheet of drawings, which disclose preferred embodiments of the invention.

On the drawing:

Figure 1 is a broken cross-sectional view of a condenser tube mounted at its ends in tube sheets.

Figure 2 is a broken fragmentary cross-sectional view, with parts shown in elevation, illustrating a tool for forming beads on the end of a tube for holding the tube in a tube sheet.

Figure 3 is a broken fragmentary cross-sectional view similar to Figure 2 showing the position of the tool after the beads have been formed on the condenser tube.

Figure 4 is a top plan view of the tool shown in Figures 2 and 3.

Figure 5 is a bottom plan view of the tool shown in Figures 2 and 3.

Figure 6 is a fragmentary cross-sectional view of a condenser tube end mounted in a modified form of tube sheet.

As shown on the drawing:

In Figure 1, the reference numeral 10 designates generally a condenser tube having the ends thereof mounted in tube sheets 11 and 12. The tube sheets 11 and 12 have apertures 13 extending therethrough. The apertures 13 are counterbored as at 14 to define shoulders 15 in spaced relation from the inner faces of the tube sheets. This provides a portion 16 on each tube sheet disposed in snug relation around the tube in spaced relation from the extreme ends of the tube.

Packing rings 17 are disposed around the tube ends for abutting the shoulders 15. The packing rings may be of hard fiber, vulcanized rubber, or like material.

Calking material 18 such as lead is threaded into the counterbores 14 of the tube sheets and sealed against the ends of the tube. The calking material 18 seals the ends of the tube in the tube sheets 11 and 12, but as the tube expands and contracts during operation of the condenser due to variable temperatures, it is apt to work loose in the tube sheets and even slide out of one of the tube sheets.

In order to prevent this condition, according to this invention, there are provided protruding beads 19 and 20 on one end of the tube for abutting opposite sides of the portions 16 of the tube sheet 11, as shown in Figure 1. This structure securely holds and locks the end of the tube 10 in the sheet 11. The other end of the tube, however, is preferably not provided with beads for locking it in the tube sheet 12. This end, therefore, can move relative to the tube sheet 12 and permit an expansion and contraction of the tube. However, since the other end of the tube is securely held, the tube can never work out of the tube sheet or move sufficiently to damage the calking material 18.

The beads 19 and 20 are formed in the tube 10 after the tube has been mounted in the tube sheets 11 and 12. These beads are made by a tool designated generally by the reference numeral 25 in Figures 2 to 5 inclusive. The tool 25 comprises a housing portion 26 having a cylindrical end 27 thereon adapted to fit in the tube 10. As best shown in Figure 5, the end 27 is split into four segments a, b, c, and d by slots 28 extending back from the bottom of the hous-

ing for a considerable distance. This structure makes possible an expansion of the end 27, as hereinafter more fully described.

Protruding beads 29 and 30 are formed around the end 27 of the housing member 26, with the bead 30 being adjacent the bottom of the member and the bead 29 spaced from the bead 30 at a distance substantially equal to the width of the portion 16 of the tube sheet 11. A collar 31 is threaded on the housing member 26 above the end 27 thereof. This collar 31 is positioned on the housing 26 to align the beads 29 and 30 with the portion 16 of the tube sheet 11, and can be locked in adjusted position by means of a set screw 32 engaging the housing 26. In this manner, the collar 31 is merely adjusted on the housing 26 so that when the end 27 is inserted into the end of the tube 10 in the tube sheet 11 until the collar abuts the outer face of the tube sheet, the beads 29 and 30 on the end 27 will be aligned on opposite sides of the portion 16 of the tube sheet.

An expander rod 33 is slidable through the housing 26 and has a tapered end portion 34 engageable with the cylindrical end 27 of the housing. The other end of the expander rod 33 is threaded as at 35 for receiving thereon a nut 36 adapted to engage the top of the housing 26. The rod 33 has a hexagonal head 37 adapted to be engaged by a wrench, and a striking head 38 at the extreme end thereof. As shown in Figure 2, the end 27 of the housing 26 is inserted in the tube 11 until the preadjusted collar 31 on the housing abuts the outer face of the tube sheet 11. This positions the beads 29 and 30 of the end 27 on opposite sides of the portion 16 of the tube sheet. The nut 36 on the rod 33 is in spaced relation from the top of the housing 26. The end 38 of the rod 33 can then be given a blow by a hammer for forcing the tapered end 34 of the rod through the cylindrical end 27 of the housing to cause an expansion of the segments *a*, *b*, *c*, and *d* of the cylindrical end, as shown in Figure 3. This expansion forces the beads 29 and 30 on the cylindrical end into the tube 10 to form the beads 19 and 20 on the tube, as shown in Figure 3.

The nut 36 is then threaded on the rod 33 into abutting relation with the top of the housing 26 of the tool. The hexagonal head 37 of the rod is engaged by a wrench to prevent the rod from turning, and the nut 36 is rotated by another wrench for retracting the rod from the housing. When the rod is retracted, the segments *a*, *b*, *c*, and *d* of the end 27 will spring back into position and the tool can be removed from the tube.

In the modification shown in Figure 6, the portion 16 of the tube sheet 11 has the ends thereof tapered as at 40 and 41 to provide seats converging in the same general direction. These seats receive the beads 19 and 20 of the tube end 10. Since the beads 19 and 20 are rounded, they will have fuller engagement with tapered surfaces such as 40 and 41 than with sharp edges. This construction affords a very tight lock for the end of the tube, since in the formation of the beads 19 and 20 the tube will become locked on the portion 16 by virtue of the fuller contact between the beads and the seats of the portion 16.

While the invention has been illustrated in connection with calking material, it should be understood that the holding structure and the method of locking tubes in mountings therefor, according to this invention, can be used in any construction for securing tubing in tube holding or mounting devices of any nature.

We are aware that many changes may be made and numerous details of construction may be varied through a wide range without departing from the principles of this invention, and we, therefore, do not purpose limiting the patent granted hereon otherwise than necessitated by the prior art.

We claim as our invention:

In a tube structure including a plate and a tube connected thereto, means for fastening and sealing an end of the tube in a transverse hole in said plate countersunk at one end portion and having sealing packing in the countersunk portion of the hole which abuts a shoulder at the bottom of the countersunk portion, said means comprising longitudinally spaced circular beads depressed radially from the wall of the tube after insertion of an end of the tube in said hole, one bead being depressed outwardly into engagement with a side edge of the plate at an end portion of the hole opposite from its countersunk portion, and the other bead being depressed outwardly within the confines of said plate into engagement with an edge of said shoulder inside said hole and against said packing, said edges engaged by said spaced beads facing in opposite longitudinal directions, whereby the portion of said plate defining the uncountersunk end portion of the hole is tightly interlocked with said tube by said beads to prevent longitudinal movement of said tube in either direction relative to said hole.

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