

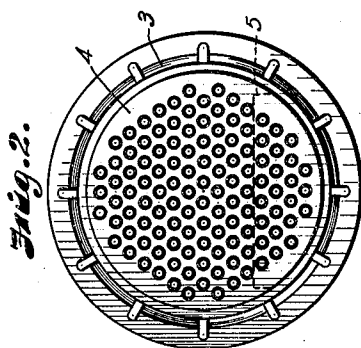
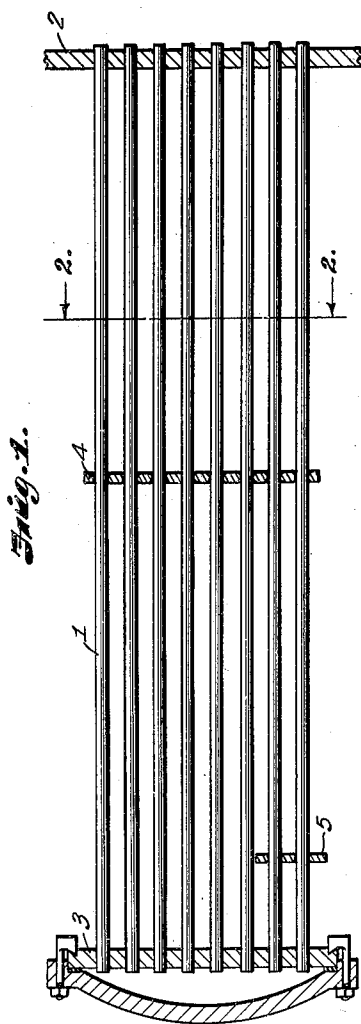
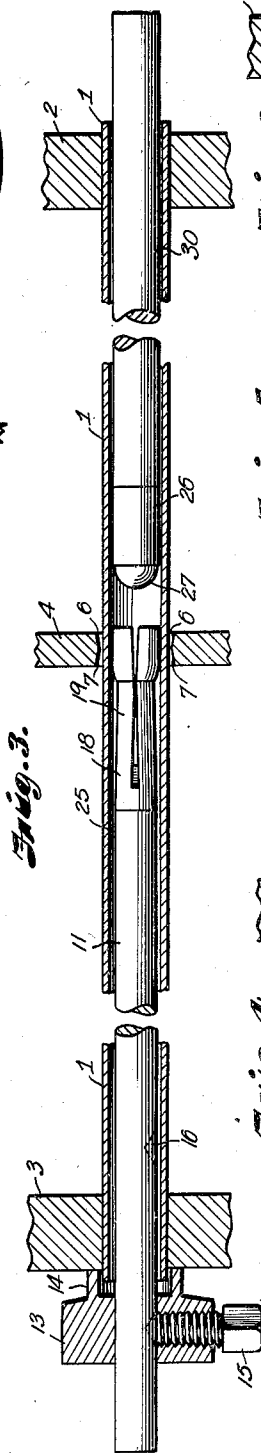
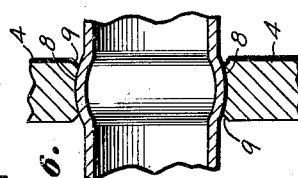
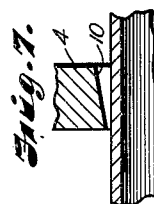
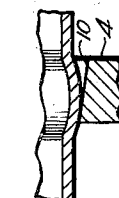
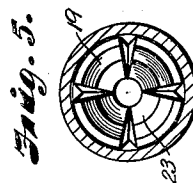
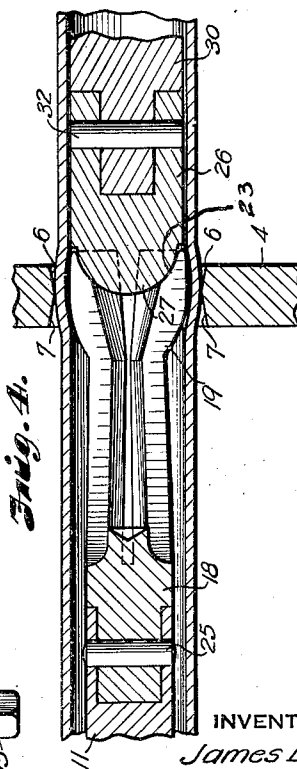
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J. B. FORBES

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HEAT EXCHANGER

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INVENTOR
James B. Forbes
BY *Thos. E. Seefield*
ATTORNEY

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HEAT EXCHANGER

James B. Forbes, New York, N. Y., assignor to
Alco Products Incorporated, New York, N. Y.,
a corporation of Delaware

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2 Claims. (Cl. 257—236)

My invention relates to heat exchangers and more particularly to tube support plates for heat exchange tube bundles for preventing vibrations and minimizing chafing.

5 It has been common practice in heat exchangers having long tubes to furnish a tube support plate structure consisting of one or more support plates drilled with tight fitting holes through which the tubes pass. Such a structure is provided to eliminate vibration of the tubes. Great
10 care has been exercised in the past to obtain a close fit between the tubes and the holes through which they pass, but, due to manufacturing tolerances there has always been clearance between the tube and the tube support which allowed the
15 tube to vibrate causing chafing and eventually resulting in leaks.

It is an object of my invention to provide a method of securing a tubular member within a
20 closely fitting plate orifice.

Another object of my invention is to provide a method of reducing vibration of plate supported heat exchanger tubes.

Another object of my invention is to provide a
25 tube support plate structure for reducing vibration and minimizing chafing.

A further object of my invention is to provide a tool for externally expanding heat exchanger tubes.

30 Other objects of my invention will appear from the following description.

In the accompanying drawing which forms part of the instant specification and is to be read in conjunction therewith and in which like
35 numbers refer to like parts throughout the several views:

Figure 1 is a sectional elevation of a tube bundle of a heat exchanger structure showing the tube support plate of my invention.

40 Figure 2 is a sectional view taken through the line 2—2 of Figure 1.

Figure 3 is an enlarged detail view partly in section showing a tube in the region of the support plate before being expanded.

45 Figure 4 is an enlarged detail view showing the tube in the region of the support plate after being expanded.

Figure 5 is an end view of the expansion head of the tool of my invention in place in the tube.

50 Figure 6 is an enlarged detail view showing a tube expanded in a support plate having a modified orifice wall.

Figure 7 is a fragmentary sectional view showing a tube in place before expansion in a support
55 plate having a modified orifice wall.

Figure 8 is a view of the tube shown in Figure 7 after expansion.

In general, my invention relates to a method of securing tubular members within a plate orifice and a tool which may be inserted within a tube and expanded at the point of contact between a tube and a tube support plate in order that the tube may be forced outward into intimate contact with the walls of the surrounding plate orifice. An adjustable collar is provided on the
10 shaft of the expansion tool in order that the expansion head may be located at predetermined distances within the length of the tube. A support shaft having a removable head is provided for insertion within the tube and expandible
15 head to force the tube walls outwardly.

More particularly referring now to the drawing, heat exchanger tubes 1 are supported by a fixed tube sheet 2 and a floating tube sheet 3. One or more tube support plates 4 are mounted
20 intermediate the tube sheets 2 and 3. A small floating head support plate 5 may be provided adjacent the floating tube sheet 3 for supporting a few of the total number of heat exchanger tubes if desired.

It will be seen, from Figure 4, that the tube 1 is passed through the support plate 4, so as to provide a very close fit between the tube and the support plate. The walls 6 and 7 of the orifice diverge outwardly from the center of the support
30 plate.

The tube walls upon expansion are in intimate contact with the diverged orifice walls 6 and 7 as indicated in Figure 4 thus insuring elimination of vibration between the tube and support
35 plate with its attendant chafing which will eventually result in break-down of the tube walls. As an alternative the orifice walls 8 may be cylindrical with chamfered edges 9 as shown in Figure 6 or may diverge outwardly from the face
40 of the support plate as shown at 10 in Figures 7 and 8.

Referring now to Figure 3, a shaft 11 having an end socket, is provided with a collar 12 having an annular flange 14 parallel to the longitudinal axis of the shaft 11. A set screw 15 is provided in the collar 12 for adjustably locating the collar along the shaft. At selected points along the shaft recesses 16 are provided for engagement by the set screw 15. An expansion
50 head 18 is secured to the end shaft 11 by pin 25, the expansion head 18, comprising a plurality of fingers 19, integrally connected at one end and forming a recess-portion 23 at the free ends. A removable head member 26 having a hardened
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steel nose 27 at one end is secured to shaft 30 by pin 32.

In operation, the expandible head 18 is locked to the shaft 11 by means of the pin 25 and inserted into the tube until the expandible head is within the area embraced by a selected plate orifice. Inasmuch as this distance may be accurately determined from the exterior of the tube, the collar 13 may be set at a selected point on the shaft corresponding to the measured distance to insure that the expandible head within the tube will be accurately located with relation to the tube support plate. The removable nose piece 26 is locked to the shaft 30 by means of the pin 32 and inserted within the tube until the hardened head 27 engages the recess portion 23 of the expandible head 18. A series of blows are delivered to the protruding end of the shaft 30 while the protruding end of the shaft 11 is held in position by the collar 13 against what may be either the floating head tube sheet 3 or the fixed tube sheet 2. These blows force the expander element 26 inside of the expandible head 18 which, in turn, forces the wall of the tube to a greater diameter bringing said tube in fixed relation with the side walls of the tube support plate opening. After completion of this expanding operation the tool may be withdrawn from the tube.

It will be observed that I have accomplished the objects of my invention. I have provided an expansion tool by which I am enabled to internally expand a heat exchanger tube and provide a method of securing fixed contact with the sur-

rounding walls of a plate orifice to prevent vibration and minimize chafing.

It is to be understood that the invention is susceptible of modifications falling within the range of equivalents and that I do not wish to be limited to the particular form of construction or method of operation shown and described except insofar as appears in the following claims. For instance, the fingers 19 of the expansion head 18 may be formed as a plurality of separate units or fingers which would be fastened together by means of a clamping ring. With such construction, it would be obvious that, in event one finger became distorted or broken, it could be replaced without the necessity of replacing the entire unit.

Having thus described my invention, what I claim is:

1. A heat exchanger comprising a tube bundle having tubes, tube sheets, a support plate intermediate said tube sheets having orifices through which said tubes pass, a raised portion integrally formed on each tube, each raised portion fixedly contacting the wall of the orifice through which each tube passes through a major portion of its perimeter.

2. In a heat exchanger, a tube bundle having tubes, a support plate intermediate the ends of said tube bundle and having orifices for the passage of the tubes therethrough, the tubes being expanded in the region of said support plate to firmly contact the orifice walls.

JAMES B. FORBES.