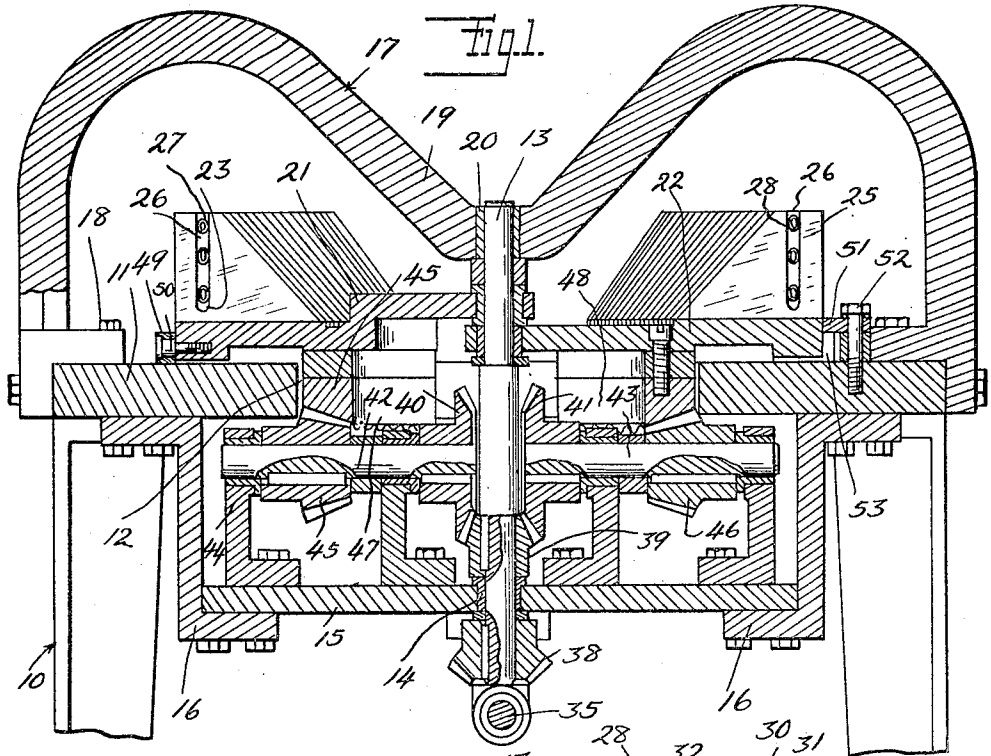
May 2, 1933. W. C. RITTER 1,907,006

METHOD AND APPARATUS FOR MANUFACTURING HEAT EXCHANGE UNITS

Filed March 9, 1931 3 Sheets-Sheet 1

Fig. 1.



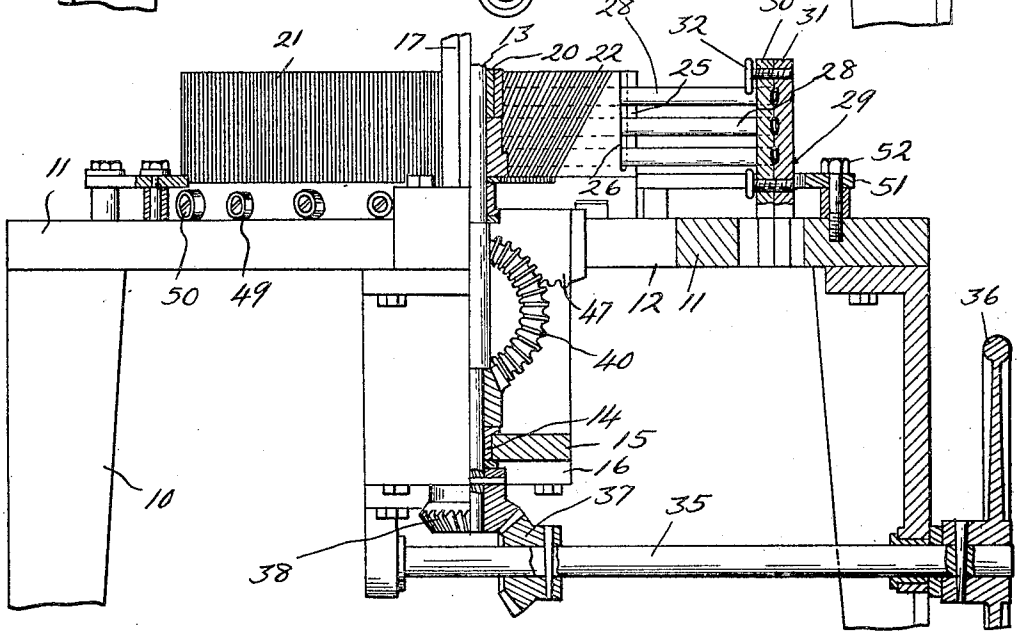


Fig. 2.

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METHOD AND APPARATUS FOR MANUFACTURING HEAT EXCHANGE UNITS

Filed March 9, 1931 3 Sheets-Sheet 2

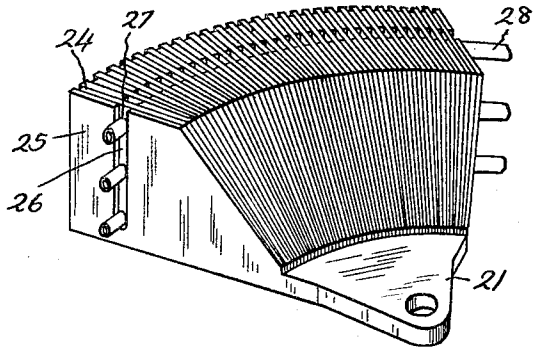


Fig 4.

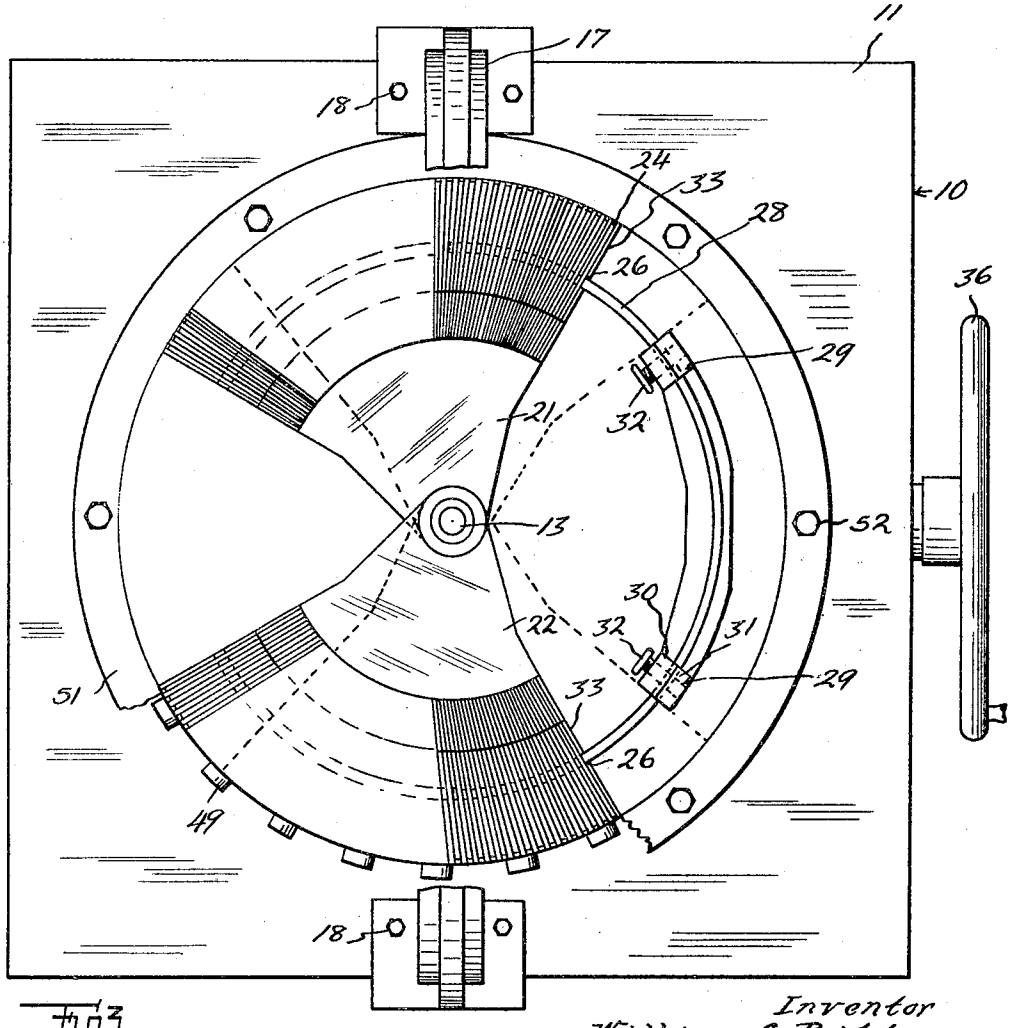


Fig 3.

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William C. Ritter

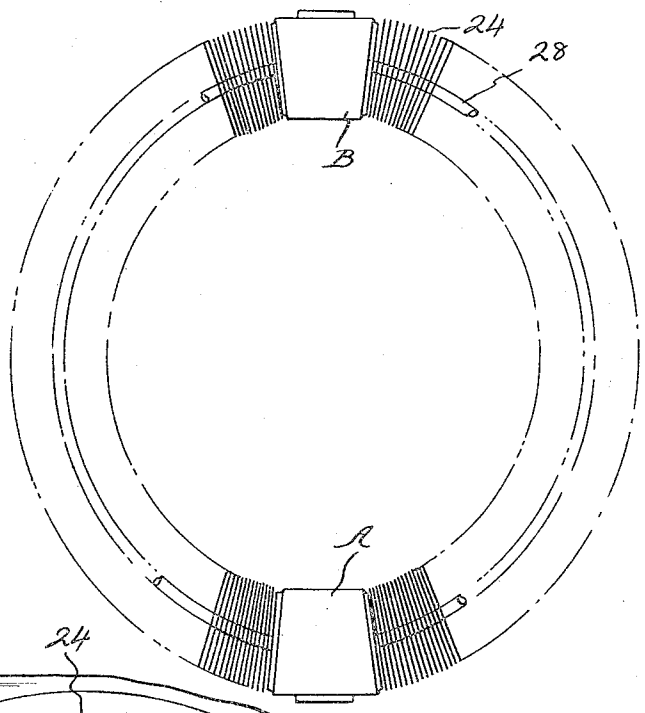
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Atty's

May 2, 1933. W. C. RITTER 1,907,006

METHOD AND APPARATUS FOR MANUFACTURING HEAT EXCHANGE UNITS

Filed March 9, 1931 3 Sheets-Sheet 3

Fig. 5.



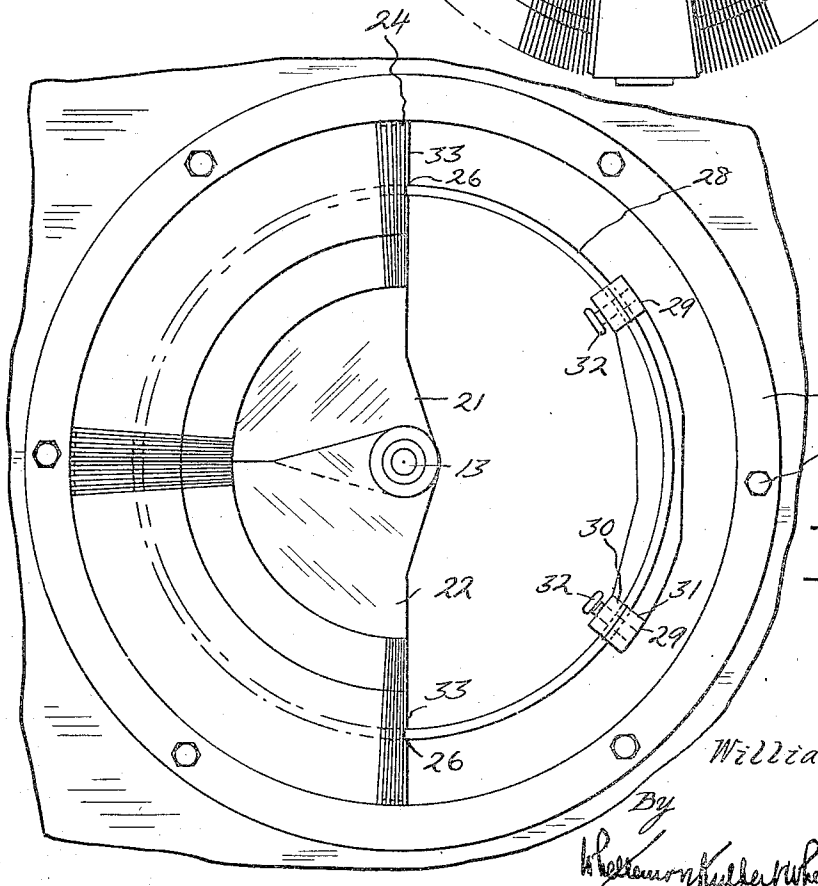


Fig. 6.

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UNITED STATES PATENT OFFICE

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METHOD AND APPARATUS FOR MANUFACTURING HEAT EXCHANGE UNITS

Application filed March 9, 1931. Serial No. 521,335.

This invention relates to a method and apparatus for manufacturing heat exchange units of the type provided with a plurality of tubes having a plurality of radiating fins.

The invention concerns itself more particularly with the manufacture of circular or annular heat exchange units of the fin and tube type and contemplates an improved method and a novel apparatus for accomplishing this result in a simple and efficient manner.

A further object of this invention is to provide apparatus which, in addition to expediting the method of manufacture and reducing the cost thereof, insures proper spacing of the radiating fins on the tubes.

The foregoing as well as other objects will be made more apparent as this description proceeds, especially when considered in connection with the accompanying drawings, wherein:

Figure 1 is a central sectional view through the assembling apparatus;

Figure 2 is a fragmentary side elevational view partly in section of the construction shown in Figure 1;

Figure 3 is a plan view of the construction shown in Figure 1 with certain parts broken away for the sake of clearness;

Figure 4 is a fragmentary perspective view illustrating the manner in which the fins are assembled upon the tubes;

Figure 5 is a plan view of a completed radiator unit constructed in accordance with this invention; and

Figure 6 is a view similar to Figure 3 showing the parts in another position.

In general, the present invention contemplates fashioning circular heat exchange units of the type previously described by uniting together a plurality of prefashioned segments. The segments are formed by arranging a plurality of fins in separate groups with the fins in each group arranged on a common radius and provided with preformed openings therethrough also having a common radius. A plurality of tubes corresponding in length of curvature to the segments are extended through the openings in the fins in each group and serve to assemble the groups to form a segment of the circular unit. In this connection it should be understood that the relative sizes of the openings and tubes is such that the latter frictionally engage the sides of the openings upon being extended therethrough for establishing a contact therebetween and incidently for temporarily securing the fins to the tubes to permit the segment to be removed from the apparatus without disturbing the spacing of the fins. Upon removal of the segment from the apparatus, the fins may be permanently secured to the tubes in any suitable manner such as by a soldering operation.

The particular method employed for fashioning the heat exchange units will be more fully understood by the detailed description of the novel apparatus utilized in carrying out the method.

In detail, the apparatus comprises a table 10 having a substantially flat top portion 11 centrally apertured as at 12 for the passage therethrough of the vertically extending drive shaft 13. The drive shaft 13 is journaled at the lower end thereof in a bearing 14 carried by a plate 15 secured in spaced relation below the top portion of the table 11 by means of the brackets 16 carried by the table. For supporting the upper end of the drive shaft 13, I provide a bracket 17 having the opposite ends thereof secured to opposite sides of the table as at 18 and having downwardly extending portions 19 intermediate the ends thereof for supporting a suitable bearing 20 which in turn forms a journal for the upper end of the shaft 13.

Mounted upon the top portion 11 of the table for movement relative thereto is a pair of fin holding devices 21 and 22 having the inner ends thereof arranged in superposed relation and journaled upon the shaft 13 intermediate the bracket 17 and top portion 11 of the table. The outer end portions 23 of the fin holding devices are arranged in a common horizontal plane and in the present instance are fashioned to form quarter segments of a circle as clearly shown in Figure 3 of the drawings. The arrangement is such that when the outer end portions 23 are in abutting relation, they cooperate with each

other to form a substantially semi-circular section.

As shown particularly in Figure 4, the outer end portions 23 of the devices 21 and 22 are formed with a plurality of laterally spaced upwardly projecting partitions 25 extending radially from the axis of rotation of the drive shaft 13. The space between the partitions 25 is such as to receive the radiating fins of the heat exchange unit and each of the partitions are vertically slotted as at 26 opposite the openings 27 formed in the fins. The construction is such that the slots 26 in the partitions and the openings 27 in the fins are arranged on a common radius concentric with the axis of rotation of the shaft 13 for receiving the semi-circular tube sections 28 of the heat exchange unit.

Upon assembling the fins with the holding devices 21 and 22, the latter are in the position shown in Figure 3 and the tubes 28 are supported upon the table opposite the fin holding devices by means of the clamps 29. The clamps 29 are detachably secured to the top portion 11 of the table and are preferably formed of cooperating sections 30 and 31 engageable with opposite side walls of the tubes and detachably clamped together by means of the fastener elements 32. The semi-circular tubes 28 are of a radius coincident with the radius of the slots 26 and openings 27 are held by the clamps 29 in registration with the aforesaid openings 27 and slots 26 so that rotation of the holding devices about the axis of the shaft causes the tubes to project through the slots and openings aforesaid. The length of the tubes is so determined that when the parts are in the position shown in Figure 6, the opposite ends of the tubes extend within the slots 26 in the end partitions 33 of the fin holding devices 21 and 22 in registration with the openings 27 in the adjacent fins. The arrangement is such that when the devices 21 and 22 are moved to extend the tubes through the fins, the opposite ends of the tubes will extend beyond the fins at the opposite ends of the devices 21 and 22 so as to permit assembling the ends with the headers A and B as will be more fully hereinafter set forth.

Referring now to the operation of the apparatus as thus far described and assuming that the parts thereof are in the position shown in Figure 3, it will be apparent that since the tubes 28, slots 26 and openings 27 are on a common radius concentric with the axis of rotation of the shaft 13, rotation of the devices 21 and 22 in opposite directions about the aforesaid axis causes the end portions of the tubes to extend through the slots 26 in the partitions and openings 27 in the fins. As soon as the opposite end portions of the tubes are extended within the fins, the clamps 29 are preferably detached from the tubes and the table out of the path of travel of the devices 21 and 22 permitting continued movement of the latter in the aforesaid directions until the end portions 33 of the devices abut each other at which time the tubes are extended through all of the fins supported by the devices 21 and 22 and one section of the heat exchange unit is thus formed.

The section thus formed is then removed from the apparatus and the fins 24 secured to the tubes in any suitable manner such as by a soldering operation. The apparatus is then again set up and another section indentical to the one just described is produced in the same manner as the latter. The two sections may then be secured together by the headers A and B forming a substantially circular or annular unit. In this connection it is to be noted that the opposite ends of the two semi-circular sections may be joined to the headers by soldering or otherwise securing the free ends of the tubes, which, as previously stated, project beyond the end fins, to the headers.

For effecting a rotation of the fin holding devices 21 and 22 in opposite directions to extend the tubes 28 within the fins, I provide the following construction. Journaled upon the table 10 below the top portion 11 thereof is a shaft 35 having a suitable hand wheel 36 secured to one end thereof for rotating the same and having a beveled gear 37 secured to the opposite end portion and adapted to mesh with a correspondingly shaped gear 38 secured to the lower end of the drive shaft 13. Keyed to the drive shaft 13 is a second beveled pinion 39 adapted to mesh with a pair of beveled pinions 40 and 41 respectively secured to the driven shafts 42 and 43 extending outwardly from diametrically opposite sides of the drive shaft 13. The arrangement is such that rotation of the drive shaft in one direction effects a rotation of the driven shafts 42 and 43 in an opposite direction. The outer end portions of the driven shafts 42 and 43 are journaled in suitable brackets 44 extending upwardly from the plate 15 and beveled pinions 45 and 46 are secured respectively to the shafts 42 and 43. The pinions 45 and 46 respectively mesh with suitable racks 47 and 48 which in turn are respectively secured to the fin holding devices 21 and 22. Thus, it will be observed that rotation of the hand wheel 36 effects a rotation of the pin holding devices in opposite directions about the axis of the shaft 13 to sleeve the fins over the tubes as previously described. Rotation of the fin holding devices 21 and 22 is facilitated by means of a plurality of rollers 49 journaled upon suitable pins 50 secured to the periphery of the devices 21 and 22 and engaging the top surface of the table. In this connection it is to be further noted that the devices are accurately guided during rotation to extend the tubes through the open-

ings 27 in the fins by a suitable plate 51 secured in spaced relation to the top portion 11 of the table by means of fastener elements 52 and cooperating with the latter portion of the table to form a journal 53 for receiving the rollers 49.

Thus, from the foregoing it will be observed that the particular method employed herein for fashioning circular heat exchange units consists in supporting a series of laterally spaced fins in two separate groups, each group in the specific embodiment of the invention corresponds to a quarter of a circle with the fins in each group arranged on a common radius struck from the center of the circle. The fins in each group extend radially outwardly from the above mentioned center and as previously stated are formed with a plurality of openings therein also arranged on a common radius struck from the center aforesaid for receiving a plurality of tubes. The tubes are semi-circular and are supported concentric with the above center on the same radius as the openings in the fins so that relative rotation of the groups and tubes causes the latter to extend through the openings in the fins of both groups uniting the latter to form a semi-circular section corresponding to substantially one-half of the heat exchange unit. The segment thus fashioned is removed from the apparatus and the fins and tubes permanently secured together by a soldering or other suitable operation. The above operations are then duplicated to form a second semi-circular segment which upon completion is united to the semi-circular segment previously formed by means of the headers to form a substantially circular unit.

What I claim as my invention is:

1. Apparatus for forming substantially circular heat exchange units having means for supporting a plurality of fins extending radially from a fixed point and provided with openings therethrough located on a radius struck from said fixed point, means for supporting a tube on the radius aforesaid, and means for effecting relative movement of the two above mentioned means about the fixed point aforesaid to extend the tube through the openings in the fins.

2. Apparatus for fashioning substantially circular heat exchange units having a support mounted for swinging movement about a fixed axis and fashioned to position a plurality of fins formed with apertures therethrough located on a common radius struck from the axis aforesaid, and means for supporting a tube on a radius coincident with the radius aforesaid whereby movement of the fins about the aforesaid axis relative to the tube causes the latter to extend through the openings in the fins.

3. Apparatus for forming substantially circular heat exchange units having means for supporting a plurality of fins provided with openings therethrough located a predetermined distance from a fixed point, and means for supporting a tube on a radius concentric with the point aforesaid and in registration with the openings whereby relative movement of the fins and tube about the said fixed point toward each other causes the tube to extend through the openings.

4. Apparatus for fashioning substantially circular heat exchange units of the fin and tube type having a plurality of supporting devices mounted for relative movement about a common axis and provided with means for positioning a plurality of fins extending radially from said axis and having openings therethrough concentric with the axis, means for supporting a tube between the supporting devices and on a radius coincident with the radius of said openings, and means for moving said devices about the axis in opposite directions for extending the tube through the openings in the fins supported by both devices.

5. Apparatus for fashioning substantially circular heat exchange units of the fin and tube type having a plurality of supporting devices mounted for relative movement about a common axis and provided with means for positioning a plurality of fins having openings therethrough arranged on a radius concentric with the axis, and means for supportting a tube between the supporting devices and on a radius coincident with the radius of the openings in the fins whereby movement of the devices about the axis aforesaid toward the tube causes the latter to extend through the openings in the fins supported by both devices.

6. Those steps in the method of manufacturing substantially circular heat exchange units having fins and having a member extending through the openings in the fins, which consist in supporting a plurality of fins with the openings arranged on a common radius, and relatively shifting said fins and a member to engage the member within the openings.

7. Those steps in the method of manufacturing substantially circular heat exchange units of the fin and tube type which consist in supporting a plurality of fins having openings therein with the openings arranged on a common radius, and relatively shifting said fins and a tube to engage the latter within the openings in the fins.

8. Those steps in the method of manufacturing substantially circular heat exchange units of the fin and tube type which consist in supporting a plurality of groups of fins with the openings in each fin through which the tubes pass arranged on a common radius, and uniting said groups by relatively shifting the latter and tubes to engage the tubes within the openings in the fins.

9. Apparatus for forming heat exchange units having fins provided with openings therethrough and arcuate tubes extending through the openings, comprising means for supporting a plurality of fins with the openings therethrough arranged concentric with respect to a fixed point, means for supporting a tube in registration with the openings, and means for effecting a relative movement of the two above mentioned means for engaging the tube within the openings in the fins.

10. Apparatus for fashioning heat exchange units having fins provided with openings therethrough and arcuate tubes extending through the openings, comprising a pair of supporting devices mounted for relative movement about a fixed axis and having means for positioning a plurality of fins with the openings therethrough concentric with the said axis, means for supporting a tube between the supporting devices and on a radius coincident with the radius about which the openings are located and in registration with the openings, and means for moving said devices about the axis in opposite directions for extending the tube through the openings in the fins supported by both devices.

11. Those steps in the method of manufacturing heat exchange units having fins and substantially arcuate tubes extending through openings in the fins, which consist in supporting a plurality of fins with the openings therethrough arranged concentric with respect to a fixed point, positioning a tube on a radius coincident with the radius about which the openings aforesaid are located and in registration therewith, and relatively shifting the fins and tube about the fixed point aforesaid to engage the tube within the openings in the fins.

12. Those steps in the method of manufacturing heat exchange units having fins and circular tubes extending through the fins which consist in positioning a series of fins in separate groups with the openings therethrough arranged concentric with respect to a fixed point, supporting an arcuate tube between the groups in registration with the openings therethrough, and moving said groups toward each other relative to the tube to engage the latter within the openings and thereby form a segment of the heat exchange unit.

13. Those steps in the method of manufacturing substantially circular heat exchange units of the fin and tube type which consist in positioning a series of fins in separate groups with the openings through the fins arranged concentric with respect to a fixed point, supporting an arcuate tube between the groups in registration with the openings through the fins, relatively moving the groups about said point toward the tube to engage the latter within the openings and thereby form a segment of the heat exchange unit, similarly forming another segment of the unit and subsequently securing said segments together.

In testimony whereof I affix my signature.

WILLIAM C. RITTER.