Feb. 14, 1956 J. BECK 2,734,259

METHOD OF MAKING HEAT EXCHANGER

Filed Sept. 6, 1951

Fig. 1

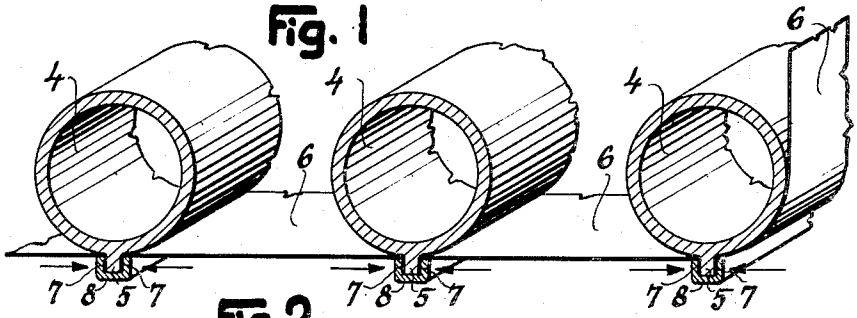


Fig. 2

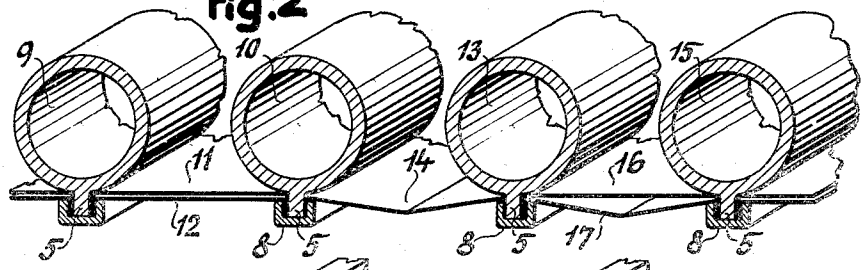


Fig. 3

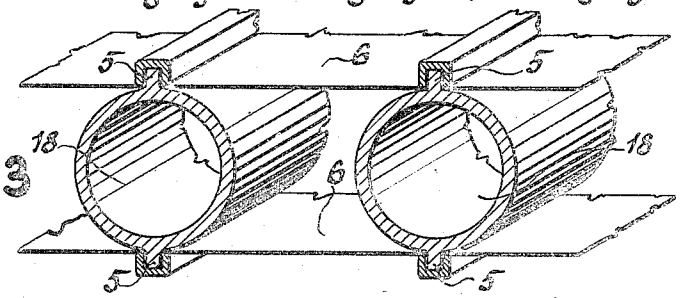
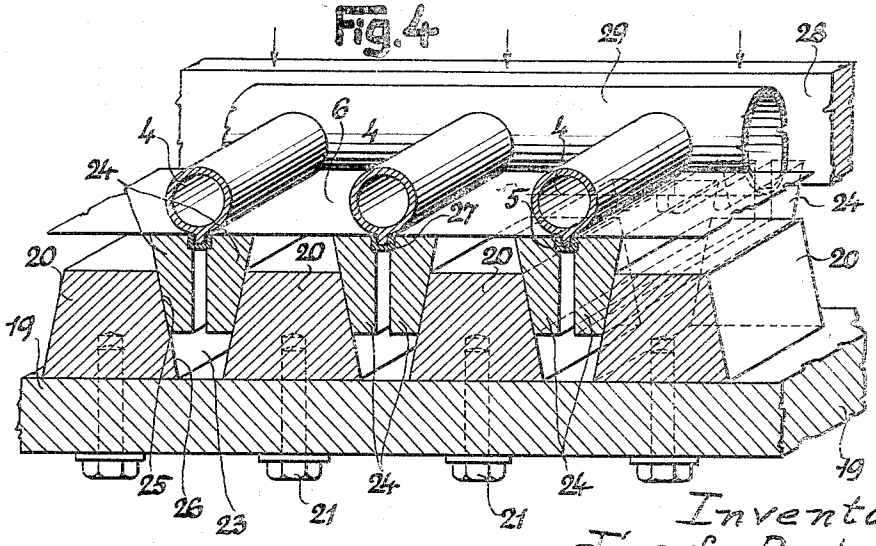


Fig. 4



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2,734,259

METHOD OF MAKING HEAT EXCHANGER

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Claims priority, application Hungary September 11, 1950

1 Claim. (Cl. 29—157.3)

This invention relates to a heat exchange device having tubes for conducting the inner medium and fins or plates connected to the said tubes and preferably provided with slots for guiding the outer medium and transferring the heat from the tubes to the said outer medium such as air.

One of the primary objects of this invention is to provide a heat exchange device including tubes for heating or cooling fluids associated with thermal exchange or fin plates with an improved joint of great strength and heat conductivity between the tubes and the plates mounted on these tubes.

A further object of the invention is to provide an efficient, rapid and simple method of assembling heat exchange devices of the kind described above.

A still further object of the invention is to provide a construction and method of assembly for heat exchange devices which will improve their appearance and reduce their cost without sacrifice of heat transfer capacity.

To these ends the structure essentially comprises a group of distributing tubes preferably arranged parallel to one another and connected on both ends to headers, and plate members assembled with and connected to the tubes. According to the invention each one of the distributing tubes is provided with at least one longitudinal rib and the plates arranged between every two neighboring tubes bear with their bent up edge flanges against the ribs of the tubes and are connected to the respective ribs by means of clamps arranged on the outer side of the said edges.

The device may be made in various sizes by selecting the desired length of the tubes and the desired number of tubes and plates.

Tubes and plates are made of metal and advantageously the tube may be formed of extruded metal. Aluminium and an aluminium alloy is especially well adapted for this purpose although the tube may be formed of any other suitable metal.

The invention is exemplified by the illustrations in the accompanying drawing in which

Fig. 1 is a perspective view of one form of the invention showing the distributing tubes and the plates arranged between them,

Fig. 2 is a cross section of another embodiment of the heat exchanger,

Fig. 3 is a cross section of a modified arrangement with plates on both sides of the distributing tubes,

Fig. 4 is the perspective view of a device adapted to connecting the plates with the distributing tubes arranged on a common header.

Referring to the drawings more particularly, Fig. 1 shows as a preferred form of the invention a part of a heat exchange unit adapted for use as a radiator. As shown in this figure the main part of the unit is a group of tubes **4** each tube having a longitudinally extended rib **5** projecting therefrom and associated with the edge flanges **7** of plates **6** arranged between every two neighbouring tubes **4**. For this purpose the edge flanges **7** of the plates **6** bear against the ribs **5**. The plates are fixed

in this position by clamps **8** having a U-shaped cross section and extending nearly over the whole length of the ribs **5** of the tubes **4**. Each one of these clamps encompasses the bent out edge flanges **7** of the neighbouring plates **6** and presses them against the rib **5** situated between the two edge flanges **7**. The clamps will be fixed in the shown position by pressing the side walls of the clamp in the direction indicated by the arrows in Fig. 1. A device adapted to this method of fixing of the clamps will be described farther on.

Fig. 2 shows an embodiment with two parallel plates **11** and **12** between the tubes **9** and **10**, two plates **16** and **17** between the tubes **13** and **15** and one single plate **14** between the tubes **10** and **13**. The plates **11**, **12** and **16** are plain like those in the foregoing figure, but the plates **14** and **17** are bent outwardly. By the arrangement of two plates between two neighbouring tubes the edge flanges of the first plate are applied directly to the respective rib **5** of the tube while the edge flanges of the second plate bear against the edge flanges of the first plate. One rib **5** and all the edge flanges of the plates assembled on this rib are encompassed by one common clamp **8**.

Fig. 3 shows an arrangement in which each tube **18** is provided with two longitudinal ribs **5** diametrically opposite to one another whereby plates **6** are arranged on both sides of the row of tubes **4** fixed to the ribs **5** in the same manner as shown in Fig. 1.

In assembling the apparatus first the distributing tubes **4** are connected to the headers **29** for example by soldering (Fig. 4), then the plates with their bent out edge flanges **7** inserted between the tubes **4** and then the adjacent edge flanges and ribs encompassed by the clamps **8** and pressed together. During this pressing process stresses are originated in the plates tending to move two neighbouring tubes **4** one towards the other causing leakage at the joints between the tubes **4** and the header **29**.

In order to avoid this and to secure the tubes **4** in their predetermined positions all the plates **6** of the heater are being attached to their respective ribs **5** on the tubes simultaneously, whereby each tube **4** is fixed in its predetermined position and each plate is subjected to a tensile strain during the simultaneous pressing of the flanges **7** of the clamps **8** so that the plates **6** will be drawn out until their edge flanges **7** fit perfectly to the ribs **5**.

A mechanical device adapted to this process is partly shown in Fig. 4. On a ground-plate **19** there are secured by means of screws **21** steel bars **20** of trapezoidal cross section, the bars **20** having at least the same length as the tubes **4**. The bars **20** are disposed right in the middle of the distance between two adjacent tubes **4** and their side faces are chamfered so that these faces are inclined towards one another. In this manner grooves **23** have been formed between each pair of bars **20**, having a wedge shaped cross section. In each one of these grooves **23** between two adjacent bars **20** two jaws **24** are provided which are moveable up and down independently from one another. They are of the same length as the ribs **5** of the tubes **4** and are wedge shaped. Their inclined side faces **25** cooperate with the inclined side faces **26** of the bars **20** so that the distance between the planparallel inner faces of two jaws **24** forming one pair in one and the same groove **23** decreases proportionately with the merging of the jaws into the groove. At the upper end of each jaw along its inner edge a cut-out **27** is provided for the reception of the clamp **8**.

Before assembling the plates **6** and the tubes **4** the jaws are to be lifted up and the clamps **8** inserted in the cutouts of each pair of jaws, then the edge flanges **7** of the adjacent plates are loosely seated between the sidewalls of the respective clamps and finally the rib **5** of the tube **4** is inserted between the respective edge. At

this stage of the manufacture of the device the distributing tubes 4 are preferably already connected to the headers 29 usually by means of soldering. Cross beams 28 are then put on to both the protuding ends of the jaws 24 and pressed downwardly by a pressing device not shown in the drawing, whereby the jaws 24 gliding on the inclined faces 26 simultaneously press the clamps 8 on both sides, this pressure being of sufficient intensity to squeeze the side walls of each clamp, the edge flanges of the plates and the rib, and crush them into full metal to metal contact with each other. Hereby the plates 6 are being racked, yet the tubes 4 remain unchanged in their original position and are not subjected to distortions.

Instead of pressing the clamps 8 they may be fixed also by hammering or in any other suitable manner.

One advantage of the device consists in the simple manufacturing of the tubes 4 due to the fact that no grooves are to be made in the ribs. Assembling of the plates 6, tubes 4 and clamps 8 can be practiced without any difficulty even in case of curved tubes and ribs in the manner described above without being compelled to remove parts of the rib 5. Another advantage consists in the simple form of the pressing tools since they are to be applied on the outer surfaces of the assembly even in case of two or more ribs on one tube as shown in Fig. 3.

The headers 29 may also be connected to the tubes 4 after the plates 6 and clamps 8 have been fixed on the group of tubes 4 as shown in Fig. 4.

What I claim is:

A method of assembling fin plates on the tubes of a heat exchange device, including a plurality of substantially parallel tubes each provided with at least one external longitudinal rib and each secured at its ends to

headers, comprising, after the ends of the tubes have been secured to the headers with the ribs on the tubes all extending in the same direction outwardly from the tubes and header assembly, positioning a plurality of clamps, of U-shaped cross-section having spaced side walls in parallel relation and spaced apart to register with and receive the ribs on the tubes, positioning fin plates of a width to extend between the adjacent sides of the ribs of an adjacent pair of tubes and having edge flanges to lie against the sides of the ribs and of a height substantially equal to the height of the ribs with the edge flanges of a pair of adjacent plates loosely seated between the side walls of a clamp, inserting the rib of each tube into its corresponding clamp between the edge flanges of the adjacent pair of plates seated in the clamp, and simultaneously forcibly gripping the side walls of all the clamps with a pressure of sufficient intensity to squeeze the side walls of each clamp, the edge flanges of the plates therein and the respective rib and crush them into full metal-to-metal contact with each other.

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