Nov. 21, 1967 WAHEI KIKUCHI ET AL 3,353,250

METHOD FOR MANUFACTURING A HEAT EXCHANGER

Filed March 24, 1964 2 Sheets-Sheet 1

FIG. 1

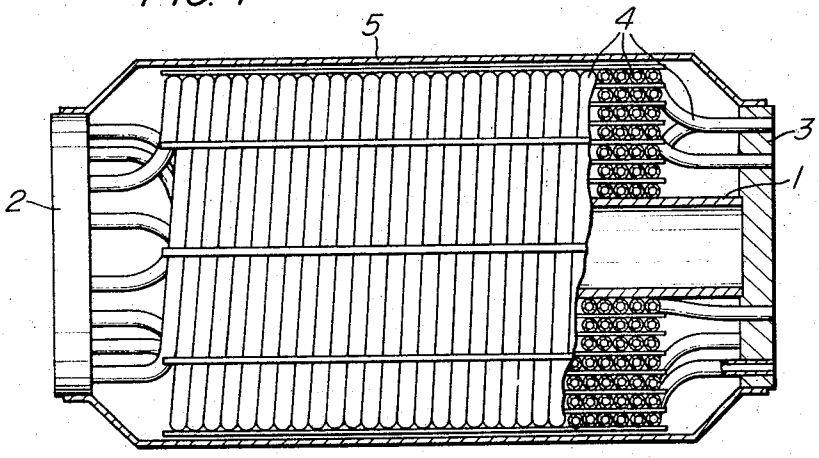
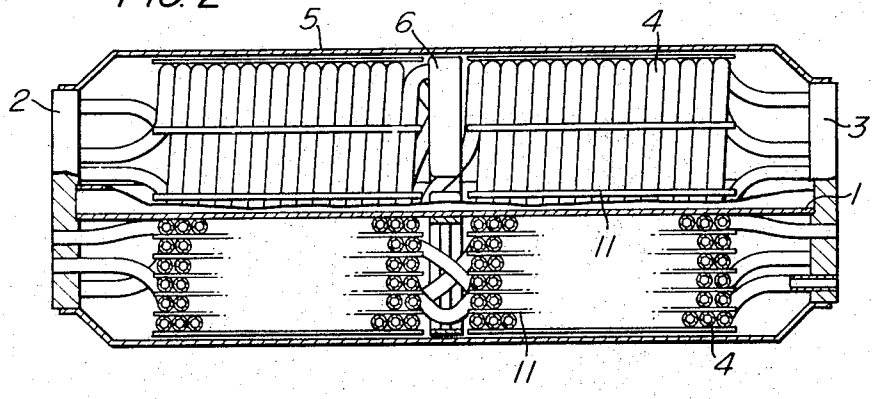


FIG. 2



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FIG. 3

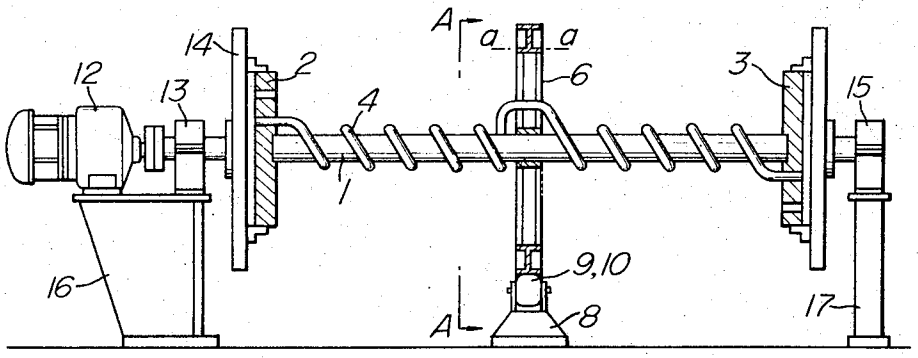


FIG. 4

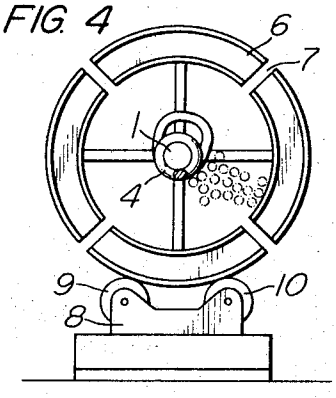
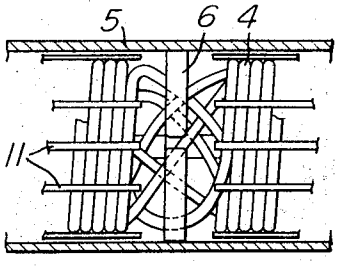


FIG. 5



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METHOD FOR MANUFACTURING A HEAT EXCHANGER

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Claims priority, application Japan, Apr. 1, 1963, 38/16,146
2 Claims. (Cl. 29—157.3)

The present invention relates to a method of manufacturing a heat exchanger.

In gas separators and the like a great number of Hampson heat exchangers are employed as the most important main instrument. Hampson heat exchangers are illustrated in the patents to Hampson, No. 1,896,080 and 1,896,081. This type of heat exchanger may comprise a heat conducting tube made of thin copper tube and wound about a core metal 20 to 50 times through spacers. When a heat exchanger of a very large length in comparison with the coil diameter is made, there are many difficulties in designing and manufacturing. In other words, with a heat exchanger as long as 7 m. (about 23.3 ft.) the core metal has to be made considerably thick or the heat exchanger itself has to be divided into two parts so as to keep the flexure of the exchanger owing to its own weight during winding of the heat conducting tube under a certain value. An example of a wound heat exchanger that is wound in two parts and subsequently connected together by soldered sleeves (15) is found in the patent to Giauque, Patent 2,508,247, issued May 16, 1950. This patent also illustrates the above mentioned spacers **14** that are used when the heat exchanger tube is wound in multiple layers; also, this patent illustrates the manifold **19** for connecting the tubes of the multiple layers together. Accordingly the whole plant, as well as the heat exchanger itself becomes very large in size, and construction cost and other expenses rise in the manner of a geometric progression.

The present invention provides a method of manufacturing a heat exchanger in which the diameter of a core metal can be determined not from the viewpoint of strength but from the viewpoint of heat conducting efficiency. In detail, a heat exchanger made by this method uses a support ring which has a proper number of notches through which a heat conducting tube passes and supports a core metal at one or more points except at the two ends of the metal, and a support table with rollers rotatably supporting the support ring. The method is characterized in the way of winding the heat conducting tube; namely the tube is wound about the core metal through the notches of the support ring as the core metal is supported through the support ring and is rotated together with the support ring.

Further detail of the invention will be explained in reference to the accompanying drawings.

FIGURE 1 illustrates a wound type of prior art heat exchanger with its drum cut away and the tubes partly in section;

FIGURE 2 illustrates a wound type heat exchanger that has been made by the method of the present invention;

FIGURE 3 illustrates a conventional heat exchanger winding apparatus employing the apparatus **6** and **8–10** of the present invention method;

FIGURE 4 is a front view of the support ring of the present invention taken along line A—A of FIGURE 3; and

FIGURE 5 is a partial view similar to FIGURE 2 illustrating the winding of a heat conducting tube while using the support ring of the present invention.

Reference numeral **1** in FIG. 1 is a core metal; **2** and **3** are brackets supporting the ends of the core metal **1**; **4** is a heat conducting tube; and **5** is a drum. The multiple layers of the coiled heat exchanger tube **4** are held apart from each other by spacers **11** in a conventional manner as shown in the above-mentioned prior art patent to Giauque with spacer strips **14**. In FIGURE 2, the old elements that per se form no part of the present invention are designated by numerals that are identical to the numerals used in FIGURE 1 so that the features of the present invention may be clearly set apart from the prior art. Numeral **6** indicates a support ring to support the core metal **1** at one or more points except at the two ends of the core metal (in the present embodiment at one point in the central portion of the core metal); **7** indicates notches formed radially in the support ring in order to pass the heat conducting tube **4**; and **8** is a support table with two rollers **9** and **10** to rotatably support the support ring **6**.

In FIGURE 3, a prior art heat exchanger winding device **12–17** is shown employing the apparatus of the present invention for winding a heat exchanger coil according to the method of the present invention. A motor **12** is used to drive the shaft of a suitable chuck **14**; the chuck shaft is supported in the bearing **13**. The bearing **13** and motor **12** are suitably mounted on a stationary support **16**. The chuck **14** is used to hold the bracket **2** and a similar chuck is used to hold the bracket **3**. The chuck for the bracket **3** is freely supported in a bearing block **15** that is in turn supported on a stationary support **17**. The support ring **6** and its bearing structure **8–10** of the present invention is used with the above described conventional heat exchanger coil winding device to practice the method of the present invention.

In the process of winding the heat conducting tube about the core metal, the core metal **1** and the support ring **6** are made to rotate by a power-driven rotating device as the core metal is supported by the support table **8** with rollers through the support ring **6**. And the heat conducting tube **4** is wound about the core metal **1** through spacers **11** many times, for example from the right end of the core metal. When the heat conducting tube **4** reaches the central portion of the core metal **1**, the tube is passed from the right half to the left half of the core metal through one of the notches **7** of the support ring **6** and wound on.

Thus, according to the present invention winding of a heat conducting tube can be performed as the core metal is supported at one point other than its two ends. Therefore the substantial span of the core metal and thereby the moment of inertia of the core metal can be reduced. That enables use of a core metal of a much smaller diameter, and moreover assures safe and easy performance of winding process of a heat conducting tube. Thus not only the heat exchanger itself but also the whole plant can be made much smaller in size. And material cost, construction cost and other expenses can be largely cut down. Further, since it is not necessary any more to divide the heat exchanger into two parts, better heat exchanging efficiency, maintenance and operation can be expected.

According to the present invention the portion around the support ring is incompletely wound with the heat conducting tube as indicated in the central portion of FIG. 5. But the substantial length of the portion is only 20 cm. (about 8 inches). Lengthening of the total length by 20 cm. solves the problem.

What is claimed is:

1. In a method of manufacturing a wound tube heat exchanger of relatively great weight and axial extent on a relatively weak core selected for its effect on the heat exchanger independently of its support characteristics,

including the steps of providing a core having opposed ends, rotating said core about an axis through its ends, winding a continuous heat exchanger tube helically around said core in multiple layers from one opposed end to the other opposed end of the core, wherein the improvement comprises: supporting the core between its opposite ends by a drivingly connected support ring; supporting the support ring in a bearing for rotation with the core; helically winding the tube first on the core between one end of the core and the support ring; thereafter passing the tube, intermediate its terminal ends, radially through a radially extending outwardly opening slot in the support ring; and thereafter helically winding the tube on the core between the other opposed end of the core and the support ring.

2. The method according to claim 1, including the step of providing the support ring with an outer substantially circular surface broken only by the slots and supporting this outer circular surface on spaced rollers rotatably mounted in a stationary support below the core.

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