Jan. 3, 1939. W. SEIFERT 2,142,679

HEAT EXCHANGER

Filed April 22, 1936

Fig. 1

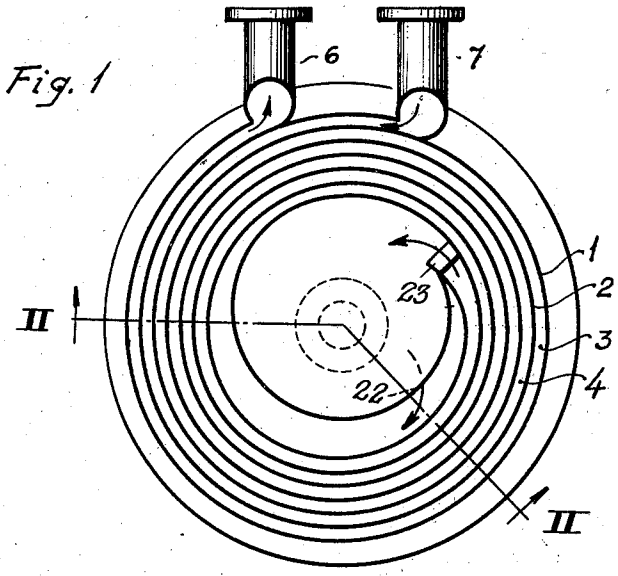


Fig. 2

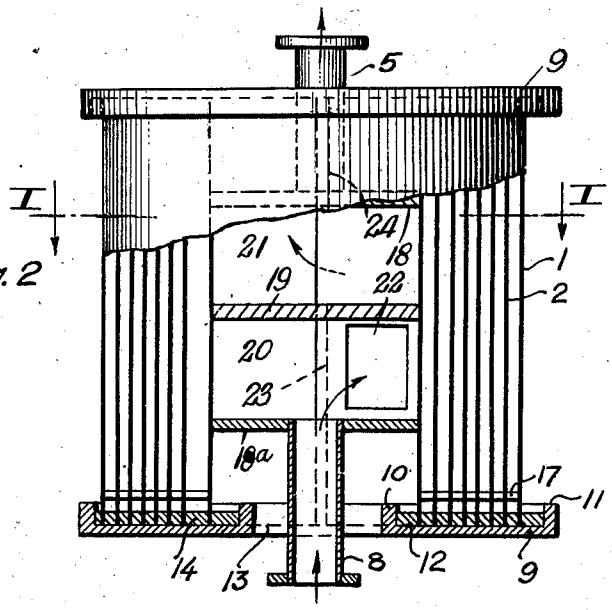
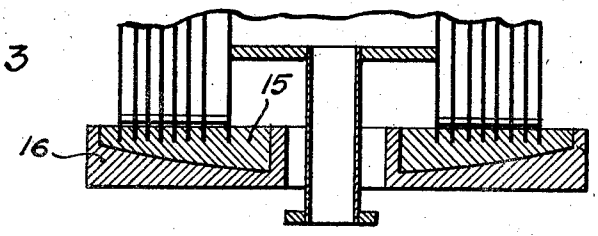


Fig. 3



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HEAT EXCHANGER

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4 Claims. (Cl. 257—245)

This invention relates to heat exchangers, and more particularly to heat exchangers having heat transmission walls of sheet metal bent to spiral shape to form convolute channels for fluids which exchange heat.

Due to the particular structure of such heat exchangers difficulties have arisen in providing them with suitable end closures. Thus closure bands rolled into the spiral ends of the channels cannot suitably be removed. Closures consisting of covers and packings are not reliable, partly as they do not render full security against leakage, and partly as they are difficult to apply to the apparatus. Moreover, closures of both these kinds are expensive. Particularly they increase considerably the costs of manufacture of small heat exchangers of the type referred to.

It is an object of my invention to provide a closure in apparatus of the kind referred to which closure is particularly inexpensive in manufacture and ensures complete tightness.

Another object of my invention is to provide an apparatus of the kind referred to having closures at the spiral ends of its channels which are easily removable and nevertheless as resistant and tight as any hitherto known closure for the same purpose.

My invention has further for its object to materially reduce the entire cost of manufacture of comparatively small apparatus of the kind referred to by reducing the cost of their closure which cost is, for small apparatus, a disproportionally large part of the entire cost of manufacture.

Still another object of my invention is to provide a closure for apparatus of the kind referred to which closure is quite as resistant and tight as welded joints but much more easy and inexpensive to arrange and the arrangement of the closure will not cause any injurious deformation of the convolute walls of the apparatus.

With these and other objects not specifically mentioned in view, the invention comprises the provision of certain constructions and arrangements hereinafter fully described and then specifically set forth in the claims hereunto appended.

In the drawing:—

Fig. 1 is a cross sectional view taken on the line I—I of Fig. 2 of an apparatus embodying the invention;

Fig. 2 is a view, partly in section, on the line II—II of Fig. 1; and

Fig. 3 is a sectional view, similar to Fig. 2, illustrating part of a modified embodiment of the invention.

Referring now to the drawing, the apparatus has two heat transmission walls 1 and 2 of sheet metal, which are bent to spiral shape, so that two parallel convolute channels 3 and 4 for heat exchanging fluid are formed. A fluid to be heated is introduced into the channel 3 through the inlet connection 8 and discharged through the outlet connection 6 while the heating fluid is introduced into the channel 4 through the connection 7 and discharged through the connection 5. The convolute body of the apparatus is formed by rolling up plates of copper, iron or steel to convolute shape and inserting distance pieces 17 or bands into the convolute channels to stay and hold apart the convolute walls thus obtained. Thereby a convolute shaped body will be obtained which is open at both of its face ends. The connection pipes 5 and 6 are secured to plates 18 and 18a, respectively, which are secured in fluid-tight relation to the portion of the convolute wall bounding the central space of the heat exchanger. The space between walls 18 and 18a is divided by means of a fluid-tight partition 19 into an inlet chamber 20 and an outlet chamber 21. The inlet 8 communicates through the chamber 20 and an opening 22 in the wall 2 with the channel 3, and the channel 4 communicates through the chamber 21 with the outlet 5. The channel 4 is closed with respect to the chamber 20 by means of a wall 23 which extends from the partition 19 to the bottom of the convolute, while a wall 24, which extends from the upper plate 18 to the upper end of the convolute, closes the channel 4 with respect to the space formed above plate 18. The ends of the convolute shaped body are covered with covers 9 which are cast or machined to form an interior annular rim 10 and an outer annular rim 11 between which rims is obtained an annular cavity 12 which may be some millimeters in depth. The inner diameter of the rim 11 is slightly greater than the width of the convolute wall body. The covers 9 have central holes 13 for the connections 5 and 8. The spiral ends of the channels 3 and 4 are filled with a fusible metal 14 such as tin or other metal having a point of fusion below that of the covers 9 and walls 1 and 2.

This closure is formed by filling the annular cavity 12 with a metal (possibly pulverous metal) which is then fused conveniently by heating the cover 9. Then one end of the convolute shaped body is inserted into the metal bath and the cover 9 and convolute body are cooled, so that the fused metal will solidify and form a rigid and tight joint

between the cover 9 and the walls 1 and 2. If desired, the joint thus obtained may be released from stresses due to fluid pressures, etc., by securing the covers by means of bolts, staples or the like. Before inserting the convolute wall edges into the metal bath the said edges are cleaned by means of an acid, etc., which might for instance be effected by dipping them into a shallow acid bath etc. Possibly, instead of forming a cavity in the cover 9 the latter may be provided with removable rings of wood, for instance, replacing the integral rims 10 and 11.

This closure can be easily removed by heating the cover with a blow torch, for instance, so that the closure metal 14 is fused again and then the fluid channels can easily be cleaned and inspected, whereafter the convolute body is again placed into the metal bath which is cooled and solidified. As the removal and applying of this closure is effected by simultaneous heating over the entire length of the convolute walls the latter will not be subjected to any local heat stresses and, consequently, there will not arise any undue deformations of the convolutions.

As shown in Fig. 3 the easily fusible closure metal can form a cover 15, i. e. part of the cover is fused into the spiral ends of the channels 3 and 4 between the wall edges. In such cases there is used a separate casting-mould 16. After the closure metal has solidified the casting-mould is removed and in case the closure metal is to be fused down again the casting-mould is applied to the apparatus as shown in Fig. 3.

While I have shown two more or less specific embodiments of my invention, it is to be understood that this has been done for purposes of illustration only and in no manner limits my invention, the scope of which is to be determined by the appended claims viewed in the light of the prior art.

I claim:—

1. In a heat exchanger having heat transmission walls of sheet metal having spiral shape to form convolute fluid channels, covers on the spiral ends of said channels, an outer and an inner annular rim on each cover forming an annular mould, and a metal of a lower point of fusion than said walls and said cover, said metal filling said mould and the spiral ends of said channels between the spiral edges of said walls, said cover and fusible metal being removable from said spiral ends as a unit when the fusible metal is melted, said rims serving to retain the melted metal.

2. In a heat exchanger having heat transmission walls of sheet metal having spiral shape to form convolute fluid channels, a closure of fusible metal between the spiral edges of said walls, and a cover on said fusible metal closure, said fusible metal having a lower point of fusion than said walls, said cover forming a casting-mould for said closure removable from said edges and constructed to retain said fusible metal while in liquid form when the cover is removed, and one of said channels having a fluid connection opening through said cover.

3. In a heat exchanger having heat transmission walls of sheet metal having spiral shape to form convolute fluid channels, a closure of fusible metal between the spiral edges of said walls, a cover on said fusible metal closure, and a pipe for fluid connected to one of said channels, said fusible metal having a lower point of fusion than said walls, said cover having a central opening for said pipe and forming a casting-mould for said closure removable from said edges and constructed to retain said fusible metal while in liquid form when the cover is removed.

4. In a heat exchanger having spiral sheet metal heat transmission walls forming convolute fluid channels, closure means for the spaces between the edges of said walls including a body of low fusion point metal extending between said edges and a cover member having a surface confronting said edges shaped to form a depression for confining a pool of said low fusion point metal on said cover member when said body of metal is in molten condition.

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