Feb. 25, 1964 J. COSPEN 3,121,940

FINNED HOLLOW ARTICLE

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Fig. 1

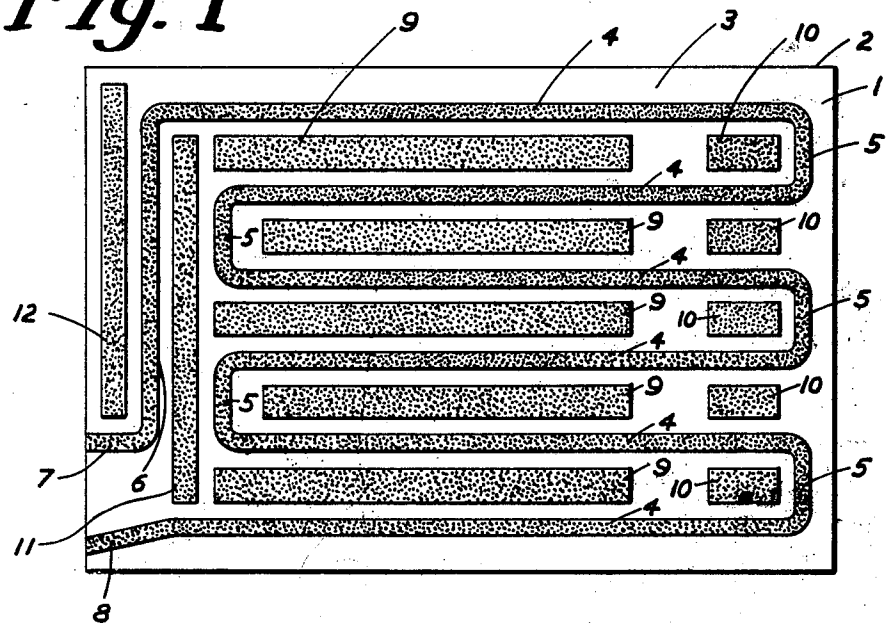
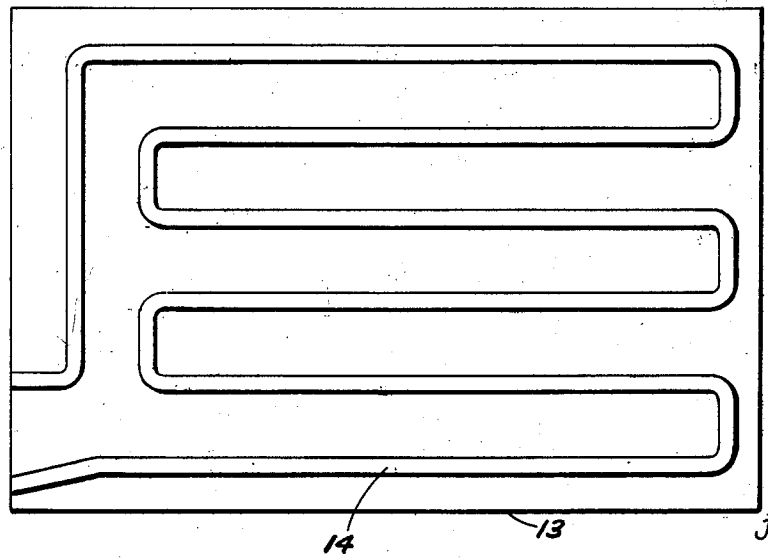


Fig. 2



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Fig. 3

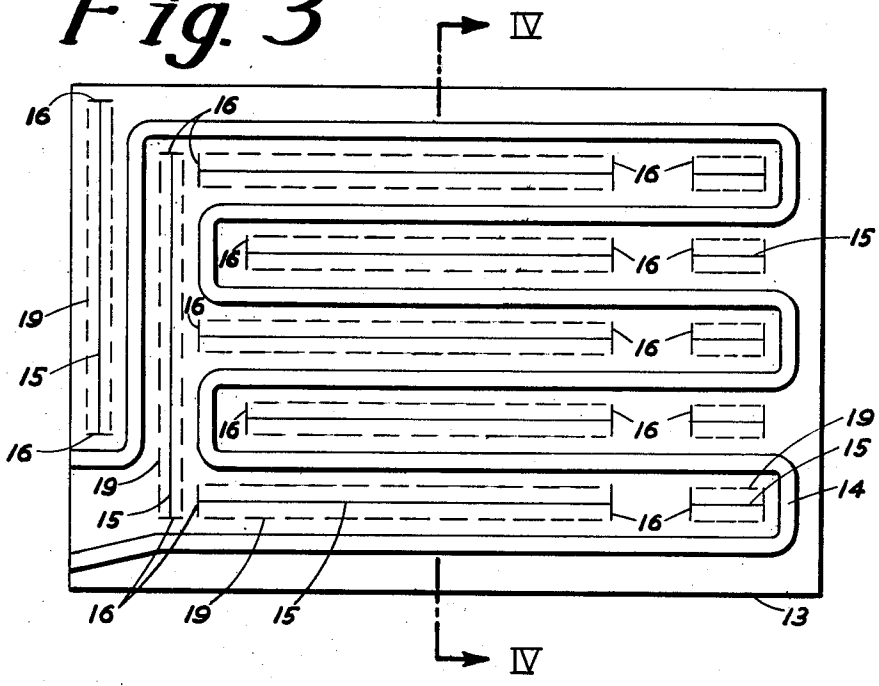
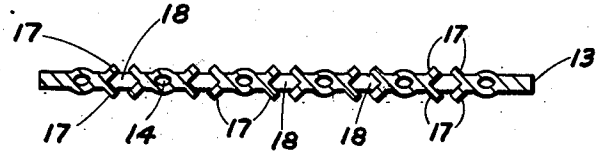


Fig. 4



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FINNED HOLLOW ARTICLE

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5 Claims. (Cl. 29—157.3)

This invention relates to hollow articles and more particularly to a heat exchanger having integral fins.

In accordance with the teachings contained in United States Patent No. 2,690,002, issued on September 28, 1954, a pattern of weld-inhibiting material is applied to a weldable surface of a metal sheet over which a second sheet is superimposed. The sheets are secured together to prevent relative movement between them and then pressure-welded together, as by rolling, in their adjacent areas not separated by the weld-inhibiting material. Subsequent to the pressure welding operation, the resultant sheets are usually softened by annealing and the unjoined portion defined by the pattern of weld-inhibiting material is outwardly expanded by injecting therein a fluid pressure of sufficient magnitude to permanently distend the sheets in the area adjacent the applied pattern of weld-inhibiting material. The expanded portions define a system of passageways for fluid flow. The aforesaid process is equally applicable to any number of superposed sheets having interposed between them an appropriate pattern of weld-inhibiting material. The resultant panel obtained by the aforesaid process is characterized by the absence of any interface between the complementary sheets forming the resultant panel providing improved characteristics when used as a heat exchanger.

It is often desirable that the heat exchange tubing for boilers, refrigerators, condensers and the like be provided with external fins. Such heat transfer fins are usually brazed or soldered on the tubing except where the tube structure is very heavy and permits the fins to be cast, extruded, or rolled. However, especially where the tubing is of the flat or oblong sheet metal type, thin walled tubing and the fins are usually brazed or soldered together. This is not only expensive and time consuming, but frequently fails to result in a rigid and efficient joint. Generally, a brazed or soldered joint is of reduced heat exchange efficiency for lack of unimpeded heat transfer through the joint. Another heretofore known method of forming fins is a helical rolling method which, however, has the disadvantage of requiring a fully formed round tube blank together with an internal mandrel and which has the further disadvantage of requiring a considerably thick tube wall and complicated apparatus and controls for the proper extension of integral fins. This prior method is not readily adapted to formation of fins in conjunction with relatively thin sheet metal walls.

Accordingly, one object of this invention is to provide a simple, low cost and improved design of finned heat exchangers.

Another object of this invention is to provide a novel and improved relatively thin and economical panel structure having integral flanges or fins suitable for various purposes such as strengthening or fastening for heat exchange.

Another object of this invention is to extend the surfaces of a heat exchanger fabricated according to the process of the aforesaid patent without increasing the weight of the unit.

Other objects and advantages will become more apparent from the following drawings and description in which:

FIGURE 1 is a plan view of a sheet of metal having

applied to it patterns of weld-inhibiting material according to one embodiment of this invention;

FIGURE 2 is a plan view of an embodiment of this invention illustrating a ssytem of passageways distended in accordance with the pattern of weld-inhibiting material applied in FIGURE 1;

FIGURE 3 is a plan view illustrating a successive step in the fabrication of the finned heat exchanger from the embodiment of FIGURES 1 and 2; and

FIGURE 4 illustrates one configuration of a finned heat exchanger that may be obtained from the panel depicted in FIGURE 3.

In accordance with this invention a pattern of weld-inhibiting material is applied to a clean weldable surface 1 of a metal sheet 2 so as to define a desired system of passageways 3. This pattern includes a series of stripes 4 interconnected at alternate adjacent terminal portions by lateral stripes 5. One of the longitudinal stripes 4, closest to a lateral edge, is connected to the end of a lateral stripe 6 whose other end extends longitudinally to the edge of sheet 2 by means of a stripe 7. Another longitudinal stripe 4, closest to the other lateral edge, is connected to a stripe 8 which extends to an edge of sheet 2.

A plurality of additional patterns of weld-inhibiting material is also provided on surface 1 of sheet 2. As illustrated in FIGURE 1 these additional patterns are applied in a rectangular configuration. A pair of these rectangular configurations, a long one 9 and a short one 10, are provided between each pair of adjacent longitudinal stripes 4. However, it is to be understood that a singular rectangular pattern of weld-inhibiting material can also be used. In addition, laterally extended rectangular patterns of weld-inhibiting material 11 and 12 are applied adjacent each side of laterally extending stripe 6.

Subsequent to the application of the weld-inhibiting material on the surface of sheet 2, a second sheet is super-imposed on its surface 1 and pressure welded thereto in the areas not separated by weld-inhibiting material in accordance with the aforesaid patent. The resultant pressure welded panel 13 is illustrated in FIGURE 2 with the unjoined portions defining the desired tubular passageways 14 expanded to facilitate the description of this invention. However, it is to be understood that the aforesaid passages may be either distended or undistended for fabrication of the desired structure of this invention.

Subsequent to the expansion of passages 14, the resultant unjoined portions defined by the rectangular configurations of broken lines 19 are bisected by slitting at 15, by any appropriate means such as shearing or punching or the like, in the direction lengthwise of the longest dimension of the rectangular configuration. Two additional slits 16 are provided at the terminal portions of slits 15 is a direction perpendicular thereto along the edges of the rectangular configuration 19. The resultant series of slits comprises a long slit 15 terminating perpendicularly in the mid-point of a short slit 16, forming in effect a T-shape at each end of slit 15. In each instance, slits 15 and 16 extend through both complementary portions of panel 13 adjacent the rectangular unjoined area resulting for the application of weld-inhibiting material. After the panel has been slitted, the aforesaid complementary portions are then separated from each other by bending along opposite unslitted edges of rectangle 5 so as to extend in opposite directions out of the plane of the panel to form fins or flanges 17 leaving openings 18 in the areas of the panel from which the fins or flanges 17 were formed.

Although a specific rectangular configuration for the finned patterns and a specific means of forming them

has been described, it is to be understood that the fin patterns may be of any desired irregular or complex design. The fins may also be formed from the fin patterns by first expanding them followed by milling off the crest of the expanded fin patterns. And, although the primary purpose of this invention is directed to extending the heat exchange surface of a heat exchanger by provision of fins integral with the exchanger, it is to be understood that the resultant fins may be employed as flanges for fastening, spacers or any suitable purpose.

Although the invention has been described with reference to specific embodiments and details, various modifications and changes, within the scope of this invention, will be apparent to one skilled in the art and are contemplated to be embraced within the invention.

What is claimed is:

1. A method of making a finned hollow panel comprising interposing between superposed sheets of metal a first pattern of weld-inhibiting material and at least one separate second pattern of weld-inhibiting material, said first pattern corresponding to a predetermined configuration of fluid passages and said second pattern defining a fin pattern with said second pattern spaced from the peripheral edges of said sheets, pressure welding said superposed sheets in the areas not separated by said weld-inhibiting material, and cutting at least one first slit through the complementary portions of said panel adjacent said second pattern, cutting at least two spaced second slits at spaced points on said first slit and spaced apart a distance to provide substantial fin surface, each of said second slits traversing said second pattern laterally relative to said first slit, and separating between adjacent second slits said complementary portions to extend in opposite directions out of the plane of said panel whereby said separating forms an opening through said panel.

2. A method of making a finned hollow panel comprising interposing between superposed sheets of metal a first pattern of weld-inhibiting material and at least one separate second pattern of weld-inhibiting material, said first pattern corresponding to a predetermined configuration of fluid passages and said second pattern defining a fin pattern with said second pattern spaced from the peripheral edges of said sheets, pressure welding said superposed sheets in the areas not separated by said weld-inhibiting material, cutting at least one first slit through the complementary portions of said panels, cutting at least two spaced second slits at spaced points on said first slit and spaced apart a distance to provide substantial fin surface, said second slits traversing said second pattern in a direction perpendicular to said first slit and separating between adjacent second slits said complementary portions to extend in opposite directions out of the plane of said panel whereby said separating forms an opening through said panel.

3. A method of making a finned hollow panel comprising interposing between superposed sheets of metal a first pattern of weld-inhibiting material and at least one separate second pattern of weld-inhibiting material, said first pattern corresponding to a predetermined configuration of fluid passages and said second pattern defining a fin pattern with said second pattern spaced from the peripheral edges of said sheets, pressure welding said superposed sheets in the areas not separated by said weld-inhibiting material, cutting at least one first slit through complementary portions of said panel adjacent said second pattern, cutting at least two spaced second slits at spaced points on said first slit and spaced apart a distance equal to a major part of the length of said first slit, said second slits traversing said second pattern in a direction perpendicular to said first slit and being intersected by said first slit, and separating all complementary portions adjacent said second pattern and bounded by said first slit and between adjacent pairs of said second slits to extend in opposite directions out of the plane of said panel whereby said separating forms an opening through said panel.

4. A method of making a finned hollow panel comprising interposing between superposed sheets of metal a first pattern of weld-inhibiting material and at least one separate second pattern of weld-inhibiting material, said first pattern corresponding to a predetermined configuration of fluid passages and said second pattern defining a fin pattern with said second pattern spaced from the peripheral edges of said sheets, pressure welding said superposed sheets in the areas not separated by said weld-inhibiting material, cutting at least one first slit through complementary portions of said panel adjacent said second pattern, cutting two spaced second slits at the terminal portions of said first slit, said second slit traversing said second pattern in a direction perpendicular to said first slit and being intersected by said terminal portions and separating all complementary portions bounded by said first and both said second slits to extend in opposite directions out of the plane of said panel whereby said separating forms an opening through said panel.

5. A method of making a finned hollow panel comprising interposing between superposed sheets of metal a first pattern of weld-inhibiting material and at least one separate second pattern of weld-inhibiting material, said first pattern corresponding to a predetermined configuration of fluid passages and said second pattern defining a fin pattern with said second pattern spaced from the peripheral edges of said sheets, pressure welding said superposed sheets in the areas not separated by said weld-inhibiting material, cutting at least one first slit through complementary portions of said panel adjacent said second pattern, cutting two spaced second slits at the terminal portions of said first slit, said second slit traversing said second pattern in a direction perpendicular to said first slit and being bisected by said terminal portions, and separating all complementary portions bounded by said first and both said second slits to extend in opposite directions out of the plane of said panel whereby said separating forms an opening through said panel.

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