April 26, 1960 D. K. BLEIKAMP ET AL 2,933,806

HOLLOW ARTICLES

Filed Feb. 5, 1957

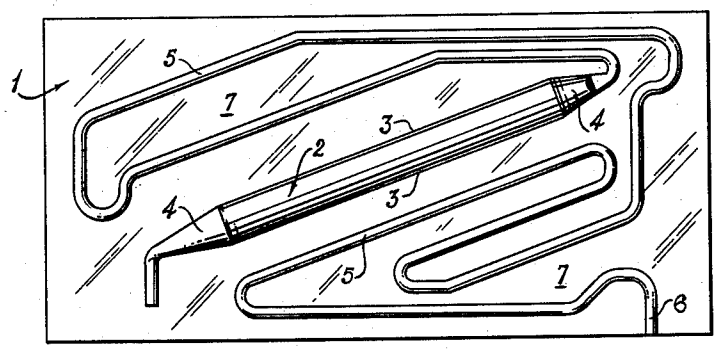


FIG. 1.

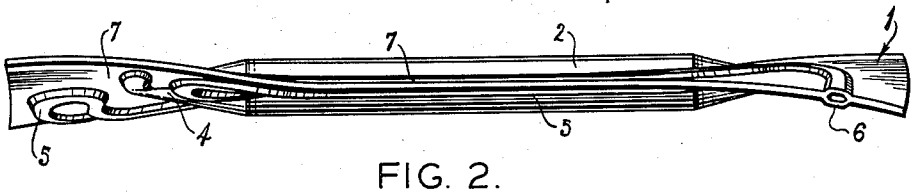


FIG. 2.

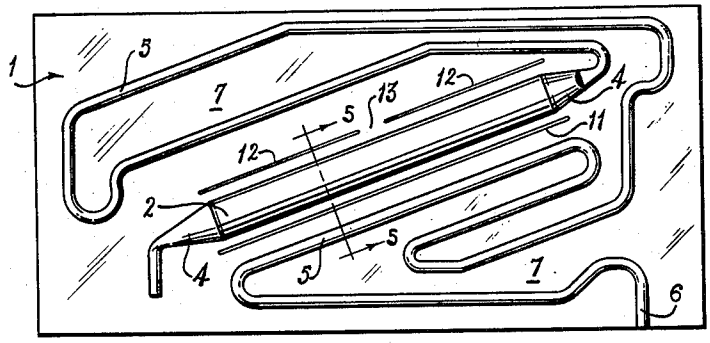


FIG. 3.



FIG. 4.

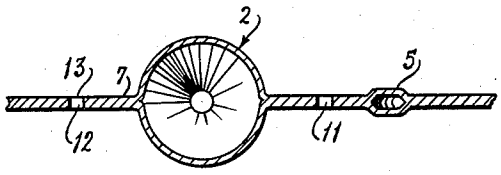


FIG. 5.

INVENTOR.
DONALD K. BLEIKAMP
WILLIAM V. WENGER
THERON F. PAULS

BY Lionel E. Lipp Robert F. Ruemeli
ATTORNEYS

United States Patent Office 2,933,806
Patented Apr. 26, 1960

2,933,806

HOLLOW ARTICLES

Donald K. Bleikamp, Berkeley, Mo., and William V. Wenger, Wood River, and Theron F. Pauls, East Alton, Ill., assignors to Olin Mathieson Chemical Corporation, East Alton, Ill., a corporation of Virginia

Application February 5, 1957, Serial No. 638,282

1 Claim. (Cl. 29—157.3)

This invention relates to the fabrication of hollow articles and more particularly to a construction preventing distortion in finished hollow articles.

In certain types of hollow panels operating conditions may cause the panel to distort in an undesirable manner. For example, in plate-like hollow panels of the type used as an evaporator in refrigerators, a fluid conveying circuit is provided in a sheet-like structure. When the pressure of the fluid is relatively high either temporary or permanent distortion of the panel may occur. In testing such panels pressures greatly in excess of the normal operating pressures are applied within the hollows and distortion is even more likely to occur.

One example of panels of this type will be found in U.S. Patent 2,690,002. This patent is directed to fabricating sheet metal panels by sandwiching a pattern of weld-inhibiting material between a pair of metal sheets and welding the sheets together in their adjacent areas not separated by the weld-inhibiting material. The unjoined inner portion of the resultant blank as defined by the weld-inhibiting material, is expanded by injecting therein a fluid pressure of sufficient magnitude to permanently distend the sheets. Various methods are known to prevent excessive distortion of the blanks when they are being expanded. For example, the blank may be positioned between spaced apart restraining pads which limit outward distension of the hollows, or the blank may be clamped between dies and the unjoined portion thereof expanded into recesses in the dies. It is often desirable to provide such panels with relatively large hollows to serve as accumulators or boilers in refrigerator evaporator panels. These relatively large hollows may either be expanded simultaneously with the smaller hollows by use of dies or they may be fully expanded separately from the smaller hollows without the use of dies. The relatively small hollows are normally expanded outwardly less than the large hollows, but at a substantially higher pressure. When the blank is clamped between spaced apart pressure pads all the hollows may be expanded into firm engagement with the pressure pads at a pressure substantially in excess of that which will cause the blank to rupture if it were unrestrained between the pressure pads. The outer surfaces of the hollows are usually flattened by the pads. In expanding the relatively large hollow outwardly in excess of the expansion of the smaller hollows, a lower pressure must be utilized to prevent rupturing the large hollow. It is therefore normal practice to expand the large hollows after the small hollows have been expanded. If the large hollow is in the same fluid circuit as the small hollows the large hollow will also expand into engagement with the pressure pads. If the large hollows are not in the same fluid circuit as the small hollows they will obviously not expand simultaneously with the small hollows. It has been found advantageous to expand the small hollows either prior to the expansion of the large hollows or simultaneous therewith so that upon full expansion of the large hollows the small hollow will reinforce the solid portion of the panel and retard warping, and to a slight extent, drawing-in of the web of the panel toward the large hollow. Such warping normally occurs transverse to the plane of the panel and results in the panel being wavy rather than flat. Rupturing of the hollows in a panel of this type normally occurs at the juncture of the wall of the hollow and the solid web. During the full expansion of the large hollow, the small hollow and the web may be restrained to prevent warping the panel or the design of the small hollows may be such as to either prevent or localize warping. In any event, flat panels devoid of any substantial warping may be produced by techniques presently known.

The completed panel may be subjected to testing and operating pressures of such magnitude that the panel will warp. Such warping is particularly likely to occur because of stresses occurring in the web of the panel immediately adjacent the larger hollows, caused by deflection or strain of the large hollow when subjected to a pressure. It should be noted that during fabrication of the panel various expedients may be resorted to to prevent warping and other distortion. During normal operation and testing of the completed panel such special measures to prevent undesirable distortion usually cannot be applied.

The present invention is directed to retarding such distortion by slitting the web of a panel adjacent a hollow which might otherwise cause distortion when subjected to a pressure.

Although this invention will be described with particular reference to hollow sheet metal articles of the type described in the aforementioned patent, the invention is equally applicable to other types of hollow articles fabricated by other methods and of materials other than metal. For example, the hollow articles may be fabricated entirely of plastic or of plastic and metal adhesively secured together, and metal panels may be fabricated as by seam welding two sheets together. It is not necessary to the practice of this invention, that the hollow article include both large and small hollows. The invention is equally applicable to an article having a single hollow and an adjacent web. The invention is particularly applicable to preventing distortion in hollow panels subjected to internal pressures, but is also applicable to stresses applied in other ways, as by an external pressure.

It is an object of this invention to prevent distortion in hollow articles.

Another object of this invention is to prevent strains on a localized portion of a hollow panel from affecting other portions of the panel.

Additional objects and advantages will be apparent from the following description and drawings illustrating an embodiment of the invention in which:

Figure 1 is a plan view of a hollow panel.

Figure 2 illustrates an edge view of the panel shown in Figure 1, after it has been subjected to a load, such as a pressure in the hollows, the arrow in Figure 1 indicating the edge shown in Figure 2.

Figure 3 shows the panel in Figure 1 after slits have been cut in the web of the panel adjacent a hollow portion thereof.

Figure 4 illustrates an edge view of the panel shown in Figure 3 after a load such as a pressure within the hollow has been applied to the hollow panel. The arrow in Figure 3 indicating the edge shown in Figure 4.

Figure 5 is a sectional view taken on the line 5—5 in Figure 3.

Referring to the drawings, and more particularly to Figure 1, a panel 1 has a large hollow portion 2 including substantially parallel side walls 3 and tapered end

portions 4. The large hollow 2 is joined at its ends to smaller tube-like hollows 5. These hollows all terminate in an inlet 6. The large hollow 2 is both wider and distended outwardly a greater amount than are the small hollows 5. Adjacent the hollows is a solid web 7. When a relatively high fluid pressure is injected into the hollows through the inlet 6 the large hollow 2 will tend to twist and perhaps change its configuration causing the smaller hollows 5 and the web 7 to draw in toward the large hollow and warp the panel as indicated in the side view shown in Figure 2. A 1100 aluminum panel of .070 inch thickness having a large hollow 2 approximately ¾ to 1 inch in width and about a foot in length, and small hollows 5 approximately ⅜ inch wide when subjected to an internal fluid pressure of approximately 250 p.s.i. is likely to warp. The panel will not necessarily warp in the manner illustrated in Figure 2, but irrespective of the shape of the warped panel, any such warping is usually undesirable and renders the panel unusable.

Figure 3 shows the panel of Figure 1 after a pair of slits 11 and 12 have been cut through the web of the panel close to the large hollow 2 and substantially parallel to the walls of the hollow. The ends of the slits 11 extend to a point adjacent the tapered portions of the large hollow. The slit 11 is continuous between the tapered portions 4, but the slit 12 is interrupted at its midpoint. Such interruption as 13 provides a solid web which adds greater strength to the panel but will not prevent distortion of the panel as well as will a continuous slit. If desired additional reinforcing interruptions 13 may be provided in the panel. The slits 11 and 12 preferably extend to a point adjacent the tapered portions 4 of the hollow 2.

Figure 4 shows an edge view of the panel shown in Figure 3 and indicates a lack of substantial warping after a fluid pressure of the aforementioned magnitude has been injected into the hollow portion of the panel.

In panels which are expanded from blanks, as described in the aforementioned patent, the blank may be slit adjacent any hollow which is likely to cause deleterious warping of the finished panel prior to expansion of the hollow.

Although this invention has been described with particular reference to certain embodiments, materials, and details, various modifications will be apparent to one skilled in the art and the invention is therefore not to be limited to the embodiments, materials or details except as set forth in the appended claim.

We claim:

In the fabrication of a hollow article from a pressure welded panel formed by selectively welding portions of adjacent surfaces of superposed component sheets to define between and within the margins of said sheets a pattern of internally unjoined portions corresponding to a desired configuration of a continuous tubular passageway bounded by a solid welded web, said unjoined portions comprising at least a first unjoined portion and an adjacent substantially parallel relatively larger second unjoined portion separated by a portion of said solid welded web with each of said first and second unjoined portions adapted for simultaneous expansion by fluid pressure to form corresponding tubular portions of different cross-sectional areas to contain fluid medium therein, the method of preventing distortion of said panel during expansion of said second unjoined portion to its corresponding tubular portion, comprising cutting through said solid welded web of said panel along a line spaced from both said first and second unjoined portions but adjacent to and substantially equidistant from the juncture of said second unjoined portion with the said solid web said cut terminating within the peripheral portions of the panel, and distending said first unjoined portion and said second larger unjoined portion into their corresponding tubular portions with fluid pressure.

References Cited in the file of this patent

UNITED STATES PATENTS

2,690,002	Grenell	Sept. 28, 1954
2,759,247	Grenell et al.	Aug. 21, 1956
2,781,645	Simmons	Feb. 19, 1957
2,788,195	Karmazin	Apr. 9, 1957
2,896,312	Schell	July 28, 1959