United States Patent

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[54] SIDEWALL FOR A PRISMATIC CONTAINER
1 Claim, 4 Drawing Figs.

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[50] Field of Search 220/83, 1, 42; 9/54, 89, 91, 58, 162, 163, 167, 168, 169, 207, 216, 217, 218; 215/1

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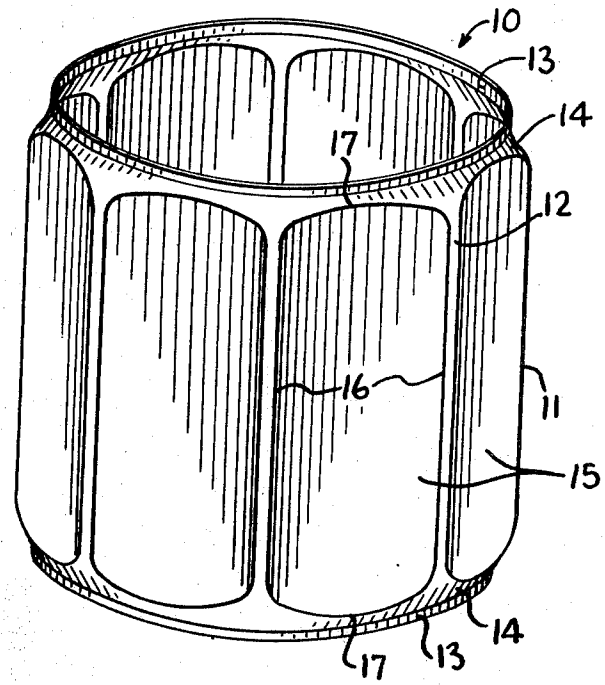
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ABSTRACT: A sidewall for a prismatic shipping container is disclosed in which radially expandable die segments are used to engage a cylindrical blank of sheet material and thereby form straight axial side edges and convex connecting end edges to define flat prismatic side surfaces.



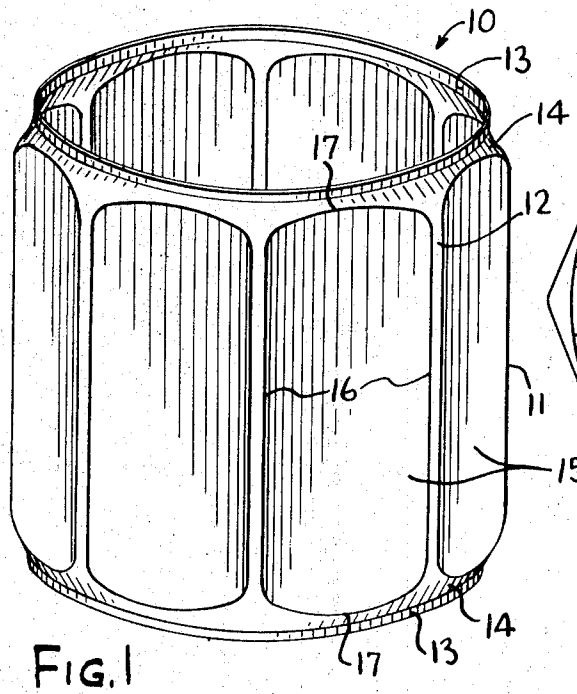


FIG. 1

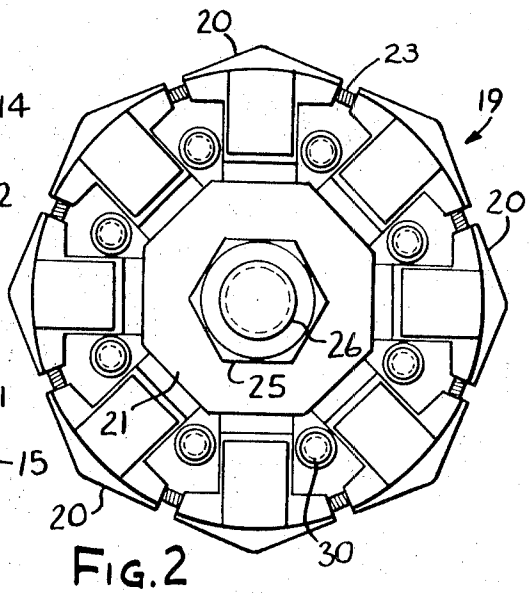
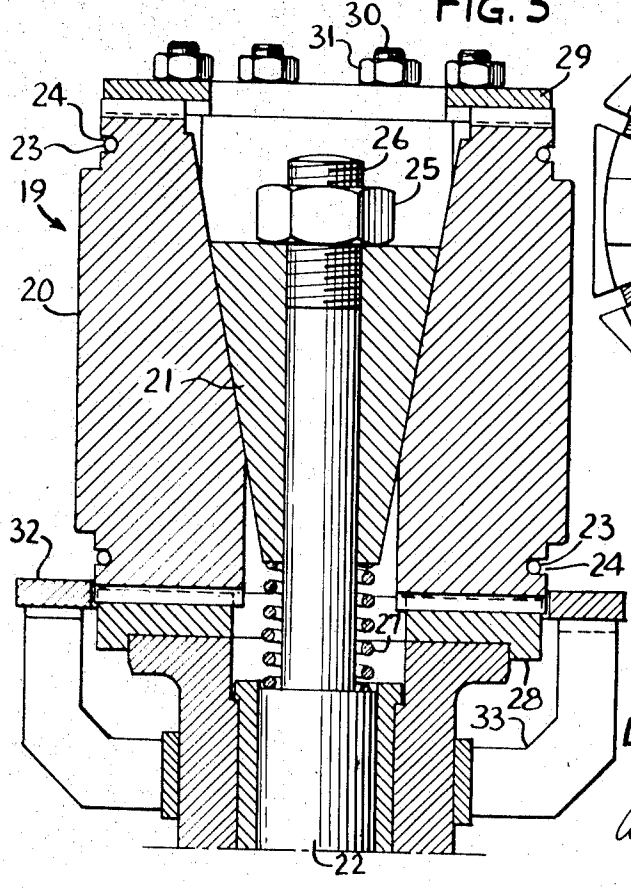


FIG. 2

FIG. 3



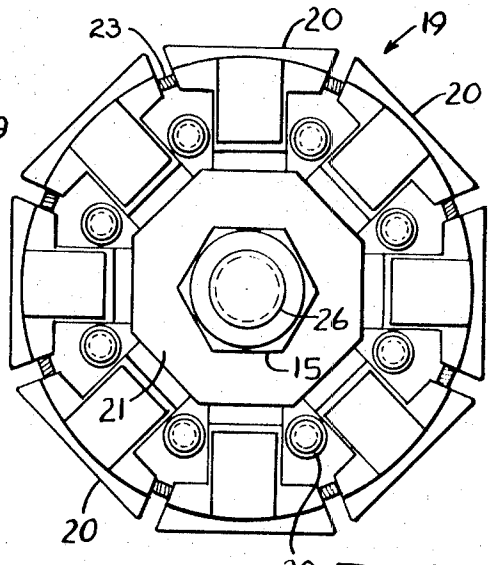


FIG. 4

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SIDEWALL FOR A PRISMATIC CONTAINER

The present application is a divisional application based on the copending application of this inventor identified as Ser. No. 585,110, filed Oct. 7, 1966, now U.S. Pat. No. 3,459,028 for METHOD AND APPARATUS FORM A FOR MAKING A SIDEWALL FOR A PRISMATIC CONTAINER.

The present invention relates generally to shipping containers such as drums, and more particularly concerns forming from sheet material a sidewall having a prismatic shape.

To make the maximum use of transport or storage space, shipping containers are often made with a cross section in the shape of a regular polygon. By the choice of a suitable geometry, such as a four, six or eight-sided figure, the containers thus formed may be made to stack in closer relationship to one another, and are additionally given greater resistance to rolling and tumbling than is the case with conventional cylindrical containers.

Prismatic containers of this type are characterized by a central prismatic body portion which is linked at each end to a circular opening by a transition portion which is created during the forming operation. In this way, conventional end portions or closures such as are employed in conventional cylindrical containers may be utilized.

In previous methods of forming sidewalls of this type from sheet material, a cylindrical blank is formed, after which the central portion of the blank is expanded into polygonal form by means of a plurality of rods which are moved radially outward away from the central axis of the container. In this way each rod forms a corner of the prismatic sidewall portion. However, this method has various disadvantages, the major one being that a great percentage of scrap results due to the formation of cracks in the region of the corners of the prism sidewalls. It is believed that these cracks are primarily due to the relatively greater degree of elongation in the region of the prism corners during the forming operation as opposed to that which takes place in other portions of the container sidewall. In this connection, it is further believed that the axial deformation in these regions, as opposed to circumferential, is primarily responsible for such difficulties.

In view of the foregoing, it is a principal object of the present invention to provide an improved sheet a material sidewall for a prismatic container. It is a particular aim to provide for the construction of such containers in a manner which avoids excessive axial elongation in the region near the ends of the side panels which form the prismatic shape of the container, so that the cracks and other defects may be thereby avoided. A further object is to achieve the construction of an improved prismatic container sidewall by means of the foregoing method.

Other objects and advantages of the invention will become apparent as the following description proceeds, taken in conjunction with the accompanying drawing, in which:

FIG. 1 is an elevation in perspective of a prismatic sidewall produced according to the method and with the exemplary apparatus of the present invention;

FIG. 2 is a plan view of an exemplary apparatus for forming sidewalls for prismatic shipping containers embodying the features of the present invention;

FIG. 3 is a side elevational section taken in the plane 3–3 of FIG. 2, illustrating the expanding die segments by which the prismatic shape of the sidewall is formed; and

FIG. 4 is a plan view illustrating an alternative embodiment of the exemplary apparatus illustrated in FIG. 2.

While the invention is acceptable of various modifications and alternative forms, specific embodiments thereof have been shown by way of example in the drawing and will herein be described in detail. It should be understood, however, that it is not intended to limit the invention to the particular forms disclosed, but, on the contrary, the intention is to cover all modifications, equivalents and alternative falling within the spirit and scope of the invention as expressed in the appended claims.

Turning now to the drawings, there is shown in FIG. 1 a prismatic container sidewall **10** of the type to which the present invention is directed. The greater portion of the container comprises a central portion **11** with a cross section in the shape of a regular or substantially regular polygon having somewhat rounded axial corners **12**. The corners **12** may alternatively be sharply defined without departing from the invention. In the illustrated embodiment, the sidewall is contained constructed in octagonal form, but it will be seen that it may have any desired number of sides, as with hexagonal or square construction.

In addition to the central portion **11**, the container sidewall **10** also comprises an opening or end portion **13** at each end which has a circular shape and a diameter which is equal to or smaller than the diameter of the inscribed circle of the polygon. By the provision of such circular openings, the container thus formed may be fitted with conventional end members and closures such as are used with conventional cylindrical shipping containers. Connecting the central portion **11** and the end portion **13** are transition portions **14** having an axial length which is relatively short compared to the axial length of the central portion **11**. The shipping container thus formed is thus of substantially prismatic shape, while still allowing the use of circular fittings and closures on the end portions **13**.

In accordance with a principal aspect of the invention, the sidewall **10** is formed with flat surfaces **15** which define the prismatic configuration and which are shaped in a manner which avoids excessive stresses in an axial direction in the region of the extremities of the prismatic central portion **11**. As illustrated in FIG. **1**, the flat surfaces **15** are bounded on each side of edge segments **16** which lie parallel to the central axis of the sidewall **10**. The edges **16** interconnected at their ends by outwardly curved segments **17** which, according to the invention, are formed in such a manner that the length of the edge segments **16** is shorter than the overall length of the flat surfaces **15** measured along an axial centerline. In this manner, concentration of strain in the region of the extremities of the flat surfaces **15** and the corners **12** is avoided, resulting in a considerable reduction of scrap in comparison with previous methods of making such sidewalls.

A exemplary apparatus for carrying the invention into effect is illustrated in FIGS. **2** and **3**. This apparatus, indicated generally at **19**, consists of a plurality of die segments **20** which are radially movable in an outward direction. The die segments **20** together define the full area of the flat prismatic surfaces **15** of the sidewall **10** to be formed, or at a minimum they are shaped so as to define at least the edge segments **16**, **17**.

According to the preferred embodiment of the invention, as shown in FIGS. **2** and **3**, each of die segments **20** defines the intersection of two adjacent flat surfaces **15** in the completed container sidewall **10**. In other words, each die segment **20** defines one axial edge **16** and a part of each convex connecting edge **17** for each of the two flat surfaces **15** concerned. It has been found that the method according to this preferred embodiment results in a more uniform distribution of the strains encountered in forming such containers, including strains on both the axial and circumferential directions. The result is a method by which containers by may be conveniently and rapidly formed with a high degree of resistance to tears, splits and other failures due to nonuniform stretching of the material of the blank as the container sidewall **10** is formed into prismatic shape.

Means are provided in the apparatus **19** for forcibly moving the die segments **20** radially outwards to engage a cylindrical container blank (not shown) which is placed over the apparatus **19**. For this purpose, a truncated pyramidal actuator **21** is provided which may be selectively moved along the central axis of the apparatus **19** by means of a central actuating rod **22**. Power means (not shown) are provided for moving the actuating rod **22** back and forth to cause the actuator **21** to expand and retract within the apparatus **19**. Such means may comprise hydraulic, mechanical, electrical, or any other suitable actuating means. As the actuator **21** is withdrawn by the actuating rod **22**, the beveled surface of the pyramidal actua-

tor 21 wedges the individual die segments 20 apart, causing the individual segments 20 to move radially in an outward direction.

For the purpose of retracting the die segments 20 when the actuator 21 is reversed in its motion, a pair of helical springs 23 is carried in circumferential grooves 24 at each end of the apparatus 19. When the actuator 21 is moved upwardly (as seen in the FIGS.), the die segments 20 are drawn inwardly by the springs 23, and the apparatus 19 is thereby contracted. The stroke of the actuator 21 is constant for a given movement of the actuating rod 22, but its points of starting and stopping may be adjusted by means of an adjusting nut 25 screwed on a threaded end 26 of the rod 22. A spring 25 is provided between the actuator 21 and a shoulder of the operating rod 22 to insure constant contact of the actuator 21 against the adjusting nut 25.

The die segments 20 are mounted as a group in a cagelike structure consisting of a lower ring 28, an upper ring 29, and tie rod 30 secured by nuts 31. (It should be noted that the nuts 31 and ring 29 have been deleted from FIG. 2 in order to better show the die segments 20 and associated structure). The apparatus 19 further comprises an annular supporting table 32 for supporting the cylindrical container blank, the table 32 being mounted on a frame or base 33.

In carrying out the method of the present invention, a suitable cylindrical blank (not shown) made of fibre, sheet metal, or other suitable material is placed over the apparatus 19 and seated against the table 32. Being of simple cylindrical form, the blank may be easily and economically produced on any equipment suitable for the purpose. The only requirement is that the blank have sufficient diameter to fit over the die segments 20 of the apparatus 19 when in the contracted position.

When the blank is in position, the actuating rod 22 is moved downwardly (as seen in FIG. 3), thereby moving the actuator 21 in a manner which forcibly wedges the individual die segments 20 outwardly in a radial direction, causing the blank to be locally expanded in a manner resulting in the configuration shown in FIG. 1.

In the preferred embodiment, illustrated in FIG. 2, the die segments 20 are so formed that the planes of separation between adjacent segments 20 coincide with the axial centerlines 18 of the flat surface 15 to be formed. Thus, each of the die segments 20 defines a corner 12 of the completed container, and incorporates one axial edge 16 and part of each transverse edge 17 of the adjacent flat surfaces 15 to be formed. The circumferential strain during forming of the central portion 11 of the sidewall 10 is thereby concentrated in the zones of the blank which will ultimately constitute the corners 12 of the container sidewall 10.

According to another embodiment of the invention, illustrated in FIG. 4, each of the die segments 20 are defines a single flat surface 15 of the completed container sidewall 10, instead of defining the intersection of two adjacent surfaces 15 as in the embodiment of FIG. 3. In this embodiment, a separating plane 35 is defined between each of the two die segments 20 as the apparatus 19 is expanded, so that the corner 12 of the completed container wall 10 is bridged over the opening between the die segments 20 during the forming operation. With this embodiment, the die segments 20 need not necessarily engage the entire flat surfaces 15 to be formed. The die segments 20 could, as an alternative, embody recesses corresponding to the central portions of the flat surfaces 15 of the completed container center section 11, but is should be noted that at least the edges of the blank which are to comprise the edge segments 16, 17 of the flat surfaces must be engaged by a respective portion of the die segments 20.

As another alternative of the embodiment illustrated in FIG. 4, each of the die segments 20 may consist of two rods shaped generally in a wide U-shaped, being jointed at their ends to define an outline which follows the edges 16, 17 of the flat portions 15 of the completed container.

In the embodiments illustrated in the drawings, the apparatus comprises eight die segments 20 and consequently the central portion 11 of the completed container sidewall 10 will be octagonal cross section. The apparatus may, however, include any desired number of die segments 20 so that the resulting container sidewall 10 will have a prismatic central portion 11 having a square, hexagonal, or any other desired prismatic shape.

I claim:

1. A prismatic container sidewall made of sheet material defining inner and outer surfaces and having a central portion with a cross section substantially in the shape of a regular polygon, two extremities having a substantially circular cross section of a diameter not larger than the diameter of the inscribed circle of said polygon, and two transition portions connecting said extremities to said central portion, said prismatic central portion inner and outer surfaces comprising a plurality of flat prismatic surfaces having substantially parallel straight axial edges connected at each end by convex connecting edges such that the length along the central axis of the flat surfaces thus formed is substantially longer than along adjacent axial edges.