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PAPER REINFORCED THIN-WALLED METAL CONTAINER
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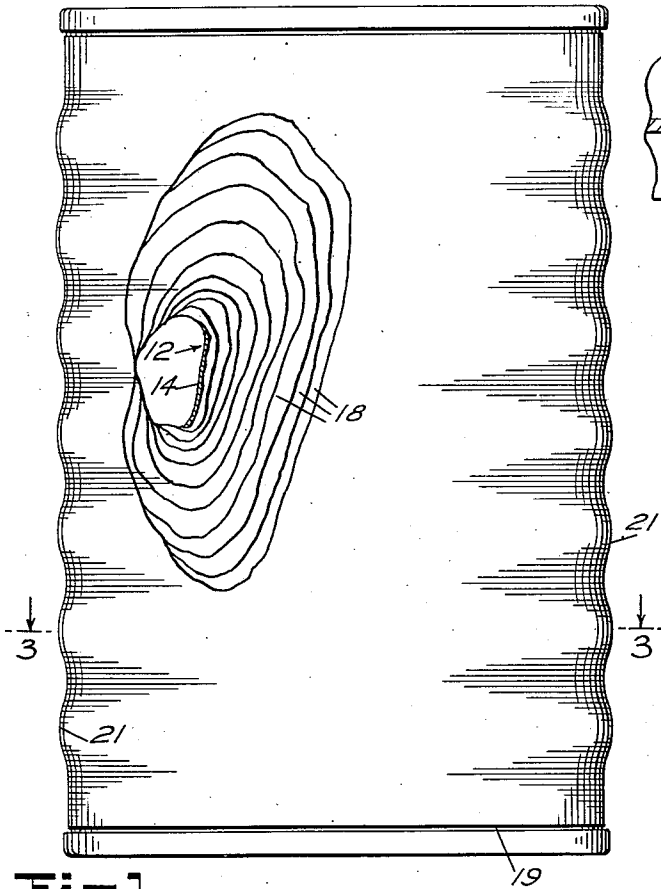


Fig. 1.

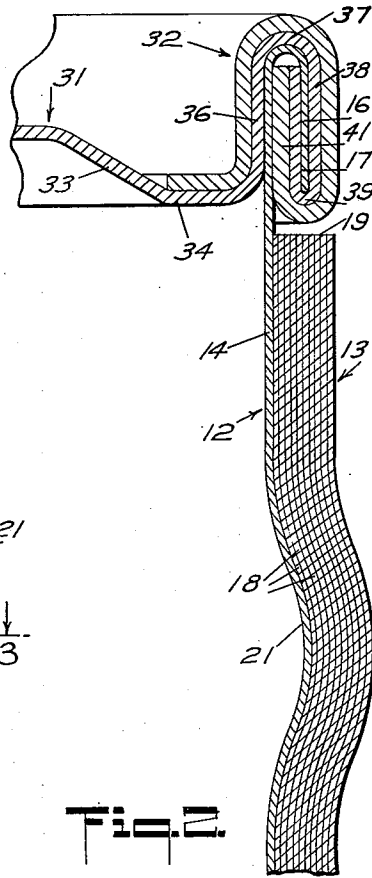


Fig. 2.

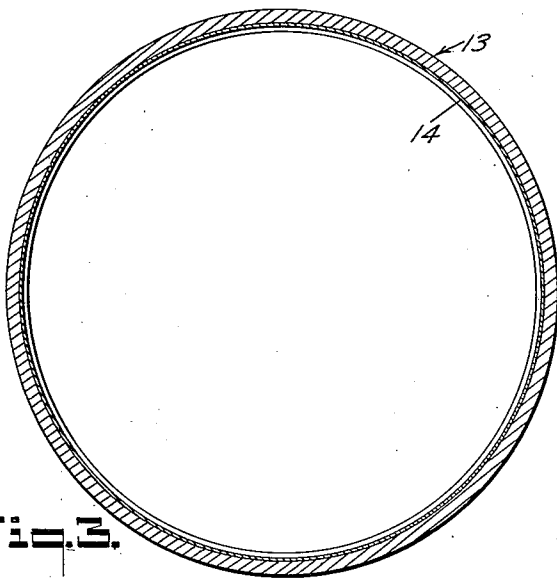


Fig. 3.

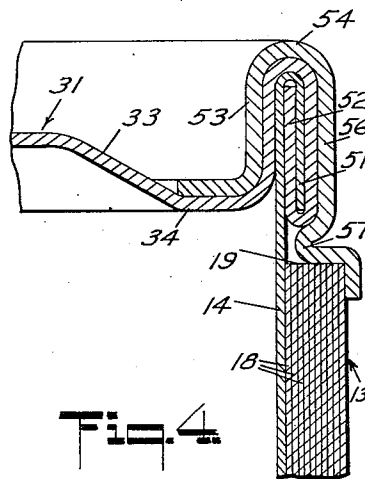


Fig. 4.

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PAPER REINFORCED THIN-WALLED METAL CONTAINER AND METHOD OF MAKING SAME

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3 Claims. (Cl. 220-11)

This invention relates to metal containers, such as drums, and more particularly to a form of drum construction in which metal and paper components are combined to form the finished product.

As is well known in the art, for many years metal drums having a wide range of sizes have been utilized for storing and shipping pourable or other products. In general, such drums have included a cylindrical body portion, a bottom, and a top, the latter usually being removable and/or provided with an opening to permit removal of the drum contents. It will be readily appreciated that in drums having a capacity in the range of 50 gallons, the drums must be constructed in a rugged manner to properly support the internal load which may run in excess of 400 pounds without undue deformation or leakage. Accordingly, present day metal drums are conventionally constructed out of heavy gauge steel, such as 18 gauge, and are usually further reinforced by providing peripheral swedges on the body thereof.

Drums of the type just mentioned may be adequate from a standpoint of strength, but are most undesirable from a cost and weight standpoint, as large amounts of relatively expensive and sometimes critical metal must be employed. It is in part due to this that fibre drums or containers have become increasingly popular, but these non-metallic drums are naturally weaker than their metal counterparts and are not capable of carrying many types of products which have a deleterious effect on the fibre-board or other substance from which the drum is constructed.

It is therefore an object of the present invention to provide a metal drum-type container in which the gauge of the metal is materially reduced from that found in conventional metal drum construction, but which possesses strength characteristics of the nature found in such conventional construction.

Another object of this invention is to provide a container utilizing a light gauge metal core wherein an outer layer or layers of a paper product is secured to the core for providing an outer reinforcing shell, and to provide a method of manufacturing the same.

Another object of the invention is to provide a container comprising an inner tubular metal core to which an outer shell or wrapping of paper or the like has been applied, in which intermediate portions of the core are subjected to a deforming operation after the paper has been applied thereto, in order to radially expand the core and thereby hold it firmly within the shell against longitudinal and rotational displacement relative thereto.

Still another object of the invention is to provide a container of the character described in which adjacent body portions of the core and shell are simultaneously radially expanded and deformed so as to cause the core to be forced into tight frictional engagement with the shell.

It is a further object of this invention to provide a container of the character described which is light weight and

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which may be manufactured at a cost far less than that of conventional all metal drums.

A still further object of the invention is to provide a container of the above type which is more resistant to shock than conventional metal drums, and which is likewise superior in resisting punctures which might normally be expected with light metal construction.

Yet another object of the invention is to provide a container of the character described in which peripheral swedges or corrugations may be unitarily formed in both the inner metal core and outer paper or fibre shell so as to greatly increase the strength of the container, such forming being effected without danger of destroying the bond between the core and shell, without injury to the shell, and without requiring any complicated special equipment.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth in the following description of the preferred form of the invention which is illustrated in the drawing accompanying the forming part of the specification. It is to be understood, however, that variations in the showing made by the said drawing and description may be adopted within the scope of the invention as set forth in the claims.

Referring to said drawing:

Figure 1 is a vertical elevational view, partly in section, of the container of the present invention.

Figure 2 is an enlarged sectional view of a portion of Figure 1.

Figure 3 is a sectional view taken substantially in the plane indicated by line 3-3 of Figure 1.

Figure 4 is a portional view, similar to Figure 2, illustrating a modified form of drum closure.

In broad terms, the container of the present invention comprises the use of a relatively thin-walled core of metal of the like and an outer shell encompassing and secured to said core, such outer shell consisting of a plurality of layers of paper, such as kraft fibre paper, convolutely wound around the core and possessing an aggregate thickness greatly in excess of the thickness of the metal in the core. By way of example, conventional metal drums are usually constructed out of steel having a 16 or 18 gauge; but in accordance with the teachings of the present invention, the metal core may be formed of 26 gauge steel with sufficient layers of paper wrapped therearound to provide an additional thickness of approximately 0.14 inch. Such novel construction permits the production of light weight and low cost containers which may be disposed of after a single use. The invention is further directed towards the container reinforcement closure and method of producing the unit.

Referring now to Figures 1 and 2 of the drawing, it will be seen that, as above mentioned, the container includes an inner core or liner 12 and an outer shell 13, the core 12 comprising a generally tubular member 14 of light gauge metal, which, by way of example, may be 26 gauge steel plate. For a purpose to be later explained, the ends of member 14 are provided with a radial outward and axially inward U-shaped bent portion 16 so to provide a receiving groove 17.

It will be readily appreciated that even if the core 12 was provided with reinforcing swedges or the like, its very light construction would render the same very weak and subject to puncturing and excessive deformation upon impact or other loads being imparted thereto. Accordingly, as a principal feature of this invention, the light weight, non-metallic shell 13 is secured thereto so as to greatly increase its strength without adding materially to its desired light weight. Shell 13 is preferably formed by tightly winding a plurality of layers 18 of paper around the outer peripheral surface of the core, the width of the paper layers preferably being somewhat less than the

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length of the core whereby the opposed edges 19 of the shell will be slightly spaced from the end portions of the core so as to permit subsequent installations of the end closures. Notwithstanding this spacing, it will be understood that substantially the entire area of the core is reinforced by the shell, or, as will be later explained, by other reinforcing means. By way of example, the paper comprising the shell may be that designated as 47 lbs./1,000 square feet kraft liner board, and by using ten layers thereof, a 0.14 inch will be approximately obtained.

To secure the paper to the core, an adhesive such as silicate of soda may be placed on one surface of the paper, and as the latter is wound around the core, the innermost layer will adhere to the metal, and each subsequent layer will likewise adhere to the immediately preceding layer so that even where ten layers are utilized, the finished container will possess substantially unitary characteristics. If desired, in order to utilize conventional fibre drum construction equipment, the first layer of the paper need not be so coated, as it has been found that sufficient bond is obtained between the core and shell by the tightness of the convolutions and the subsequent deforming operation, notwithstanding the elimination of the initial adhesive bond between the core and shell.

In conventional drum construction it has long been a practice to provide one or more peripheral corrugations to add structural rigidity thereto, and may likewise incorporate more pronounced peripheral swedges for the purpose of facilitating rolling of the container along the ground. This corrugation feature, while most desirable from a strength standpoint, is more difficult to incorporate in products such as fibre board containers. However, the container of the present invention incorporates the desired additional rigidity feature notwithstanding the fact that shell 13 is composed of paper layers by utilizing a plurality of swedges substantially deeper than the aforementioned conventional corrugations. The swedges in the core and shell are indicated at 21 in the drawing.

The swedges or reinforcing beads 21 are provided by placing the core 12 on conventional expanding blocks which engage the inner peripheral surface of the liner. However, in constructing the drum, it is important to note that the radial pressure is imparted to the core and shell while the adhesive is still wet. If the adhesive were allowed to first dry, the expansion of the core or liner would tend to tear the paper layers. Furthermore, as the paper will be somewhat stretched while wet, upon drying, there will be some contraction and accordingly a desirable tightening of the shell layers around the metal core.

In connection with the swedges, it has been found preferable to space the same approximately four inches apart and provide them with a height of approximately $\frac{1}{4}$ inch. This spacing is preferable over closer spacing which tends to give an accordion-collapsing effect to the container or a greater spacing which renders the unit less rigid. Likewise, the swedging height mentioned affords maximum strength without danger of tearing the paper layers.

The foregoing construction comprises the body of the drum or container, and from the description given, it will be understood that the paper or fibre shell is approximately ten times the thickness of the metal core. This, together with the swedges formed in the metal and paper renders the body far stronger than would ordinarily be expected from the use of the light gauge metal and encompassing paper.

Means are provided forming end closures for the container body so as to seal the interior thereof against leakage. As the top and bottom closures may be identical, only one is illustrated in detail in the drawing. Referring first to Figure 2 of the drawing, the closure is shown as including a head or lid 31 and a reinforcing ring 32 arranged to co-operate and interlock with the previously mentioned portion 16 of the tube 14. Lid 31 is preferably embossed and may likewise be provided with a pouring opening, neither of these features being shown as they are well known in the art and form no part of the pres-

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ent invention. The lid is further provided with a servi 33 for additional strength, and the lid closure proper then continues outwardly from the servi to terminate in a flat annular portion 34 lying in parallel offset relation to the main plane of the lid. The lid extends axially outwardly from portion 34 as indicated at 36 adjacent member 14, thence radially as shown at 37, axially inwardly as shown at 38, and terminates in a U-shaped bend 39 with the distal portion thereof seated in recess 17 immediately adjacent the outer leg of liner portion 16.

Reinforcing ring 32 is formed to completely overlie portions 34, 36, 37, 38 and 39 of the lid with a distal end portion 41 likewise disposed in recess 17 between the distal portion of bend 39 and the inner leg of the liner bent or curled portion 16. In construction, the reinforcing ring forms a press fit with the lid, and as will be apparent, the structure just described forms a double lock seam between the end closure assembly and the body.

In Figure 4, a somewhat modified form of drum closure is provided. Although this modification has certain manufacturing deficiencies, it possesses the advantage of completely overlying the shell edges 19. As indicated in said figure, the metal member 14 is provided with a U-shaped bent portion 51 at the ends thereof, but the recess formed thereby is sufficient only to receive the distal end 52 of the lid, the latter completely embracing such end portion and forming a double lock seam therewith. The reinforcing ring is substantially different from ring 32 in that it merely comprises a U-shaped band having a short leg 53, a cross leg 54 and a long leg 56, such band overlying the end of the outer lid element. As will be seen, leg 56 is sufficiently long to cover the edges 19 of the paper layers, and an inward crimp or bead 57 disposed between such edge and the lock seam positively holds the paper as well as the ring in proper fixed relationship.

With the closure arrangements above described, satisfactory results have been obtained using 24 gauge metal plate for the lids and 20 gauge plate for the reinforcing rings. Here, too, it will be appreciated that a substantial cost and weight advantage has been obtained over conventional all metal drum construction.

With the foregoing constructional details of the container set forth, the process utilized in making such containers will next be described. In view of the simplicity of such process and the conventional equipment employed therein, no drawings or detailed explanation is deemed necessary.

To start, the light gauge metal is rolled and welded to form the liner or core 12, after which the ends are provided with outwardly extending radial flanges which later are further deformed to define a portion of the double lock seam. The core is then placed on a suitable mandrel and rotated while the paper is supplied thereto in convolute form to provide the layers 18. Preferably, the paper is supplied from a continuous roll, and either prior to the time it contacts the core or after the first layer has been applied, a suitable adhesive, such as silicate of soda, is applied to one surface of the paper so that the respective convolutions will adhere to the core and to adjacent convolutions. After approximately ten layers of paper have been applied, the paper is cut, leaving the container body with substantially more than ten times the thickness of paper as the thickness of the metal due to the added thickness of adhesive between adjacent layers.

While the adhesive, and consequently the paper is still wet, the swedging operation is effected, such operation comprising the placing of the body on radially expandible blocks which serve to force portions of the core and corresponding portions of the paper shell outwardly. It is important to note that the moist paper will expand with the metal swedge, and upon drying, the paper contraction or shrinkage serve to tighten the paper layers into a firm positive engagement with the core. If the paper layers were dry during such swedging, the shell would be subject to rupturing or tearing due to the resistance of dry paper to expansion forces.

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It is also important to note that even though tension is applied to the paper during the winding of the convolutions around the core, it has been found impossible from a practical standpoint to have the wrapping in sufficiently tight engagement with the core to prevent relative movement between the core and shell. Therefore, as an important feature of this invention, means are provided, in combination with the adhesive and the aforementioned paper shrinkage for holding the core firmly within the shell against longitudinal and rotational displacement relative thereto.

It is apparent that by placing the swedges fairly close to one another as above mentioned, the relatively ductile metal core will experience a radial expansion or deformation along substantially the entire length thereof, such deformation being a maximum at the swedge itself and a minimum intermediate adjacent swedges. However, the less ductile paper shell is ordinarily not capable of being deformed to the same extent as the core.

This variation in expansion characteristics between the core and shell permits the core to be forced against the paper shell throughout substantially the entire area thereof, and such characteristics, in combination with the aforementioned contraction of the paper upon drying, results in the shell tightly embracing the core. A container thus formed is capable of withstanding severe external or internal forces without resulting in the separation of the core and shell, and this is true even when the container is filled with its contents. Also, the swedging and the pressure of the shell against the core greatly increases the rigidity of the unit and its resistance to collapsing and crushing.

The closure assemblies are next formed, the lids being blanked, drawn and embossed. After the ring has been formed, it is pressed onto the lid, and thereafter the closure assembly may be double seamed onto the container body.

If desired, the outer layer of the shell may be coated with a suitable water and/or fire resistant compound, but such coating forms no independent part of the present invention.

From the foregoing, both the method and details of construction of our improved type of shipping container will be apparent. Although lighter and cheaper than its all metal counterpart, it will satisfactorily withstand the tests required for containers of this category. Aside from the foregoing, the container of the present invention is in fact superior to all metal containers in that the normal resiliency of the paper layers renders the unit more resistant to shocks and likewise more resistant to accidental blows from a sharp object.

It is also important to note that as it is desirable to reduce the metal gauge as much as possible, the core 12, after being rolled and welded, will in most instances be incapable of maintaining itself in true cylindrical form. In other words the core itself will not be stable or form retaining. However, by placing the core on a cylindrical mandrel preparatory to the forming of the paper shell

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13, the core will be placed into its desired form, and after the paper layers are secured thereto, the mandrel may be removed, and the thickness of the paper layers is sufficient so as to thereafter assist in maintaining the core, and consequently the entire container, in such desired cylindrical form.

What is claimed is:

1. A container comprising an inner metal tubular core having an outwardly and downwardly directed flange at one end thereof radially spaced from said core, an outer shell consisting of a plurality of layers of paper having an aggregate thickness in excess of the core thickness encompassing and secured to said core and longitudinally spaced from the distal end of said flange, said shell extending radially outwardly beyond said flange, a metal end plate overlying said one end of the core and having an upwardly directed annular flange in engagement with the inner peripheral surface of said core and a continuation thereof defining a U-shaped bend encompassing said core flange, and a metal ring overlying and engaging said plate flange and the outermost portion of said bend for securing said plate and core together, a portion of said ring being positioned substantially immediately adjacent and overlying said shell end whereby substantially all of the outer peripheral surface of said core is covered by said shell, plate and ring.

2. A container comprising an inner cylindrical metal core of non-form retaining characteristics and having an outwardly and downwardly directed U-shaped bend at an end thereof, an outer shell consisting of a plurality of layers of paper having an aggregate thickness in excess of the core thickness encompassing and secured to said core to make the unit form retaining, one end of said shell being longitudinally spaced from said core bend and extending radially outwardly beyond said bend, an end plate positioned against said core end and having an annular portion in lock seam engagement with said core bend, and a metal ring overlying and engaging a portion of said plate and having an outer end portion overlying and engaging the outermost layer of paper of said shell adjacent said end thereof.

3. Apparatus as set forth in claim 2 in which said ring is deformed radially inwardly intermediate its portions in engagement with said plate and shell end.

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