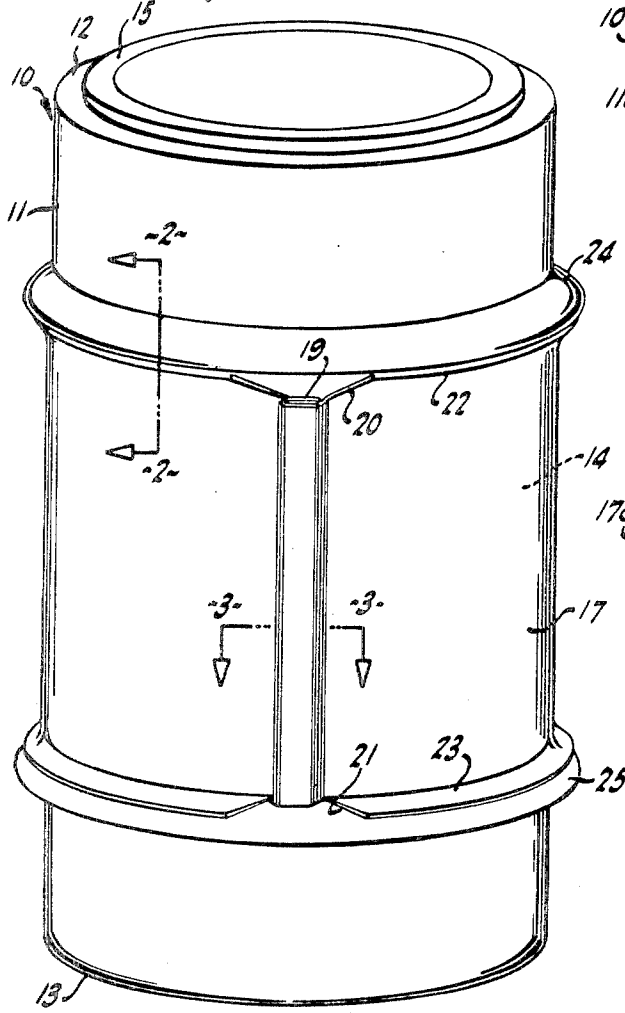
March 17, 1970 E. M. RAABE 3,501,047

REINFORCED CONTAINER

Filed June 10, 1968

FIG-1



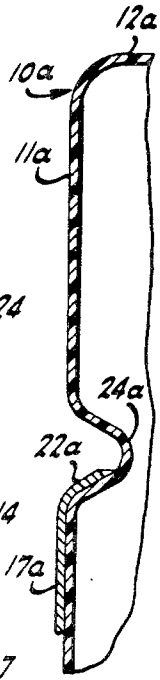


FIG-4

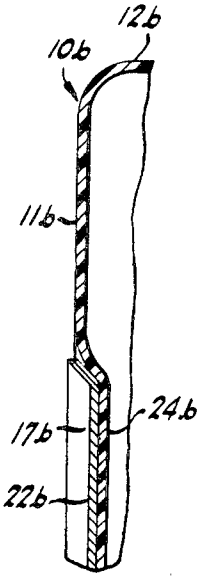


FIG-5

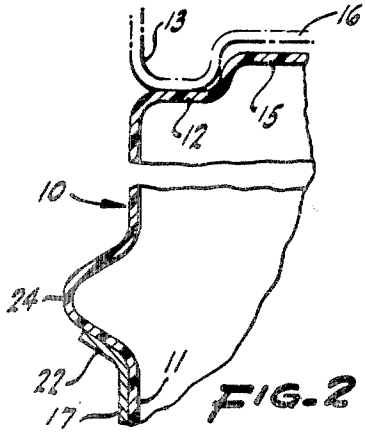


FIG-2

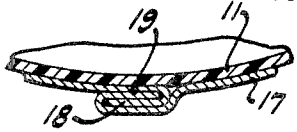


FIG-3

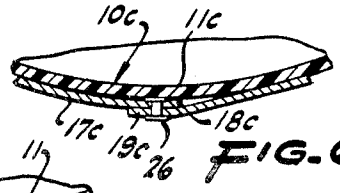


FIG-6

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REINFORCED CONTAINER

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ABSTRACT OF THE DISCLOSURE

A plastic container adapted to hold a fluent material (fluid materials, and semi-fluid materials such as granular and pulverulent matter). The container is provided centrally with a relatively stiff reinforcing band thereabout to prevent deformation of the container side wall under stress as when a plurality of filled containers are stacked one upon another. The band is constrained in its circumjacent relation with the container against translational displacements with respect thereto in vertical directions, and it is of sufficient vertical width to enclose the center of pressure of any fluent material filling the container.

This invention relates to a container structure and, more particularly, to a reinforced plastic container adapted to receive fluent materials therewithin and especially liquids and semi-fluids such as viscous liquids and granular and pulverulent matter. A typical container embodying the invention may have a capacity of about 5 gallons, and when filled is adapted to be stacked one upon another for storage and shipment.

One of the major problems concerning commercial use of molded plastic containers is their limited strength unless the wall thickness thereof is made quite great which is economically unattractive. Such limited strength often leads to sagging or other deformation thereof as when filled containers are stacked one upon another for storage and shipment. In this respect, the part of the container most subject to deformation is its side wall structure which tends to deflect laterally when under stress. For example, thin wall plastic containers of the 5 gallon size when filled with a fluent material begin to deform and topple when a stack thereof exceeds eight to ten units in height, and the problem of such deformation becomes even more severe as the warehousing temperatures increase which appears to make the container walls more flexible. Further, it has been observed that where long-term storage of such containers is contemplated, stacks thereof exceeding six units in height result in slow but progressive deformation of the container body. Another instance of deformation under stress results from filling the containers with a hot product (i.e., 150° to 200° F., for example) because upon cooling of such product the resultant vacuum within a container tends to cause the same to collapse inwardly unless precaution is taken to prevent this occurrence.

In view of the foregoing, an object, among others, of the present invention is to provide an improved reinforced plastic container which will substantially obviate the foregoing disadvantages and limitations and which will enable thin wall plastic containers to approach the more idealized strength conditions represented by all-steel containers. In accomplishing this result, the container is provided circumjacent the side wall structure thereof with a stiff reinforcing band having sufficient strength to prevent lateral deformation of the container side wall structure which it might otherwise experience as a consequence of a stress-inducing internal vacuum or a stress-inducing weight resulting from a plurality of filled containers being stacked one upon another. The band, which

may be formed of a metal such as steel, is constrained against translational axial or vertical displacements with respect to the side wall structure of the container by cooperative locking means substantially coextensive with the entire length of the band. The reinforcing band is symmetrically disposed with respect to the container and is of sufficient width from top to bottom thereof so as to enclose the general area about the center of pressure of any fluent material filling tthe interior of the container.

Additional objects and advantages of the invention, especially as concerns specific features and characteristics thereof, will become apparent from the following description of the illustrative exemplary embodiments of the invention shown in the accompanying drawings in which:

FIGURE 1 is a broken perspective view of a reinforced container embodying the invention;

FIGURE 2 is an enlarged, broken vertical sectional view taken along the line 2—2 of FIGURE 1;

FIGURE 3 is an enlarged, broken horizontal sectional view taken along the line 3—3 of FIGURE 1;

FIGURE 4 is a vertical sectional view, similar to that of FIGURE 2, illustrating a modified form of the invention;

FIGURE 5 is a broken vertical sectional view, similar to that of FIGURES 2 and 4, illustrating a further modified form of the invention; and

FIGURE 6 is a broken horizontal sectional view, similar to that of FIGURE 3, illustrating a still further form of the invention.

The embodiment of the invention illustrated in FIGURE 1 comprises a container generally denoted with the numeral **10**. As in the usual case, the container is cylindrical and it is provided with a side wall structure **11**, a top wall **12**, and a bottom wall **13** that together define a material-receiving compartment **14** therewithin. The container **10** is sometimes referred to as a pail and, in the usual case, is intended to receive a liquid material therewithin, paint and other industrial products for example. As respects the present invention, however, any fluid or semi-fluid material may be received within the compartment **14** and, for convenience, such materials may be referred to hereinafter generally as fluent materials. Examples of a semi-fluid are granular and pulverulent matter such as sand or grit, cement, plaster, etc. Evidently, fluent materials are non-rigid and conform to the configuration of the compartment **14**, wherefore the lateral pressure forces of such material act against the side wall structure **11** at the center of pressure thereof (center of pressure being the point at which the resultant of all of the pressure forces of a fluent material acts against an upwardly extending wall containing the same and which, as is well known, approximates a location that is one-third of the height of the material as measured upwardly from the bottom surface thereof).

The container **10** is formed of a synthetic plastic material and any such material customarily used for this purpose may be employed including the polyolefins as, for example, low and high density polyethylene, polypropylene, copolymers, polyvinyl chloride, and other moldable materials which are usually thermoplastic in character. Accordingly, any conventional molding technique may be employed to fabricate the plastic container **10** including blow molding, rotational molding, thermoforming, solid phase forming and vacuum forming—individually or in combinations thereof. Also, the container may have either a large opening at the top thereof, sometimes known as a "full open head" or a small opening at its upper end, sometimes known as a "tight head." Since the container **10** is intended to be stacked with a plurality thereof one upon another, the top wall **12** and bottom wall **13** of each container may be provided with stabilizing means to facilitate such stacking as, for example, an upwardly protruding por-

on **15** provided along the top wall **12** and an upwardly re-essed portion **16** provided along the bottom wall **13**, as hown best in FIGURE 2.

Circumjacent the side wall structure **14** intermediate he top wall **12** and bottom wall **13** is a relatively stiff band **7** that snugly engages the side wall structure **11** and is ffective to reinforce the same. The reinforcing band **17** ıay be made of any suitable material or laminates of vari-us materials including metal, fiber, paper, other plastics, tc., and in the form shown is made of a metal such as steel 100 lb. steel tin plate, for example). The band has inter-ɔcking transverse edge portions, shown best in FIGURE and generally denoted **18** and **19**, which secure it in the nnular form illustrated. In this respect, the transverse dges of the band **17**, which is of definitive length, are ırned upon themselves to provide a hook-shaped con-guration, and since the terminal edges of such edge por-ons are directed in opposite directions, they simply inter-ɔck with each other, as shown in FIGURE 3, when the and **17** is circumjacent the side wall structure **11** of the ontainer. As will be observed in FIGURE 1, the band **17** djacent the edge portions **18** and **19** thereof is reduced lightly in vertical width or dimension, as shown at **20** and **1**.

The purpose of such reduction in vertical dimension to obviate interference between the overlapped trans-erse edge portions **18** and **19** of the band and the longi-ıdinal edge portions thereof which are rolled or turned ıterally outwardly to a slight extent, as is most evident in 'IGURE 2. Such outwardly turned top and bottom longi-ıdinal edge portions of the band **17** are respectively de-oted with the numerals **22** and **23** and they extend entirely long the length of the band except for the areas **20** and **21** f reduced dimension adjacent the seam-defining inter-ɔcking transverse edges **18** and **19**. The longitudinal edge ortions **22** and **23** respectively face outwardly projecting ibs or ridges **24** and **25** provided by the side wall structure **1** and define abutment surfaces therewith effective to posi-vely locate the band along the side wall structure and re-st relative translation displacements therebetween in axial irections defined between the top and bottom walls of the ontainer.

Such constraining means may take other forms, such s the alternate constructions respectively shown in FIG-'RES 4 and 5. In FIGURE 4 the longitudinal edge por-ons of the reinforcing band are turned laterally inwardly ɔ as to be received within recesses formed in the side wall ructure of the container. Clearly the structural assem-lage illustrated in FIGURE 4 is very similar to the struc-ıre composition heretofore considered and, therefore, the ıme numerals are used to designate respectively corre-ɔonding components except that the suffix *a* has been add-d for purposes of differentiation. Accordingly, the rein-ɔrcing band **17***a* is seen tto have an upper longitudinal dge portion turned inwardly, as shown at **22***a*, so as to eat within the recess or inwardly projecting rib **24***a* pro-ided therefor in the side wall structure **11***a*.

The bands **17** and **17***a* are each confined against verti-al displacements by longitudinally disposed abutment ırfaces or locking means, but in the further modified con-ruction shown in FIGURE 5, the constraint upon the and is imposed by axially or vertically disposed abutment ırfaces. Again, the structural assemblage is similar to ıose heretofore considered and the same numerals are sed to designate respectively corresponding elements ex-ɛpt that the suffix *b* is added. Accordingly, the side wall ructure **11***b* of the container **10***b* is provided with a lurality of angularly-spaced, vertically-disposed flutes or ɛcesses **24***b* that project inwardly toward the interior of ıe container. Cooperative with such recesses **24***b* are a lurality of inwardly projecting ribs or corrugations **22***b* ɔrmed along the reinforcing band **17***b* so as to respective-' seat within the recesses **24***b*. Any suitable number of ıch cooperative recesses **24***b* and ribs **22***b* may be used. Evidently, such recess formations along the side wall

11*b* of the container and rib formations along the reinforc-ing band **17***b* tend to further stiffen and thereby strengthen the container so as to resist lateral deformation of the side wall thereof. In a somewhat analogous manner, the longitudinally disposed ribs or projections **24**, whether in-wardly or outwardly directed, and the mating edge por-tions **22** of the band similarly stiffen and further strengthen the container. It will be appreciated that other arrange-ments may be used to constrain the reinforcing band along the side wall of the container, including sufficient friction, an adhesive anchorage of the band to the container side wall, and embedding the band within the side wall during the molding process to make the band integral with the container.

Similarly, various arrangements may be used to inter-connect the transverse edge portions of the reinforcing band other than the interlocking seam or similar type con-nection illustrated in FIGURE 3 and heretofore described. Illustrative of such variants is the arrangement illustrated in FIGURE 6 in which such transverse edge portions of the band are secured together by a plurality of rivets which can be pre-inserted and then locked in place after the band is in position about the side wall of the con-tainer. Again, the structural composition is similar to those heretofore considered so that the same numerals are used to identify the respectively corresponding compo-nents except that the suffix *c* is added thereto. Accordingly, the side wall structure **11***c* of the container **10***c* is provided with a circumjacent reinforcing band **17***c* having over-lapping transverse edge portions **18***c* and **19***c* locked to each other by a plurality of rivets **26**. If the rivets **26** are pre-inserted, the outer ends thereof may be flattened, as shown, after the band **17***c* has been drawn about the con-tainer side wall.

Still other arrangements might be employed for secur-ing the edges of the reinforcing band to each other such as spot or seam welding, solder, and adhesives including hot-melt types. Further, the transverse edges of the band can be secured to each other prior to the band being posi-tioned in circumjacent relation with the side wall of the container rather than subsequent thereto as heretofore described, and in such case band positioning may be accomplished by cooling the plastic container so as to cause temperature shrinkage thereof and by then sliding the endless band into position along the side wall of the container.

It will be evident in FIGURE 1 that the reinforcing band is symmetrically located along the container between the top and bottom walls thereof, and that the band is relatively wide. Thus, the band reinforces the container along the portions of the side wall thereof most likely to deform as a consequence of the pressure force of the container contents operative thereagainst and as a conse-quence of any compressive force applied to the side wall because of a plurality of such containers being stacked one upon another.

Further in this respect, the band **17** has a width of the order of one-half of the total height of the container be-tween the top and bottom edges of the side wall thereof, and the band extends downwardly to enclose the center of pressure of any fluent material filling the compartment **14**, and which center of pressure is at a position about one-third of the height of the container as measured up-wardly from the bottom wall thereof. Accordingly, when containers are stacked one upon another, the aggregative forces operative upon the side wall of the container in-cluding the internal pressure forces of the fluent material active outwardly thereagainst and the compressive forces transmitted thereto because of the external weight sup-ported by the container are effectively resisted by the reinforcing band in association with the side wall struc-ture, which band is located at the area where deforma-tion is most likely to occur. Although such aggregative forces ordinarily tend to deform the side wall outwardly,

the band also reinforces the container side wall against inward deformation.

The band **17** performs a further advantageous function in that it provides a convenient location at which to include container decoration, advertising, instructions or other information regarding the product and its use. In this respect, the plastic materials from which the containers are usually fabricated do not lend themselves to surface printing and decoration without special surface treatment either by flame, electronic, or mechanical techniques. With the reinforcing band **17**, simple and inexpensive lithography can be used to provide the necessary or desirable matter on the container since such matter is simply printed onto the stock sheets from which the bands are formed prior to their being cut, rolled, and fabricated as necessary to enable the transverse ends of the band to be secured to each other and to enable the band to cooperate with the positioning and constraining means provided by the container.

A very significant savings in material is effected by use of the invention because in the usual case the amount of plastic material required is reduced to the order of one-third to two-thirds that which otherwise would be necessary. For example, a thick wall, free standing container requiring about three pounds of plastic material can have a thin wall counterpart requiring only one to two pounds of plastic (depending upon the particular use) and a band formed of 28 to 30 gauge steel without appreciable change, if any, in the strength of the container.

While in the foregoing specification an embodiment of the invention has been set forth in considerable detail for purposes of making a complete disclosure thereof, it will be apparent to those skilled in the art that numerous changes may be made in such details without departing from the spirit and principles of the invention.

What is claimed is:

1. A container having a bottom wall, a top wall and side wall structure extending therebetween and defining a compartment therewith for the receipt of fluent material aid the like, said side wall strtucure being plastic and exhibiting a tendency to deform laterally under stress as when a plurality of filled containers are stacked one upon another, a relatively stiff reinfonrcing band in engagement with the outside of said side wall structure and constraining the same against any such deformation, said band being substantially medially disposed with respect to the top and bottom walls of said container and sufficiently wide to extend downwardly below the center of pressure of any such material filling said compartment, and means for positively locating said band along said side wall structure so as to resist relative translational displacements therebetween at least in the axial directions defined between the top and bottom walls of said container, said band being circumjacent said side wall structure and said means for locating said band therealong including cooperative abutment surfaces respectively provided by said side wall structure and band and being spaced axially of the container, said abutment surfaces comprising a laterally turned edge portion provided by said band along each free edge thereof and a pair of axially spaced ribs provided by said wall structure in facing contact with said laterally turned edge portions.

2. The container of claim **1** in which each of said laterally turned edge portions and each of said ribs extends radially outwardly.

3. The container of claim **1** in which each of said laterally turned edge portions and each of said ribs extends radially inwardly.

4. A container having a bottom wall, a top wall and side wall structure extending therebetween and defining a compartment therewith for the receipt of fluent material and the like, said container being plastic and the side wall structure thereof being characterized by exhibiting a tendency to deform laterally under stress as when a plurality of filled containers are stacked one upon another, a relatively stiff reinforcing band circumjacent said side wall structure in substantially contiguous relation therewith and constraining the same against any such deformation, said band being disposed intermediate said top and bottom walls and being of definitive circumferential length with the opposite ends thereof secured to each other, and means including cooperative abutment surfaces provided by said side wall structure and band for positively locating said band along said side wall structure so as to resist relative translational displacements therebetween at least in the axial directions defined between the top and bottom walls of said container, said abutment surfaces being spaced axially of the container and being substantially continuous along the circumferential length of said band, said oppoiste ends of the strip forming said band being overlapped and defining a vertically disposed lock seam maintaining said band in said circumjacent relation with said side wall structure, said abutment surfaces comprising a laterally turned edge portion provided by said band along each free edge thereof and a pair of axially spaced ribs provided by said side wall structure in facing opposition with said laterally turned edge portions and said band being reduced in width adjacent said lock seam so that said laterally turned edge portions do not interfere therewith.

5. The container of claim **4** in which each of said laterally turned edge portions and each of said ribs extends radially outwardly.

6. The container of claim **4** in which each of said laterally turned edge portions and each of said ribs extends radially inwardly.

7. A container having a bottom wall, a top wall and side wall structure extending therebetween and defining a compartment therewith for the receipt of fluent material and the like, said side wall structure being plastic and exhibiting a tendency to deform laterally under stress as when a plurality of filled containers are stacked one upon another, a relatively stiff reinforcing band of definitive circumferential length disposed intermediate said top and bottom walls of said container and being in coaxial engagement with the outside surface of said side wall structure and constraining the same against any such deformation, and means including cooperative abutment surfaces provided by said side wall structure and band for positively locating said band along said side wall structure so as to resist relative translational displacements therebetween at least in the axial directions defined between the top and bottom walls of said container, said abutment surfaces comprising a first radially turned edge portion provided by said band along a free edge thereof and a first rib provided by said side wall structure in opposed facing engagement with said laterally turned edge portion.

8. The container of claim **7** in which said abutment surfaces further comprise a second radially turned edge portion provided by said band along the other free edge thereof and a second rib provided by said side wall structure in opposed facing engagement with said second laterally turned edge portion, said first and second cooperative abutment surfaces being axially spaced with respect to said container.

9. The container of claim **8** in which said side wall structure is provided with a plurality of angularly spaced and axially disposed recesses and said band is provided with a plurality of angularly spaced and axially disposed projections generally conforming to said recesses and being respectively seated therein, the axially spaced extremities of each recess and the projection seated therein constituting the aforesaid cooperative abutment surfaces.

10. The container of claim **8** in which said axially spaced abutment surfaces are substantially continuous and extend circumferentially with respect to said container.

11. The container of claim **10** in which each of said laterally turned edge portions and each of said ribs extends radially outwardly.

12. The container of claim **10** in which each of said

laterally turned edge portions and each of said ribs extend radially inwardly.

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U.S. Cl. X.R.

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