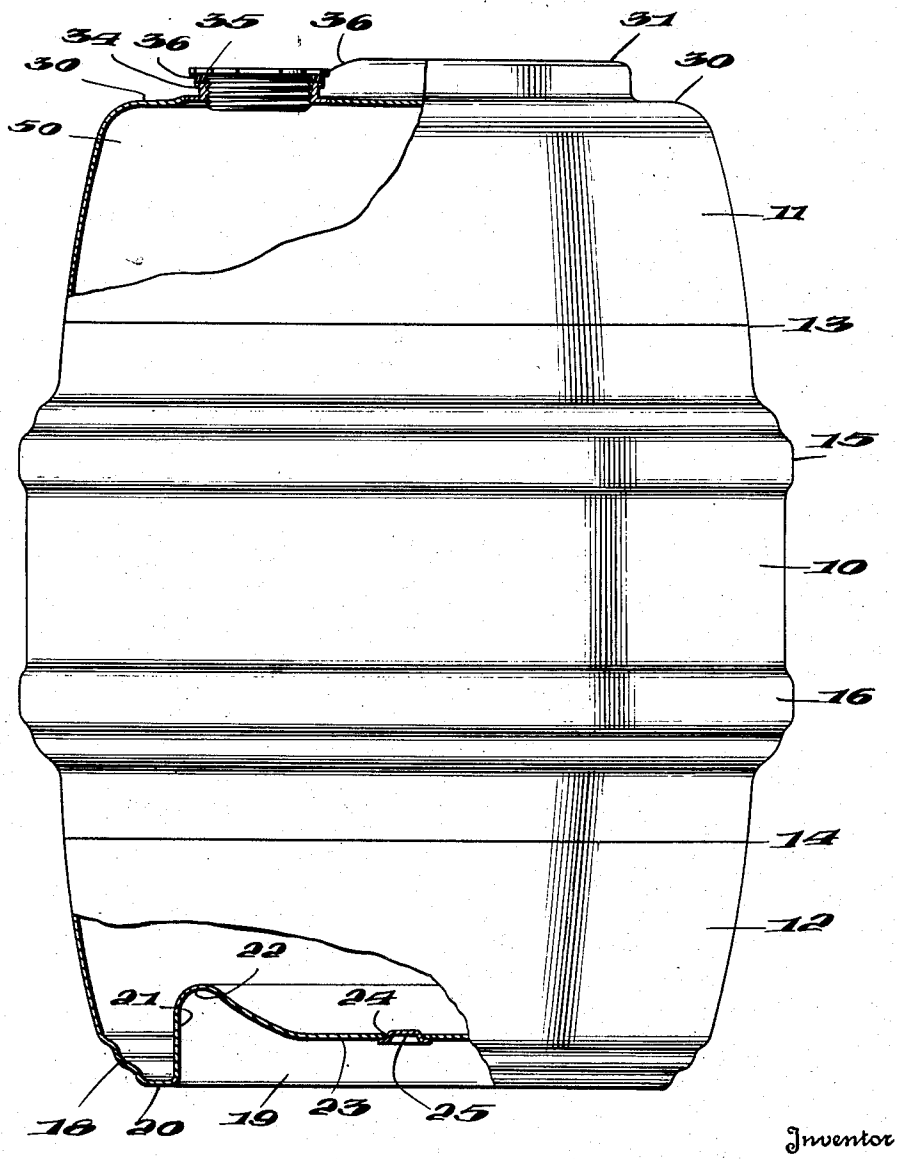
Dec. 8, 1953 G. TRAUTVETTER 2,661,872

CONTAINER

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Fig. 1.



Inventor
GEORGE TRAUTVETTER,

By Robert B Pearson

ATTORNEY

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Fig. 2.

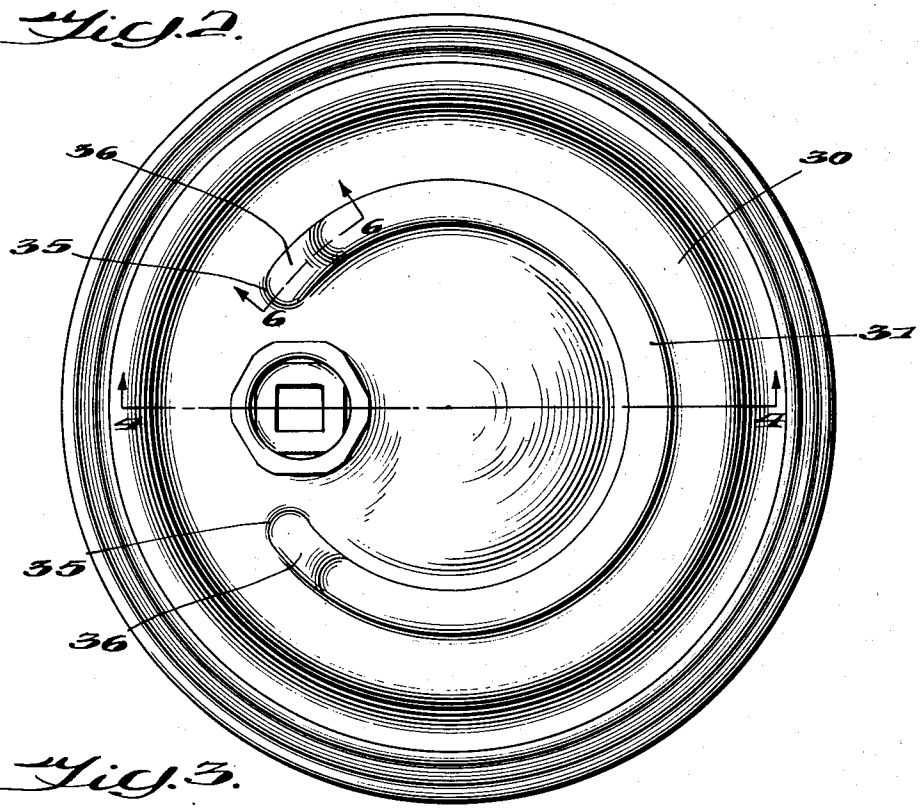
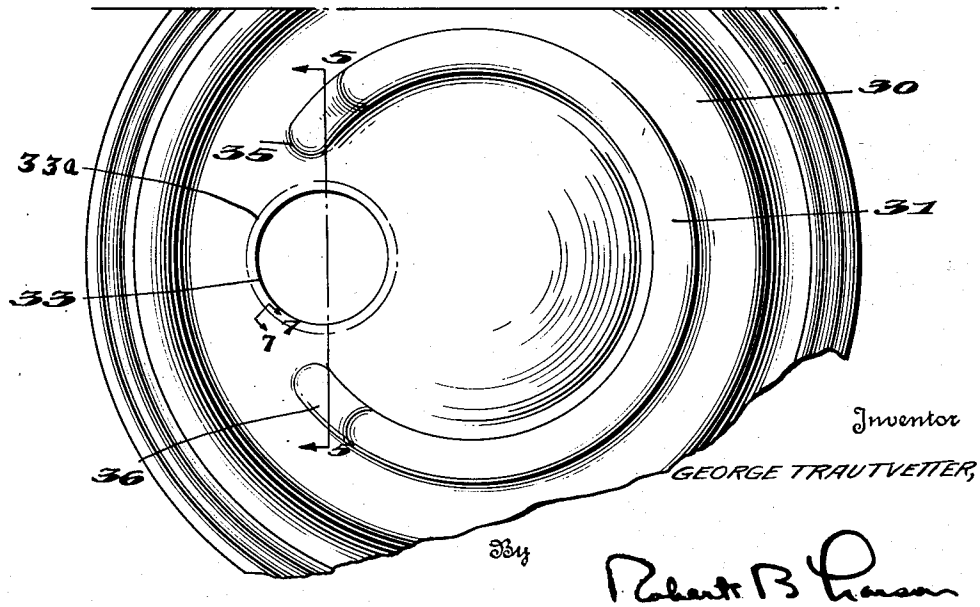


Fig. 3.



Inventor
GEORGE TRAUTVETTER,
By
Robert B Pearson
ATTORNEY

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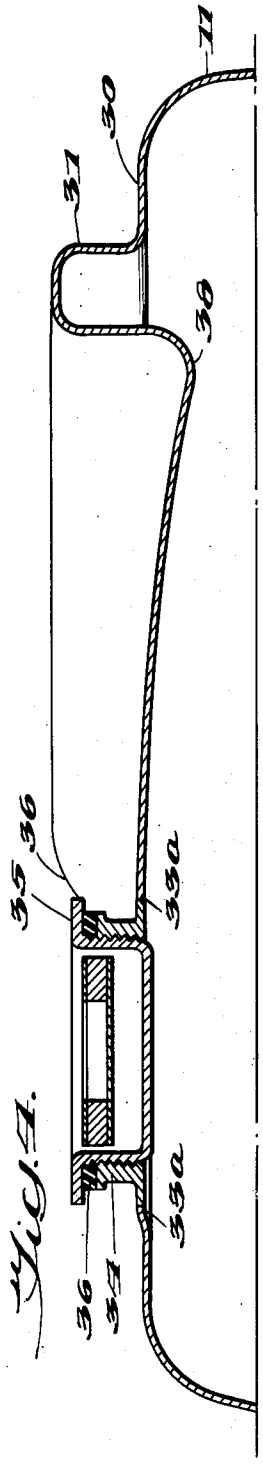


Fig. 4.

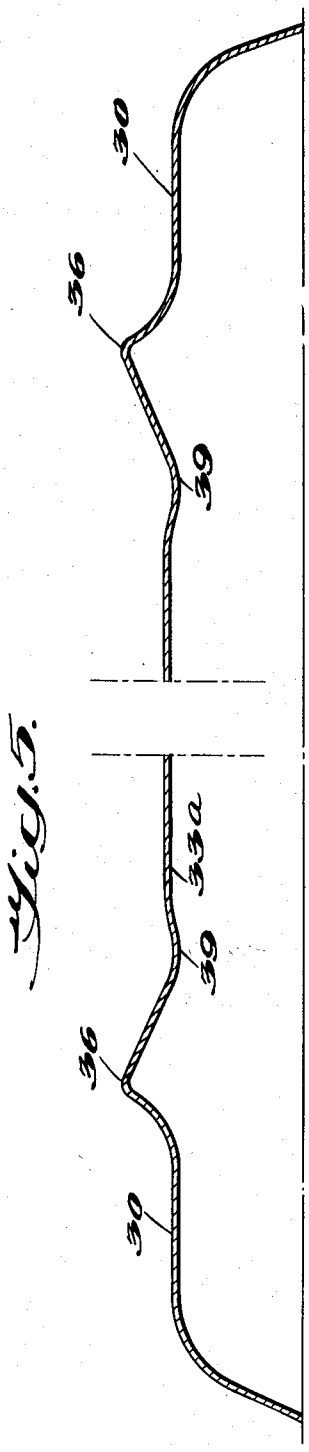


Fig. 5.

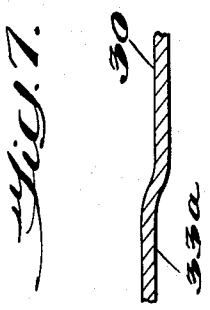


Fig. 7.

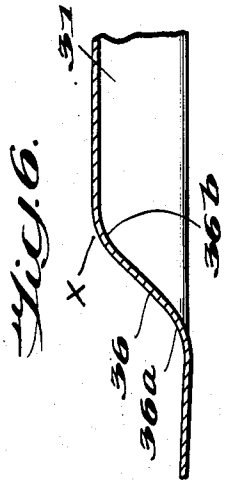


Fig. 6.

Inventor

GEORGE TRAUTVETTER,

Robert B Pearson

ATTORNEY

Patented Dec. 8, 1953

2,661,872

UNITED STATES PATENT OFFICE

2,661,872

CONTAINER

George Trautvetter, Jenkintown, Pa., assignor to Heintz Manufacturing Company, Philadelphia, Pa., a corporation of Pennsylvania

Application October 24, 1949, Serial No. 123,225

4 Claims. (Cl. 222—143)

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This invention relates to containers, and more particularly to metallic containers of the type used for transporting chemicals in liquid form, although many of the features which are found for the first time in the container to be described in this specification will be useful in other types of containers, and such use is considered to fall within the inventive concept which is about to be described.

Chemicals in liquid form are transported in this country almost exclusively in large glass bottles, protected by wood crates, and known as carboys. The cost and breakage rate involved is high, and for many years industry has been searching for a new type of container which could supplant the old ones, and which would be more convenient to handle, would stand rough usage and handling, would not be attacked chemically by the substances transported, and which could be produced economically. Of outstanding importance in any such container are a combination of features which prior inventors have been unable to combine into a single container, namely stacking by use of mating parts on adjacent stacked containers, and the ability of the container to be emptied of the last drop of contents without the need for putting the container through a series of troublesome and time consuming maneuvers such as rolling, shaking, tumbling, etc. Other important features incorporated into the present invention along with the two outstanding ones just referred to are grips for convenient handling without adding any parts, and location of a pouring spout so that not only is the complete emptying feature provided, but also the spout and its plug are protected at all times against blows which could so damage these parts as to render the entire container unuseable.

The important feature of complete emptying which has already been discussed is of great value not only in assuring rapid emptying of the entire chemical contents, but equally important, the emptying of washing fluids.

It is an important object of the invention to provide a container having the advantages set forth above.

Another outsanding object of the invention is the provision of a container having in combination the advantages of mating stacking structure and complete emptying without the trapping of fluids, during emptying, in portions of the containers which facilitate stacking.

A further object of the invention is to provide a container which can be made cheaply of corrosion resisting materials such as stainless steel by stamping operations and the welding together of several sections to make the container.

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Another object of the invention is the provision of a container from thin stainless steel in such a manner that the container has great strength and the ability to withstand the dropping and other rough handling which go along with shipping by commercial carriers. In connection with this object of the invention, a container made in accordance with the preferred form of the invention to be described herein, has withstood the following severe tests required by the Interstate Commerce Commission, and as a result was approved by that body for the interstate shipment of liquid chemicals:

In the drop tests the container was filled to 98% capacity and was dropped six feet, striking

a. diagonally on plug on concrete floor,
b. on head opposite plug on concrete floor,
c. on a longitudinally welded seam on concrete floor,
d. on a circumferentially welded seam on an I bar rail,
e. on a longitudinally welded seam striking on an I bar rail,
f. on the juncture of longitudinally and circumferentially welded seams on an I bar rail, and
g. on a bottom weld striking on a three inch diameter steel ball mounted on a steel base with the top of the ball six inches above the floor.

In all of these drop tests, as well as in the other tests to be described, the container tested was made of 16 gauge stainless steel type 304, the seams being inert gas shielded gas welded. The plug was of the screw type with a polyethylene gasket, and the capacity of the container was 15 gallons, nominal. The empty container weighed 24 pounds.

The drop tests described above dented the container but not enough to render it unuseable, and the only leakage took place when a few drops of liquid escaped through the gasket on impact when the container was dropped on the head opposite the plug.

The container also passed successfully an immersion test in water while containing dry air under 80 lbs./sq. in. pressure, and a pressure test at the same pressure for five minutes. The gasket passed a test under a loading of 300 lbs./sq. in. A corrosion test with nitric aid was also passed.

The above and other objects of the invention will be more apparent from a study of the follow-

ing specification when taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a side elevational view of a container made in accordance with a preferred form of the invention, portions of the container being broken away to show details of the construction;

Fig. 2 is a top plan view of the container shown in Fig. 1;

Fig. 3 is a fragmentary view similar to Fig. 2, but showing the upper end of the container prior to the welding in place of the threaded pouring spout shown in Fig. 4;

Fig. 4 is a cross sectional view taken on line 4—4 of Fig. 2;

Fig. 5 is a cross sectional view taken on line 5—5 of Fig. 3;

Fig. 6 is a fragmentary sectional view taken on line 6—6 of Fig. 2; and

Fig. 7 is a fragmentary sectional view taken on line 7—7 of Fig. 3, the scale being double that of Figs. 4–6.

Referring now to Fig. 1 of the drawings, there is shown a container made up of a central portion 10 with upper and lower end portions 11 and 12 joined thereto by welding along lines 13 and 14, respectively. The central section 10 comprises a strip formed with a pair of rolling surfaces 15 and 16, and having its ends welded together along a longitudinally extending line which is not shown. The configuration of central section 10 is not novel, the important considerations with respect to this section being that the rolling surfaces are formed in such manner that no corners are formed in which fluid can become entrapped during emptying, and that the marginal portions of the section blend in smoothly with the curves of the end portions 11 and 12. It will be seen that the central section is identical at each end so that it does not matter which end receives an upper end 11 and which end receives a lower end section 12.

The lower end section 12 is formed of sheet material by stamping or other suitable operations, and is dimensioned at its upper edge so as to meet the edge of the central section in edge to edge engagement, and to merge smoothly into the line of the center section. The outer wall of the lower section 12 flares outwardly, and near its extreme lower end, it is provided at 18 with circumferential strengthening corrugations. A circular central identation 19 defines the inner limit of the flat, annular lower surface of the section 12 as shown at 20.

The indentation or cavity 19 has side wall 21 extending generally parallel with the axis of the container to a point 22 whence the wall 21 curves downwardly to a central flat portion 23 which is spaced above the plane of the lowermost surface 20 of the section. Central flat portion 23 has a hole in its center which is utilized for the insertion of welding instruments into the interior of the container during manufacture, after which the hole, shown at 24, is closed by a permanent closure 25 which is seated in the hole by a press fit and is then welded about its periphery to the outer surface of the container.

The cavity 19 in the lower surface of the container is used in stacking and is dimensioned to receive a mating circular rib on the upper surface of the upper end section 11 as will now be discussed in greater detail.

The lower portion of the upper end section 11 is shaped and dimensioned to meet the upper edge of the central section 10 in edge to edge engagement and to merge smoothly into the curve of this section.

The upper portion of upper end section 11 must be formed with great care, as it is the novel and ingenious configuration of this part of the container which is of first importance in providing the desirable features of the container.

The side walls of the end section 11 curve inwardly smoothly and merge into an annular flat portion 30 which extends in a complete circle about the upper end of the container, and which receives the flat, annular surface 20 of the container which is stacked above. The provision of these two flat surfaces on each container is of much importance in permitting the stacking of a number of containers in a self supporting stack which does not wobble dangerously.

Stacking is also made secure by an upstanding rib 31 on the upper end of end section 11, immediately inwardly of the flat surface 30. The outer, axially extending surface of rib 31 is located and dimensioned so as to fit snugly, but freely slidable within the indentation 19 in the bottom of the container stacked above. Rib 31 does not complete an entire circle, as it is interrupted as is evident from Figs. 2 and 3, where the opening 33 for the pouring spout 34 is located. This pouring spout is welded into its opening, and is internally threaded to receive a threaded plug 35 which seals the pouring opening with the aid of a suitable annular gasket 36. The plug has exterior and interior configurations which permit the use of different types of wrenches for tightening and removing the plug. As can be seen from Fig. 2, the opening 33 is positioned, and the plug is dimensioned so that the plug does not extend outside of the extension of the circle of the outer surface of the rib 31, otherwise it would interfere with stacking.

The uppermost surface of rib 31 lies substantially in a plane normal to the axis of the container over most of the length of the rib, and each end of the rib slopes downwardly from this plane to merge smoothly into the upper surface of the end of the container at 35. The sloping portion at each end of the rib is shown at 36 (see Fig. 6). It is important that the angle which surfaces 36 make with a plane normal to the axis of the container not be sufficiently steep to permit trapping of liquid in the corner 36b shown in Fig. 6, and in the container which was tested as described herein, this angle was 45 degrees. The curves at each end of these surfaces 36 were formed about ¾ inch radii. For purposes of explanations which will follow, two points X can be located by extending the surfaces 36 and the plane of the upper edge of rib 31 by imaginary lines, these points X being located at the intersection of these lines as shown in Fig. 6.

Inwardly of rib 31, the upper surface of end section 11 curves upwardly from a low point 38 (Fig. 4) located below the level of surface 30, to the plane of the opening 33, the plane of this opening being raised above all other portions of the end section 11 except for the rib 31 and its sloping end portions. Looking at Fig. 4, it will be seen that the inner surface 33a of the container immediately surrounding the opening 33 is raised above the inner surface of the flat area 30, and above all other portions of the curve extending from point 38 to the area 33a, Fig. 5 shows a section taken near the center point of opening 33, the section line of this view cutting

through the sloping surfaces **36**. This view shows how the inner surface area **33***a* is raised, the area **39** being generally on a level with the areas **30**. The sloping surfaces **36** terminate at the level of and blend into the area **39**, so that they terminate lower than the area **33***a*. The importance of these various levels will be discussed presently. Fig. 7 shows in an enlarged manner the extent of the raising of area **33***a* over the area **30**.

From the foregoing and a study of the drawings, it will be seen that the raised area **33***a*, as defined by the broken line **33***b* around the opening **33** (Fig. 3), provides a funnel-like configuration when the container is inverted during emptying.

The depression **38** located opposite the pouring opening provides a convenient hand grip when one hand of a user is placed about the adjacent portion of rib **31** with the fingers extending into depression **38**, while the other hand grips a corresponding portion of the lowermost portion of the container, with the fingers of that hand extending into the indentation **19** and pressed against wall **21**.

The positioning of opening **33** and area **33***a* are quite critical, their location being governed by several factors. They cannot extend radially beyond the circle formed by extending the line of the outer vertical surface of rib **31**, for the raised area **33***a* cannot break the flatness of stacking surface **30** upon which the surface **20** of the next higher stacked container must rest. Neither the pouring spout nor the plug **35** may extend beyond this circle for they must not interfere with stacking, as they would if they blocked free sliding over rib **31** by the lower end of the container stacked above. On the other hand, the radially outermost limits of opening **33** must not be located closer to the axis of the container than a straight line connecting the radially outermost points on the two surfaces **36**, as liquid could then be trapped in the end portions of rib **31**. In the embodiment shown, the section line **5—5** on Fig. 3 passes just inwardly of the center of opening **33** and normal to a radius passing through the center of opening **33**, and from the location of this line it can be seen that a similar line passing through the center of opening **33** would pass approximately through the center of each sloping surface **36**.

Rib **31** should be as long as possible without violating the requirement just discussed, since the steadiness of the stacking depends to a considerable extent upon the extent of the contiguous areas of wall **21** and the outer wall of rib **31**. The angle of each sloping wall **36** cannot be too steep or trapping at the intersection of walls **36** and the upper surface of rib **31** will result. If this angle is too flat, the size of rib **31** becomes decreased unnecessarily. An angle of 45° for walls **36** proved to be the most efficient angle, all factors being considered. Because of the fact that the liquid caught by rib **31** during emptying escapes from the rib along the inner surfaces of sloping rib portions **36**, the rib should blend into these sloping surfaces by a gentle curve. In the container tested as described herein, the curves **36***a* and **36***b* were formed on ¾ inch radii. The lateral edges of surfaces **36** also curve into the side surfaces of rib **31**.

One other important requirement is that there not be any portions of the interior surface of the container located radially outwardly of the stacking surface **30**, which are higher than the interior surface of this area, as this would permit trapping of fluid in such raised places.

The following are the dimensions and various measurements of the container which was tested as described herein:

Overall length	22 inches
Greatest overall width	17 inches
Length of lower section **12**	5¼ inches
Length of central section **10**	11 inches
Length of upper end section	5¾ inches
Greatest depth of indentation **19**	2⅛ inches
Width of indentation **19**	9$\frac{13}{16}$ inches
Diameter of circle forming outermost surface of rib **31**	9⅞ inches
Surface **30** to uppermost surface of rib **31**	$\frac{15}{16}$ inch
Outside width of rib **31**	$\frac{15}{16}$ inch
Angle between points X	102 degrees
Diameter of opening **33**	3 inches
Greatest diameter of flat portion **33***a*	3⅜ inches
Distance from axis to center of hole **33**	3¼ inches
Central area of upper end **11** from point **33** to surface **33***a* is spherical, formed on radius of	14 inches
Amount of raising of surface **33***a* over plane of surface **30**	$\frac{1}{16}$ inch
15 gallon level below plane of surface **30** approx	1$\frac{7}{16}$ inches

In emptying liquid from the container shown, the plug may be removed either by a male or female type of wrench. The container is then tilted as by rotating Fig. 1 counterclockwise from the upright position. If the container is held with its axis at approximately 45° above horizontal, the last bit of liquid will collect in the "corner" **50** of the container adjacent the pouring opening. No liquid can remain in the rib **31** because of the downward sloping disposition of the upper end of the container, and because of the angle of end portions **36** of the rib. From this position, the container is slowly tilted further to the completely inverted position during which the remaining liquid will run directly to the pouring opening and out of the container, not a single drop being left.

If the container is emptied by turning it immediately to an inverted position, the contents would drain out except for a small portion remaining in the rib **31**. It is a simple matter to tilt the container toward an upright position with the pouring opening down, just sufficiently to permit the remaining contents to drain out of the rib **31** along the interior surfaces of sloping rib portions **36**, until the remaining liquid collects in the "corner" **50**, after which it is easily drained as already described.

Because of the precise location of the pouring opening relative to the ends of rib **31** and the provision of raised portion **33***a*, the last bit of liquid remaining in "corner" **50** runs into the portion **33***a* and out of the opening rather than into the rib **31** during the final emptying operation, and it is impossible to trap liquid in any portion of the container.

The container described and shown herein provides for the first time a combination of complete emptying, interfitting stacking, ruggedness, light weight, relatively low cost, and ease of production in a container.

As the outer lateral surface of rib **31** can be in other configurations than circular, for example it could be along the major portion of the perimeter of a square, pentagon, hexagon, etc.,

as long as the corners are somewhat rounded to facilitate fabrication and to prevent trapping, the claims refer to the lateral wall of the rib as having the configuration of or lying along the major portion of the perimeter of a closed, plane-geometric figure.

The embodiment of the invention as shown is one which has been successful in practice, and while it is a preferred form of the invention, it is not intended to limit the invention thereto. The invention is capable of numerous variations from the preferred embodiment, and also such variations falling within the scopes of the appended claims are considered to embody the inventive concept.

I claim:

1. End structure for a container of relatively thin material, comprising a male stacking element in the form of a relatively narrow discontinuous rib extending from the main portion of the end of the container in an axial direction, the outer lateral wall of said rib having the configuration of a major portion of the perimeter of a closed, plane-geometric figure, said discontinuity providing the rib with spaced end portions, a pouring opening located between said end portions and wholly within the perimeter of said closed figure, and a plane outer stacking surface of substantial width and area lying normal to the longitudinal axis of the container and positioned radially outwardly of and surrounding said figure, said rib being of gradually decreasing height in said end portions until its interior surface merges into the interior surface surrounding said opening and at a level at least as low as the level of the interior surface area corresponding in location to said outer stacking surface, the inner lateral wall of said rib being elongated in an axial direction in the vicinity of a point located diametrically opposite from the pouring opening, to provide an indentation in the end of the container which is useful as a hand grip during handling of the container.

2. End structure for a container of relatively thin material, comprising a male stacking element in the form of a relatively narrow discontinuous rib extending from the main portion of the end of the container in an axial direction, the outer lateral wall of said rib having the configuration of a major portion of the perimeter of a closed, plane-geometric figure, said discontinuity providing the rib with spaced end portions, a pouring opening located between said end portions and wholly within the perimeter of said closed figure, and a plane outer stacking surface of substantial width and area lying normal to the longitudinal axis of the container and positioned radially outwardly of and surrounding said figure, said rib being of gradually decreasing height in said end portions until its interior surface merges into the interior surface surrounding said opening and at a level at least as low as the level of the interior surface area corresponding in location to said outer stacking surface, the inner lateral wall of said rib being elongated in an axial direction in the vicinity of a point located diametrically opposite from the pouring opening to provide an indentation in the end of the container which is useful as a hand grip during handling of the container, said opening being positioned so that any line joining the two end portions of said rib lies closer to the axis of the container than the radially outermost point of said opening, the level of the interior surface of the container immediately surrounding the opening being higher than any other interior portion of the container except those areas forming part of said rib.

3. End structure for a container of relatively thin material, comprising a male stacking element in the form of a relatively narrow discontinuous rib extending from the main portion of the end of the container in an axial direction, the outer lateral wall of said rib having the configuration of a major portion of the perimeter of a closed, plane-geometric figure, said discontinuity providing the rib with spaced end portions, a pouring opening located between said end portions and wholly within the perimeter of said closed figure, and a plane outer stacking surface of substantial width and area lying normal to the longitudinal axis of the container and positioned radially outwardly of and surrounding said figure, said rib being of gradually decreasing height in said end portions until its interior surface merges into the interior surface surrounding said opening and at a level at least as low as the level of the interior surface area corresponding in location to said outer stacking surface, the inner lateral wall of said rib being elongated in an axial direction in the vicinity of a point located diametrically opposite from the pouring opening to provide an indentation in the end of the container which is useful as a hand grip during handling of the container, the remaining portion of the area of the end of the container lying inwardly from said rib having the configuration of a portion of a sphere, with the interior surface of said area blending smoothly into the area immediately surrounding said pouring opening, said opening being positioned so that any line joining the two end portions of said rib lies closer to the axis of the container than the radially outermost point of said opening, the level of the interior surface of the container immediately surrounding the opening being higher than any other interior portion of the container except those areas forming part of said rib.

4. End structure for a container of relatively thin material, comprising a male stacking element in the form of a relatively narrow discontinuous rib extending from the main portion of the end of the container in an axial direction, the outer lateral wall of said rib having the configuration of a major portion of the perimeter of a closed, plane-geometric figure, said discontinuity providing the rib with spaced end portions, a pouring opening located between said end portions and wholly within the perimeter of said closed figure, and a plane outer stacking surface of substantial width and area lying normal to the longitudinal axis of the container and positioned radially outwardly of and surrounding said figure, the outer edge of said plane outer stacking surface being spaced a substantial distance inwardly and above the portion of said end structure having the greatest diameter, the intermediate portion of the end structure having a smooth, inwardly curving configuration providing free flow of liquid during emptying, high resistance to damage by dropping, and ready rolling of the container end over end, said rib being of gradually decreasing height in said end portions until its interior surface merges into the interior surface surrounding said opening and at a level at least as low as the level of the interior surface area corresponding in location to said outer stacking surface, said opening being positioned so that any line joining the

two end portions of said rib lies closer to the axis of the container than the radially outermost point of said opening, the level of the interior surface of the container immediately surrounding the opening being higher than any other interior portion of the container except those areas forming part of said rib.

GEORGE TRAUTVETTER.

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