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(54) A method for producing a sheet metal container, such a container and an apparatus for performing the method

(57) The container is of sheet metal and comprises a shell (1) of a single layer of the sheet material, a joint (16) extending from the top of the shell to its base, which shell (1) constitutes a side wall (2) of the container. The container comprises also a rim at the top of the container and a mounted base (9) of sheet metal. The shell (1) extends in the base area of the container from the side wall (2) radially through a curvature (12) toward the centre of the base and in to the joint (10) between the shell (1) and the mounted base (9), the shell (1) forming an annular base area (13) around the mounted base (9).

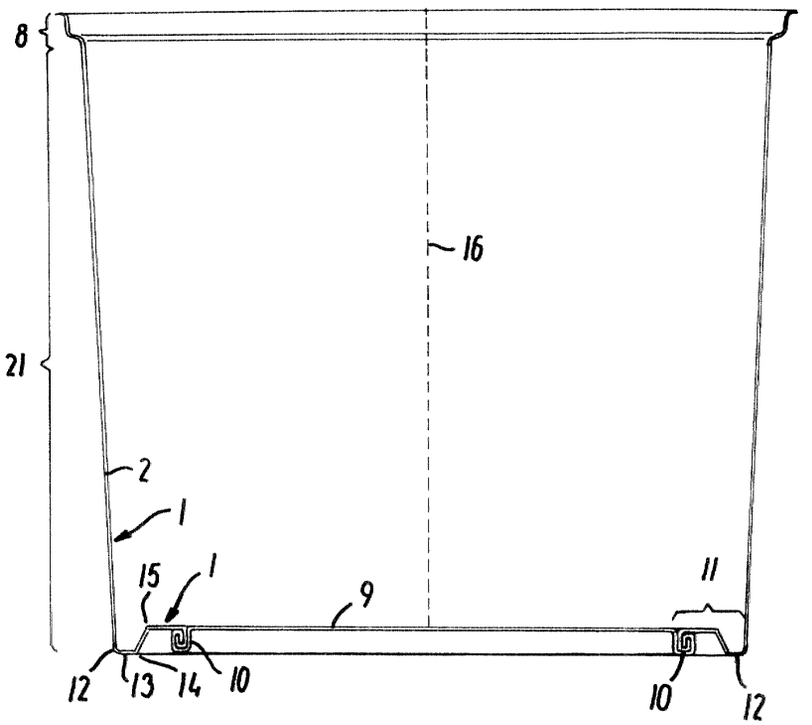

FIG.3

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Description

[0001] The invention relates to a method for producing a sheet metal container, including formation of a shell by bending an essentially square, preferably rectangular, piece of sheet metal and joining two essentially parallel lateral edges of the sheet material, which sides thus meet, expansion of the shell, narrowing and flanging of a bottom portion of the shell and mounting of a base of a corresponding sheet material. The base is essentially plane.

[0002] This is a known way to produce this kind of containers, e.g. used for transport and retail sale of paint and the like, i.e. a so-called technical sheet metal packaging. The joining of the two lateral edges of the shell material can e.g. be made by spot welding and the base can e.g. be mounted by seaming.

[0003] The invention relates further to a metal sheet container comprising a shell of a single layer of the sheet material, a joint extending from the top of the container to its base, which shell forms a side wall of the container, and comprising a rim at the top of the container and a mounted base of metal sheet.

[0004] The present invention is based on a container with a form as the one shown in WO 92/04248 where the base is formed by a method corresponding to the one shown in EP-A-0 377 985 by narrowing and flanging an end of a shell and mounting of a base, e.g. by seaming. Thus is obtained a container where the rim of the base is formed by a flange, and the side wall from the flange extends a little obliquely upwards and outward to a bend and then further essentially vertically upward. The diameter in the area with said bend has no particularly precise dimensions, and therefore, in order to stack both empty and filled containers and containers closed with a lid, relatively small dimensions with a large tolerance must be given, which is inconvenient when stacking more containers upon each other since such a stack might not be vertical, and thus under unfortunate circumstances will be likely to overturn. Said bend can furthermore form a weak point in relation to the large loads from above, e.g. when stacking many containers on top of each other.

[0005] The container described in WO 92/04248 has a mounted rim element at the top portion of the shell. This rim element is formed by punching a ring out of a square sheet blank, forming the ring and seaming it on to the shell. A surplus hereof will be a circular disc punched out of said ring.

[0006] WO 99/37420 describes a deep-drawn can body in which a hole is provided in the base, and a reversed cup is inserted and glued on to the rim of said hole or seamed there on to whereupon the flange is pressed up in the can. A beverage can with a refrigerating facility is thus obtained.

[0007] US-A-5 022 254 describes the expansion of a tubular can body by means of an expansion cartridge divided in segments.

[0008] DE-A-195 02 992 describes a pressure vessel, e.g. an aerosol can produced by rolling a sheet metal piece together with a large overlap (at least one turn) and seaming a base from within, the end portion of the vessel body being narrowed after the base has been inserted in the interior of the body, and seamed with the base, the flange being in the interior of the can.

[0009] EP-A-0 377 985 describes a method of and an apparatus for narrowing and formation of flanges in the end of a tubular can blank.

[0010] DE-A-34 02 197 describes an apparatus and a method for producing aerosol cans, whereby the seams of the bottom and the top are pressed into the can and a thus resulting "sandwich-flange" is bent over the seam.

[0011] US-A-3 921 848 describes an aerosol can where the base in an embodiment is formed such that the shell extends through a curvature and essentially vertically up to a seam where it is connected to a base sheet. Thus, the shell provides a single, narrow base area around the mounted base. The base of the aerosol can is designed in the same way as described above with reference to DE-A-34 02 197, the mounted base with the seam being pressed up in the container.

[0012] The object of the invention is to provide a container, a method for producing such a container and an apparatus for performing the method, whereby disadvantages of the prior art are avoided.

[0013] According to the invention, this is obtained by means a method which is characterized in that by the expansion of the shell, the portion of the shell immediately above the base portion is expanded essentially more strongly than the base portion, and that the more strongly expanded portion is pressed down around the base in order to provided an additional, annular base surface around the mounted base. It is thus possible by expansion of the portion of the shell immediately above the base portion to calibrate the diameter of the base portion. Thereby, the conicity of a conical container can be reduced in relation to that of known containers (approximation to a cylindrical form), which is an advantage as to strength. The strength of the corner of the container between the base and the side wall is further enhanced as the joint between the side wall material and the base material which is usually a flange joint or seam constitutes a weak point. By means of the invention, this joint is removed into the base surface of the container where the joint is less exposed to impacts, e.g. if a container falls by accident and lands on the edge between the base and the side wall.

[0014] In an embodiment where the top portion of the shell is provided with a rim element formed by an annular piece of sheet material of the same kind as that of the base, the mounted base is formed preferably of a piece of sheet material of a diameter equal to or smaller than a piece remaining from the formation of the rim element. An essential material saving is thus obtained since a piece of material which would be wasted in the

prior art is used for the base.

[0015] By a first expansion of the shell, the base portion of the shell is essentially not expanded, whereas the remaining portion of the shell is expanded whereby a shoulder-shaped transition is formed between the base portion and the remaining portion of the shell. This facilitates the later pressing down of the portion of the shell above the base portion.

[0016] The portion of the shell immediately above the base portion is expanded preferably to predetermined dimensions in connection with its being pressed down around the base. The said calibration is thus obtained of the diameter of the base portion.

[0017] In a preferred embodiment of the method, a top portion of the shell is expanded essentially less than a central part of the shell during the expansion of this central part, and subsequently the top portion is expanded and flanged separately. It is thus possible to obtain a very heavy deformation of the top portion of the shell, either with a view to mounting a rim element or with a view to rolling the top portion of the shell in order to provide an integrated rim reinforcement.

[0018] The object is further obtained by a container which is characterized in that the shell in the base area of the container from the side wall extends through a curvature and radially toward the centre of the base and to the joint between the shell and the mounted base, whereby a part of the shell forms two annular base areas around the mounted base, a radially exterior of the two base areas being situated in the bottom level of the container, and the radially interior of the two base areas being situated at a higher level. Both annular base areas have a radial extension and the radially interior base area extends thus a distance in a radial direction away from the joint.

[0019] In an embodiment with a mounted rim element formed by an annular piece of sheet material with an internal and an external diameter, the mounted base is preferably formed by a piece of material with a diameter being equal to or smaller than the internal diameter of the annular blank of the rim element. It is thus obtained that the base can be formed by the centre circle part from the cut-out of the rim element.

[0020] In a preferred embodiment where the base is seamed on to the shell, the shell extends in the base area from the curvature at the side wall inward toward the centre of the base, upward and through a curvature inverse in relation to the first curvature to the seam situated outside the container between the shell and the base.

[0021] The shell thus extends preferably essentially horizontally from the first curvature to a second curvature, from there obliquely into the interior of the container to said inverse curvature and further on essentially horizontally to the seam.

[0022] According to the invention, an apparatus for performing the method comprises means for formation of a shell by bending of an essentially square, preferably rectangular piece of sheet material and joining of two essentially parallel lateral edges of the sheet material, which sides thus meet, means for expansion of the shell, means for narrowing and flanging of a base portion of the shell and means for mounting of a base of a corresponding sheet material, where means for expansion of the portion of the shell immediately above the base portion are meant to also press this portion down around the base in order to provide an additional, annular base surface around the mounted base. Furthermore, there are preferably means for expanding and flanging the top portion of the shell separately.

[0023] By means of the invention, it is possible to provide a sheet metal container, which because of a very heavy extension of its material is relatively light and thus material saving without the strength being reduced in relation to that of known containers. Especially in the preferred embodiment where the container has a mounted rim element, a material saving is obtained.

[0024] In the following, the invention will be explained more in detail by means of an example of embodiment with reference to the schematic drawing, where

Fig. 1 shows a metal sheet container with a cover,
Fig. 2 is a partial sectional view of a container like the one shown in Fig. 1 with a corresponding container placed on the top,
Fig. 3 is a vertical sectional view of the container in Fig. 1 before the mounting of a rim,
Fig. 4 is a vertical sectional view of a known container with another rim form, and
Figs. 5-11 illustrate the production of the container in Fig. 1.

[0025] The container shown in Figs. 1 and 2 has a body with a side wall 2 formed by a shell 1, on which wall supports 3 are mounted for a handle 4. The container has furthermore a cover 5 of a design known per se and which abuts on the rim surrounding the opening of the container. The cover 5 has as usual an essentially plane centre area 5a surrounded by plane rim area 5b raised in relation to the centre area. The rim is in the shown embodiment constituted of a rim element 6 mounted at the opening of the container (Fig. 2), which element through a flange joint or seam 7 is connected with the top portion 8 of the shell 1. The side wall has in the embodiment example a circular cross section and is vaguely conical such as it is per se known according to containers for paint and the like, so-called technical tinplate packaging. The invention can also be used in connection with containers with a cylindrical side wall and containers with another cross section than circular. The container shown in Fig. 1 can have a cubic content of 2-5 1, however, the invention can be used in connection with containers with a cubic content from 1 to 20 1 or even from 0.25 to 40 1.

[0026] As appears from Figs. 2 and 3, the container according to the invention has a base with a character-

istic form. A part of the base is constituted by a base element 9 which is connected to the shell 1 by a flange joint or seam 10 which is known per se. However, the shell 1 has a base portion 11 which from the side wall 2 through a curvature 12 with a small radius of curvature extends radially toward the central axis of the container during formation of an annular, external base surface 13, through a further curvature 14 up in the container and through yet another curvature 15 to the seam 10. The container rests essentially on the external base surface 13 when the container stands on a plane surface.

[0027] As appears from Fig. 2, by means of this base form and a corresponding dimensioning of the different areas 5a and 5b of the cover, an improved control of the stacked containers in relation to each other is obtained, as the base area 23 between the curvature 15 and the seam 10 of a container when stacked rests on and is guided in position by the cover area 5b of the subjacent container.

[0028] Fig. 4 shows a vertical section through the top of a container known per se where instead of the mounted rim 6, a folding 6a is formed of the top portion of the shell 1 in order to provide a strong rim. A container with this rim form can also be provided with a base designed according to the invention.

[0029] A container with a base according to the invention can be produced as will be explained in the following with reference to Figs. 5-11.

[0030] At first, a preferably rectangular piece of sheet metal, e.g. with a thickness of 0.20-0.24 mm and of the quality T 56 or T 61, is folded to form a tubular shell 1, and the lateral edges thus meeting are mutually connected e.g. by means of a spot welding 16 (Fig. 5). The portions of the shell 1 placed above the base portion 11 are expanded radially to form a tube with an expanded top portion 17, a non-expanded base portion 11 and a shoulder or curvature 12 at the transition from the top portion 17 to the base portion 11 (Fig. 6).

[0031] The base portion 1 is narrowed radially and flanged by methods known per se to form a narrowed base portion 11 with a flange 19 (Fig. 7). A base element prepared for the purpose 9 is seamed in a known manner together with the base portion 11 by means of the flange 19 during the formation of a seam 10 (Fig. 8).

[0032] An expander cartridge with thrust pad segments 20 and preferably an extension equalizing membrane is guided down into the shell 1 and presses first the area at the shoulder or the curvature 12 down to the level of the underside of the seam 10 (Fig. 9). It is preferably controlled that the segments 20 are placed such in relation to the spot welding 16 of the shell (1) that this is positioned centrally in relation to a segment 20 as shown in Figs. 9 and 10. The segments 20 are then dispersed radially as their top portions are dispersed more than their bottom portions, the central part 21 of the shell 1 being provided with a conical form with determined dimensions (Fig. 10). The height of the segments 20 is limited such that the top portion 8 of the shell 1 is essentially not expanded at this step. The succession of the pressing down and dispersion of the segments 20 can be inverted in relation to the above mentioned, or the two movements can be effected more or less at the same time.

[0033] The top portion 8 is subsequently expanded and flanged separately by means of rolls 22 (Fig. 11).

[0034] By the method according to the invention, the shell 1 is expanded more strongly than usually. In order to avoid that the area around the spot welding 16 which is usually the weakest place in the shell 1, cracks during expansion, the said central placement of the spot welding 16 is made in relation to a segment 20, and the top portion 8 is expanded as stated by spin flanging such that the tensile stress in the deformation zone is kept at a relatively low level during expansion. If the area around the spot welding 16, or the joint if another type of joint is used, will hold, there is according to the invention nothing to prevent that the top portion 8 is expanded together with the central part 21 of the shell 1.

[0035] After the flanging of the top portion 8, the container blank is ready for mounting of the rim element 6 in a manner known per se.

[0036] By the invention, several advantages are obtained. Firstly, material and thus weight are saved because the shell 1 due to the heavy, even extension of the material is relatively and uniformly thin. Because of strain-hardening, this weight saving is obtained without reducing the strength of the container. Secondly, it is obtained that as a blank for the production of the base element 9, a disc material or a centre circle part cut out of the blank from which the rim element 6 is formed. This centre circle part is wasted in prior art, and therefore, a general considerable saving of material and weight is obtained in the production of a container. Thirdly, a container is obtained with a more precise diameter at the bottom portion of the side wall 2, because this diameter is determined by the expansion of the segments 20. Therefore, the container can be produced with a finer tolerance and thus a little larger diameter dimensions on said place, which is an advantage when the containers are stacked as shown in Fig. 2, since a more precise positioning is obtained of the base of one container within an edge 23 of the cover 5 of the next container. The possibility of a stack of several containers being skew is thus minimized and consequently the risk of such a stack tumbling over is minimized. The said larger diameter dimension entails furthermore that the conicity of the container is smaller, which is an advantage as to strength.

[0037] In relation to known containers where the side wall below has a bend in order that a seam edge between the side wall and the base does not project over the diameter of the side wall, a larger strength is obtained because said bend entails that at a major load, the container may during stacking yield such that the breakpoint on one single place along the circumference sinks to the foundation. The stacking may then risk tum-

bling. A base designed according to the invention essentially eliminates the risk of the base yielding at one single place in relation to the rest of the circumference.

Claims

1. A method for producing a sheet metal container, including

   - formation of a shell (1) by bending an essentially square, preferably rectangular, piece of sheet metal and joining (16) two essentially parallel lateral edges of the sheet material, which sides thus meet,
   - expansion of the shell (1),
   - narrowing and flanging of a bottom portion (11) of the shell and
   - mounting of a base (9) of a corresponding sheet material, **characterized in that** by the expansion of the shell (1), the portion (17) of the shell immediately above the base portion (11) is expanded essentially more strongly than the base portion (11), and

   that the more strongly expanded portion (17) is pressed down around the base (9) in order to provide an additional, annular base surface (13) around the mounted base (9).

2. A method according to claim 1, where the top portion (8) of the shell is provided with a rim element (6) formed by an annular piece of sheet material of the same kind as that of the base (9), **characterized in that** the mounted base (9) is formed of a piece of sheet material of a diameter equal to or smaller than a piece remaining from the formation of the rim element (6).

3. A method according to claim 1 or 2, **characterized in that** by a first expansion of the shell (1), the base portion (11) of the shell is essentially not expanded, whereas the remaining portion (17) of the shell is expanded whereby a shoulder-shaped transition (12) is formed between the base portion (11) and the remaining portion (17) of the shell (1).

4. A method according to claims 1-3, **characterized in that** the portion (21) of the shell immediately above the base portion (11) is expanded to predetermined dimensions in connection with its being pressed down around the base (9).

5. A method according to claims 1-4, **characterized in that** a top portion (8) of the shell (1) is expanded substantially less than a central part (21) of the shell during the expansion of this central part (21), and subsequently the top portion (8) is expanded and flanged separately.

6. A metal sheet container comprising a shell (1) of a single layer of the sheet material, a joint (16) extending from the top of the container to its base, which shell (1) forms a side wall (21) of the container, and comprising a rim at the top of the container and a mounted base (9) of metal sheet, **characterized in that** the shell (1) in the base area of the container from the side wall (2) extends through a curvature (12) and radially toward the centre of the base and in to the joint (10) between the shell (1) and the mounted base (9), whereby a part of the shell (1) forms two annular base areas (13, 23) around the mounted base (9), a radially exterior (13) of the two base areas being situated in the bottom level of the container, and the radially interior (23) of the two base areas being situated at a higher level.

7. A container according to claim 6 with a mounted rim element (6) formed by an annular piece of sheet material with an internal and an external diameter, **characterized in that** the mounted base is (9) formed by a piece of material with a diameter being equal to or smaller than the internal diameter of the annular blank of the rim element (6).

8. A container according to claim 6 or 7, **characterized in that** the shell (1) in the base area from the curvature (12) at the side wall (2) extends inward toward the centre of the base, upward and through a curvature (15) inverse in relation to the first curvature (12) to the seam (10) situated outside the container between the shell (1) and the base (9).

9. A container according to claim 8, **characterized in that** the shell (1) extends essentially horizontally from the first curvature (12) to a second curvature (14), from there obliquely into the interior of the container to said inverse curvature (15) and further on essentially horizontally to the seam (10).

10. An apparatus for performing the method according to claim 1, comprising

    - means for formation of a shell by bending of an essentially square, preferably rectangular piece of sheet material and joining of two essentially parallel lateral edges of the sheet material, which sides thus meet,
    - means for expansion of the shell,
    - means for narrowing and flanging of a bottom portion of the shell and
    - means for mounting of a base of a corresponding sheet material, **characterized in that** means (20) for expansion of the portion of the shell immediately above the base portion are

adapted to also press this portion down around the base in order to provide an additional, annular base surface around the mounted base.

11. An apparatus according to claim 10, **characterized by** means (22) for expanding and flanging the top portion of the shell separately in relation to the remaining part of the shell.

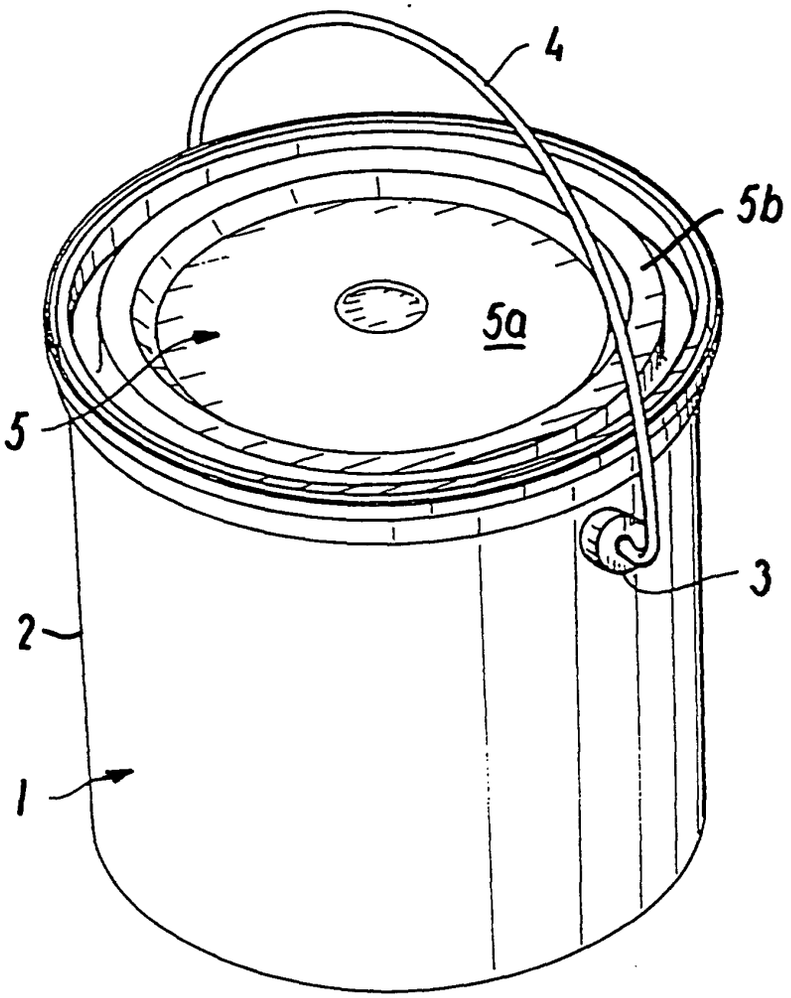

FIG.1

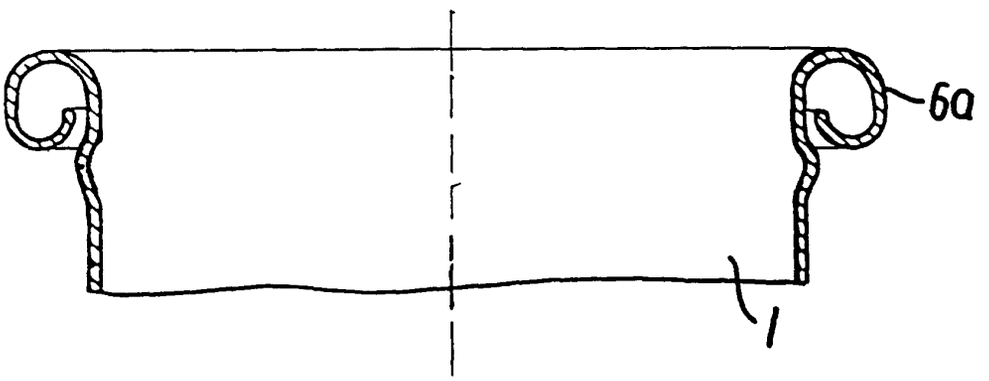

FIG.4

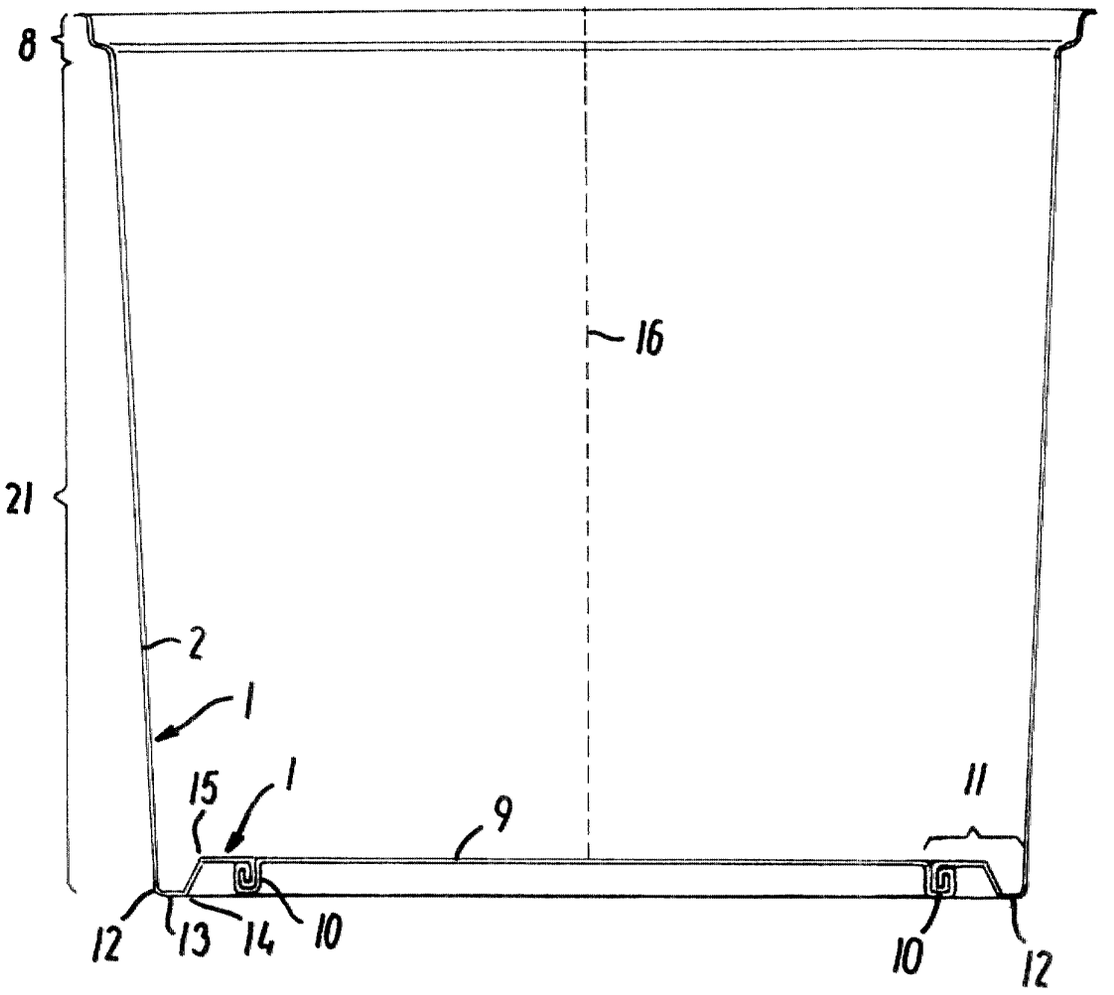

FIG.3

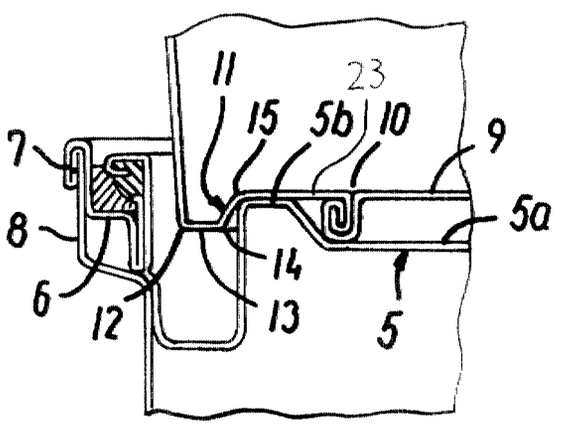

FIG.2

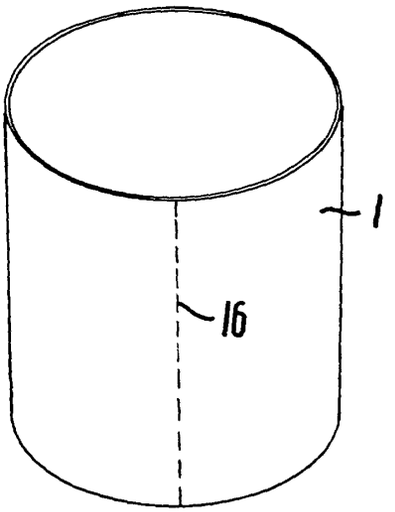

FIG. 5

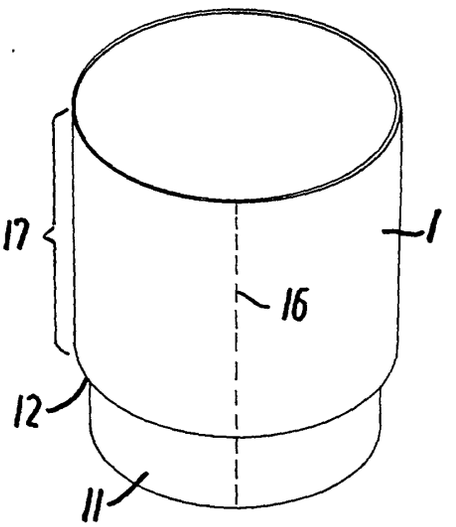

FIG. 6

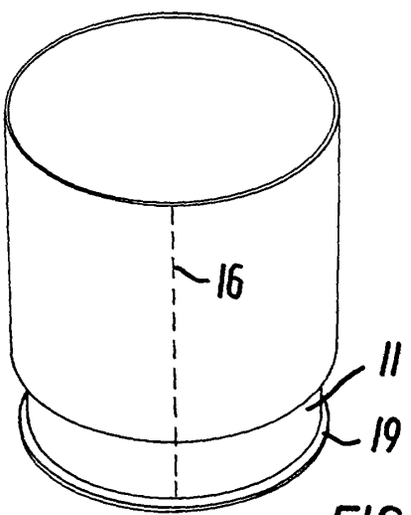

FIG. 7

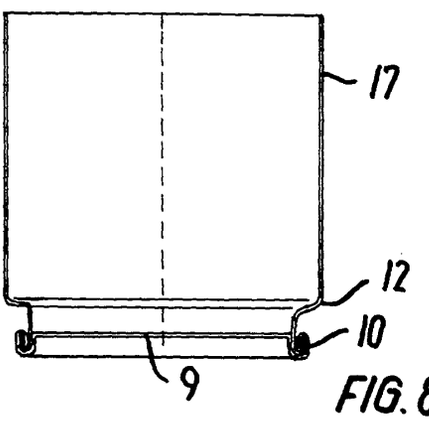

FIG. 8

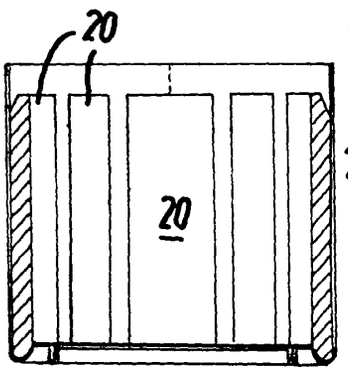

FIG. 9

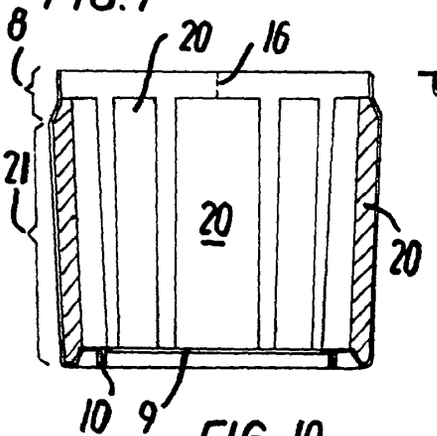

FIG. 10

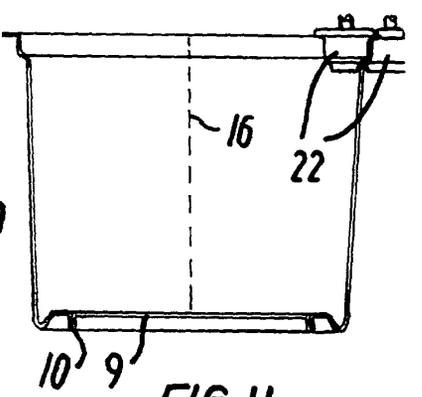

FIG. 11