

UNITED STATES PATENT OFFICE

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ART OF PRODUCING CONTAINERS

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My invention relates to the art of producing containers destined for any suitable or desired use such, for example, as containers adapted to have a fluid medium existing therein under high pressure conditions.

In accordance with my invention, a container is formed or produced by a drawing operation effected on a mass of metal. Preliminarily, there is formed a tube-like structure which is closed at one end by a transverse wall surface, the container bottom surface being suitably shaped or fashioned as desired. An opening of suitable diameter or configuration is then formed in the aforesaid transverse wall surface whereby there is produced an inwardly directed flange with the lower surface of which a closure plate is adapted to be tightly engaged in response to the application of pressure developed interiorly of the container.

Usually, the lower surface of the aforesaid flange should be machined to provide a smooth and even seating surface for said closure plate which preferably is movable axially out of and into the container before and after each filling operation.

Further objects and characteristics of my invention will become apparent from the following detailed description taken in connection with the accompanying drawing.

My invention resides in the art or method of producing containers, and in the features, relations and operations of the character hereinafter described and claimed.

For an understanding of my invention, reference is to be had to the accompanying drawing, in which:

Figure 1 is an elevational view, partly in section, illustrating a stage in the construction of a container structure in accordance with my invention;

Fig. 2 is an elevational view, partly in section, of a container structure as existing in a subsequent stage of the manufacturing operation;

Fig. 3 is an elevational view, partly in section, showing the container structure of Fig. 2 with an associated valve mechanism;

Fig. 3a is a plan view of the container structure shown in Fig. 3;

Fig. 4 is an elevational view, partly in section, of the container structure as existing in a subsequent stage of the manufacturing operation;

Fig. 4a is a plan view of the container structure shown in Fig. 4;

Fig. 5 is an elevational view, partly in section, of a completed container;

Fig. 5a is a plan view showing the filling opening of the container of Fig. 5; and

Fig. 5b is a plan view showing the closure plate of the container of Fig. 5.

Referring to Fig. 1, A represents a seamless partly completed structure destined to be a container, tank or the like. Preferably, the structure A is obtained or produced by a suitable drawing operation effected on a plate or billet of steel. As shown in Fig. 1, the structure A comprises a top section or transverse wall surface *a* having circular side wall structure *b* depending therefrom, the latter being open at its bottom as illustrated.

Fig. 2 is representative of the structure A after it has been reheated and subjected to a suitable shaping operation whereby there is produced a curved lower section *c* terminating in a depending neck *d* forming a passage opening into said structure A. Alternatively, a plane bottom wall may be provided at the lower part of the container as hereinafter described in connection with other forms of the invention.

Figs. 3 and 3a are representative of the structure A as it appears in Fig. 2 with the exception that the neck *d* is shown as having been internally threaded for the reception of suitable valve or closure mechanism B.

Referring to Figs 4 and 4a, the top section *a* of the structure A is shown after it has been provided with a circular opening *e*. This opening *e* may be produced in any suitable manner, as by a boring or cutting operation. As clearly appears on the drawing, the circular opening *e* is concentric with respect to the side wall structure *b*, and the diameter of said opening *e* is somewhat less than that of said side wall structure *b*. Accordingly, after formation of the circular opening *e*, all that remains of the aforesaid top section *a* is a circular flange *a1*.

In accordance with my invention, the inner lower surface $a2$ of the flange $a1$ should be plane and even for the reception in sealing relation with respect thereto of a suitable closure arrangement. Said flange surface $a2$ may thus be rendered plane and even in any suitable manner such, for example, as may be effected by the application thereto of any suitable tool herein illustrated diagrammatically at 1, Fig. 4.

In Fig. 5a, the aforesaid circular opening e is shown after it has been provided with notches or recesses f, f disposed, respectively, at opposite diametric sides thereof. The notches f, f may be formed by a suitable milling operation performed on the flange $a1$ and, preferably, they define arcs of a circle having a substantially smaller radius than that of the circular opening e .

Obviously, if desired, the above described smoothing operation for the flange surface $a2$ may be performed after, as well as before, the production of the notches f, f .

Usually, the structure A as it exists in its completed state in Fig. 5 is adapted to serve as a container or tank for any suitable substance or material which remains therein at a pressure higher than atmospheric pressure, said substance or material usually being introduced into said structure A through the opening e . Accordingly, said opening e serves as a filling opening and it is necessary that it be sealed during use of the container. For this purpose, there may be utilized a closure plate g of the character illustrated in Figs. 5 and 5b, said closure plate being generally circular save for oppositely disposed arcuate projections h, h . The diameter i of said closure plate should slightly exceed the diameter of the circular opening e and each arcuate projection h should define the arc of a circle somewhat greater in diameter than that of that circle of which each notch f is an arc. On its upper surface, the closure plate g may carry an eyelet j to which, for manipulating purposes, a chain k is secured. As clearly appears, the closure plate, including the arcuate projections h, h , is peripherally flanged for the reception of a sealing gasket, not shown.

When the closure plate g is in closing position as shown in Fig. 5, the upper peripheral surface thereof presses the aforesaid gasket into engagement with the lower flanged surface $a2$. When thus in closing position, the arcuate projections h, h are disposed, respectively, in alinement with the notches f, f , the upper peripheral surface of each projection h pressing a section of the aforesaid gasket into engagement with that overlying surface of the flange $a1$ which defines the adjacent notch f . With the parts in the relation shown in Fig. 5, it is assumed that the gas pressure interiorly of the container is greater than atmospheric pressure. As a result,

the closure plate g is positively retained in closing position and, the greater the gas pressure in the container, the more firmly is said closure plate retained in closed position.

When it is desired to open the container filling opening, the gas pressure interiorly of the container is suitably reduced to that of the atmosphere, as by opening of the valve mechanism B, and the closure plate g is lowered from the flange $a1$ and disposed axially of said container. Then, with the closure plate g disposed axially, it is so positioned that the major axis (the straight line extending from tip to tip of the projections h, h) extends vertically, or approximately so, the closure plate g being now readily removable from the container. In a correspondingly simple manner, the closure plate may be re-seated interiorly of the container when it again becomes desirable to close the same.

An important characteristic of my invention involves the use of a container or tank of the character herein described as a converter of solid or semi-solid carbon dioxide. To this end, with the closure plate g removed from the container, one or more blocks of the aforesaid solid or semi-solid carbon dioxide may be introduced thereinto whereupon said closure plate g is placed in closing position as shown in Fig. 5 and so held in suitable manner until there has been sufficient evolution of carbon dioxide gas interiorly of the container to produce pressure therein in excess of atmospheric pressure. Thereafter, the closure plate is held in container-sealing position by gas pressure, the sealing action occurring, in accordance with my invention, at the surface $a2$ of the flange $a1$.

Where the container is thus utilized as a converter of carbon dioxide, it is desirable that a plurality of discharge or dispensing conduits be fitted therein adjacent the top thereof. As herein shown, two such conduits m and n are utilized, the conduit m passing carbon dioxide gas to a suitable carbonator, or equivalent, not shown, and the conduit n having connected thereto a tube, not shown, which dips into the liquid carbon dioxide so that the latter may be dispensed and used for any desired purpose. For each of the conduits m and n , a suitable hole is drilled in the container side wall b and, after a strengthening boss is welded in position as shown, each hole is suitably threaded for the reception of the conduit to be associated therewith.

During the final stage of the drawing operation, the side wall structure b is left at such thickness that it will withstand a maximum interior container pressure of the order of 3,000 pounds per square inch, or more. Further, the thickness of the end section a is so chosen that the resultant flange $a1$ will withstand, without bending or deformation,

an interior container pressure such as noted above. In practice, it has proven desirable to so shape the container side wall structure *b* that the upper part thereof is tapered to some extent, the thickness of the metal increasing as the top of the container is approached. In this manner, the maximum amount of metal is disposed in the region of maximum strain.

Obviously, my invention is not to be limited to the formation of a filling opening in the end section *a* such as illustrated in Fig. 5a. As well, said filling opening might be elliptical, square, or rectangular, the respective closure plates to have a corresponding configuration. Or, the filling opening might be circular in which case, the closure plate would remain interiorly of the container during the filling operation. In view of the above, it will be understood that the term "diameter" is used in the appended claims in a general sense with respect to the opening formed in the transverse wall surface *a*. When the filling opening is elliptical, square or of other suitable configuration, I mean by the term "diameter," a dimension of said opening transversely of the longitudinal axis of the container.

In operation, the tank or container hereinafore described is supported in upright position in any suitable manner. For example, suitable leg structure, not shown, may be welded or otherwise suitably secured to the tank whereby it is supported in upright position as shown.

The advantages of my invention are numerous and of importance. By the described manufacturing operations, the tanks or containers are advantageously and satisfactorily produced with minimum expense. By the described drawing operation, the seamless container A is provided with the top section *a* which is later apertured so as to form the filling opening.

With my invention, the arrangement is such that the interior seating surface for the closure plate may be suitably machined to provide a smooth, even surface whereby leakage of the container contents is prevented. This, in accordance with my invention is of great importance.

While the invention has been described with respect to a certain particular preferred example which gives satisfactory results, it will be understood by those skilled in the art after understanding the invention, that various changes and modifications may be made without departing from the spirit and scope of the invention and it is intended therefore in the appended claims to cover all such changes and modifications.

What is claimed as new and desired to be secured by Letters Patent is:

1. In the art of manufacturing a container, the steps which consist in producing,

by a drawing operation effected on a mass of metal, a tube-like structure closed at one end by a transverse wall surface, shaping the other end of said tube-like structure to form a neck having an opening of restricted diameter, and forming in said wall surface an opening having less diameter than that of said wall surface whereby an inwardly directed flange is produced at the top of said tube-like structure.

2. In the art of manufacturing a container, the steps which consist in producing, by a drawing operation effected on a mass of metal, a tube-like structure closed at one end by a transverse wall surface, shaping the other end of said tube-like structure to form a neck having an opening of restricted diameter, forming in said wall surface an opening having less diameter than that of said wall surface whereby an inwardly directed flange is produced at the top of said tube-like structure, and machining the lower surface of said flange to render it smooth and even.

3. In the art of manufacturing a container, the steps which consist in producing, by a drawing operation effected on a mass of metal, a tube-like structure closed at one end by a disk-like wall surface, shaping the other end of said tube-like structure to form a neck having an opening of restricted diameter, threading said neck for the reception of a valve stem, forming in said wall surface an opening having less diameter than that of said wall surface whereby an inwardly directed flange is produced at the top of said tube-like structure, machining the lower surface of said flange to render it smooth and even, and forming openings in said tube-like structure adapted for the subsequent reception of dispensing conduits, respectively.

4. In the art of manufacturing a container, the steps which consist in producing, by a drawing operation effected on a mass of metal, a tube-like structure closed at one end by a transverse wall surface, shaping the other end of said tube-like structure to form a neck having an opening of restricted diameter, and forming in said wall surface an opening having less diameter than that of said wall surface whereby an inwardly directed flange is produced at the top of said tube-like structure, said opening being of non-circular configuration and adapted for the passage therethrough of a closure plate of corresponding configuration.

5. In the art of manufacturing a container, the steps which consist in producing, by a drawing operation effected on a mass of metal, a tube-like structure closed at one end by a transverse wall surface having substantially greater thickness than that of said tube-like structure, shaping the other end of said tube-like structure to form a neck having an opening of restricted diameter, and forming in said wall surface an opening hav-

ing less diameter than that of said wall surface whereby an inwardly directed flange is produced at the top of said tube-like structure, said opening being of non-circular configuration and adapted for the passage there-
through of a closure plate of corresponding configuration.

6. In the art of manufacturing a container, the steps which consist in producing,
by a drawing operation effected on a mass of metal, a tube-like structure closed at one end by a transverse wall surface, shaping the other end of said tube-like structure to form the container bottom surface, and forming in said wall surface an opening having less diameter than that of said wall surface whereby an inwardly directed flange is produced at the top of said tube-like structure.

7. In the art of manufacturing a container, the steps which consist in producing, by a drawing operation effected on a mass of metal, a tube-like structure closed at one end by a transverse wall surface, shaping the other end of said tube-like structure to form the container bottom surface, forming in said wall surface an opening having less diameter than that of said wall surface whereby an inwardly directed flange is produced at the top of said tube-like structure, and machining the lower surface of said flange to render it smooth and even, said opening being of non-circular configuration and adapted for the passage therethrough of a closure plate of corresponding configuration.

8. In the art of manufacturing a container, the steps which consist in producing, by a drawing operation effected on a mass of metal, a tube-like structure closed at one end by a transverse wall surface, shaping the other end of said tube-like structure to form the container bottom surface, forming in said wall surface a circular opening having less diameter than that of said wall surface whereby an inwardly directed flange is produced at the top of said tube-like structure, and forming arcuate notches in said flange at opposite diametric sides thereof.

9. In the art of manufacturing a container, the steps which consist in producing, by a drawing operation effected on a mass of metal, a tube-like structure closed at one end by a transverse wall surface, shaping the other end of said tube-like structure to form a neck having an opening of restricted diameter, forming in said wall surface a circular opening having less diameter than that of said wall surface whereby an inwardly directed flange is produced at the top of said tube-like structure, forming arcuate notches in said flange at opposite diametric sides thereof, and machining the lower surface of said flange to render it smooth and even.

In testimony whereof I have signed my name to this specification.

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