A plastic bung drum is provided with a mouth portion made integral with the body of the drum. The circumferential edge of the mouth portion is bent to form an inwardly projecting lip, while an intermediate section of the mouth is provided with an inwardly projecting circumferential bulge, forming a bead. A closure which fits into the mouth of the drum has its opposite edges bent to form outwardly extending circumferential lips, and is provided with a pair of intermediate circumferential flanges which, with the adjacent lips, form a groove at each end of the closure. These grooves engage the inwardly extending circumferential lip and bead on the drum. A peripheral weld is then made to produce a secure, substantially inseparable joint between the inwardly bent lip on the mouth of the drum and the corresponding lip on the closure.

3 Claims, 1 Drawing Figure
3,910,450

BUNG DRUM MADE OF PLASTICS WITH ONE OR MORE BUNG OPENINGS

RELATION TO OTHER CASES

This application is a continuation-in-part of copending U.S. application Ser. No. 362,316, filed May 21, 1973.

BACKGROUND OF THE INVENTION

Plastic bung drums are commercially available articles. They are typically made in one piece by a blow-molding method, whereby one or two bungs or stoppers are provided in the mold parting line. These stoppers are usually located in corresponding recesses of an end closure so as to provide a flat stacking surface. For reasons of stress distribution under a stacking load, such drums, in most cases, are made with a slight bulge and, at the transition to the lower and upper end closure, they have relatively large radii. Such drums, with their contours rounded and smooth on all sides, are very difficult to handle as compared with metal drums which are provided with recessed bottoms and a folded edge, as is prevalent in the case of drums holding large volumes. The customary molded gripping troughs at the upper end of the jacket offer only an insufficient possibility for handling, and they weaken the statics of the drum in an unjustifiable manner.

One solution which has been proposed was to provide a crane ring on the upper closure. Such a device, however, is not suitable for frequent manipulation by hand. Moreover, the upper closure of such a drum whose flat surface is broken by the crane ring does not have the required strength in the case of a strain induced during falling.

Furthermore, bungs or stoppers formed by blow molding of the hot material cannot be produced with the necessary precision because of the shrinking process and tensions which develop during cooling. By this method, crooked or oval bung holes are produced which require bungs of special design to bridge the clearances, with the result that it is not possible to use many of the existing devices for filling, closing, sealing, and emptying of drums. The upper end closure, which may be uneven for the same reason is, moreover, more subject to abrasion, and thus does not permit marking with the designation of the contents and with instructions for use. Likewise, the frequently used loading by means of vacuum lift is impossible because of the uneven upper end closure.

Another very serious disadvantage of such drums stems from the process of production during which a portion of preformed plastic material is squeezed off at both ends, welded, and then blown against the inside wall of the mold. As a result of the squeezing at the two ends, this preform is no longer rotationally symmetrical at the critical points, causing variations in the thickness of the wall during blowing because of uneven stretching of the material. These differences can range within an order of magnitude of 1:3. Such differences in the thickness of the wall occur in an extreme form on the upper end closure, in particular, where for the purpose of forming bungs lying close to the edge, the preformed mass must additionally be expanded. Therefore, in order to fulfill the requirement for a minimum thickness of the wall in the case of drums produced in this way, a disproportionately high consumption of material is required which, besides introducing considerable additional costs, also reduces the efficiency of production.

It was then discovered that drums, with approximately fully open tops, where the preformed mass is squeezed off only at the lower end closure, have a considerably better distribution of wall thickness and can be produced considerably faster.

On such drum is disclosed and claimed in the already mentioned copending U.S. patent application Ser. No. 362,316, filed May 21, 1973, whose disclosure is hereby incorporated by reference.

In general, the copending application discloses an open-end drum which can be blow molded from a thermoplastic resin, such as a high density, high molecular weight polyethylene. The top of the open end is bent inwardly substantially at right angles to the axis to form a mouth comprising a circular, flat, horizontal lip having a diameter smaller than that of the main body of the drum. Just below the bent-in lip portion, the drum is circumferentially recessed to form a bead-like bulge which is also of smaller diameter than the main body of the drum. The inwardly bent lip and the circumferential bead together give the mouth at the top of the drum an S-like cross section.

The drum is provided with a separate extruded closure portion, preferably of the same thermoplastic material, and is made to fit inside the mouth of the drum. This closure has a recessed bottom in which are formed one or more bung holes. The depth of the closure portion is, in general, governed by the depth of the mouth of the drum, which is to say, the vertical length of the S-shaped formation.

The upper edge of the closure portion is bent outwardly to form a flat, circular rim or lip which is adapted to rest on the inwardly extending upper lip of the drum, while the bottom edge of the cover is bent outwardly to contact the lower anticlinal surface of the bead on mouth of the drum. Together, the two outwardly bent lips of the closure portion encompass the entire S-formation at the top of the drum. In addition, the closure portion is provided with a pair of parallel, circumferential flanges which, with their adjacent outwardly bent lips, respectively form grooves to receive the inwardly bent lip and bead of the drum. The groove which receives the bead is of such dimensions that a tight fit is provided. However, the upper groove is slightly deeper than the length of the lip at the upper edge of the drum.

Prior to assembly, a gasket of appropriate thickness is inserted in the upper groove. The drum is warmed to soften and expand the plastic material to enable the cover to be inserted and for the lip and bead to be inserted in their respective grooves. Upon cooling, the drum shrinks and forms tight, substantially inseparable joints which resist deformation by the various stresses to which the drum may be subjected during handling and storage.

Although the drum construction just described, which is the subject of the previously identified copending U.S. patent application, has solved many of the difficulties encountered in the use of plastic drums, there are situations in which it would be advantageous to have a bung drum which is sealed on all sides and along all edges formed by joined parts and which does not have any gasket between the body of the drum and the cover.
One object of the present invention is to provide a plastic bung drum combination assembled from separate drum-body and closure portions which does not present visible joint edges at the assembly sites.

Another object is to provide such a plastic bung drum combination in which the joint edges are sealed.

A further object is to provide such a plastic bung drum combination in which the use of gaskets is dispensed with in assembling the drum.

These and other objects which will become apparent to those skilled in the art are achieved in accordance with the present invention.

In general, the above objects are achieved through a significant modification of the drum described in the copending application.

The body portion of the bung drum of the present invention also is made of thermoplastic material, such as, for example, polyethylene, and is advantageously produced by the blow-molding method, leaving approximately a full opening at the upper edge of the body of the drum.

The upper end of the body portion, constituting the mouth of the drum, has a recessed circumferential bead and an inwardly bent edge or lip which, preferably, is of one piece with the body of the drum and is of the same thickness.

Basically, the mouth portion can have any desired shape as long as it has a recessed bead and an inwardly bent outer edge or lip. For this purpose, the upper portion of the body of the drum, constituting the mouth, is molded to provide a recessed external circumferential groove which results in an inwardly projecting circumferential bead on the inside surface of the mouth of the drum. The wall of the drum then arches outwardly, in the direction of the upper edge to form an external bead. The latter is bent inwardly at right angles to the axis of the drum. The result of the sequence of recessed bead, outwardly arched bead, and inwardly bent upper edge is to form a mouth having a vertical S-shaped cross section.

The recessed groove, together with the overhanging externally arched beam, form a secure gripping surface for handling the bung drum. By providing a series of axially disposed ribs or corrugations in the external surface of the outwardly arched bead, the safety and security of the gripping surface can be greatly augmented.

The cover for the drum according to the present improvement, is essentially the same as that in Ser. No. 362,316. Thus, as in the earlier case, circumferential grooves on the injection molded cover engage the inwardly bent edge and the recessed bead on the mouth at the top of the drum which is heated prior to assembly. However, according to the present invention, no gasket is inserted in the upper groove on the cover. The relative depth of that groove and width of the inwardly bent lip of the drum body portion are such that the lip completely fills the groove, providing an extremely rigid and inseparable joint when the drum is cooled after assembly. Similarly, the recessed lower bead on the drum fits tightly against the walls of the lower groove on the cover.

In accordance with the present invention, in order to eliminate the external, visible joints, the joint formed by the inwardly bent lip on the drum body portion and the overlapping, outwardly bent rim or lip of the upper groove on the cover is sealed by welding these overlapping parts. This is accomplished in a known manner by the spin-welding process or by means of a heated wire. The bead deposited by the welding procedure should, preferably, extend almost to the bend at the upper end of the drum.

Welding the mouth of the drum to the cover further strengthens the massive rim which is formed by the engagement of the bent edge and recessed bead on the mouth of the drum with the respective circumferential grooves on the cover.

The outside surface of this rim is advantageously roughened or fluted. This massive rim, besides providing ideal handling capability, decisively strengthens the bead of the drum. By means of its high stiffness, it especially counteracts the feared distortions which occur when the drum is dropped. Whenever the closure portion is produced by injection molding, the bung holes are of a much higher precision and permit the use of standard bung plugs and sealing caps. Moreover, they are protected during the insertion of the closure. The latter, for its part, is completely even and thus can also take markings.

Even in case of the bung drum of the present invention, the effect is utilized that blow-molded hollow bodies made of thermoplastic material have a considerable linear shrinkage, which can be precisely determined and controlled by partial control of the injection temperature and variation of the thickness of the wall. This shrinkage may amount to up to 3% of the diameter in case of a circular cross section. Thus, for example, in the case of a drum opening of 500 mm diameter, there results on both sides an engagement of 7.5 mm between the upper lip of the drum and the groove on the closure, a dimension which is entirely sufficient to provide a safe connection of the two parts, especially whenever the body of the drum and the closure are welded together in accordance with the present invention.

Since in the case of the described drum there is an absolutely uniform wall thickness in the middle and upper areas of the drum, the required material consumption is reduced considerably. At the same time, the efficiency of the blowing machine increases considerably because of the absence of the closure portion during manufacture of the body of the drum, because of fewer stresses and tensions during cooling, and because of lower weight of the body of the drum. Thus, despite the separate manufacture of the closure by injection molding, considerable technical advantages result.

THE DRAWING

In order that the invention may more readily be understood by those skilled in the art, reference is now made to the single FIGURE of drawing in which there is shown a longitudinal cross section of an upper portion of the drum and cover.

Referring to the drawing, it will be seen that the body 1 of the drum is integral with the S-shaped mouth portion 2. The mouth has an inwardly projecting, bead-like bulge 3 and an inwardly directed edge 4, which is separated from the bead-like bulge 3 adjacent an outwardly arched groove 5. The bead-like bulge 3 forms a recessed groove 18 on the outside, which serves as a gripping recess. In addition, the outside of the mouth is provided with a plurality of ribs or corrugations 17. As
seen in the drawing, recessed cover portion 6 is provided with the grooves 9 and 8 on the outside surface of the rim 7, which grooves are defined by a first circumferential flange 12 and first outwardly bent lip 13, and by a second circumferential flange 11 and second outwardly bent lip 10, respectively. The inwardly bent lip 4 engages flush on all sides with the groove 9. In other words, as will further be apparent from the drawing, the first circumferential flange 12 and first outwardly bent lip 13 on the closure portion 6, extend radially outward beyond the radial inner extent of inwardly bent circumferential lip 4 of the drum body portion so that flange 12 and lip 13 firmly engage substantially all of the area of the opposite longitudinally spaced surfaces on lip 4. The flanges 11 and 12 are connected by a plurality of ribs 15 at intervals. A bung hole 16 is provided in the opening in cover 6.

In order to establish the connection between the body 1 of the drum and closure 6, the latter is inserted into warmed mouth 2 in such a way that the bulge 3, projecting inwardly, and the inwardly bent lip 4 of mouth 2 will snap into the grooves 8 and 9, respectively of the rim 7 on the cover 6. In the subsequent cooling of mouth 2, the latter will shrink to such degree that the projecting bulge 3 is pressed firmly into the groove 8 and the inwardly bent lip 4 is pressed into the groove 9. The trimmed and thus completely smooth front surface of lip 4 at the same time is pressed firmly against the base of groove 9, so that a safe sealing of the connection is assured. The outwardly arched groove 5 of neck 2 is filled up by the two flanges 11 and 12 of the grooves 8 and 9 which, for the purpose of reinforcement, are connected with a number of ribs 15, disposed at a distance from one another. The second outwardly bent lip 10 and second circumferential flange 11 which define the groove 8 are seen from the drawing to extend radially outward beyond the radial inner extent of bulge 3 such that the second flange and the second lip firmly engage opposite longitudinally spaced surfaces 21 and 22, respectively, of bulge 3. Corrugation 17 on neck 2 provides a gripping surface and thus improves one's ability to handle the drum. Recess 18, together with corrugations 20 on cover 6 further improve the ability to obtain a secure grip on the drum during handling.

Finally, the outside edge of the outwardly bent, lip 13 of the closure portion is welded by means of seam 19 to the inwardly bent lip 4 near the point of the bend, to produce a unitary structure.

The invention, as described above, provides a drum which is completely closed on all sides and edges and which requires no gaskets between the body of the drum and the closure. The absence of resilient gaskets and the manner in which the closure is secured in the mouth of the drum results in a rigid, nondeformable structure which is augmented by the welded seam between the cover and the mouth. This not only increases the rigidity of the mouth area, but also provides the most possible seal against possible leaking of the contents.

Although the drawings described above show the preferred structure for the drum according to the present invention, it will be obvious to those skilled in the art that the design of the interacting elements of the neck of the drum and of the cover can be varied without departing from the spirit of the invention.

What is claimed is:

1. A drum of the type having a plastic body portion and a separate plastic closure portion firmly seated within an end of the body portion comprising the combination of:
   a. a body portion having a mouth portion at one end thereof, said mouth portion having
      1. an inwardly projecting circumferential bead-like bulge, said bulge defining a generally radially inwardly projecting annular gripping recess,
      2. an inwardly bent circumferential lip located outwardly of said bulge relative to a longitudinal axis of the drum, and
   b. a plastic end closure for said mouth portion having circumferential margin means firmly anchored within the mouth portion of said body portion to resist distortion of the latter while preventing removal of said end closure from said body portion, said margin means comprising
      1. an outwardly-bent circumferential lip at each end,
      2. a first circumferential flange forming, with a first of said outwardly bent lips, a first groove engaging and seating the inwardly bent circumferential lip of the mouth portion of the drum, said first circumferential flange and said first outwardly bent lip extending radially outward beyond the radial inner extent of the inwardly bent circumferential lip on the mouth portion of the drum body portion such that said first circumferential flange and said first outwardly bent lip firmly engage substantially all of the area of the opposite longitudinally spaced surfaces on said inwardly bent circumferential lip, the inwardly bent circumferential lip extending into said first groove the entire depth thereof, and
      3. a second circumferential flange forming with the second of said lips a second annular groove engaging and seating the inwardly projecting circumferential bead-like bulge of the drum, said second circumferential flange and said second lip extending radially outward beyond the radial inner extent of said bulge such that said second flange and said second lip firmly engage opposite longitudinally spaced surfaces of said bulge, said engagements forming substantially inseparable joints; and
   c. a peripheral bead of material forming a weld joining the peripheral edge of the first of said lips of the closure portion and said inwardly-bent circumferential lip of the mouth portion of the drum.

2. A drum according to claim 1 wherein the end closure is provided with one or more bung holes.

3. A drum according to claim 1 wherein the mouth portion, including the inwardly bent circumferential lip and the inwardly projecting circumferential bead-like bulge, is formed integral with the body portion of the drum.

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