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(54) SWAGE-FORMING OF CONTAINER OR PREFORM INTERNAL THREADS

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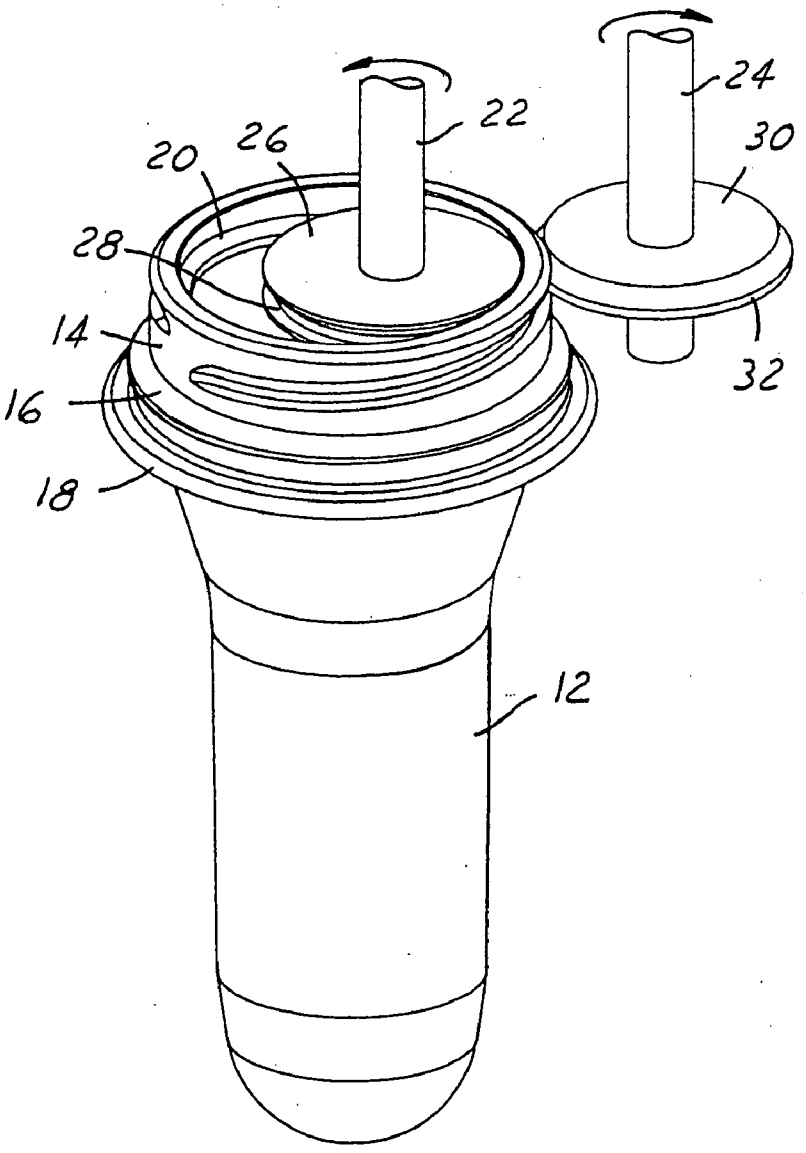
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(57) **ABSTRACT**

A method of making a plastic container having a body and an internally threaded finish includes providing a preform of molded plastic construction having a body and an integral neck, and expanding the body of the preform within a mold cavity to form the body of the container. Either prior to or subsequent to blow molding the container body, at least one internal thread is formed in the neck by engaging an inner surface of the neck with a first rotary tool having a peripheral channel, engaging an outer surface of the neck with a second rotary tool having a peripheral bead, and causing rotation of the neck and tools to swage at least one internal thread in the neck.



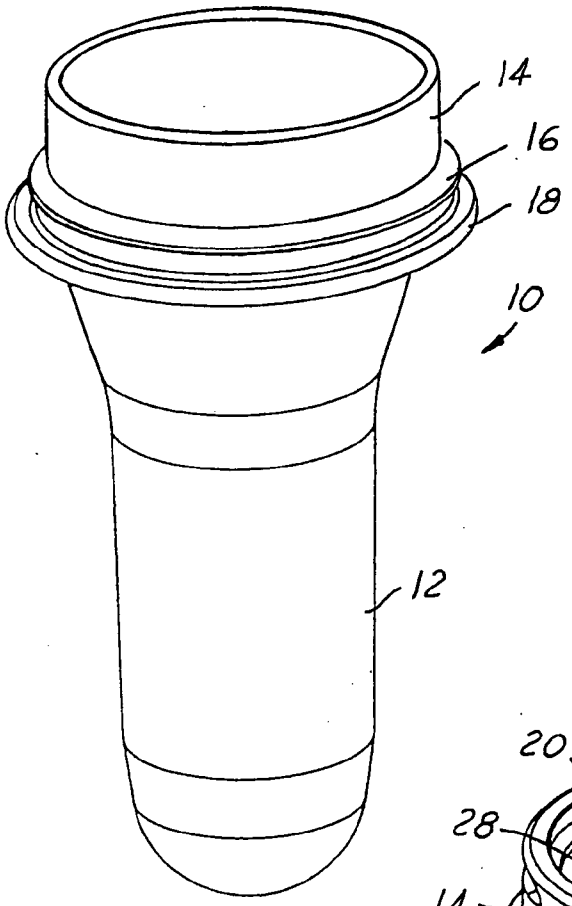


FIG. 1

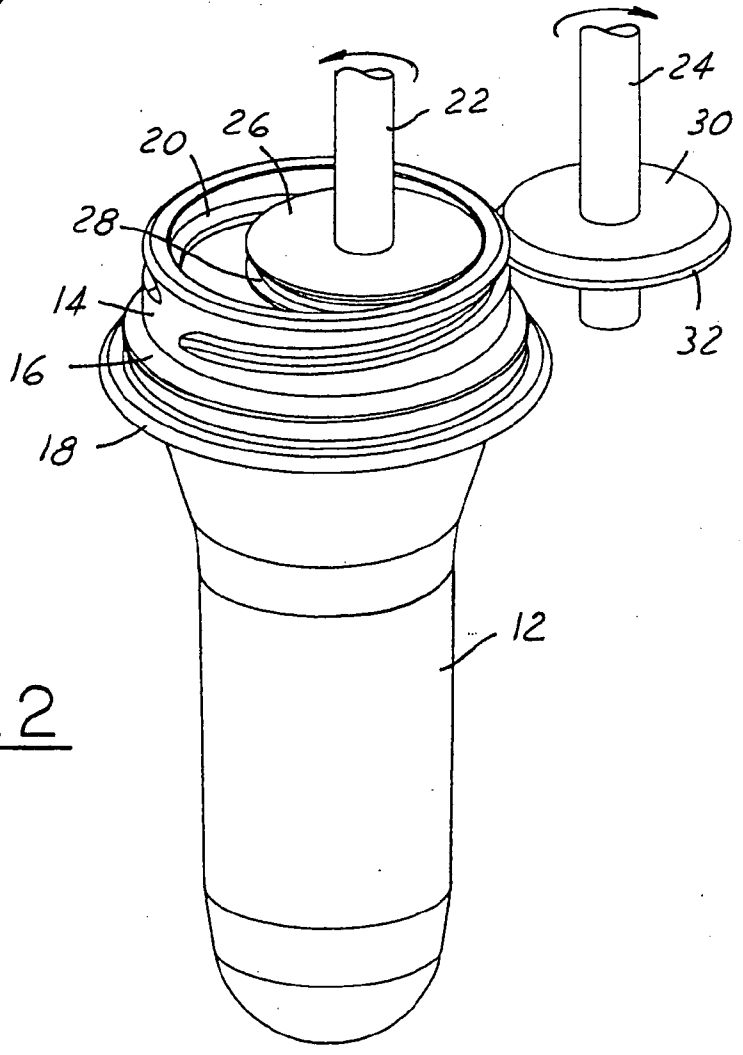


FIG. 2

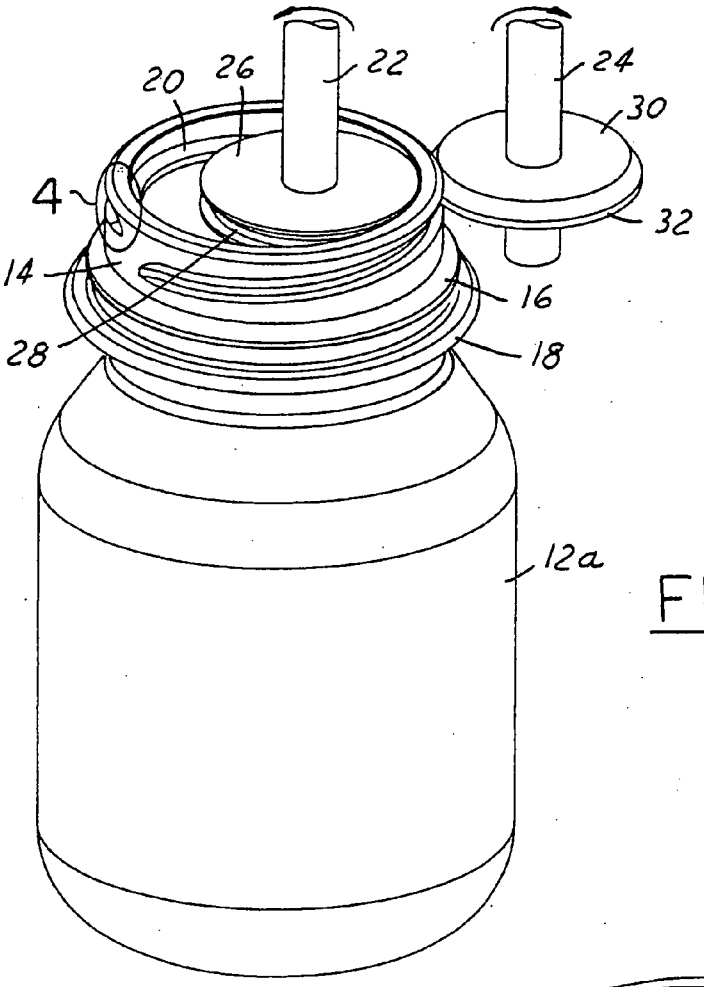


FIG. 3

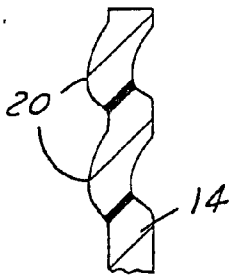


FIG. 4

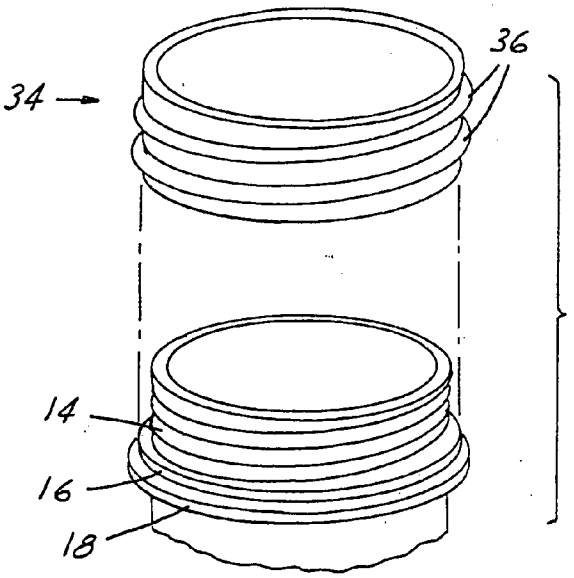


FIG. 5

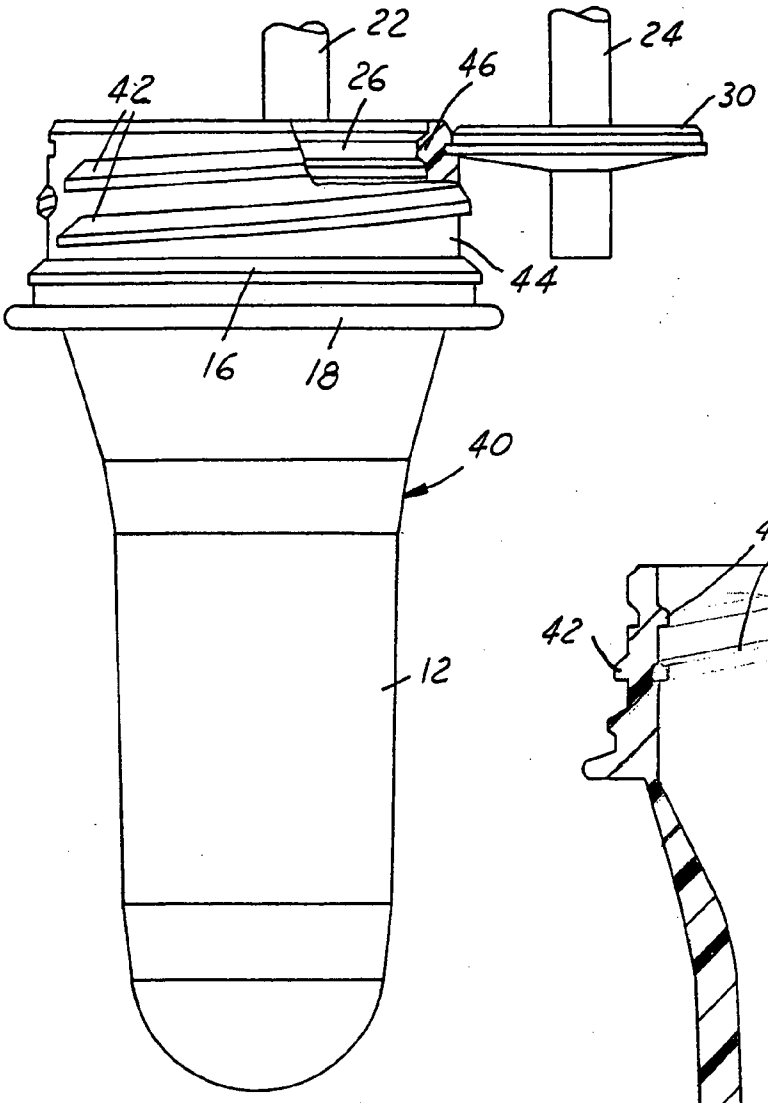


FIG. 6

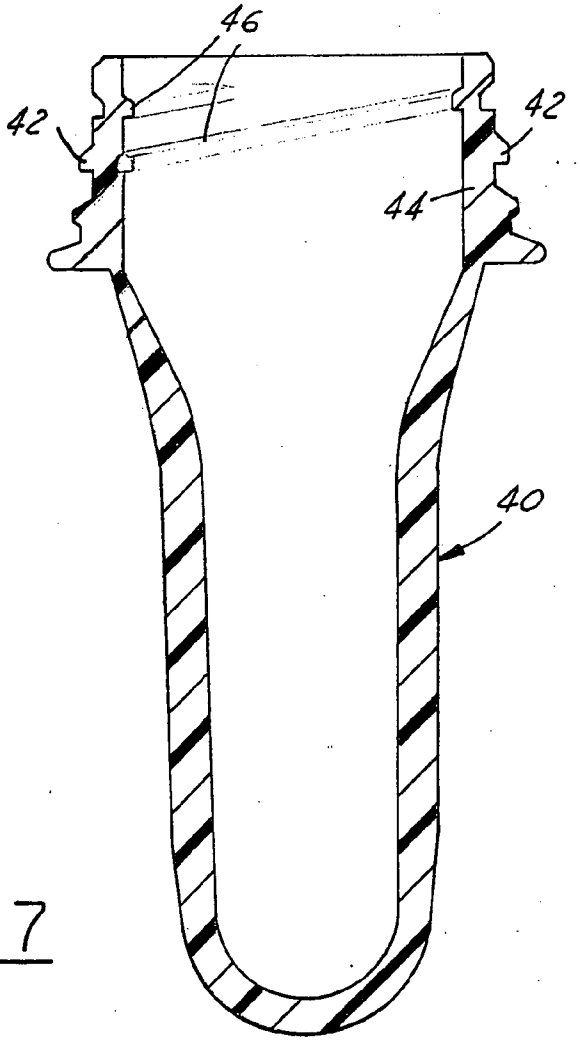


FIG. 7

SWAGE-FORMING OF CONTAINER OR PREFORM INTERNAL THREADS

[0001] Reference is made to copending application Ser. No. 10/329,666 filed Dec. 24, 2002.

[0002] The present application is directed to plastic containers and preforms for blow molding plastic containers, and more particularly to a method of forming internal threads on the preform or container finish.

BACKGROUND AND SUMMARY OF THE INVENTION

[0003] In the manufacture of plastic containers, such as monolayer or multilayer polyethylene terephthalate (PET) containers, it is conventional to mold a container preform having a body and a finish with one or more external threads. The finish typically is molded to its final geometry in the preform, while the body of the preform is subsequently blow molded to the desired geometry of the container body. However, this manufacturing technique is not well suited for fabrication of preforms or containers having internal threads because, among other reasons, it is difficult to strip a preform having molded internal threads from its forming mold. It is therefore a general object of the present invention to provide a method of forming internal threads in the finish of a molded plastic preform or container, and to provide a preform or container finish manufactured in accordance with such method.

[0004] A method of making a plastic container having a body and an internally threaded finish, in accordance with one presently preferred aspect of the invention, includes providing a preform of molded plastic construction having a body and an integral neck, and expanding the body of the preform within a mold cavity to form the body of the container. Either prior to or subsequent to blow molding the container body, at least one internal thread is formed in the neck by engaging an inner surface of the neck with a first rotary tool having a peripheral channel, engaging an outer surface of the neck with a second rotary tool having a peripheral bead, and causing rotation of the neck and tools to swage at least one internal thread in the neck.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] The invention, together with additional objects, features, advantages and aspects thereof, will be best understood from the following description, the appended claims and the accompanying drawings, in which:

[0006] **FIG. 1** is a perspective view of a container preform molded without threads in accordance with one aspect of the present invention;

[0007] **FIG. 2** is a schematic diagram that illustrates swaging internal threads in the preform of **FIG. 1**;

[0008] **FIG. 3** is a schematic diagram that illustrates swaging internal threads in a container molded from the preform of **FIG. 1**;

[0009] **FIG. 4** is a sectional view of the portion of **FIG. 3** within the area **4**;

[0010] **FIG. 5** is an exploded fragmentary perspective view of a preform or container finish assembly having both internal and external threads in accordance with another aspect of the present invention;

[0011] **FIG. 6** is a schematic diagram that illustrates swaging internal threads in a preform having molded external threads; and

[0012] **FIG. 7** is a sectional view of a preform having molded external threads and swaged internal threads.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0013] **FIG. 1** illustrates an exemplary container preform **10** having a body **12** and an integral neck **14**. Neck **14** preferably is cylindrical in contour, and has no internal or external threads in this embodiment as molded. The specific preform **10** illustrated in **FIG. 1** is molded with an external stop bead **16** for cooperating with tamper-indicating structure in a closure secured to the final container, and a support flange **18** that facilitates handling of the preform and the container. Bead **16** and flange **18** are optional. Cylindrical neck **14** is of generally uniform radial wall thickness. Preform **10** can be injection molded or compression molded of monolayer plastic construction such as PET, or of multilayer plastic construction having matrix or structural layers of PET, for example, and one or more intermediate layers of barrier material such as ethylene vinyl alcohol (EVOH) or nylon. The barrier layers may or may not extend into preform neck **14**.

[0014] In accordance with one aspect of the present invention, internal threads are swage-formed in neck **14** either prior to or subsequent to blow molding preform body **12**. As illustrated in **FIG. 2**, one or more internal threads **20** are swaged in preform neck **14** prior to blow molding preform body **12**. These threads **20** are swaged into the preform neck by means of a first rotary tool **22** that engages the inner surface of neck **14**, and a second rotary tool **24** that engages the outer surface of neck **14**. Inner tool **22** includes a disk **26** with a peripheral channel **28**. Outer tool **24** includes a disk **30** having a peripheral bead or rib **32**. With tool **22** in engagement with the internal surface of neck **14** and tool **24** engaged with the external surface of neck **14**, the tools (and preform) are rotated so that bead **32** deforms or swages the plastic material of neck **14** into channel **28** on tool **22**. This deformation can be assisted and promoted, if desired, by heating one or both of the tools **22**, **24**. After the internal threads **20** are formed in neck **14**, preform **10** is placed in a suitable blow mold, and preform body **12** is blow molded to form the body **12***a* (**FIG. 3**) of a container.

[0015] **FIG. 3** illustrates an alternative technique for swaging internal threads **20** in preform neck **14** after blow molding container body **12***a*. Reference numerals in **FIG. 3** that are identical to those in **FIGS. 1-2** indicate identical parts. Whether the internal threads are swaged in the preform neck prior to or subsequent to blow molding the preform body, the neck **14** remains of substantially uniform radial thickness as illustrated in **FIG. 4**.

[0016] **FIG. 5** illustrates a method of forming a preform or container having both internal and external threads in the preform or container finish. After swaging one or more internal threads **20** into the neck **14** of the preform or container (**FIG. 2** or **FIG. 3**), a separately made finish ring **34** is secured over the external surface of neck **14**. Finish

ring **34** has one or more external threads **36** preformed therein. As a modification to **FIG. 5**, stop bead **16** and/or support flange **18** may be formed in ring **34** rather than in the preform. Thus, the final container in accordance with the embodiment of **FIG. 5** includes both internal and external threads, with the internal threads being swaged into the container neck and the external threads being formed on a separate finish ring.

[**0017**] **FIGS. 6 and 7** illustrate another method of making a preform having both internal and external threads. In this preform **40**, the preform is molded with external threads **42** on the preform neck **44**. After molding, and either prior to or subsequent to blow molding the preform body, swage tools **22**, **24** are used to form internal threads **46** on neck **44**.

[**0018**] It may be desirable to heat neck **14** during the thread forming operation. This heating preferably is carried out by conduction from tools **22**, **24**. The neck preferably is heated to a level above room temperature, such as in the range of 50° C. to 100° C. for PET finishes. The temperature of the finish neck preferably should not exceed the glass transition temperature Tg of the neck material by more than about 40 to 50° C. For example, finish neck heating to a level of 120° C. or above can cause distortion and warping of the neck. Five seconds of contact time is ample for thread formation when neck **14** has a thickness of 0.5 to 1 mm (0.019 to 0.039 inch). A lesser contact time, such as on the order of one second, may not be adequate unless the finish neck is very thin, which would not be desirable in the embodiments of **FIGS. 1-4** but could be accommodated in the embodiment of **FIG. 5**.

[**0019**] Thus, one or more internal threads are swage formed on the E wall of preform and container neck **14**. All or a portion of the preform or container neck can be crystallized before or during formation of internal threads **20** to prevent shrinkage or distortion. This would be particularly desirable in hot-fill applications, where the temperature of the material placed in the container otherwise might cause shrinkage or distortion of the container finish. Crystallization of the container finish can extend throughout the radial thickness and the axial length of the neck, including stop bead **16** and/or support flange **18** where provided, if desired.

[**0020**] There have thus been disclosed a preform, a container and a method of manufacture that fully satisfy all of the objects and aims previously set forth. The preform, container and method of manufacture have been disclosed in conjunction with several presently preferred embodiments thereof, and a number of modifications and variations have been discussed. Other modifications and variations will readily suggest themselves to persons of ordinary skill in the art. For example, tooling can be provided on rotary tools **22**, **24** to swage-form the top sealing surface at the axially upper edge of neck **14**. The invention is intended to embrace all such modifications and variations as fall within the spirit and broad scope of the appended claims.

1. A method of making a plastic container having a body and an internally threaded finish, which includes the steps:

(a) providing a preform of molded plastic construction having a body and an integral neck,

(b) expanding said body of said preform within a mold cavity to form said body of said container, and

(c) either prior to or subsequent to said step (b), forming at least one internal thread in said neck by:

(c1) engaging an inner surface of said neck with a first rotary tool having a peripheral channel,

(c2) engaging an outer surface of said neck with a second rotary tool having a peripheral bead, and

(c3) causing rotation of said neck and said tools to swage at least one internal thread in said neck.

2. The method set forth in claim 1 wherein said step (c) includes heating one or both of said tools.

3. The method set forth in claim 1 which includes the step, following said step (c3), of:

(d) placing a finish ring with at least one external thread over said neck to form a container having a finish with both internal and external threads.

4. The method set forth in claim 1 wherein said step (a) includes providing at least one molded external thread on said neck, such that said neck has at least one external thread and at least one internal thread following said step (c).

5. A method of making an internally threaded finish on a plastic preform or container, which includes the steps of:

(a) providing a plastic neck on the preform or container without internal threads, and

(b) forming at least one internal thread in said neck by:

(b1) engaging an inner surface of said neck with a first rotary tool having a peripheral channel,

(b2) engaging an outer surface of said neck with a second rotary tool having a peripheral bead, and

(b3) causing rotation of said neck and said tools to swage at least one internal thread in said neck.

6. The method set forth in claim 5 wherein said step (c) includes heating one or both of said tools.

7. The method set forth in claim 5 which includes the step, following said step (c3), of:

(d) placing a finish ring with at least one external thread over said neck to form a container having a finish with both internal and external threads.

8. The method set forth in claim 5 wherein said step (a) includes providing said neck with at least one external thread, such that said neck has at least one external thread and at least one internal thread following said step (c)

9. A plastic container made in accordance with the method set forth in claim 1.

10. A finish on a plastic container or preform made in accordance with the method set forth in claim 5.

11. A finish on a plastic container or preform made in accordance with the method set forth in claim 8.

12. A finish on a plastic container or preform, which includes:

a cylindrical neck of substantially uniform wall thickness and having at least one internal thread, and

a finish ring secured over said neck and having at least one external thread.

13. A finish on a plastic container or preform, which includes:

a cylindrical neck having at least one internal thread and at least one external thread.

14. The finish set forth in claim 13 wherein said neck is of molded plastic construction, said at least one external thread is integrally molded with said neck, and said at least one internal thread is swage-formed on said neck.

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