

[54] **REVERSE ANGLE THREAD SYSTEM
FOR CONTAINERS**

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[22] Filed: Oct. 16, 1970

[21] Appl. No.: 81,279

[52] U.S. Cl. 215/43, 220/39

[51] Int. Cl. B65d 41/04

[58] Field of Search 215/43; 220/39; 151/21 R, 21 B,
151/22 R

[56] **References Cited**

UNITED STATES PATENTS

3,589,550	6/1971	Rossmann.....	220/39 R
3,189,072	6/1965	Starr.....	220/39 R X
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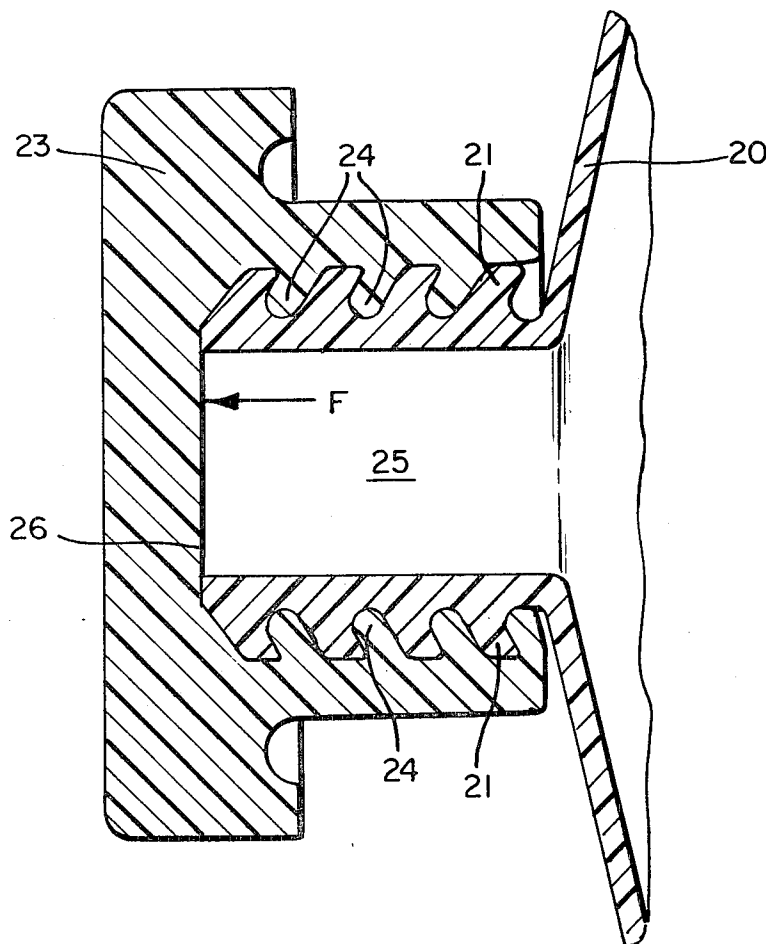
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[57] **ABSTRACT**

In a container for holding fluids having a neck portion through which the fluid is poured and a head portion, or cap which threadedly engages the neck portion, a thread system wherein the neck, or male threads are made of a relatively deformable plastic material, such male threads having a reverse downward angle and having parallel upper and lower edges, and the cap, or female member, being made of a harder less deformable material and having interengaging upward angled threads, the upward angle of the female member being greater than that of the male member such that upon threaded engagement the male threads hook within the female threads and are stressed into a strengthened engagement.

7 Claims, 3 Drawing Figures



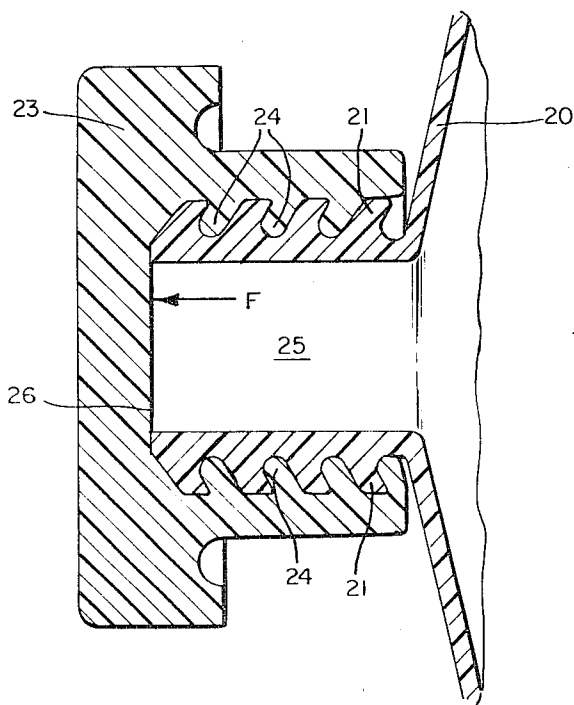


Fig. 1

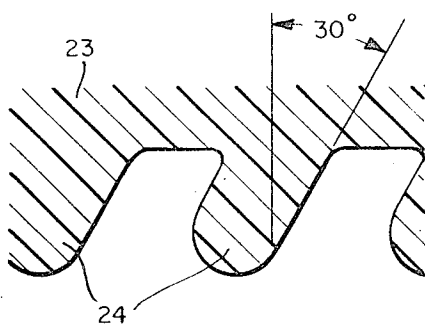


Fig. 2-a

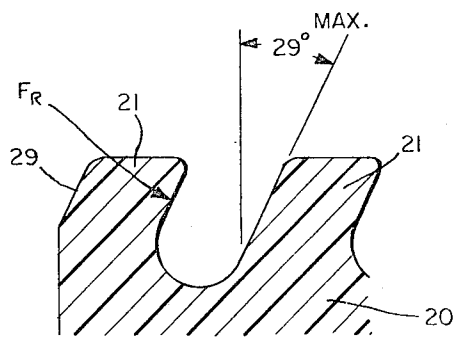


Fig. 2-b

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REVERSE ANGLE THREAD SYSTEM FOR CONTAINERS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an improvement in threaded closure systems for plastic containers utilized for high-strength applications and, more particularly, to an improved thread system which strengthens its locking engagement as the components are threaded together.

2. Description of the Prior Art

In many applications, plastic-type containers which are provided with threaded closure means, are utilized for containing liquids which give rise to considerable pressures within the vessel. In other applications, the deformable nature of the plastic container is such that, under the stresses of handling, loading, and transporting considerable pressures are generated within the vessel. Such pressures exert force on the threaded closure means, which generally consist of a threaded neck, or nozzle, and a threaded cap which interfits with such neck. It is necessary that the thread system, or assembly, be able to accommodate such internal pressures. The general source of failure in thread systems such as utilized for the above applications is that of nonuniform stress applied to the female member, or cap. In the standard 60° thread system, maximum stress is transmitted radially through the apex of each thread, causing localized strain at the apex of the receiving groove. Further, when internal pressure tends to force the cap off the container, the 60° thread of the neck provides a restraining force on the cap which has a radially outwardly directed component, which is the reverse of what is desired. Accordingly, thread constructions in containers designed to retain high pressures have generally had either oversized cross sections, or various supplemental mechanisms to strengthen the thread system.

An improvement over the standard screw design is that of the buttress-type thread, which provides a flat engaging surface normal to the axis of the container. In this thread system, the restraining force has no outward component, and in this regard represents an improvement. Buttress threads, and adaptations thereof, have been widely used in the art. See, for example, U.S. Pat. No. 3,487,442, illustrating an improvement to a buttress thread system. The buttress thread provides an improvement against shear due to axial stress, but does not improve over the standard design in providing against radial stress.

Another technique used in the art is to construct one of the closure elements of a relatively soft or deformable material, and the other of a harder material, so as to provide interengaging compression forces to strengthen the engagement of the two elements. See, for example, U.S. Pat. Nos. 2,950,033 and 2,962,185. However, in these and other thread systems, there is no means within the thread structures themselves to provide locking forces holding the male and female members together under the force of pressure from within the container. Thus, while the thread systems are tightly engaged and not easily unscrewed, there is no gripping or locking action in such structures to prevent fracture due to interaction forces between adjacent thread surfaces.

SUMMARY OF THE INVENTION

It is an object of this invention to provide a thread system for containers wherein the threads interengage in a manner such as to restrain both radial and axial forces.

It is a further object of this invention to provide a thread system for containers, which thread system is able to withstand internal container pressures of great magnitude.

It is a further object of this invention to provide a thread system for containers wherein the male and female members interlock in a manner such that thread stress is distributed evenly between such members.

Accordingly, this invention provides an improved thread system for a container having a neck member with an opening therethrough, and a cap which is screwed into a complementa-

ry threaded engagement with the neck, wherein the neck is made of a relatively deformable soft plastic material and has threads extending radially outward on the outer surface thereof, each thread being inclined at a downward angle from a plane normal to the axis of the neck, and the cap, made of a harder plastic material, has receiving threads adapted for interengagement with the neck threads, the cap threads being inclined upward from the plane normal to the axis at an angle reverse to that of the neck threads, such that upon threaded engagement the relatively deformable neck threads are pushed into locking engagement with the cap threads. The reverse angled threads permit a locking engagement of the male and female closure members which strengthens the closure against internally generated pressures. By making the angle of the neck threads less than that of the cap threads, the neck is stressed into a tight engagement with the cap.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross section of the thread system of this invention, showing the container neck and cap in threaded engagement.

FIG. 2a is an enlarged cross section of the cap threads of this invention.

FIG. 2b is an enlarged cross section of the neck threads of this invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to FIG. 1, the thread system of this invention is shown, having the container neck and cap in threaded engagement. Container 20 has an opening 25 through an upper neck portion which has downward angled threads 21, as also shown in FIG. 2b. The threads have parallel upper and lower surfaces, the surfaces being at an angle of 29° with respect to a plane normal to the axis of the neck, in the preferred embodiment. The cap 23 has threads with parallel upper and lower surfaces, the surfaces being inclined upward with respect to a plane normal to the axis of the cap, the angle of inclination being 30° in the preferred embodiment.

The cap is made of a relatively hard nondeformable plastic substance, such as polystyrene, while the container neck, or male member, is made of a softer, more deformable material, such as polyethylene. These examples of relatively hard and soft plastic materials are given for illustrative purposes only, it being understood that the invention may be practiced with any two plastic materials having relatively soft and hard properties with respect to each other.

When threaded together, as shown in FIG. 1, the threads of the two elements hook within each other, being of reverse angles with respect to the plane normal to the axis of the container and cap. Due to the reverse angle geometry, as contrasted to the standard 60° and buttress thread geometries, adjacent threads don't merely engage, but actually hook each other in a locking and mutually supporting configuration. Also, due to the lesser angle of the relatively soft plastic neck threads being forced into the greater angled receiving threads of the harder plastic cap, there is a further tightening and strengthening of the thread system.

When thus threaded together, the two elements provide a greater strength than prior art thread systems, because of the nature of the interlocking of the threads. When the pressure F within neck 25 tends to push cap 23 off container 20, the container threads 21 provide a reaction force against cap threads 24, which reaction force has a radially inward component as well as an opposing axial component, as indicated by the reaction force vector F_r . It is thus seen that the reverse angle thread acts to clamp the cap inwardly in response to axial pressure, which action provides a great advantage over prior art thread systems. It is to be emphasized that the invention provides greater strength in the thread system itself. Sealing of the cap to the container neck is of secondary importance, as the top opening of the container is usually sealed by a gasket 26 located in the bottom of the cap.

It is to be understood that the reverse arrangement of threads is the feature that causes the hooking interengagement of cap and neck, and that the threads may be angled upward instead of downward, or the male-female roles of the container neck and cap may be reversed, within the spirit and scope of this invention. Further, while the thread angles of 29° for the neck and 30° for the cap are preferred angles, and angular difference in the range of 1° to 5° may be utilized in the practice of this invention. Further, any reverse angle in the range of 25° to 45°, for the cap and neck threads, provides the strength and locking features of this invention.

Due to the nature of the threads as described, it is understood that this invention is not applicable to metal containers, but that the threads must be molded of plastic. However, the container neck and cap may be made of any suitably deformable and moldable material. The improved thread assembly, as described above, is extremely useful in containers for acids, toxic fluids, beverage containers, and particularly any substance where internal container pressures may be generated, and safety is an important factor.

I claim:

1. A container assembly comprising:

- a. a cylindrical neck member having an opening therethrough and threads around the outer surface thereof, the threads having parallel upper and lower surfaces inclined downward at a first angle from the plane normal to the axis of said neck member;
- a closure cap member in complementary threaded engagement with said neck member, having threads around the inner surface thereof, such threads having parallel upper and lower surfaces inclined upward at a second angle

greater than said first angle; and

- c. said two elements when threadedly interengaged hooking each other such that when pressure within said container assembly is exerted against said cap member, said neck threads transmit a reaction force against said cap threads having axial and radially inward components.

2. The container assembly as described in claim 1 wherein said neck member is comprised of a relatively soft plastic material, and said closure member is comprised of a relatively hard plastic material.

3. The assembly as described in claim 2 wherein the angular difference between said first and second angles is in the range of 1° to 5°.

4. The assembly as described in claim 3 wherein said second angle is 30° and said first angle is 29°.

5. The assembly is described in claim 3 wherein said second angle is in the range of 25° to 45°.

6. A container assembly comprising:

- a. a first cylindrical member having male threads;
- b. a second cylindrical member having female threads;
- c. said members being in complementary threaded engagement and having a common axis, and said threads being at reverse angles from the plane normal to said axis such that an axial force exerted upon one of said members is opposed by a reaction force transmitted through the threads of the other, said reaction force having an opposing axial component and a radially inward component.

7. The assembly as described in claim 6 wherein said male threads are inclined at a first angle from said plane, and said female threads are inclined at a second angle from said plane.

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