Sept. 21, 1965 W. J. PENTESCO 3,207,356

CLOSURE PLUG

Filed Aug. 14, 1962

Fig. 1

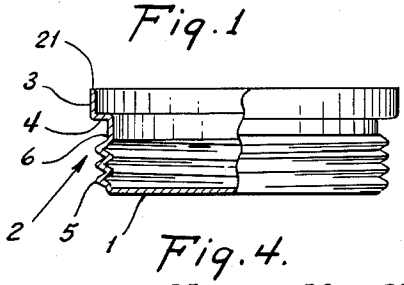


Fig. 2.

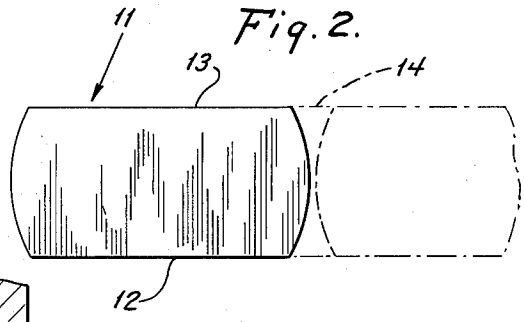


Fig. 4.

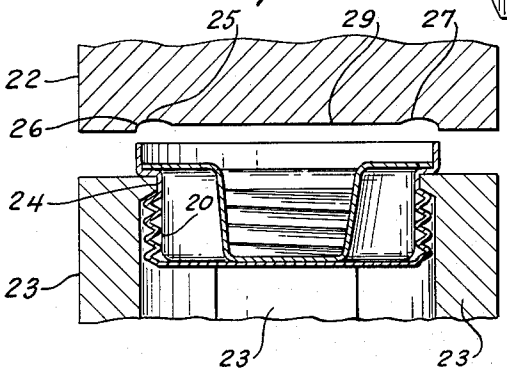


Fig. 3.

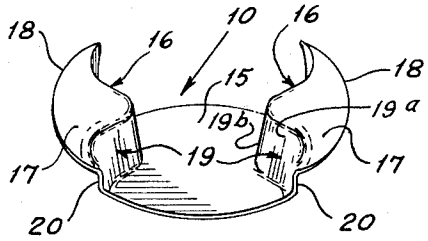


Fig. 5.

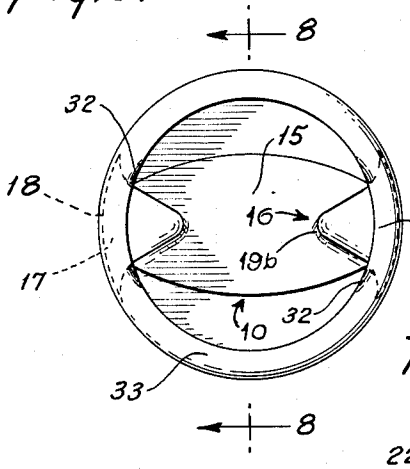


Fig. 6.

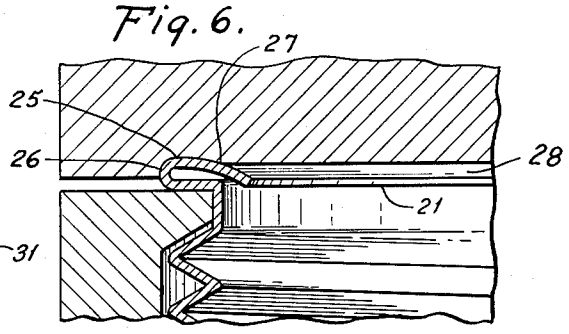


Fig. 7.

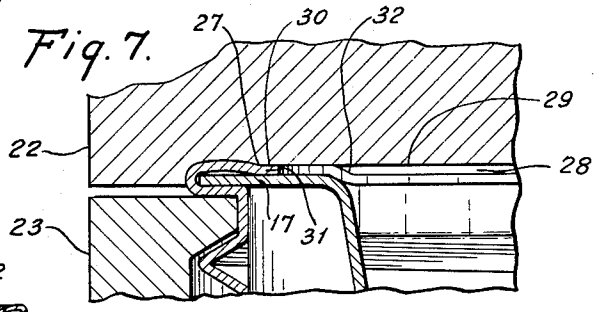
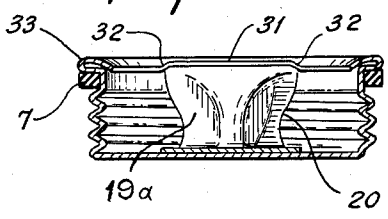


Fig. 8.



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3,207,356

CLOSURE PLUG

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3 Claims. (Cl. 220—39)

This invention relates to closure plugs for containers and methods for making the same and is more particularly concerned with the combinations of threaded plug bodies with means for actuating the plugs and methods for forming such combinations.

With the increasing trend toward lightweight containers, such as steel barrels and drums, it is becoming more and more important to provide closures of corresponding lightweight material and which will meet the recognized standards for those containers. Where lightweight threaded closure plugs are provided in closures of such large containers, the construction of a satisfactory actuating means for tightening and loosening the plug within the opening becomes quite critical. Frequently, in practice, the forces exerted in tightening the plug are far greater than are necessary to effect a tight seal. In such instances the excessive force applied, instead of providing a tight closure, tends to distort the plug and cause the closure to leak. Further, since comparable force must be applied to the plug to remove it, unless the plug and the actuating means have been properly constructed, distortion of the plug or the actuating means on removal will make that removal more difficult.

A lightweight plug possessed of the advantages of the prior art plugs of heavier material must be provided with a wrench engaging means which, in itself, is of suitable strength in addition to having a connection between the wrench engaging means and the plug which provides adequate torque resistance. Also, the forces applied to the plug, through the wrench engaging means, must be distributed over the plug in such a way as to eliminate any distortion of the plug or reduce it to an inconsequential minimum. At the same time the whole of the construction, as well as the method of manufacture, must lend itself to the production of a simple, economical, effective closure in order to make a commercially attractive product.

It is accordingly a primary object of this invention to provide lightweight closure plugs for the closures of large containers with effective wrench engaging means;

Another object is to provide for a strong engagement between the wrench engaging means and the plug;

Another object is to provide such means and such engagement in a manner to protect the plug against distortion when actuated;

A further object is to provide a wrench engaging insert for closure plugs which is so formed as to effectively resist distortion or collapse.

A further object is to provide such an insert which imparts a high degree of rigidity to the closure plug.

Further objects are to provide methods for forming the wrench engaging insert and for assembling such inserts with the plug body in simple economical manner.

Still further objects will in part be obvious and in part be pointed out as the description of the invention, taken in conjunction with the accompanying drawing, proceeds.

In that drawing:

FIG. 1 is a part elevation part vertical section of a partially formed plug in accordance with the invention;

FIG. 2 is a plan view of a strip of material illustrating the blanking of a plug insert therefrom;

FIG. 3 is a perspective view of the completed wrench engaging insert;

FIG. 4 is a vertical section of the curling die with the plug blank and insert assembled together and mounted therein and with the curling anvil of the die in position to commence its curling operation to complete the plug;

FIG. 5 is a top plan view of the finished plug;

FIG. 6 is a fragmentary vertical section of the curling anvil in contact with a somewhat open portion of the plug rim.

FIG. 7 is a view similar to FIG. 6 but at the position where the plug rim is curled over on the end of the insert; and

FIG. 8 is a vertical section taken along line 8—8 of FIG. 5 and looking in the direction of the arrows.

Considering first the plug body as shown in FIG. 1, the same is formed by blanking a hollow cup-shaped member out of a circular blank of light gauge sheet metal, to have a bottom **1** with an upstanding cylindrical side wall **2** therearound. The uppermost portion **3** of the side wall is of increased diameter with respect to the rest of the plug. This portion subsequently becomes the head of the plug. An annular shoulder portion **4** extends substantially parallel to the bottom **1**. The side wall **2** has roller swaged threads **5** imparted thereto. A thread formation of this type, besides providing an effective securing means, adds substantial rigidity to the plug body. This is highly important when lighter gauge stock is employed as in the instant invention. Between the threaded portion **5** and the shoulder **4** the side wall is inset to form a gasket seat with a cylindrical bottom **6**, for the reception of a gasket **7**, as shown in FIG. 8.

FIG. 2 illustrates a strip **11** of sheet metal from which the wrench engaging insert, generally indicated at **10** in FIG. 3, is blanked. It can readily be seen that in the production of the insert blanks, wastage is kept to a minimum due to the fact that the strip, having parallel sides **12** and **13**, need only have the double concave portion **14** punched out of it.

Considering the finished insert **10** shown per se in FIG. 3, it can be seen that it is formed with an intermediate flat base portion **15** and end portions formed upwardly from that base into wrench engaging lugs **16**. The lugs **16** extend substantially perpendicularly from the base portion **15** and have flat top portions **17** substantially parallel to the base **15**, which terminate in the convexly curved free edge extremities **18**. The upstanding side wall **19** of each lug extends in substantially a sine curve from one free vertical edge **20** to the opposite one. These curves are concave at the side positions **19***a* and project inwardly toward each other at their mid-positions **19***b*.

The design of the insert **10** is such that it is easily produced from the strip **11** in a progressive die having two stations. In the first station the strip is formed into the configuration of FIG. 3 and in the second station the blank is punched out of the strip **11**. In the finished insert **10**, the curvature of the edge extremities **18** and the distance therebetween brings those surfaces into correspondence with the inner surface of the enlarged upper portion **3** of the plug wall, while the height and spacing of the free edge portions **20** of the lugs **16** is such as to enable them to fit snugly within the threaded portion of the plug side wall for a reason to be discussed hereinafter. The curvature of the sides of the base **15** of the insert is due to the stretching of the metal in the formation of the end portions.

FIG. 4 illustrates the next step in the manufacture of closure plugs in accordance with this invention. First the insert **10** is seated within the plug, with the base portion **15** resting upon the bottom **1** and the flattened tops of the wrench engaging lugs resting upon the upper surface of the annular shoulder **4**. This assembly is placed within a curling die having a rolling anvil **22** and

a plurality of expandable supporting jaws 23. The jaws 23 each have an inwardly projecting lip 24 which abut the plug gasket seat 6 and underlies the annular shoulder 4 when the jaws are in closed position. These lips effectively support the plug assembly during the curling operation and, at the termination of the press cycle when the jaws expand, release the plug so it can be ejected from the die.

The rolling anvil 22 has an annular groove 25 formed therein, which contacts the upper edge of the enlarged wall portion 3, rolling the same inwardly so as to secure the insert upon and against the surface of the shoulder 4. An important object of this invention is to effectively secure this wrench engaging insert within the plug body so as to withstand torques in the 25 lb. ft. range, without that securing requiring a rolling anvil configuration whereby the plug would need to be oriented within the die in any particular manner for matching up with the rolling anvil. This materially decreases production time and simplifies the apparatus required.

FIGS. 6 and 7 illustrate, in detail, how the rolling anvil of the instant invention, having a uniform configuration throughout, forms the upstanding wall portion 3 into the head of the plug to achieve the result desired. FIG. 6 shows the die in closed position after having fully formed a portion of the plug head spaced from the inserts, while FIG. 7 shows the condition that prevails where the fully formed head overlies an insert. The curvature of the curling surface 25 is such that, when the die closes, the upper end 21 of the enlarged wall portion 3 is first engaged by that surface at approximately the position 26. As the die continues moving down, the curling surface turns the end 21 inward and then causes most of the height of the portion 3 to be curled inwardly in the form of an open bead as seen in FIG. 6. When the metal being curled, reaches the inner end 27 of the curling surface, it will follow its now natural tendency to continue in the inward path in which it has been directed by the surface 25 to a position below the plane of the shoulder 4 as indicated at 28.

In the portions of the circumference where the upper wall portion 3 is formed over the top 17 of the lugs, a substantially different movement of the metal takes place. The metal still forms a bead but that bead is substantially filled by the top 17. Beyond the position 27 of the rolling anvil, however, the metal overlies the top 17 of the lug 16 and is held against it by the bottom surface 29 of the rolling anvil as indicated at 30.

Thus the portion 31 of the inturned wall extending inwardly of the inner end 27 of the curling surface and over the lug top 17 is forced down flat against that top to keep hold of the lug, and the insert, tightly in the plug.

Turning of the insert in the plug is precluded by the abrupt downward shouldering of the inturned portion of the plug head 33 as it departs at 32 (FIG. 8), at either side of the lug top 17 from the flat portion 31 into the downwardly directed portion 28. This shouldering, taken in conjunction with the close fit of the insert in the plug body and within the head 33, assures that when a wrench is engaged with the lugs 16 to actuate the plug, the insert will withstand much greater torque before breaking free than would ever be needed to effectively tighten or loosen the plug. At the same time, and importantly, the uniformity of the perimeter and top of the plug head are maintained throughout its circumference as needed for effective closing and sealing. In addition, the doubling over of the enlarged portion 3 adds rigidity to the plug head which, as can be seen in FIG. 8, backs up and supports the gasket when the plug is tightened into a closure. If this support is not sufficient, or is uneven, tightening of the plug in a manner to prevent leakage may be difficult and may distort the plug.

Reverting again to the showing of the curling anvil in FIGS. 4, 6 and 7, it is to be noted that the particular curvature applied to the curling surface 25 of the anvil is of material significance. If, for instance, the curvature were too pronounced, or the curve was too short, the free end edge 21 of the portion 3, as it emerged from the surface 25 at the position 27, would dig down into the upper surface of the lug portions 17 and would either collapse the portion 17 downwardly or be itself collapsed at that position. If, on the contrary, the curvature of the surface was too flat or extended beyond the position 27, the free portion 28 of the turned over edge would not extend downwardly to a sufficient extent to lie against the sides of the lug portion 17 to prevent the insert from rotating.

The product and method of manufacture disclosed here provide a plug of lightweight metal having structural qualities heretofore thought to be found only in much heavier and more costly closure plugs. The wrench engaging insert fits snugly within the plug with the edge 20 making line contact with the inner surface of the threaded side wall (FIG. 4), hence not only adding rigidity to the plug but supporting the wrench engaging lugs in such a manner as to minimize any likelihood of their collapsing under excessive loads. This arrangement provides for an even distribution of the forces throughout the plug wall, which are applied when the plug is actuated and which in the prior art plugs have often resulted in leakers due to a distorted plug.

Though in the foregoing description and in the accompanying drawing a preferred form of the invention has been shown and described, it is to be understood that the article and method, so disclosed, are presented for illustrative and not limiting purposes.

Having disclosed my invention, what I claim is new and desire to secure Letters Patent for is:

1. A rotatably applied closure plug for containers, said plug having a body formed as a generally cup-shaped member and comprising a bottom and an upstanding wall therearound, securing means on the plug adapted to interact with other securing means on a container at an opening therein to secure the plug to the container upon relative rotation of the two such securing means, the entire upper circular edge of said wall of the cup-shaped member terminating in a laterally extending head having a flat first portion extending outwardly from said wall and then curled into an inwardly and downwardly extending second portion closely overlying said first portion, an actuating means engaging insert seated wholly within said cup-shaped member, said insert extending diametrically within said plug having an elongated intermediate portion and opposite extremities positioned between said first and second portions, said inwardly extending second portion terminating in a free edge overlying said extremities and extending down to a position below said extremities and closely adjacent said upper edge of said wall throughout the remainder of the periphery of said cup-shaped member forming an abutting surface on either side of said extremities so that the insert is effectively secured against rotation relative to said cup-shaped member.

2. A closure plug as in claim 1, the intermediate portion of said insert comprising a pair of opposed upstanding actuating member engaging lugs extending radially inwardly of said wall and a flat elongated base connecting said lugs and seated upon said bottom.

3. A rotatably applied closure plug for containers, said plug having a body formed as a generally cup-shaped member and comprising a bottom and an upstanding wall therearound, securing means on the plug adapted to interact with other securing means on a container at an opening therein to secure the plug to the container upon relative rotation of the two such securing means, the entire upper circular edge of said wall of the cup-shaped member terminating in a laterally extending head having

a flat first portion extending outwardly from said wall and then curled into an inwardly and downwardly extending second portion closely overlying said first portion, an actuating means engaging insert seated wholly within said cup-shaped member, said insert extending diametrically within said plug having an elongated intermediate portion and opposite extremities positioned between said first and second portions, said intermediate portion comprising a pair of apposed upstanding actuating member engaging lugs extending radially inwardly of said wall and a flat elongated base connecting said lugs and seated upon said bottom, each lug having an upwardly presented top surface lying in a plane parallel to said base and extending radially outwardly of said extremities, said inwardly extending second portion terminating in a free edge overlying said extremities and extending down to a position below said extremities and closely adjacent said upper edge of said wall throughout the remainder of the periphery of said cup-shaped member so that the insert is effectively secured against rotation relative to said cup-shaped member.

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