Nov. 5, 1968 J. M. DE VOE 3,408,902

METHOD OF MAKING CLOSURE FOR CONTAINERS

Filed Dec. 12, 1966 2 Sheets-Sheet 1

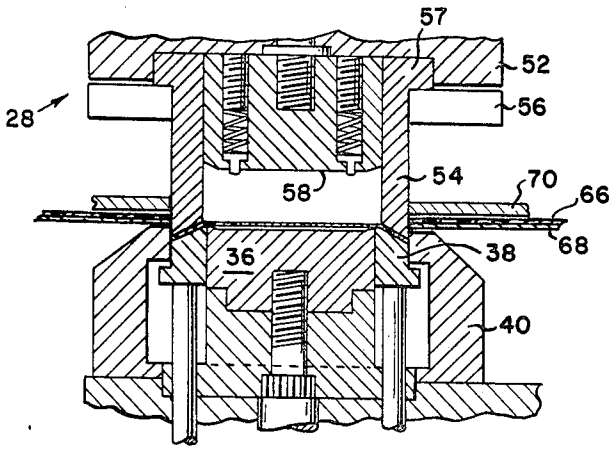

Fig.5

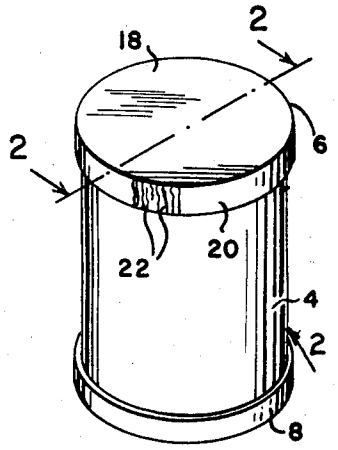

Fig.1

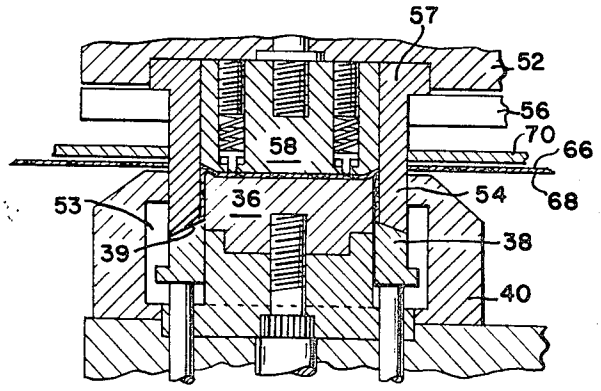

Fig.6

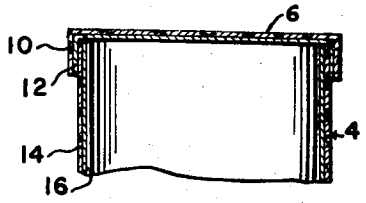

Fig. 2

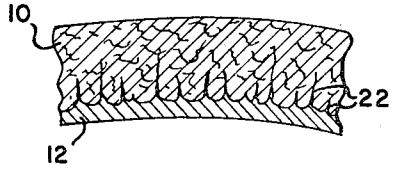

Fig. 7

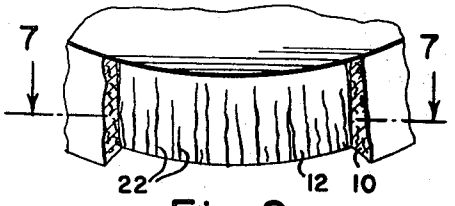

Fig.8

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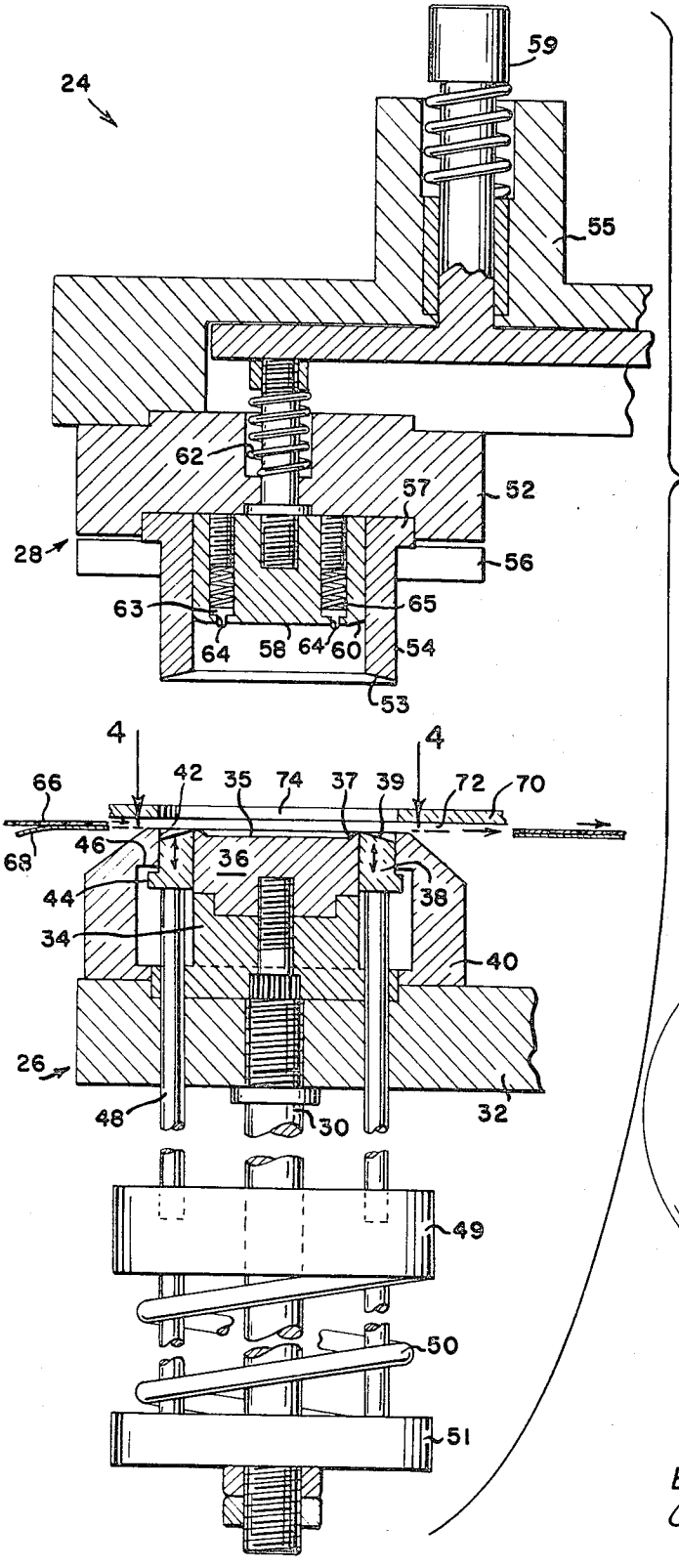
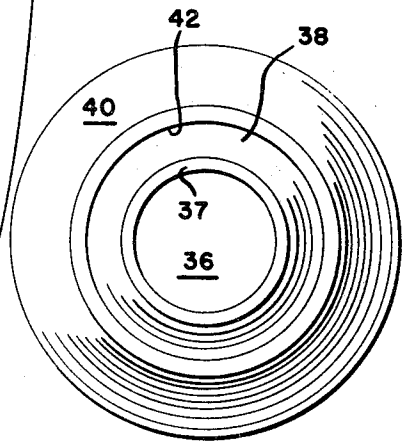


Fig. 3

Fig. 4



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METHOD OF MAKING CLOSURE FOR CONTAINERS

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5 Claims. (Cl. 93—1.3)

This invention relates to closures for containers and more particularly to fluid-tight or moisture-proof closures formed of layers of paper and metal foil.

Moisture-proof or vapor-proof containers have been made by producing cardboard or paperboard containers and lining them with metal foil. In some of the prior containers the foil lining has been attached to the cardboard by gluing, but that has not proven to be a satisfactory way of producing the closures for such containers. A closure in which the layers are glued together is not sturdy, and it tends to lose its shape, which weakens the closed container, and it also causes the closure to fit less snugly against the container walls than is desired. A tight fit between the closure and the container is particularly important in a moisture-proof container, and the lid should continue to hug the container tightly even after it has been removed from the container and replaced on it several times.

An object of this invention is to provide a container closure that is strong and sturdy, and which fits tightly on the container. A further object is to provide a container closure that will retain its desirable characteristics after repeated removal from the container and replacement thereon. A further object of the invention is to provide a simple and inexpensive method of making such closures. These and other objects will be in part obvious and in part pointed out below.

Stated in somewhat simplified form, this invention comprises forming container lids from paper and foil layers, e.g., in a punch press, while the paper is damp, and in such a way that a number of small, sharp ridges or barbed fins are created in the foil against the paper and are forced into the surface of the paper, after which the paper is shrunk. The ridges or fins are intimately interlocked into and are gripped by the fibers of the paper so that the lid is sturdy and compact. Hence, an integral lid is formed of the layers of paper and foil without the use of adhesive.

In the drawings:

FIGURE 1 is a perspective view, with a portion cut away, of a container with closures made in accordance with the present invention;

FIGURE 2 is a cross-sectional view of a portion of the container shown in FIGURE 1, taken along line 2—2;

FIGURE 3 is a cross-sectional view of a punch press for producing the closure shown in FIGURE 1;

FIGURE 4 is a plan view of the die portion of the punch press shown in FIGURE 3, taken along line 4—4 in FIGURE 3; and

FIGURES 5 and 6 are similar to FIGURE 3, except that they show the punch press in different stages of its cycle, and they are schematic in that they show a single sheet of the paper and foil.

FIGURES 7 and 8 are detailed sectional views of the completed closure.

Referring to FIGURE 1 of the drawings, a cylindrical container 2 comprises a side wall 4 and end closures 6 and 8. End closure 6 (see also FIGURE 2) is in two layers, a paper layer 10 and a metal foil layer 12. Side wall 4 is of similar construction, comprising both a paper layer 14 and a foil layer 16. Each of the layers of closure 6 is a single circular piece or disc which has been shaped to form a shallow cylinder with a flat, disc-like end wall

18 and a cylindrical side wall 20 formed by portions 19 and 21, respectively, of the paper and foil layers. The internal diameter of side wall 20 is such that it fits snugly against the side wall 4 of the container. The portion of the sidewall 20 that has been cut away to expsoe the cylindrical portion 21 of the foil layer 12 is enlarged in FIGURE 8, and shows a great many small ridges 22 in portion 21. These ridges project into and interengage with the paper layer portion 19, creating a strong bond between the two layers and forming an integral mechanically-laminated wall.

FIGURES 3 through 6 show the portions of a standard punch press that have been adapted to produce closure 6 in accordance with the present invention. The punch press 24 includes a fixed die assembly 26 and a movable punch assembly 28 which moves vertically to engage the die 26 as shown in FIGURES 5 and 6.

Referring to FIGURE 3, the die assembly 26 includes a shaft 30 upon which components of the die assembly are mounted. Attached in a stationary manner to shaft 30 are: a die shoe 32; a center post 34; a circular pad 36; and, a peripheral cutting ring 40. Pad 36 presents a flat upper surface 35 except that it has a raised rim portion which presents an elevated peripheral edge surface 37. Edge surface 37 is an inverted frusto-conical surface so that it slopes toward the center of pad 36. Circular pad 36 is surrounded snugly by a draw ring 38 which has frusto-conical top surface 39, and (see also FIGURE 4) is mounted resiliently in a manner later to be described. Draw ring 38 is surrounded snugly by cutting ring 40, the inner edge of the top of which is a cutting edge 42.

Draw ring 38 is adapted to slide vertically inside cutting ring 40 along the outside of pad 36 and central post 34 with its upward motion limited, however, by the engagement of a flange 44 on the draw ring with a horizontal edge surface 45 of ring 40. Draw ring 38 is supported by a plurality of rods 48, the upper ends of which are fixed to the draw ring, and each of which is rigidly attached at its lower end to a ring 49 that slides on shaft 30. A heavy compression spring 50 presses upward on ring 49 urging draw ring 38 toward the position shown. Spring 50 rests upon a disk 51, which is supported adjustably on shaft 30.

The punch assembly 28 of the punch press is located above the die portion 26 and moves downwardly and engages the die assembly in the course of each closure-forming cycle of the machine. Punch assembly 28 comprises: a punch head 55; a punch holder 52 which is mounted in a fixed manner on head 55; and, a punch 54 which has a top flange 57 by which it is rigidly affixed to holder 52 by a clamp ring 56. Punch 54 is a circular ring which is similar to draw ring 38 and has the same general outer and inner radii except for the flanges 44 and 57. Punch 54 is positioned above the draw ring and has a bottom frusto-conical surface 53 which is identical with surface 39 of the drawing and forms a cutting edge which mates with cutting edge 42 of the stationary cutting ring 40. As the punch assembly moves downwardly to engage the die assembly, punch 54 enters the space between pad 36 and cutting ring 40, and surface 53 engages surface 39 so that the continued movement pushes draw ring 38 down, overcoming the upward force of spring 50. Also, as will be explained below, the cutting edges interengage to cut a disc portion which is formed into a closure 6.

Slidably mounted within punch ring 54 and normally resting against punch holder 52 is a punch pad 58, which is of substantially the same radius as pad 36. Punch pad 58 has a bottom surface which is flat except that the edge is somewhat beveled to form a frusto-conical edge surface 60 that is adapted to mate with the raised edge surface 37 of pad 36. Punch pad 58 is rigidly mount-

ed on a shaft which is surrounded by a compression spring **62** by which the shaft and the punch pad are normally held in the position shown in FIGURE 3. Punch pad **58** contains a plurality of air vents **64** which are normally closed by valves **63** which are urged to closed position by springs **65**. However, the vents are opened when the projecting noses of valve **63** are pressed upwardly.

The sheets of paper **66** and foil **68** from which the closures are produced are drawn through the punch press from left to right with foil sheet **68** passing just above the upper surface of die assembly **26** and with the paper sheet **66** directly above the foil sheet. The paper and foil sheets are guided in this movement by a metal plate **70** located a short distance above the upper surface of the die assembly **26** and forming a narrow horizontal slot **72**, through which the paper and foil sheets pass. A circular hole **74** in plate **70** is of a size to permit the punch **54** to pass through it.

In the illustrative embodiment, the foil is a thin steel foil, and the paper is kraft lined "can bottom stock" of .03 inch thickness. Prior to fabrication the paper is softened by soaking it with a light soap solution. In practice, each day the paper which is to be used the following day is wetted on a rewinder onto rolls which are stored overnight in closed containers. Hence, the paper is relatively soft, although it retains sufficient strength to permit fabrication at a commercially satisfactory rate.

The paper and foil sheets advance step-by-step with each step being for a set distance during the sheet feeding portion of each cycle when the punch assembly is in the position shown in FIGURE 3, and remaining stationary when the punch is engaging the die as shown in FIGURES 5 and 6.

The operation of the punch press is illustrated in FIGURES 5 and 6 and is as follows: As the punch head moves downwardly, punch ring **54** forces the paper and foil sheets downwardly to cutting ring **40** and thence as the punch moves past the cutting edge **42** of ring **40** the punch cooperates with the cutting edge to cut both sheets to produce a circular piece or disc from each of the sheets. The two discs thus formed are unattached at this time and by the further cooperative action of the punch and die assembly they are formed into a container closure. As the punch assembly continues to move downwardly, the peripheral portion of each of these discs is trapped between the upper surface **39** of draw ring **38** and the lower surface **53** of punch ring **54**. However, as the punch continues its downwardly motion, forcing the draw ring down before it, the peripheral portions of the paper and foil discs slip between the punch and draw rings and are reformed to a cylindrical form so that they assume a vertical position between the inner surface of punch ring **54** and side wall of pad **36**. The forming of the side walls of the closure in this manner produces the foil ridges **22** and they are embedded in the surface of the paper, the space between pad **36** and punch ring **54** being only large enough to accommodate the layers in this manner.

The inverted frusto-conical edge portion of pad **36** (FIGURE 6) cooperates with the peripheral surface of pad **58** to form the foil into a firm corner which acts as a rigid rim interconnecting the disc-like foil end wall with the cylindrical foil side wall. The innner surface of the foil is extremely smooth, with only small lines which are formed by the producing of the external ridges **22**. The forming involves bending the blanks around the raised periphery of pad **36** (see FIGURE 5) as the punch ring pushes the peripheral portions of the blanks downwardly. The peripheral portions are held in somewhat frusto-conical shape by the clamping action between the punch ring and the draw ring **38**, and are gradually drawn into the cylindrical shape. The "drag" caused by the action of the punch ring upon the blanks produces a peripheral tension upon the central disc portions of the blanks so that they are held somewhat taut. At the end of the downward movement of the punch ring, pad **58** cooperates in producing the final smooth corner. It should be noted that FIGURES 5 and 6 are somewhat schematic with respect to dimensions and the relative positioning of the parts.

As pad **58** approaches pad **36**, the trapped air lifts valves **63** and the air escapes through vents **64**. When the punch head reaches the bottom of its stroke, the pads press the paper and foil layers together. As the punch head begins its upward motion, the completed closure is pushed from its position on pad **36** by the draw ring **38** which moves upwardly with the punch head and which engages the bottom edge of the cylindrical closure wall and pushes the closure upwardly. Thus, the completed closure remains within the punch ring **54** beneath the punch pad **58** after the disengagement of the die and punch portions of the press.

When the punch ring **54** moves upwardly towards the position of FIGURE 3, punch pad **58** is pushed downwardly against the action of spring **62** to eject the closure from the punch ring. This is caused by a "knocker" (not shown) driving the central supporting shaft **59** downwardly against the action of its spring **61**. The sheets **66** and **68** of the paper and foil are then advanced another step from their supply rolls, and the punching and forming operation is repeated. While only one die assembly is shown in the drawings, it is understood that several such assemblies are mounted together on shaft **59**, and are operated simultaneously.

Subsequent to the forming of the closure as discussed above, the paper is dried so that it shrinks around the foil liner. The shrinking urges the paper fibers in around the ridges **22**, and the paper is hardened so that the closure is an integral sturdy structure. The shrinking of the paper draws it tightly around the corner edge of the foil liner in a smooth corner from the flat-top surface.

As has been pointed out above, sheet **68** in the illustrative embodiment is thin steel foil. In one particular example, the steel is tin-plated steel foil of .02 inch thickness. The working of the metal foil produces work hardening so that it has superior characteristics. Tests indicate that container closures made with such foil and the paper sheet referred to above are superior to metal lids from various standpoints, including resistance to shock. Also, such closures are superior from the standpoint of being thoroughly satisfactory over extended periods of use during which a closure may be removed from its container and replaced many times. The thin steel cylindrical wall and the rigid corner have resiliency and tend to retain the original shape. The paper provides impact protection and causes the closure to hug the container wall.

It has been found that hard aluminum foil also gives very satisfactory results in place of the steel foil. The invention contemplates that various types of paper board may be used provided they are not water repellent or water proof. The illustrative embodiment of the invention is a closure for small containers which may be used for snuff. However, it is contemplated that the invention includes the production of other components.

I claim:

1. In the method of producing container closures of the type having an end wall and a peripheral side wall structure, the steps of, wetting a sheet of kraft-coated paper for a sufficient time to soften it, positioning the sheet in a die assembly with a sheet of metal foil, cutting a blank from each of said sheets, subjecting the sheets to a simultaneous soft forming operation by pushing the peripheral side wall of the paper blank to thereby form the peripheral portions of the paper blank and the foil blank into an integral side wall structure against an inner surface which causes folds in the metal foil to be projected outwardly and to be embedded in the softened paper, and drying the paper to cause it to shrink and harden.

2. The method as described in claim **1** which includes,

forming a corner structure interconnecting the end wall of the closure to the side wall structure by pressing the blanks together at the periphery of the end wall between inverted frusto-conical die surfaces.

3. The method as described in claim 1 wherein the foil is tin-plated steel foil having a thickness of the order of .02 inch and the paper having a thickness of the order of .03 inch, and wherein the container closure has a disc-like end wall and a cylindrical side wall.

4. The method as described in claim 1 wherein the peripheral portions of the blanks are held between annular surfaces and are formed into a cylindrical side wall starting from the peripheral edge of the end wall of the closure whereby the metal foil is worked progressing radially outwardly.

5. In the art of producing components from blanks of water-softened paper and metal foil with each component having an end wall portion and a peripheral side wall

structure, the steps of, pressing the peripheral portions of the blanks together from the vicinity of the outer periphery of the end wall portion to the outer edges of the blanks, rigidly supporting the end wall portion, forming the peripheral side wall structure starting at the periphery of the end wall portion by a radial-outward progressive soft-forming operation whereby the metal foil is worked and ridges are formed in the foil which extend radially outwardly along the adjacent surface of the paper and are embedded in the paper, and drying the paper to cause it to shrink and harden.

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BERNARD STICKNEY, *Primary Examiner.*