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Ink refill cartridge for ink jet printers.

An improved refill cartridge is provided to contain a solidified ink pellet for replenishing an ink jet printer or the like with flowable ink. The refill cartridge comprises a flexible walled cup having an outwardly projecting flange at the open end thereof. The cup defines a mold for direct reception of flowable ink or the like which solidifies in place to form the ink pellet, and a removable seal cover is mounted on the flange to enclose the ink pellet within the cup during shipment and/or storage. The ink pellet is delivered when required to a printer by removing the seal cover and inverting the cup over a printer ink well while pressing inwardly on the cup wall to prevent premature release of the ink pellet. The cup is seated over the ink well by engaging an upper lip of the ink well into a shallow recessed groove in the cup flange, at which time the cup wall may be released to permit the ink pellet to fall by gravity into the printer ink well. If required, the base of the cup defines a button which can be depressed from the exterior thereof to positively push the ink pellet from the cup.

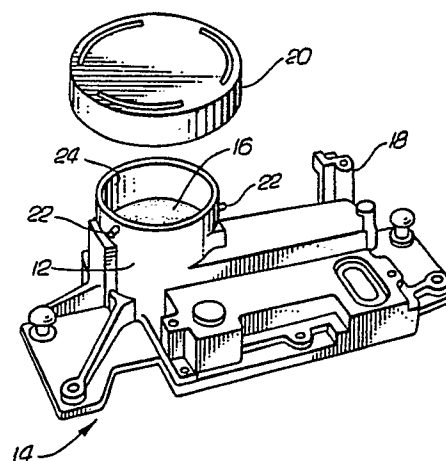


Fig. 1

INK REFILL CARTRIDGE FOR INK JET PRINTERS

BACKGROUND OF THE INVENTION

This invention relates generally to improvements in ink refill cartridges of the type designed to replenish the ink supply in printing machines, such as computer operated printers and the like. More particularly, this invention relates to an improved yet relatively simple, economical and easy to handle refill cartridge for replenishing the supply of flowable ink in modern ink jet printers.

Computer operated printers of the so-called ink jet type have become popular in recent years for use in a variety of high volume computer printer applications. In such printers, an ink well receives a supply of a flowable ink which is pumped from the well for application to paper in a dot matrix pattern by an appropriate printer head. The ink dots defining the matrix pattern tend to flow together and cure on the paper to yield resultant letters or other images of relatively high quality resolution. As the ink jet printer is used, of course, it is periodically necessary to refill the ink well with a replenishing supply of the flowable ink. Exemplary of such ink jet printers which are commercially available is the Model SI 480 Ink Jet Printer manufactured by Dataproducts Corporation of Woodland Hills, California.

The replenishing ink supply for ink jet printers has been provided in the form of wax-like solidified ink pellets which are individually prepackaged ready for placement into the printer ink well on an as needed basis. The solidified ink pellets have a relatively low melting point, typically on the order of about 150° F, such that each pellet rapidly transforms from the waxy solid state to a liquid when placed into the ink well and subjected to the normal operating temperatures of the printer which may include any appropriate heat source adjacent the ink well. Importantly, however, contamination of the ink pellet must be carefully prevented to avoid the introduction of foreign particles or substances into the ink well, wherein such foreign particles or substances can interfere with printer operation by clogging small orifices in the printer head. For example, it is desirable to avoid touching the ink pellet at any time since contaminating oils from the human fingertips can interfere with printer head operation.

In the past, in an effort to avoid ink pellet contamination, the construction of pellet-containing refill cartridges has been relatively complex and costly. More specifically, in accordance with one current refill cartridge construction, ink pellets are formed by pouring the heated ink into individual

molds wherein the ink is cooled to form the solidified wax-like ink pellets of generally cylindrical plug shape. The solidified pellets are removed from the molds and placed respectively into cylindrical cartridges each having an enlarged cap at one end for twist-lock connection with the printer ink well. The cap is mechanically linked with retention fingers at the opposite and otherwise open end of the cartridge, wherein these retention fingers normally block the contained ink pellet against removal from the cartridge. When a replenishing ink supply is required by the printer, the cartridge is inserted directly into and the cap is lockingly engaged with the ink well. As the cap engages the ink well, the linkage to the retention fingers functions to retract the fingers for purposes of dropping the ink pellet into the ink well.

While the above-described refill cartridge has generally performed satisfactorily during normal use, the cartridge necessarily requires several interconnected parts which must be formed by plastic molding or the like and subsequently assembled. These parts are subject to relatively high quality standards to guard against the presence of flash or other particulate contamination. Moreover, the assembled cartridge and contained ink pellet must be carefully packaged in a sealed manner to prevent contamination during shipment and/or storage prior to use. Still further, during shipment and storage, the cartridge must remain in a controlled temperature environment to prevent partial melting of the ink pellet, wherein such partial melting could result in pellet interlock with cartridge components to interfere with proper pellet release into the printer ink well. Accordingly, the overall construction and use of such refill cartridges has been relatively costly and complex.

There exists, therefore, a significant need for an improved ink refill cartridge for use with ink jet printers, wherein the cartridge has a simplified economical construction designed for relatively trouble-free handling and for easy delivery of a contained ink pellet to an ink jet printer. The present invention fulfills these needs and provides further related advantages.

SUMMARY OF THE INVENTION

In accordance with the invention, an improved refill cartridge is provided for use in refilling or replenishing the flowable ink supply of an ink jet printer or the like. The improved refill cartridge comprises an open-ended flexible cup adapted for

in situ molding and solidification of ink of the type used in ink jet printers. A seal cover cooperates with the cup to enclose a resultant solidified wax-like ink pellet during shipment and/or storage. When the ink pellet is required by the printer, the flexible cup is inverted over a printer ink well while permitting manual holding of the ink pellet until pellet release is desired.

In the preferred form of the invention, the flexible cup comprises a one-piece or unitary flexible plastic cup adapted for economical manufacture in volume, for example, by thermoforming or the like. The upper, open end of the cup is joined to an outwardly projecting flange having a shallow recessed groove encircling the cup and a generally planar surface bordering the exterior of said groove. In the most preferred form, the flange is joined at its outer margins by cut or score lines to adjacent flanges of additional refill cartridges, whereby the refill cartridges may be marketed conveniently in the form of separable multi-packs such as six-packs or twelve-packs or the like.

The cartridge cup provides a convenient ink pellet mold for direct reception of flowable ink which is then allowed to cool to form the solidified ink pellet. A seal cover such as a tear-off paper or paper/foil strip is mounted by an appropriate adhesive to the flange to enclose the ink pellet within the cup. Depending upon the design characteristics of the adhesive material, the cartridge may then be shipped and/or stored without requiring special attention to temperature conditions since the ink pellet, if partially or fully remelted, will not leak from the cup.

When use of the ink pellet is desired, the tear-off seal cover is removed from the cartridge flange to expose the contained ink pellet. The flexible side walls of the cup are grasped with sufficient inward fingertip pressure to permit cup inversion over the printer ink well without premature release of the ink pellet. The cup is placed onto the ink well with the flange groove receiving the upper lip of the ink well, at which time the fingertip pressure on cup side walls is relaxed sufficiently to permit the ink pellet to drop into the ink well. If the ink pellet sticks within the cup for any reason, the cup base is manually depressible relative to the side walls to positively discharge the ink pellet downwardly into the ink well.

Other features and advantages of the present invention will become more apparent from the following detailed description, taken in conjunction with the accompanying drawings which illustrate, by way of example, the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings illustrate the invention. In such drawings:

FIGURE 1 is an exploded perspective view illustrating an ink well and printer head of an ink jet printer of the type requiring periodic replenishing of a flowable ink supply;

FIGURE 2 is an enlarged perspective view depicting an improved ink refill cartridge embodying the novel features of the invention;

FIGURE 3 is a vertical sectional view taken generally on the line 3-3 of FIG. 2;

FIGURE 4 is a perspective view illustrating an interconnected multi-pack of refill cartridges corresponding with the refill cartridge of FIGS. 2 and 3;

FIGURE 5 is a fragmented perspective view similar to FIG. 4 but depicting the cartridge multi-pack in a form ready for shipment and/or storage prior to use;

FIGURE 6 is a fragmented exploded perspective view showing inversion of a refill cartridge over a printer ink well;

FIGURE 7 is a fragmented elevational view showing an inverted refill cartridge seated upon the printer ink well;

FIGURE 8 is another fragmented perspective view illustrating an inverted refill cartridge seated over a printer ink well and further depicting positive discharge of a contained ink pellet into the ink well;

FIGURE 9 is a fragmented exploded perspective view showing reclosure of the refilled ink well;

FIGURE 10 is an enlarged fragmented vertical sectional view taken generally on the line 10-10 of FIG. 7;

FIGURE 11 is a perspective view similar to FIG. 2 but depicting an alternative embodiment of the ink refill cartridge;

FIGURE 12 is a vertical sectional view taken generally on the line 12-12 of FIG. 11; and

FIGURE 13 is an enlarged fragmented vertical sectional view similar to FIG. 10 but depicting the cartridge embodiment shown in FIGS. 11 and 12.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in the exemplary drawings, an improved ink refill cartridge referred to generally by the reference numeral 10 (FIGURE 2) is provided for relatively simplified refilling of an ink supply well 12 in a printer machine, as viewed in FIG. 1. The improved ink refill cartridge 10 is designed for receiving and containing a supply of ink in a manner safeguarded against contamination, while permitting easy and reliable delivery of the ink to the printer when required.

The improved refill cartridge 10 of the present

invention provides an economical product adapted for high volume production, preferably through the use of automated equipment to avoid contact with contaminants which might otherwise interfere with proper printer operation. The cartridge 10 is especially well suited for use as a combination mold and shipment/storage container for a supply of flowable printer ink, wherein the ink has a composition designed to solidify into wax-like pellet form when cooled. The solidified ink pellet is transferable quickly and easily from the refill cartridge 10 to the printer ink well 12, whereat printer heat sources (not shown) adjacent the ink well 12 function to heat and melt the ink pellet for conversion to flowable liquid form.

FIGURE 1 depicts the printer ink well 12 as part of a head unit 14 of a modern ink jet printer. In this regard, it will be understood by those skilled in the art that the head unit 14 may take various constructional forms in accordance with the particular printer design. Direct or indirect heat sources in the vicinity of the head unit 14 elevate the temperature of the ink well 12 sufficiently to maintain an ink supply 16 therein in a flowable liquid state, typically by heating the ink supply to a temperature above about 150°F, such as a temperature of about 190°F. Upon printer operation, small quantities of the liquid ink are pumped through the head unit 14 to a printer head 18 for injection onto adjacent paper (not shown) as a dot matrix pattern defining high resolution images. A twist-on cap 20 is provided for normally closing the ink well 12 by appropriate engagement, for example, with short tabs 22 projecting outwardly from the ink well 12 near an upper lip 24 of the ink well. At periodic intervals, replenishment of the ink supply is required for printer operation to continue. An exemplary commercial ink jet printer of this general type is marketed as Model No. SI 480 by Dataproducts Corporation of Woodland Hills, California.

In accordance with one preferred form of the invention, as viewed in FIGS. 2 and 3, the improved refill cartridge 10 comprises an open-ended cup 26 for receiving and containing the replenishing ink supply. The cup 26 is formed with a flexible construction to include a lower base 28 joined to an upstanding, generally cylindrical side wall 30. The side wall 30 extends upwardly from the base 28, preferably with a slight outward taper, and terminates at an open upper end joined to an outwardly extending flange 32. Near the upper end of the cup 26, the flange 32 incorporates an upwardly open shallow annular recess or groove 34 which is bounded circumferentially by an upwardly presented planar flange surface 36 (FIGS. 2 and 3). While the method of construction and the material used may vary, a preferred cartridge 10 is constructed as a one-piece or unitary product by automated ther-

moforming processes from a lightweight polyvinylchloride sheet or other suitable plastic material.

The above-described cartridge 10 is adapted for facilitated production in quantity, and in the form of convenient multiple cartridge packs 38, such as the illustrative six-packs shown by way of example in FIGS. 4 and 5. That is, multiple refill cartridges 10 may be interconnected by mating cut or score lines 40 formed along common marginal edges of the cartridge flanges 32. With this construction, several cartridges can be marketed as a unit, with the cartridges 10 being individually separable from the multi-pack 38 to permit the ink supply therein to be loaded into the printer ink well 12, as will be described in more detail.

Each refill cartridge 10, including the cup 26 and flange 32, provides a simple and convenient mold for receiving a refill supply of the printer ink. In this regard, the ink supply may be poured directly into the upwardly open cartridge 10 while the ink supply is sufficiently heated to assume a liquid state. The cartridge 10 may then be closed immediately by an appropriate seal cover 42 (FIG. 5) of a paper-based and/or foil-backed material adapted for tear-away mounting onto the flat flange surface 36 by use of an appropriate adhesive material. The seal cover 42 and the cartridge 10 thus cooperate to enclose the ink supply which is allowed to cool and solidify, thereby assuming a generally cylindrical solid shape defining an ink pellet 44. Alternately, if desired, the ink supply within the cartridge may be allowed to solidify before mounting of the seal cover 42. In either case, however, cartridge filling and closure may proceed in an automated manner without requiring the formed pellet 44 or the cartridges 10 and seal covers 42 to be touched by human hands or otherwise exposed to undesired contamination.

The thus-filled cartridges 10 define lightweight and compact shipping containers for the solidified ink pellets 44 for shipment and/or storage purposes. The closed and sealed nature of the cartridges 10 permits the pellets 44 to be shipped or stored without significant concern for exposure to contaminants or normal elevated temperatures. That is, with the use of an appropriate adhesive material to mount the seal covers 42, partial or even complete melting of the pellets 44 during shipment or storage will not result in ink supply leakage and further will not interfere with subsequent pellet delivery to an ink jet printer, provided the pellet is resolidified before delivery to the printer.

When the printer ink well 12 requires a refill supply of ink, one of the cartridges 10 is separated from the multi-pack 38. The associated seal cover 42 is then removable quickly and easily from the cartridge 10 by simple peel-away separation from

the cartridge flange 32. The open cartridge 10 is then grasped firmly between the thumb and forefinger, as viewed in FIG. 6, with sufficient inward pressure to flex the cup side wall 30 for purposes of gripping and holding the ink pellet 44. To this end, the ink pellet 44 will normally shrink slightly upon solidification, such that an internal inwardly projecting rib 46 (FIG. 3) may be desirable to assist in gripping the ink pellet. Importantly, this manual gripping of the ink pellet 44 prevents pellet release as the cup 26 is inverted (FIG. 6) over the ink well 12. Of course, prior to this step, the ink well cap 20 has been removed.

The cartridge 10 is seated upon the ink well 12, as viewed in FIGS. 7 and 10, such that the annular groove 34 in the flange 32 is sized to receive the ink well lip 24. In this seated position, the side wall 30 of the cup 26 can be released to allow the ink pellet 44 to fall by gravity into the well. Alternately, in the event the ink pellet 44 sticks within the cartridge 10 for any reason, an outwardly convex button 48 on the cup base 28 may be depressed over-center with the fingertip, as shown in dotted lines in FIG. 10. Depression of the button 48 positively dislodges the ink pellet so that it will fall into the ink well 12. Importantly, the seated nature of the cartridge on the ink well confines any splashing ink to the interior of these components. The ink well 12 can then be reclosed using the cap 20, as shown in FIG. 9, whereupon the ink pellet will be melted within the well for supply as flowable ink to the printer head in accordance with ink demand. The now-empty cup 26 may be discarded.

FIGS. 11-13 show an alternative preferred form of the invention to comprise a modified cartridge 110. This modified cartridge 110 is provided in the form of an upwardly open cup having a flexible cylindrical side wall 130 joined to a button-like, cup-shaped lower flexible base 131 of reduced diameter relative to the side wall. The upper margin of the side wall 130 is joined to an outwardly projecting flange 132 which incorporates an annular, shallow recess or groove 134.

The modified cartridge 110 is filled and sealed in generally the same manner as previously described with respect to FIGS. 1-10. An ink pellet 44 therein is delivered to the ink well 12 of a printer by grasping the side wall 130 with sufficient pressure to hold the pellet while the cup is inverted to place the flange groove 134 into registry with the ink well lip 24. The side wall 130 can then be released to permit the pellet to fall into the well 12. If the pellet 44 sticks for any reason, the base 131 can be depressed relative to the side wall 130 for positively pushing the pellet from the cartridge.

The improved refill cartridge 10 thus provides a simple and easy-to-use device for forming, storing,

and delivering ink pellets to an ink jet printer. The cartridge is designed for economical manufacture in production quantities, and for containing an ink pellet in a manner safeguarded against undesired contamination.

A variety of modifications and improvements to the improved refill cartridge of the present invention will be apparent to those skilled in the art. Accordingly, no limitation on the invention is intended by way of the foregoing description and accompanying drawings, except as set forth in the appended claims.

Claims

1. An ink refill cartridge for ink jet printers and the like, said cartridge comprising:

a flexible cup defined by a generally upright side wall and a base at the lower end of said side wall; and

a flange projecting generally outwardly from the upper end of said side wall, said flange defining an upwardly open and relatively shallow recessed groove formed generally in circumscribing relation to said cup.

2. The ink refill cartridge of claim 1 wherein said cap and said flange comprise a unitary molding.

3. The ink refill cartridge of claim 1 wherein said cup base defines a button depressible relative to said side wall by application of fingertip pressure.

4. The ink refill cartridge of claim 1 further including an ink pellet contained within said cup, said cup side wall being sufficiently flexible upon application of inward fingertip pressure thereto to permit cup inversion with said ink pellet held within said cup.

5. The ink refill cartridge of claim 1 further including a seal cover removably mounted onto said flange.

6. The ink refill cartridge of claim 1 wherein said cup side wall has a generally cylindrical configuration.

7. The ink refill cartridge of claim 6 wherein said cup side wall further defines a short annular rib protruding a short distance into the interior of said cup.

8. An ink refill cartridge for ink jet printers and the like, said cartridge comprising:
a flexible cup defined by a generally upright side wall and a base at the lower end of said side wall, said base further defining a flexible button adapted for depression with fingertip pressure relative to said side wall.

9. The ink refill cartridge of claim 8 further including an ink pellet contained within said cup, said cup side wall being sufficiently flexible upon application of inward fingertip pressure thereto to permit cup inversion with said ink pellet held within said cup.

10. The ink refill cartridge of claim 8 further including a flange projecting outwardly from the upper end of said cup side wall, and a seal cover removably mounted onto said flange and cooperating with said cup to enclose the interior of said cup.

11. The ink refill cartridge of claim 10 wherein said flange defines an upwardly open shallow groove generally circumscribing the upper end of said side wall.

12. An ink refill cartridge for ink jet printers and the like, said cartridge comprising:

A unitarily molded flexible cup defined by a generally upright cylindrical side wall, a base at the lower end of said side wall, and an outwardly projecting flange at the upper end of said side wall; said base defining a flexible button adapted for movement upon application of fingertip pressure thereto relative to said side wall; said flange defining an upwardly open and relatively shallow annular recess encircling the upper end of said side wall;

an ink pellet contained within said cup, said side wall being sufficiently flexible to deform inwardly upon application of fingertip pressure thereto to permit said ink pellet to be held within said cup by manual grasping of said side wall from the exterior thereof; and

means for removably sealing said ink pellet within said cup.

13. The ink refill cartridge of claim 12 wherein said sealing means comprises a tear-away seal cover mounted on said flange.

14. An ink refill cartridge for ink jet printers and the like, said cartridge comprising:

a plurality of unitarily molded flexible cups each defined by a generally upright cylindrical side wall, a base at the lower end of said side wall, and a flange at the upper end of said side wall, said flange defining an upwardly open and relatively shallow recess encircling the upper end of said side wall;

said flange of each of said cups being connected to the flange of at least one other of said cups whereby said cups are interconnected as a multiple pack;

a plurality of ink pellets contained respectively within said cups, the side wall of each of said cups being sufficiently deformable inwardly upon application of manual pressure thereto to permit the ink pellet therein to be held within said cup by manual grasping of said cup side wall from the

exterior thereof; and

means for removably sealing said ink pellets within said cups.

15. The ink refill cartridge of claim 14 wherein said plurality of cups are formed as a unitarily molded pack, said flanges of said cups being interconnected along preformed separation lines.

16. The ink refill cartridge of claim 14 wherein said base of each of said cups includes a flexible button adapted for movement relative to said side wall in a direction toward the interior of said cup.

17. In combination with a printer ink well of generally upwardly open shape and defining an upper lip circumscribing said well, and ink refill cartridge comprising:

a flexible cup defined by a generally upright cylindrical side wall, and an outwardly projecting flange at the upper end of said side wall;

said base defining a flexible button adapted for movement relative to said side wall upon application of fingertip pressure thereto;

said flange defining an upwardly open and relatively shallow recess circumscribing said side wall upper end and shaped for seated reception of said ink well lip therein;

an ink pellet contained within said cup, said side wall being sufficiently flexible to deform inwardly upon application of fingertip pressure thereto to permit said ink pellet to be held within said cup by manual grasping of said side wall from the exterior thereof, said cup being invertible while manually grasped to retain said ink pellet therein as said cup is placed with said ink well lip seated within said flange recess, whereupon said ink pellet will fall into said ink well upon relaxing of inward fingertip pressure applied to said side wall; and means for removably sealing said ink pellet within said cup.

18. The combination of claim 17 further including a removable cap for mounting upon and normally closing the upper end of said ink well.

19. A method of refilling an upwardly open printer ink well in an ink printer or the like, comprising the steps of:

forming an upwardly open cup to include a generally upright flexible side wall closed at the lower end by a base, and an outwardly projecting flange at the upper end of the side wall, said flange defining an upwardly open recess surrounding the cup upper end;

filling the cup with an ink pellet in solid form;

inverting the cup with the ink pellet therein while applying inward pressure on the side wall to hold the ink pellet within the cup;

placing the cup in inverted position with the cup flange recess seated upon the ink well upper end; and

releasing the inward pressure on the side wall to permit the ink pellet to fall from the cup into the ink well.

20. The method of claim 19 wherein said cup forming step includes forming the base to define a flexible button movable relative to the side wall upon application of manual pressure thereto. 5

21. The method of claim 19 wherein said filling step comprises pouring a solidifiable ink into the cup and allowing the ink to solidify within the cup to form the ink pellet. 10

22. The method of claim 19 further including the step of closing and sealing the ink pellet within the cup for shipment and storage. 15

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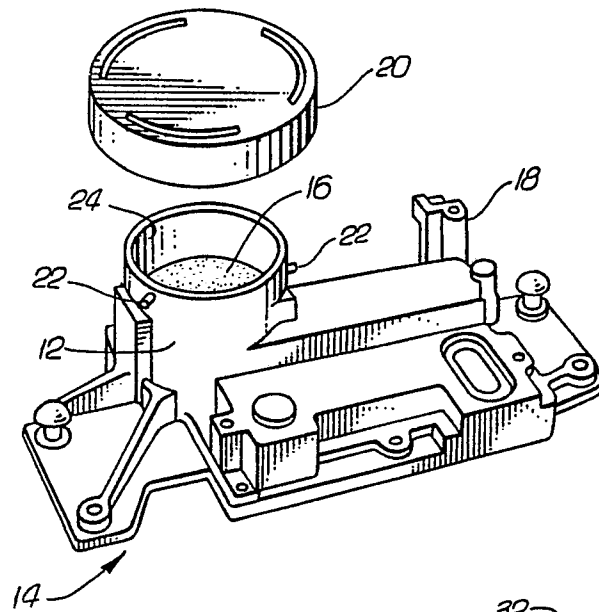


Fig. 1

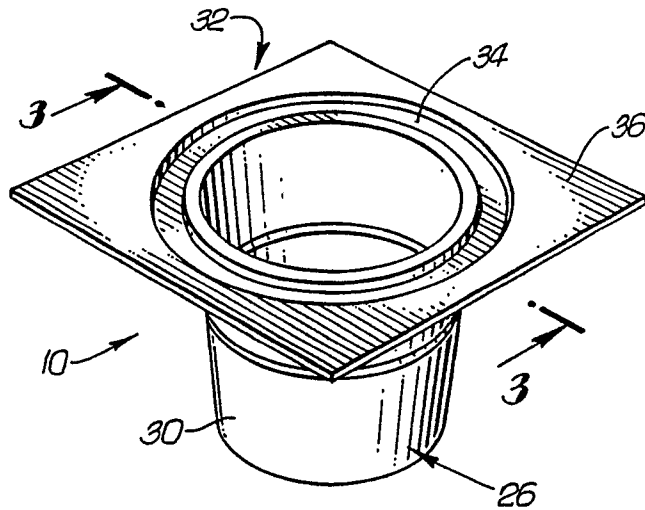


Fig. 2

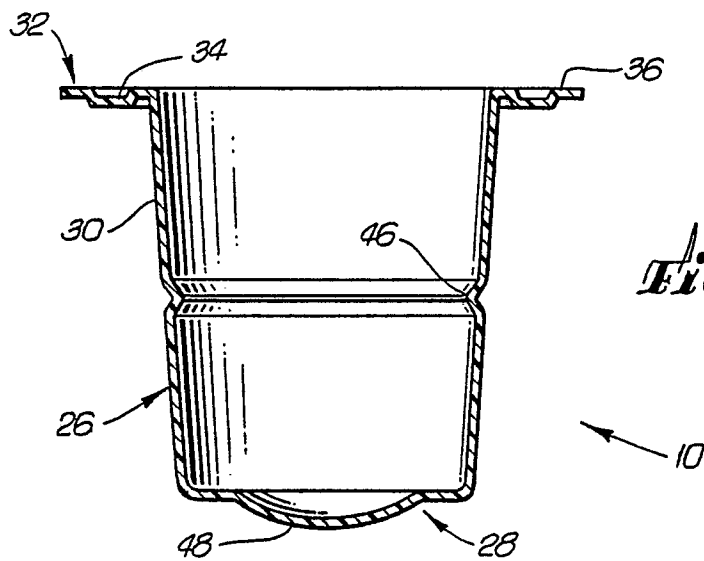


Fig. 3

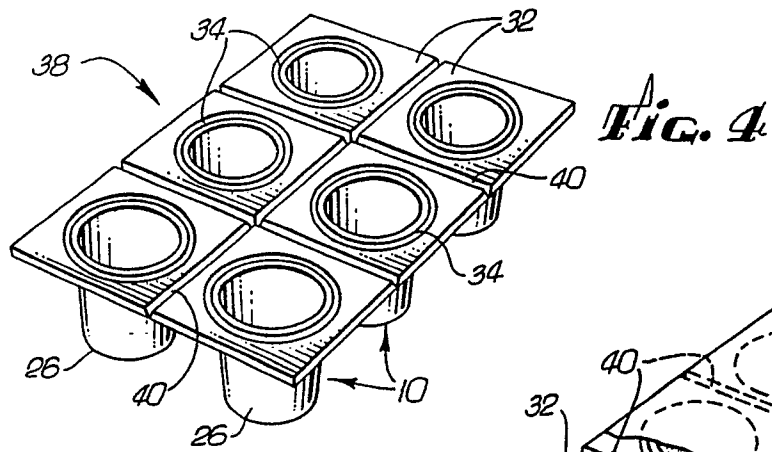


Fig. 5

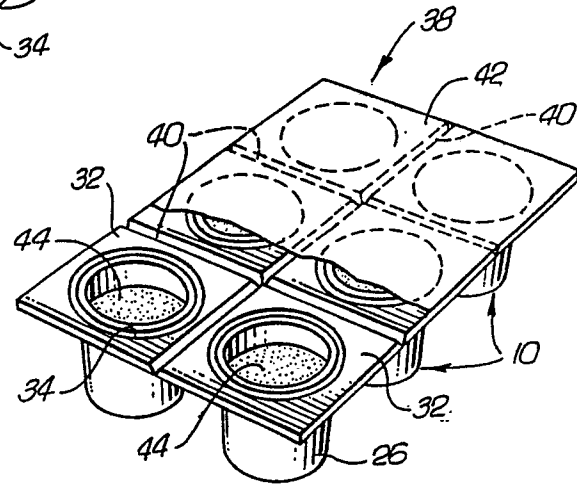


Fig. 6

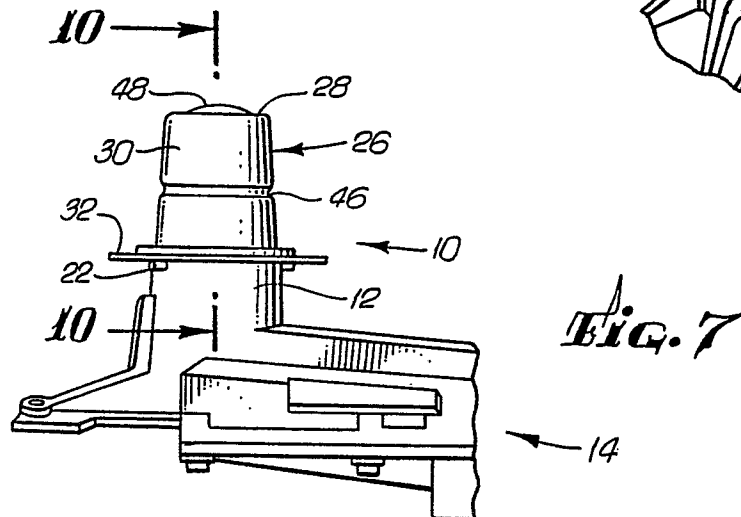
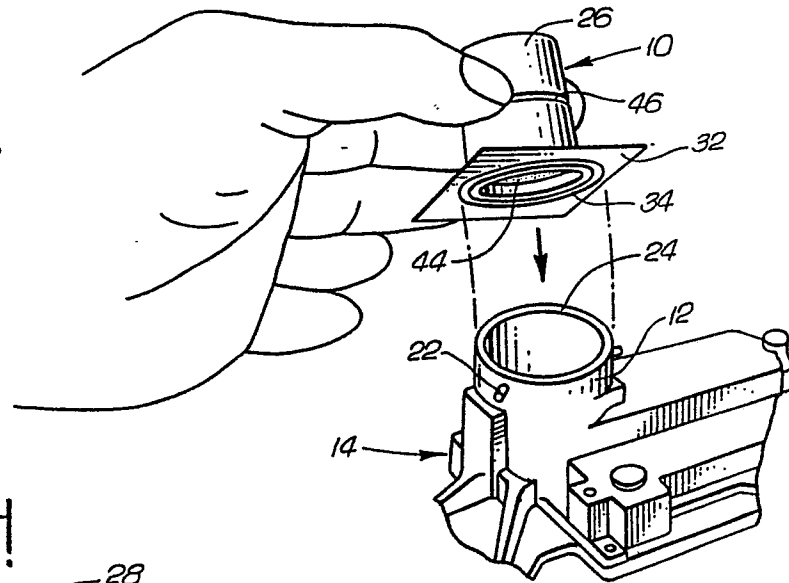


Fig. 8

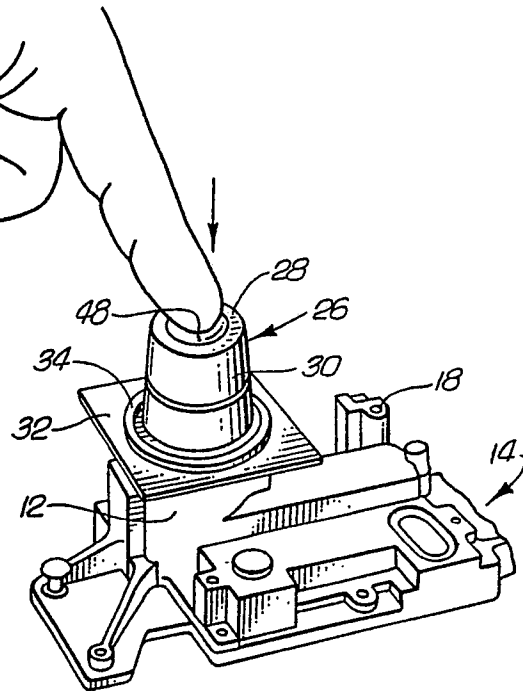


Fig. 9

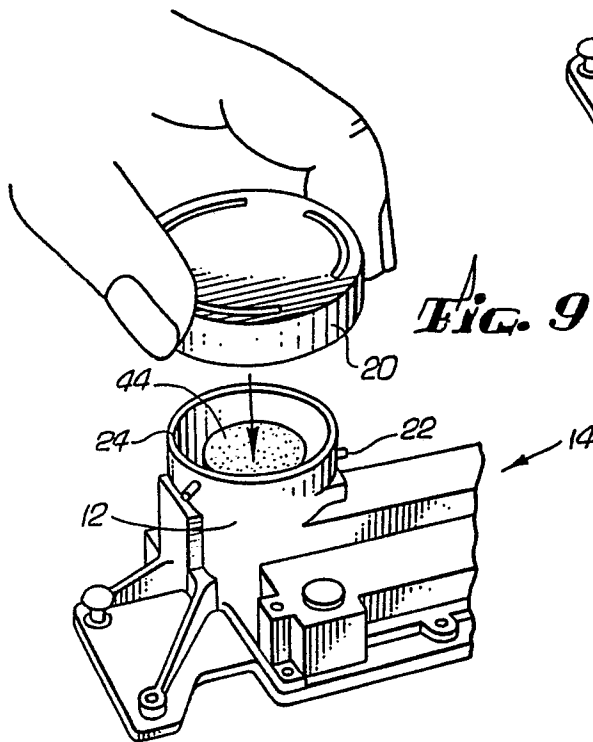
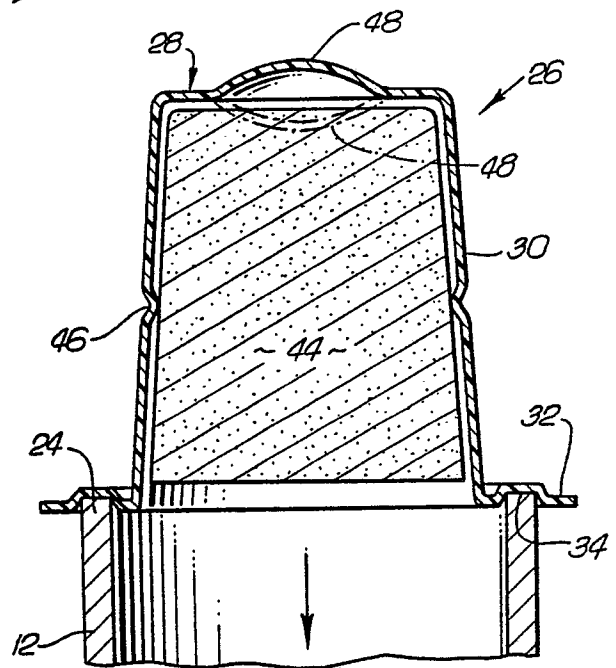


Fig. 10



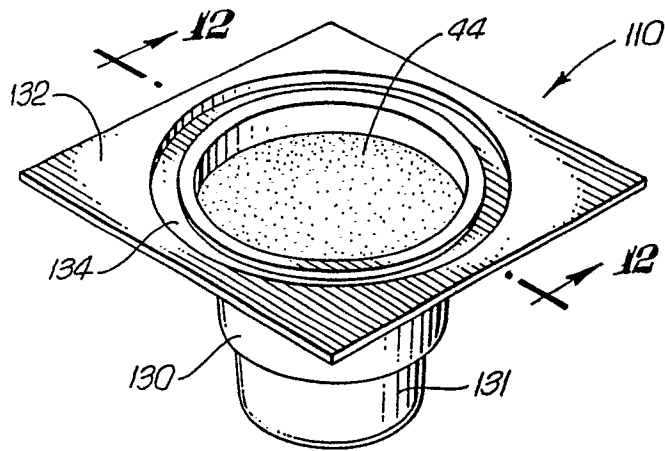


Fig. 11

Fig. 12

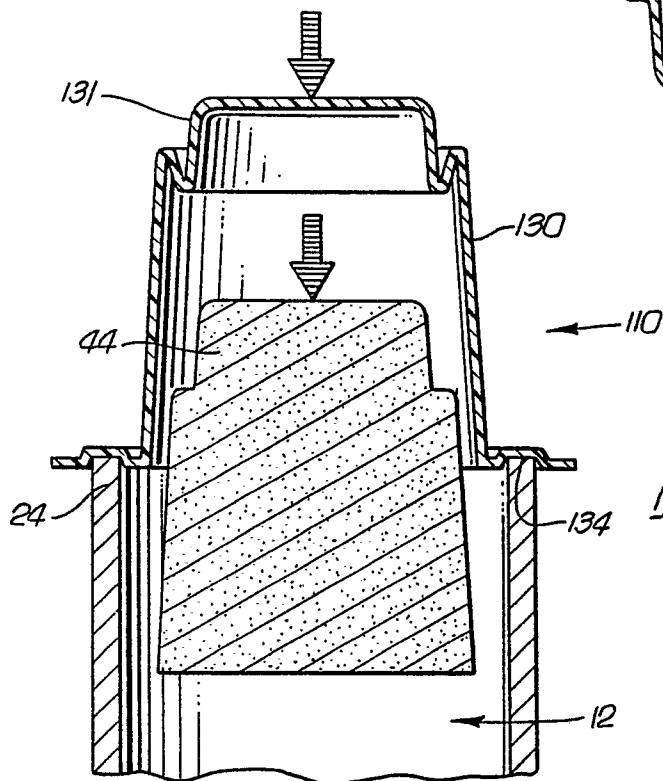
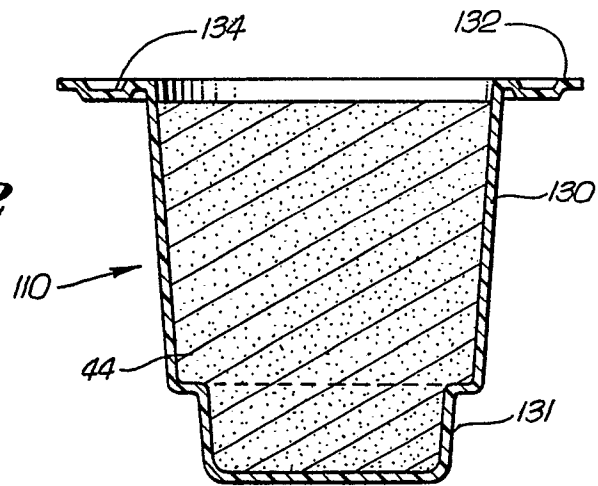


Fig. 13