

[54] **LIQUID CONTAINER**

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[22] Filed: **Apr. 6, 1973**

[21] Appl. No.: **348,487**

[52] U.S. Cl. **222/153, 222/541, 215/42, 220/27**

[51] Int. Cl. **B67b 5/00**

[58] Field of Search **222/153, 182, 541, 83; 215/7, 41, 42, 43; 220/60, 27, 39; 150/5**

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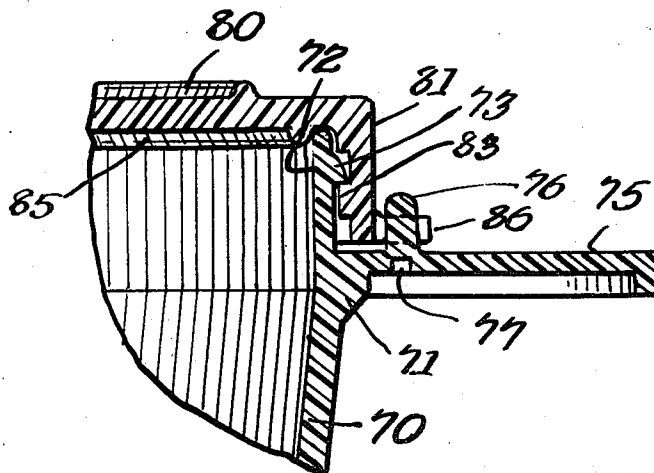
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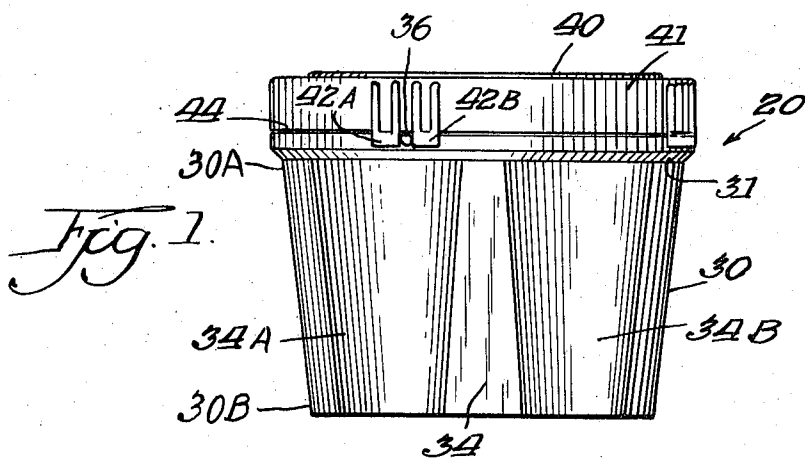
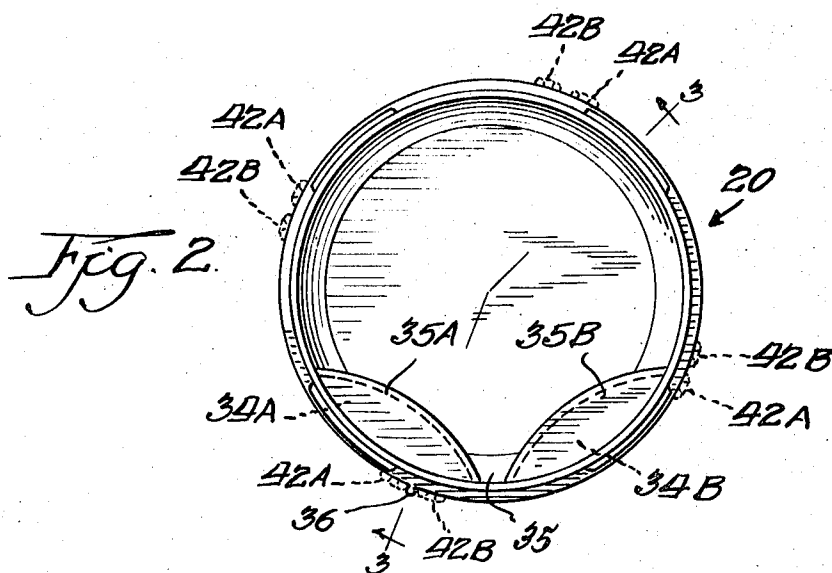
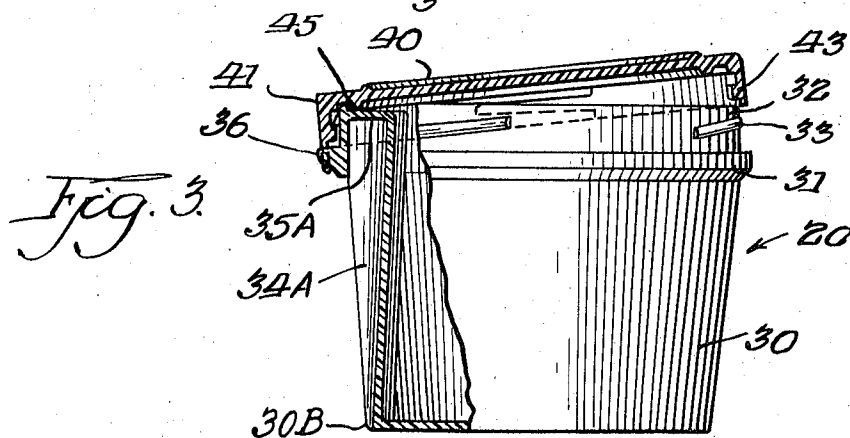
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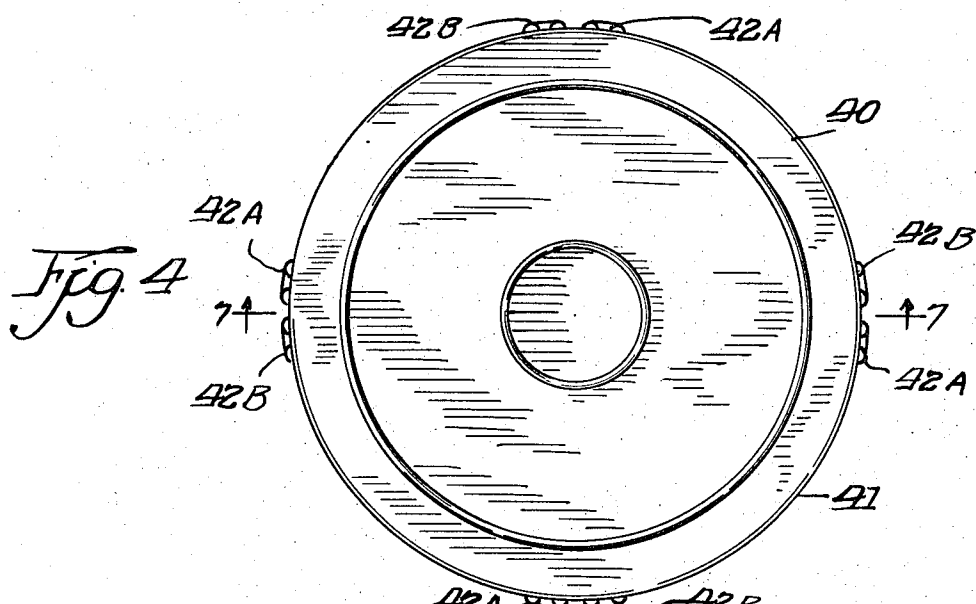
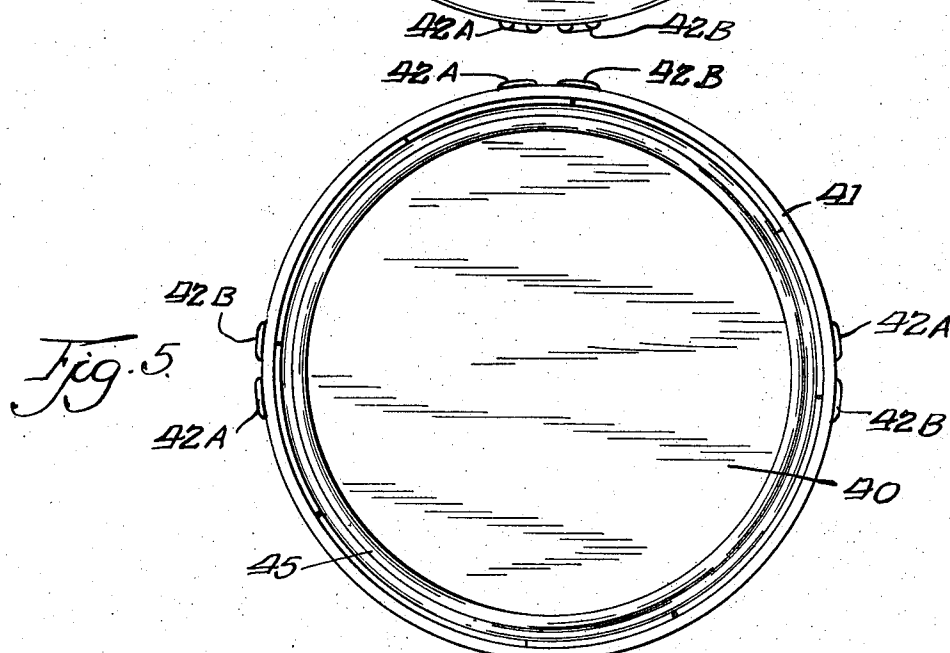
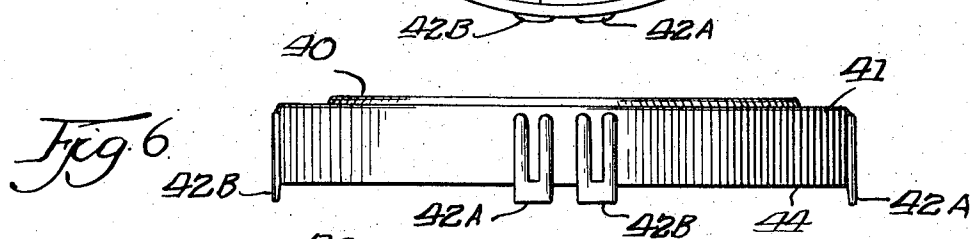
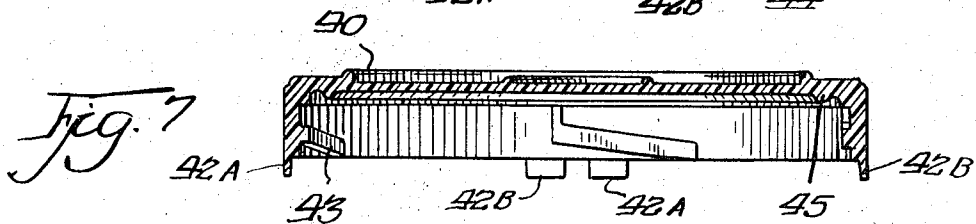
ABSTRACT

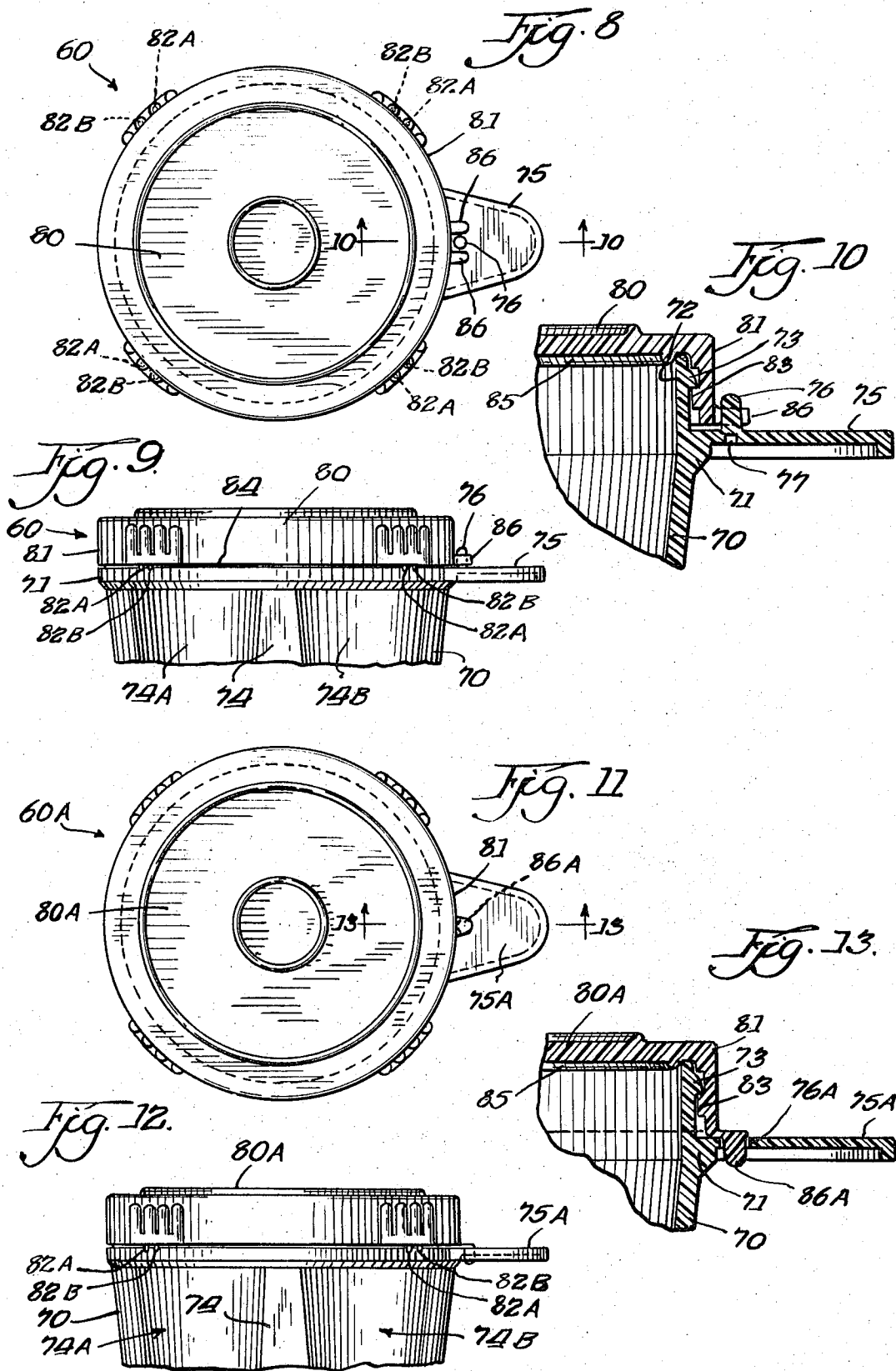
A liquid container including a receptacle and a cap threadably joined to the open top portion of the receptacle. External connecting means circumscribe the receptacle adjacent the top portion. A pair of spaced pouring sectors is formed integrally with the receptacle on the interior of said top portion adjacent said external connecting means, other features are disclosed to adapt the container for use as a sterile specimen collector.

3 Claims, 13 Drawing Figures









LIQUID CONTAINER

BACKGROUND AND GENERAL DESCRIPTION
OF INVENTION

The invention relates generally to a liquid container and more particularly relates to an improved receptacle and closure combination which incorporates means to facilitate the discharge of liquid from the receptacle without interfering with the connection between the receptacle and closure. The container also includes means to maintain the receptacle and closure in a sterile condition.

The conventional systems for providing medical institutions, such as hospitals and clinics, with containers for collecting, storing and handling liquids poses many disadvantages. For instance, it is very desirable to provide a container with a closure cap which seals the container and preserves the sterility of the liquid specimen or the like in the container. It is likewise very desirable to provide the container with a pouring spout which facilitates the discharge of the liquid from the container into other vessels, such as test tubes or the like. Heretofore it has been difficult to satisfy both of these above requirements in an economical manner.

It has been particularly difficult to satisfy both of these needs while using the most satisfactory and economical closure system, namely, a threaded connection between the receptacle and the closure cap. A threaded connection is preferred in this environment because threads will seal the cap and receptacle securely and maintain the sterility of the contents, while at the same time allowing the cap to be readily removed without jarring the receptacle and disturbing the contents. However, the use of threads or the equivalent connecting means between the cap and receptacle creates problems in providing the receptacle with a pouring spout. Since a threaded connection must be continuously circular to function, a conventional exterior pouring spout cannot be incorporated into a threaded receptacle without destroying the operation of threads.

Moreover, in some prior container systems no effort is made to assure that the interior of the container is retained in a sterilized condition until use. In other cases, the container is shipped in a sterilized package, but there is no tamper-proof system for assuring that the package was not opened long prior to the use of the packaged container. In any event, it has been found that such packaging often results in difficulty in handling and shipping, and in unnecessary duplication of manufacturing time and expense when the container is constructed from a molded plastic material. Since the high temperature conditions under which the plastic containers are molded is generally sufficient to sterilize the components of the container as they are manufactured, it is redundant to re-sterilize the components and package them in a sterile pack. This procedure is conventional, however, because most container components are not designed in a manner which retains the container in the sterile condition, present in the high temperature manufacturing step, throughout shipment and storage.

In addition, prior container designs fail to recognize the importance of designing and handling the container sealing cap properly. Since many air-borne contaminants are heavier than air, the contaminants may settle onto the interior of a cap if the cap is placed or stored

up-side down, with its interior side exposed. On the other hand, if a conventional cap is placed or stored right-side up, with the interior side unexposed, the rim of the cap is subject to contamination by contact with a contaminated supporting surface.

Accordingly, it is the object of this invention to provide a container including features which combine to overcome the foregoing deficiencies of prior container designs. The container in accordance with this invention incorporates an integral pouring spout with a threaded seal between the receptacle and cap. Other features and advantages of the present invention include a tamper-proof sealing system which allows the container to be assembled and shipped in a sterile condition, without extra sterile packaging. The sealing system indicates whether the assembly has been opened or otherwise disturbed in a manner which may contaminate the container. The container cap furthermore is provided with means for minimizing the contamination of the cap and the collected specimen.

Briefly described, the container in accordance with this invention comprises a hollow receptacle, for receiving the specimen of blood or urine or the like, and a sealing cap. The cap includes supporting legs projecting from the rim, so that the rim is held above a potentially contaminated supporting surface. Connecting means on the cap and receptacle top portion securely join the cap and receptacle in a sealed condition. A liquid pour spout is incorporated on the receptacle in a manner which does not interfere with the operation of the connecting means between the cap and the receptacle. The container also incorporates a frangible detent which is engaged between the cap and the receptacle in a manner which prevents the cap from being removed from the receptacle without shearing the detent. In accordance with this invention, the container components are formed from a plastic or other flexible elastic material which allows the cap to be snapped onto the receptacle over the connecting means to engage the frangible detent between the cap and receptacle.

EXEMPLARY EMBODIMENTS

Further objects and features of the present invention will become more apparent from the following description of several embodiments thereof taken in conjunction with the following drawings, in which:

FIG. 1 is an elevational view of a sealed sterile specimen container formed from the combination of a lid and receptacle in accordance with this invention;

FIG. 2 is a top view of the receptacle and a cap as shown in FIG. 1;

FIG. 3 is an elevational view, in partial section, as viewed along the line 3-3 in FIG. 2, showing the cap positioned for sealing engagement with the receptacle;

FIG. 4 is a top view of the sealing cap as shown in FIGS. 1-3;

FIG. 5 is a bottom view of the cap as shown in FIGS. 1-4;

FIG. 6 is a side elevational view of the cap as shown in FIGS. 1-5;

FIG. 7 is a sectional elevational view of the cap, as viewed along the line 7-7 in FIG. 4.

FIG. 8 is a top view of a second embodiment of a sealed sterile specimen container incorporating the features of this invention;

FIG. 9 is a partial elevational view of the second embodiment shown in FIG. 8;

FIG. 10 is an enlarged and removed sectional view of the second container embodiment illustrating the tamper-proof connection between the cap and the receptacle;

FIG. 11 is a top view of a third container embodiment, shown in a sealed condition;

FIG. 12 is a partial elevational view of the third container embodiment shown in FIG. 11; and

FIG. 13 is an enlarged and removed sectional view of the third container embodiment, illustrating the tamper-proof connection between the cap and receptacle.

Referring generally to the drawings, the container in accordance with this invention is indicated by the reference numeral 20. The container 20 includes a hollow receptacle 30 for receiving liquid specimens such as blood or urine, or other liquids. The receptacle 30 is made from a readily sterilizable material such as molded plastic, and is frusto-conical in configuration. As seen in FIG. 1, body of the receptacle 30 tapers so that the top portion 30A is larger than the bottom portion 30B by a selected dimension. The top portion 30A of the receptacle 30 includes an outwardly circular flange 31. A rim portion 32 of the receptacle 30, above the flange 31, is provided with connecting means in the form of external screw threads 33. The threads 33 can be either a continuous thread or an interrupted bayonet-type thread, and are adapted to securely seal a cap to the receptacle 30.

The receptacle 30 also includes pouring means to facilitate the discharge of the liquid specimen or the like from the container 20 without interfering with the operation of the functions of the flange 31, the rim 32 and the threads 33. Accordingly, the interior of the rim 32 is provided with a pair of pouring sectors 35A and 35B. As seen in FIGS. 2 and 3, the sectors 35A and 35B are formed integrally with the rim 32 and are circumferentially spaced to define a liquid pouring spout 35 therebetween. The spout 35 is defined by the sectors 35A and 35B on the interior of the rim 32, and can thereby guide liquid from the receptacle 30 without interfering with the external configuration and operation of the rim 32, the flange 31 and the threads 33.

The tapered body of the container 30 is also provided with a pair of arcuate recesses 34A and 34B which extend upwardly to the pouring sectors 35A and 35B. The recesses 34A and 34B are circumferentially spaced to define a channel 34 therebetween which assists in directing liquid from the receptacle 30 into the pour spout 35. Further, as seen in FIG. 3, the receptacle wall portions defining the recesses 34A and 35A are substantially vertical with respect to the bottom wall 30C of the receptacle. The recesses 34A and 34B thereby assist in the formation of the pouring sectors 35A and 35B by a molding operation, by facilitating removal of the receptacle 30 from the mold after the sectors are formed. This design thus reduces the cost of manufacturing the container 20 by eliminating the need for complicated mold cores and the like.

The container 20 in accordance with this invention also includes a cap 40 for closing the top of the receptacle 30. The cap 40 includes internal threads 43 which mate with the external threads 33 to retain the cap on the receptacle 30. As seen in FIG. 1, the skirt portion 41 of the cap 40 is dimensioned to firmly engage with the receptacle flange 31. The flange 31 prevents the cap 40 from being forcibly removed from the receptacle such as by prying the cap 40 over the threads 33.

In accordance with this invention, the skirt portion 41 of the cap 40 is provided with a plurality of spaced support legs 42A and 42B. The legs 42A and B extend downwardly from the skirt 41, and are uniformly spaced around the cap 40. As seen in FIG. 1, the legs 42A and B are spaced outwardly adjacent the receptacle rim 31 when the cap is positioned on the receptacle. As shown in FIGS. 6 and 7, the legs 42A and B also project below the rim 44 of the cap 40. The legs 42A and B therefore operate as support means for the cap 40 which prevents the rim 41 of the cap from engaging with a contaminated support surface, such as a laboratory bench, when the cap 40 is removed from the receptacle 30.

The specimen container 20 in accordance with this invention further includes a tamper-proof sealing system for preserving the container in a sterile condition. In the first embodiment shown in FIGS. 1-7, the taper-proof sealing system is integrated with the support legs 42A and 42B. As seen from FIGS. 1-3 the receptacle 30 is provided with a frangible detent 36. The detent 36 is formed integrally with the flange 31, and projects transversely outward from the flange. The size of the detent 36 is selected so that it will nest between the spaced legs 42A and 42B provided on the cap 40. As readily seen in FIGS. 1-3, once the cap 40 is in place on the receptacle 30, the threads 33 and 43 cannot be advanced to unseal the container 20 without shearing the frangible detent 36.

The legs 42A and B on the cap 40 and the detent 36 on the receptacle thereby cooperate to form a tamper-proof sealing system for the container 20. The engagement of the cap rim 41 with the flange 31 assists the sealing system by preventing the cap 40 from being removed from the receptacle without advancing the cap along the threads 33 and 43. Since the container cannot be opened without shearing off the detent 36, the presence of the detent 36 on the container 20 assures the user that the container is in a sterile condition. Similarly, if the detent 36 has been sheared off, the user is advised that the container 20 has been opened and possibly contaminated.

FIGS. 8-10 illustrate a second embodiment of the present invention in the form of a sterile specimen container 60. The container 60 includes a specimen receptacle 70 which is similar to the above-described receptacle 30. The receptacle 70 therefore includes a flange 71 and an upper rim portion 72 having screw threads 73. The receptacle 70 also is provided with an integral pouring spout system 74 formed between the symmetrical recesses 74A and 74B. The arrangement of the spout system 74 with respect to the rim 73 is identical with the system illustrated in FIG. 3 with respect to the spout 34.

The receptacle 70 further includes an outwardly projecting handle 75, for gripping by the user of the container 60. In this second embodiment the handle 75 defines a frangible detent 76 projecting upwardly adjacent the rim 72. As seen in FIG. 10, the handle 75 includes a relief 77 positioned below the detent 76 to assure that the detent can be readily sheared from the handle.

The container 60 shown in FIGS. 8-10 also is provided with a removable cap 80 for sealing the top of the receptacle 70. The skirt portion 81 of the cap 80 includes a plurality of uniformly spaced support legs 82A, B, similar to the above-described legs 42A, B. The

legs 82A, B project below the skirt 81 of the cap and function to support the cap in a manner which positions the rim 84 of the skirt 81 out of contact with any contaminated supporting surface. The skirt 81 also defines internal threads 83 which mate with the threads 73 on the receptacle 70. The length of the legs 82A-B is selected to permit the legs to clear the handle 75 when the mating threads 73 and 83 are advanced to remove the cap from the receptacle. The container 60 also includes an internal pouring spout, as shown by the spout 35 in FIG. 2.

The tamper-proof sealing system for the container 60 comprises a pair of spaced abutment shoulders 86 which project outwardly from the skirt 81 of the cap 80. As seen in FIGS. 8-10, the shoulders 86 are spaced on the cap 80 to receive the frangible detent 76 therebetween. Hence, the detent 76 and the shoulders 86 cooperate to prevent the cap 80 from being removed from the receptacle 70 after the container 60 is sterilized. If the cap 80 is removed, the detent 76 will be sheared from the receptacle 70. The absence of the detent 75 thereby informs the user of the container 60 that the seal between the cap 80 and the receptacle 70 has been broken, and that the container 60 is potentially contaminated.

FIGS. 11-13 illustrate a third embodiment of the sterile specimen container in accordance with this invention. The container 60A is similar in most respects to the container 60 shown in FIGS. 8-10, and the same components are therefore indicated by the same reference numerals. In this third embodiment the handle 75A on the receptacle 70 is provided with a recess 76A, as shown in FIG. 13. In addition, the skirt 81 of the cap 80A is modified to include a frangible detent 86A. As seen in FIGS. 11-13 the detent 86A projects downwardly from the skirt 81 in alignment with the recess 76A on the handle 75A. The detent 86A and the recess 76A thereby form a tamper-proof seal for the container 60A.

When the container in accordance with this invention is to be used as a sterile specimen collector, sterilization can be accomplished in any suitable manner which subjects the container components to an effective sterilizing medium, such as heat. Each of the components may be sterilized before assembly or after assembly. In the latter case, sterilization can be completed by subjecting the assembled cap and receptacle to a sterilizing medium under a pressure sufficient to penetrate the seal between the cap and rim of the receptacle, to thereby sterilize the interior of the container. The sterility of the container will be maintained by the seal between the cap and receptacle under normal atmospheric pressure conditions.

In accordance with this invention, it has been found that the container can be assembled, and the tamper-proof sealing system established, by utilizing the resiliency of the cap and/or receptacle. In the preferred arrangement, both the cap and receptacle are made from a resilient plastic, for economy of production and ease of assembly. In one commercial embodiment, for instance, the cap is molded from polypropylene and the receptacle is molded from polystyrene. It has been found that the cap of the container in accordance with this invention can be readily snapped on the rim of the receptacle over the mating threads. However, after the threads of the cap and receptacle are engaged, it has been found to be extremely difficult and impractical to

force the removal of the cap over the engaged threads. Thus, in practical use the cap must be removed from the receptacle by rotating the cap with respect to the receptacle and advancing the engaged threads. Due to these characteristics of the container in accordance with this invention, the cap can be snapped onto the receptacle over the threads and the tamper-proof sealing system engaged. Then, the cap cannot be removed from the receptacle in a practical fashion, without destroying the sealing system. The sealing system is therefore an accurate sterility indicator which informs the user of the sterilized condition of the container.

The process of using the container in accordance with this invention as a sterile specimen collector will be described with respect to the container 20 shown in FIGS. 1-3. The tamper-proof sealing system is engaged by positioning the cap 40 over the rim 32 of the receptacle 30 with one pair of legs 42A, 42B engaged with the frangible detent 36, as seen in FIG. 3. Then the flexible cap 40 is forced downwardly to snap the threads 43 on the cap over the threads 33 on the receptacle. As shown in FIG. 1, the cap 40 is thereby threadably engaged with the receptacle 30 with the detent 36 secured between the legs 42A and 42B on the cap 40. The flange 31 prevents the cap from being forced from the receptacle. The cap 40 thus cannot be removed from the receptacle 30, in any practical fashion, without advancing the threads 43 on the cap rotatably with respect to the threads 33 on the receptacle. If the cap 40 is rotated in such a manner the legs 42A, B will shear the frangible detent 36 from the receptacle 30.

The receptacle 30 and cap 40 can be sterilized separately before being assembled, or they may be sterilized under pressure after assembly, as described above. In either case, the container 20 is shipped to the ultimate user in an assembled and sterilized condition. Since the container 20 is sterile in its assembled condition, no separate packaging system is needed to assure that the container remains sterile until used. The user is informed of the sterilized condition of the container 20 by the presence of the unbroken detent 36. Likewise, the absence of the detent 36 from the receptacle 30 informs the user that the container has been opened and may no longer be sterile.

The container 20 in accordance with this invention also has features which assist in maintaining the sterile condition of the container and facilitate its use. The design of the cap 40 for instance, minimizes the possibility that the handling of the cap will contaminate the specimen stored in the container 20. Many of the contaminants are airborne and would settle on the interior surface of the cap 20 if the interior surfaces are exposed. Accordingly, the preferred practice in handling a specimen container is to retain the cap 20 in an upright position, and support the cap on its rim 44, after the cap is removed from its receptacle. This procedure minimizes the exposure of the interior of the cap 40 to airborne contaminants.

However, it has been found that the above procedure continues to cause contamination in specimen samples. When the cap 40 is removed from the receptacle 30, it is usually retained in an upright position by supporting the cap on a laboratory bench or the like on the rim 44 of the cap 40, thereby subjecting the rim 44 to contamination from contact with the supporting surface such as the lab bench. Contaminants which are picked up by the rim 44 are easily introduced to the specimen in the

receptacle 30 when the cap 40 is replaced on the receptacle, after the specimen is collected. The contaminants on the cap rim 44 are, in effect, displaced into the receptacle 30 by inadvertent engagement between the cap rim 44 and the receptacle rim 32 when the cap is placed on the receptacle.

In accordance with this invention, the contamination of the rim 44 of the cap 40 is minimized by the incorporation of the downwardly projecting supporting legs 42A, 42B. The legs 42A, 42B permit the cap to be stored in an upright position without causing the rim 44 to contact the contaminated supporting surface. Since the legs 42A, 42B are designed to have a small cross-sectional area, the area of the cap 40 in direct contact with the contaminating supporting surface is thereby substantially reduced. Furthermore, the legs 42A, 42B are placed on the outward portion of the cap skirt 44 to reduce the possibility that the legs will contact the rim 32 of the receptacle when the cap 40 is replaced on the receptacle. The design of the cap 40 in accordance with this invention therefore substantially minimizes the possibility of contaminating the specimen collected in the receptacle 30.

The design of the receptacle 30 in accordance with this invention also facilitates the handling of the collected specimen. The above-described arrangement of the pour spout 35 provides the receptacle 30 with means for readily pouring a liquid specimen from the receptacle. Moreover, the above-described relationship between the spout 35 and the receptacle rim 32 allows the receptacle 30 to be provided with a pour spout which does not interfere with the operation of the receptacle threads 33. The receptacle 30 can thereby be sealed tightly by the cap 40 through a threaded engagement.

The other embodiments 60 and 60A of the container incorporate the same advantages, and operate in essentially the same manner, as the above-described container 20. The legs 82A, 82B on the cap 80 or 80A hold the rim 84 of the cap above the cap supporting surface, and thereby minimize the contamination of the cap. The spout 74 is incorporated into the receptacle 70 in a manner which does not interfere with the threaded engagement between the cap and the receptacle.

Moreover, both containers 60 and 60A incorporate sealing means which indicate the sterility of the container. In the container 60 the sealing means is established by snapping the flexible cap 80 over the threads 73 of the receptacle with the abutment shoulders 86 on the cap positioned around the frangible detent 86 on the handle 75. Once this sealing means is established, the cap 80 cannot be removed from the receptacle 70 in a practical manner without unscrewing the mated threads 73, 83 on the cap and receptacle. Since the advancement of the threads 73, 83 will shear off the detent 86, the presence or absence of the detent 86 will indicate the sterility of the container 60. In the container 60A shown in FIGS. 11-13, the seal is established in a similar manner by snapping the cap 80A over the receptacle threads with the detent 86A on the cap engaged with the recess 76A provided in the receptacle handle. Rotational movement of the cap 80A with respect to the receptacle 70 will shear the detent 86A and thereby indicate that the container has been opened and may not be sterile.

Although the invention has been described with a certain degree of particularity, it should be understood

that the present disclosure has been made only by way of example. Consequently, numerous changes in the details of construction and the combination and arrangement of components as well as the possible modes of utilization, will be apparent to those familiar with the art. Such variations may be resorted to without departing from the spirit and scope of the invention.

What is claimed is:

1. A sterile specimen container comprising:

hollow receptacle means for receiving the specimen including a side wall integrally joined to a bottom wall, a circular rim portion integrally joined to said side wall and an external thread means provided on said rim portion;

closure cap means including skirt portion defining a skirt rim and having internal thread means threadably engaging said external thread means on said receptacle; circular flange means provided on said receptacle means and engageable with said skirt rim as said cap means is threadably advanced onto said receptacle means;

at least three support legs depending downwardly from said skirt portion of said cap means and spaced radially outwardly from said skirt rim to permit said skirt rim to engage said flange means, said support legs defining a support plane for said cap means spaced from said skirt rim with said cap means separated from said receptacle means, whereby said skirt rim is separated from contaminants by said legs; and

a sealing system for indicating the sealed and sterile condition of said container comprising a frangible detent positioned on one of said cap and receptacle means adjacent the interface between said cap and receptacle means, and abutment means provided on the other of said cap and receptacle means and arranged to engage with and shear said detent as said cap and receptacle means are rotated with respect to each other on said thread means, whereby the presence of said detent on said container indicates the sterility of said container;

said cap and receptacle means further being constructed from material having relative flexibility which permits said cap means to be forced onto said receptacle rim portion over said external thread means to seal said container and position said detent in operative relationship with respect to said abutment means and further to operatively engage said internal and external thread means.

2. A container for collecting and dispensing liquid comprising a hollow receptacle having a bottom wall and side wall means integrally joined to said bottom wall and tapering upwardly and outwardly from said bottom wall; a circular rim having a top edge portion and joined to the upper end of said side wall means; external threaded fastening means formed on said rim for receiving a closure cap; and pouring spout means for directing the discharge of liquid from said receptacle over the top edge portion of said rim, said spout means comprising a pair of circumferentially spaced and inwardly directed concavities provided in said side wall means forming spaced members adjacent the interior of said rim and defining an open spout portion therebetween adjacent the top edge portion of said rim, whereby said spout defined on the interior of said rim permits liquid to be discharged from said receptacle over said top edge portion of said rim without interfer-

ing with the function of said internal threaded fastening means.

3. A container in accordance with claim 2 wherein said pair of circumferentially spaced concavities extend upwardly in said tapered side wall means in a substantially vertical direction with respect to said bottom wall

and connect to said spaced members with said spaced concavities defining an upwardly directed channel in said sidewall means aligned with said open spout portion to assist in directing fluid to the spout portion defined between said members.

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