Dec. 24, 1963 J. B. McCORMICK 3,115,460

CENTRIFUGE CONTAINER

Filed April 28, 1960

Fig. 1

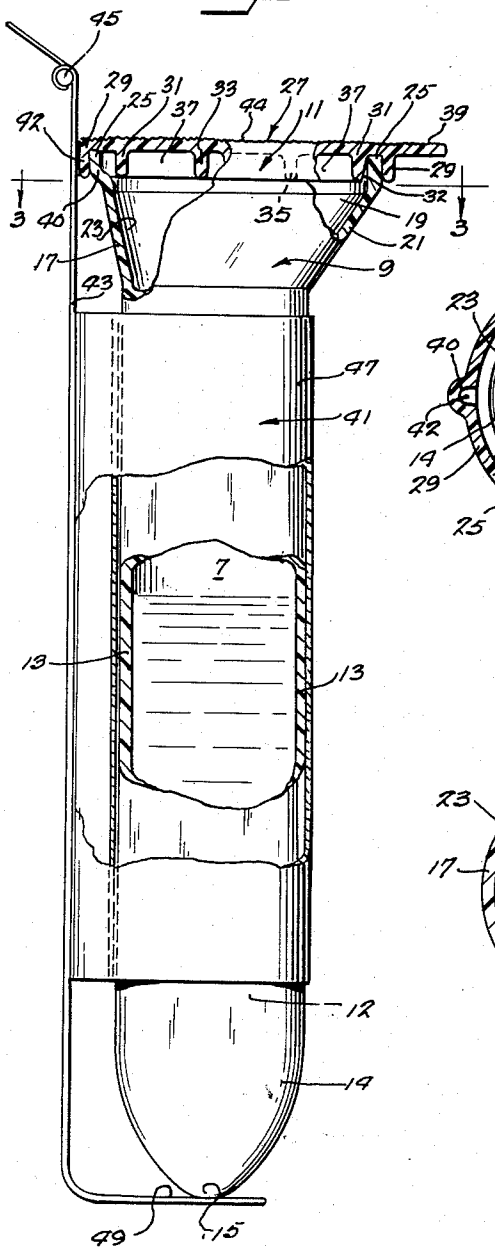


Fig. 2

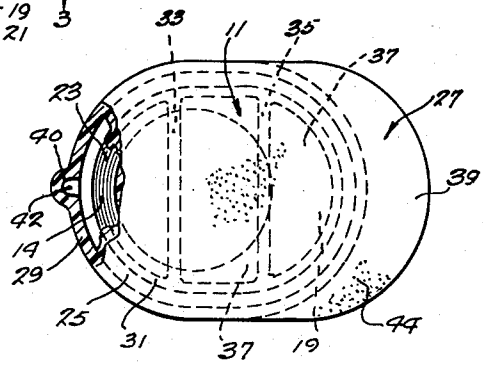
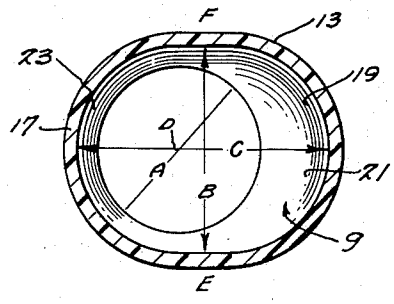


Fig. 3



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CENTRIFUGE CONTAINER

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The present invention relates to a container and, more particularly, to an improved container or tube for use in a laboratory type centrifuge for holding liquid or other material being centrifuged.

The usual type of small centrifuge container for laboratory type centrifuges is made of glass and is generally a cylindrical tube having its lower end tapered inwardly and sealed. The tapered lower end has a limited cross-sectional area in which the heavy phase of the material being centrifuged will be deposited, thereby facilitating observation. The upper end of the tube is open and the area of the mouth usually conforms to the internal area of the tube, although in some instances the walls of the tube may be provided with a rolled lip or bead. One who has used these tubes knows that it is inconvenient to pour liquid into the tubes and also that it is quite difficult to pour out the desired amount of liquid in the event that the tube is overfilled, or in the event that it is desired to decant a supernatent liquid after centrifugation.

Moreover, it is frequently of advantage to have some convenient area available for conducting spot tests on constituents or separated phases obtained during centrifugation. Conventional centrifuge containers do not provide special areas for carrying out such spot tests.

Accordingly, the principal object of the present invention is to provide an improved centrifuge container. It is also an object of the present invention to provide an improved centrifuge container which facilitates pouring of materials thereinto and therefrom. It is a further object of the present invention to provide a simple, inexpensive centrifuge container which may be disposable. It is a still further object of the present invention to provide a centrifuge container which includes means for readily carrying out spot tests of materials. It is also an object of the present invention to provide an improved centrifuge container which can be effectively utilized as storage means for contained materials and which may be effectively sealed against spillage or leakage during centrifugation. Further objects and advantages of the present invention will be apparent from the following detailed description and the drawings.

In the drawings:

FIGURE 1 is a side elevation of a preferred embodiment of a combined centrifuge tube and cap of the present invention, portions of the tube and cover being broken away, the container being shown in position in a centrifuge tube holder or basket which is schematically illustrated;

FIGURE 2 is a plan view of the cap of the centrifuge container of FIGURE 2; and

FIGURE 3 is a sectional view taken along line 3—3 of FIGURE 1.

Briefly, the illustrated embodiment of the invention comprises a centrifuge container 7 which includes a centrifuge tube 9 constructed to facilitate pouring materials into the tube, as well as decanting material from the tube. The illustrated container 7 also includes a cap 11 which is detachably connected to the tube, the cap being constructed so as to provide areas for spot testing. As will be pointed out, the illustrated cap 11 and tube 9 cooperate to provide a leak-free container for the handling and storage of materials. Both tube and cap are

preferably fabricated from inexpensive materials so as to be disposable.

Now referring more particularly to FIGURE 1 of the accompanying drawings, the centrifuge tube 9 includes a hollow, cylindrical body section 12 having annular side walls 13. At the lower end of the body section, as illustrated in FIGURE 1, the side walls 13 are tapered inwardly, as illustrated at 14, and are sealed to provide a bottom closure 15. The tapered section 14 and the bottom closure 15 may be of any conventional construction.

The upper end of the body section 12 is provided with an outwardly flared section 17 whose upper end provides a mouth 19. In providing the mouth 19, the cross section of the tube 9 is enlarged from a circular cross section having an internal diameter A as shown in FIGURE 3, to an oval cross section having a minor axis B which is but slightly longer than the diameter A of the tube and a major axis C which is substantially longer than the diameter A of the tube. As shown in FIGURE 3, the midpoint of the major axis C is offset relative to the central axis D of the tube so that a uniform, flared section 21 is provided around at least one-half of the periphery of the tube, that is, the area moving counterclockwise from the point E to the point F. For a tube having an internal diameter of 0.635 inch, the major axis may desirably be about 1.9 inches and the minor axis about 0.80 inch or less.

The flared section 21 extends well beyond the body of the tybe 9 and provides an enlarged opening for receiving liquid and/or for decantation of liquids from the tube. The periphery of the tube opposite the flared section 21 may be vertically aligned with the walls of the tube or it may be slightly flared as shown at 23, that is, the portion of the periphery moving from E to F in a clockwise direction.

It will be understood that the extent of the flared section 21 can vary, as desired, and that the presence of the non-flared or slightly flared sections at 23 allows the tube to conveniently fit the usual types of centrifuge tube holder. Thus, the flared mouth portion of the tube is restricted to less than the entire periphery of the open upper end of the tube.

Desirably, the upper portions of the flared sections 21 and 23 terminate in a vertically extending (parallel to the longitudinal axis of the tube) upper lip 25. As will be hereinafter pointed out, the lip 25 is dimensioned and adapted to cooperate with cap 11, by frictional engagement with components of the cap and is also dimensioned so that its upper surface lies in a plane so as to cooperate with the cap 11 to provide an effective seal.

The cap 11 (FIGURES 1 and 2) includes a generally flat cover member 27 which extends across the mouth 19 of the centrifuge tube. Depending from the member 27 is a rib 29 which extends around the outer periphery of the lip 25 in close proximity thereto. A second rib 31 depends from the member 27 and extends around the inner periphery of the lip 25 of the tube, as illustrated in FIGURES 1 and 2. The spacing between the ribs 29 and 31 and the height of the ribs are such that they engage the surfaces of the lip 25 of the tube with a frictional contact. In this regard, a portion of one or both of ribs 29 and 31 may be sloped to facilitate a wedging action. Thus, for example, rib 31 in FIGURE 1 is illustrated as having a tapered or sloping surface in an area designated 32 adjoining lip 25.

In order to stiffen the rib 31 and to thereby make possible a tighter fit around the lip 25, transverse reinforcing ribs 33 and 35 are provided, the ribs running generally parallel to the minor axis B of the mouth of the tube. These transverse ribs 33 and 35, in addition to aiding in effecting a frictional contact between the ribs and the lip, also provide a plurality of test zones or basins 37

suitable for carrying out spot tests when the cap **11** is removed from the tube and inverted.

In order to provide for easy removal of the cap **11**, the end of the cap adjacent the flared section **21** of the tube **9** illustrated, is provided with an outwardly extending section which provides a finger grip **39**. In the illustrated structure, the finger grip **39** is formed by an extension of the flat cover member **27**.

The cap **11** is also provided with an indexing means or keyway **40** along the periphery thereof at the end opposite the section providing the finger grip **39**. The indexing means is in the form of a generally hemispherically shaped extension of member **27** and rib **29** and is adapted to cooperatively receive a mating key **42** on the periphery of the lip, as illustrated in FIGURE 1. Key **42** and keyway **40** aid in aligning the cap **11** correctly on the tube, so that the cap **11** can be readily sealed on the tube. The key and keyway allow the cap **11** to be dimensioned within fairly close tolerances, inasmuch as a tight fit on the tube can be obtained with little difficulty.

The tube **9** and cap **11** can be fabricated of any suitable material, for example, an opaque, translucent or transparent plastic. The tube **9** is preferably inexpensive, relatively rigid, and also transparent, the latter for easy viewing of contained materials and to otherwise facilitate use of the tube. Accordingly, it is preferred to construct the tube of clear plastics, usually utilized in the fabrication of transparent containers. Acrylic plastics such as methyl methacrylate, cellulosics such as cellulose acetate, and cellulose acetate butyrate, polybutyrate, and polystyrene are among the clear plastics which are suitable. These can be readily molded into desired form under conventional conditions. Glass can also be employed.

For the cap **11** it is preferred that a relatively flexible plastic material such as polyethylene be fabricated into the cap in any conventional manner. However, it should be understood that other types of plastics or other flexible materials can be employed for the cap.

The upper surface **44** of the cover member **27** is preferably treated so that it may be written on, or the cover may be fabricated from a material which may be readily written on for purposes of identification.

The centrifuge container which has been disclosed is particularly suitable for use with biological liquids such as urine and the like. The centrifuge container is inexpensive, and is simple to use due, in part, to its improved shape, including its upper open flared end for easy pouring of materials, its pouring spout, and its built-in spot test area. Moreover, it is easier to handle and store.

In use, the substance to be centrifuged may be readily poured into the enlarged mouth of the tube. The tube may be capped and stored in a test tube rack or the like until ready for treatment. In the event that it is desired to perform spot tests on the material in the tube, the cap can be removed and inverted, whereupon a few drops of the liquid in the tube may be readily poured into the test zones **37**. Reagent may then be added to complete the spot test.

When the tube is to be centrifuged it may be inserted into a standard centrifuge tube holder or basket **41**, such as is schematically illustrated in FIGURE 1. Such a basket may include a backing plate **43** which is pivotally connected by hinge **45** to the rotor (not shown) of the centrifuge. The tube is held on the backing plate **43** by means of a loosely fitting sleeve **47** which is rigidly attached to the plate **43**. The tube is supported at its base by a base plate **49** which is also rigidly attached to the backing plate **43**. Thus, the portion **23** of the upper end

of the tube will lie forwardly of the backing plate while the pouring spout **21** will not interfere with the sleeve **47** or the plate **43**. The cap **11** may be removed during centrifugation or may be left in place.

Various features of the invention are set forth in the appended claims.

What is claimed is:

1. An improved centrifuge container comprising a hollow cylindrical tube having an open upper end and a tapered closed bottom, and a cap for said tube, said tube at its open upper end being provided with a flared mouth portion restricted to less than the entire periphery of said open upper end, the upper end of said flared mouth portion terminating in a vertically extending lip, the upper edge of said lip being generally in a single plane, said cap comprising a substantially flat cover member extending across and covering the entire open upper end of said tube, at least a portion of said cover member extending beyond the periphery of said tube and thereby forming a finger grip, and a plurality of ribs depending from the under surface of said cover member, at least some of said ribs being circumferentially disposed in frictional engagement with said open upper end whereby said cap is detachably connected to said tube, at least some of said ribs intersecting circumferentially disposed ribs so that said ribs are arranged to delineate a plurality of isolated areas suitable for spot testing materials when the cap is removed from said tube and is inverted.

2. An improved centrifuge container comprising a hollow cylindrical tube having an open upper end and a closed bottom, the upper end of said tube being provided with a flared mouth portion restricted to less than the entire periphery of said open upper end, the upper end of said flared mouth portion terminating in a vertically extending lip, the upper edge of said lip lying generally in a single plane, and a cap for said tube, said cap comprising a substantially flat cover member extending across and covering the entire open upper end of said tube, at least a portion of said cover member extending beyond the periphery of the tube and providing means for facilitating removel of the cap from the tube, and rib means on the surface of said cover member, a portion of said rib means being disposed circumferentially of said cover member and adapted to frictionally engage the open upper edge of said tube whereby said cap is detachably connected to said tube, said rib means defining at least two basins capable of retaining a small quantity of liquid for the spot testing of materials.

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