MULTIPLE LIQUID SAMPLE COLLECTION APPARATUS

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References Cited

UNITED STATES PATENTS
3,092,940 6/1963 David
3,177,870 4/1965 Salem, Jr. et al.
3,405,760 10/1968 Cinqualbre
3,561,427 2/1971 Profy
3,566,930 3/1971 Kirschner

FOREIGN PATENTS OR APPLICATIONS
197,933 8/1965 Sweden

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ABSTRACT

A liquid sample collection apparatus which includes a collection receptacle with a plurality of jointed but separable sample collection units. A liquid transmitting tube may be selectively positioned to discharge into a desired collection unit, without exposure to atmosphere and without sample cross-contamination. The tube has an outlet which is insertable through internal openings to the respective units. When a sample has been collected in one unit, the flow of fluid is stopped and the outlet end of the tube is withdrawn from the particular unit, but remains within the overall receptacle. The opening between the filled unit and its adjacent unit is then sealed, and the filled unit is separated from the receptacle. The whole system remains sealed to external contamination through successive sample collections and separations.

9 Claims, 5 Drawing Figures
MULTIPLE LIQUID SAMPLE COLLECTION APPARATUS

This invention relates to a collecting apparatus and more particularly to an apparatus for collecting samples of discharged liquids without outside bacterial contamination. The apparatus is useful for collecting successive samples from a patient, and is especially useful for the collection of urine samples for laboratory analysis to aid in therapeutic treatment of the patient, although it may be utilized for the collection of blood or other discharged liquids.

In the collection of liquid samples such as urine, it is important to collect and maintain the sample free from any external contamination which may make the sample useless, or render inaccurate the results of any analysis conducted on the sample. Moreover, exposure to atmosphere of the drainage passage or tube may lead to patient infection. Such exposure or contamination may readily occur through open air exposure of the sample, or exposure of the tube end which drains into the collection apparatus. The dangers of such contamination are pointed out in "Clinical Evaluation of Closed Urinary Drainage Systems" by Finkelberg and Kunin, J. American Medical Assn., vol. 207, pp. 1657-1662, Mar. 3, 1969, which compares eight different drainage systems for efficacy in preventing contamination of bladder urine, and later in "Bacteria During Indwelling Catheter Drainage", by Thornton and Andriole, J. American Medical Assn., vol. 214, pp. 339-342, Oct. 12, 1970.

In one prior type of collector device, such as the disposable urinary drainage bag assembly shown in U. S. Pat. No. 3,090,968, contamination can be introduced into the sample through the opening in the bag provided for the outlet end of the drainage tube. Moreover, when a replacement bag is mounted to the drainage tube for a subsequent sample, the outlet end and internal passage of the drainage tube can become contaminated by air exposure. No provision is made for successive sampling, without drain tube exposure.

We have invented a collection apparatus which provides a closed system for the collection of samples, such that multiple samples can be successively introduced to and removed from the apparatus without exposing the interior thereof, or the drainage tube, to any external contamination. By this apparatus a plurality of samples may be taken, at different times, without exposing the system or the drainage tube at any time to external contamination, each successive sample-containing unit being separable from the remaining apparatus.

One prior art device which provides for plurality of separable blood collection units is disclosed in FIG. 10 of U. S. Pat. No. 2,702,034. Such prior art devices are utilized for collecting an adult donation of blood and automatically dividing it into several infant-size infusion quantities. A common inlet to all smaller units is utilized, thus each sample compartment is opened to the other and the liquid in each compartment is subject to cross-contamination and overflow from the adjacent compartment if successive samples were to be taken. Such devices have no apparatus for the selective filling of a single removable compartment.

It has been a major object of this invention to provide apparatus including a closed system for the collection of successive and separable liquid samples, the apparatus being closed to external contamination throughout the collection of the various samples.

Another object of the invention has been to provide a liquid collection apparatus for the collection of successive liquid samples into compartments separable from the apparatus, wherein each compartment is filled separately and individually, without flow to or from the adjacent compartment.

Briefly, our invention includes a plastic collection bag divided into serially joined units or compartments, and a drainage tube disposed within the bag which is extendable or introducible through openings near the tops of the respective compartments. The tube has an outlet end and a retainer that is selectively positionable within any given compartment, the retainer holding the outlet end within the selected compartment. The compartment to which the tube end opens receives liquid from the drainage tube when an appropriate tube clamp is opened. When the desired amount of liquid has been obtained, the clamp is closed and the outlet end of the tube and retainer are withdrawn through the compartment opening so as to reside within another compartment in the bag. The opening of the filled compartment is thereafter sealed by a clamp or other sealing means, and thereafter the sealed compartment is removed from the bag for transportation to a laboratory for analysis of the sample therein. The compartment which was adjacent to the removed compartment remains sealed against external contamination by sealing means utilized subsequent to the tube's withdrawal, but prior to removal of the filled compartment.

The tube may be withdrawn into a larger, vented main compartment or reservoir which accepts regular liquid flow, until another sample is desired. The tube is then "threaded" or pushed through the compartment openings to what is now the last compartment, for the collection of another sample.

The compartmented apparatus may be formed from a plastic bag by the process of heat sealing strip areas of the bag together to define the various compartments. The sealing of the compartment openings after filling may be accomplished by a mechanical seal, by heat sealing, or in other manner. Perforations or tear lines may be formed in the heat sealed areas of the bag in order to facilitate individual removal of the various compartments.

The invention thus is capable of collecting a plurality of sequential samples at different times, and yet maintaining the entire collection system closed to external contamination.

The invention has the further advantage that the apparatus can be utilized over a long period of time, the regular flow of fluid being delivered into a larger compartment and drained therefrom as necessary through an appropriate outlet. The drainage tube may be inserted into a sample compartment only at such time as a sample is required, and the whole system remains closed to external contamination as well as to internal cross-contamination.

These and other objects and advantages will become readily apparent from the following detailed description of a preferred embodiment and from the drawings, in which:
FIG. 1 is a general side elevation of the apparatus showing the compartmented drainage bag and drainage tube;

FIG. 2 is taken along line 2—2 of FIG. 1 and shows an enlarged horizontal section of the lower portions of the separable compartments;

FIG. 3 is taken along line 3—3 of FIG. 1 and shows an enlarged horizontal section of the upper portions of the separable chambers including the clamp guides and a pair of clamps;

FIG. 4 is an enlarged vertical view taken along line 4—4 of FIG. 1 and shows a clamp in operative position; and

FIG. 5 is an enlarged horizontal sectional view of a clamp, taken on line 5—5 of FIG. 4.

Now referring particularly to the drawings, a preferred form of drainage bag or collection receptacle 10 embodying the invention is shown in FIG. 1 thereof. The bag 10 may be made from any suitable material such as thermoplastic sheet material, e.g., polyethylene, and includes a large compartment or reservoir 11 and separable compartments or units 12—15 connected to the main reservoir. The relative sizes of these are not critical, but the compartments 12—15 could usefully be of 50cc capacity, and reservoir 11 of 1800cc capacity.

The separable units 12—15 are separated from each other and from the large compartment 11, preferably by heat sealing the sides of the bag 10 together along spaced parallel strips 16—19. The heat sealed strips extend from the bottom 20 of bag 10 (as seen in FIG. 1) to points 21 short of the top 22 of the bag 10, thus leaving a passageway or open zone 8 between the points 21 and the top 22 of the bag. The passageway 8 is best seen in FIG. 3, between compartments 14 and 13, 12 and 13, 11 and 12, and 12 and 11. The opening between compartments 14 and 15 is sealed, as will be discussed. Perforations or tear lines 9 extend from the bottom 20 of the bag 10 to the points 21 in the middle of the heat sealed strips 18, and aid in separation of the compartments as will be discussed.

The large compartment or reservoir 11 of the bag includes a typical pledget 23 which commonly includes a plug of cotton or other material for providing a vent in compartment 11. Although air can pass through the pledget 23, it maintains the bag closed to external contamination.

A liquid outlet or drain 24 is provided at the bottom of compartment 11 for the purpose of draining liquid from the compartment 11 through an outlet or discharge tube 25. This tube is provided with a clamp 26 which may be opened or closed, either to drain or seal the compartment 11. It is to be noted that the drainage of compartment 11 through the tube 25 does not allow external contamination into the bag 10, because clamp 26 is only opened while fluid is flowing out of tube 25 and is closed before air enters port 24. The liquid flow itself seals the bag against the introduction of external contamination through this outlet.

A drainage tube 30 is provided for introducing liquid into the bag 10. The tube enters the bag through a fixed, sealed opening 29. The tube 30 includes an enlarged diameter circular retainer 31 located near the end 32 of the tube. The retainer may be an integral part of the tube 30, or it may be washer-shaped and fitted tightly onto tube 30. The retainer has an outside diameter of such dimension that it may be manually worked through the openings 8 provided between the various compartments. The fit of the retainer in these openings is such that the retainer will not freely pass through the openings but effectively act as a stop when it abuts one of the openings. It thereby prevents inadvertent withdrawal of the tube end from the particular compartment in which it has been placed.

The retainer is not so large, however, that it cannot be pulled through the opening when desired. To this end, the retainer may be made of a deformable material, or the material from which the bag is made may be yieldable to allow the retainer and tube to pass through the opening by a predetermined force.

For attachment of the bag 10 to collect a sample of liquid from the patient, tube 30 may be attached to a tube 35 or catheter of known type, connected to the patient for receiving the discharge liquid. A clamp 36 is provided on tube 30, or on tube 35, to valve the flow of liquid as will be described.

For sealing off one of the separable compartments 12—15 from the others, a clamp 40 such as the preferred clamp shown in FIGS. 4 and 5 may be utilized. Such a clamp may be "hairpin" or U-shaped, and comprises longitudinal legs 41 and 42, hinged or joined at 44. The legs are provided with vertically extending interfitting grooves 43 which cooperate with serrations in the opposite leg as shown in FIG. 5. The clamp may be pushed over the top portion 22 of the bag 10 and downwardly, thereby gripping the bag material in the saw-tooth or serration portion of the clamp. The legs of the clamp are yieldable, but are urged toward each other so as to clamp together material over which the clamp is applied.

Two clamps are provided for each opening associated with each heat sealed strip, so that each end of an opening 8 can be sealed when a compartment is to be separated from the bag 10. Guides or clamp confines 45 are provided as shown in FIGS. 1 and 3 to prevent the clamps from any slide slippage. These guides are located, as shown in FIG. 1, on each side of the perforations 9 and are merely longitudinal ribs, guides or projections, and may be extruded, pressed, molded or otherwise combined with the sides of bag 10 in any suitable manner.

A hanger loop 50 is provided on the bag 10 in order to facilitate the hanging of the bag in an appropriate position for receiving a liquid. Graduations as at 51 may be printed, to show liquid volume.

In use, to collect samples, such as urine samples from a patient, the bag 10 is hung appropriately near the patient and the tube 30 is connected to the catheter tube 35, which in turn is connected to the urinary bladder. During normal use, the end 32 of the tube is located within reservoir compartment 11 of the bag and the regular fluid flow is received and contained therein. This compartment may be drained as necessary by the opening of clamp 26 on outlet tube 25.

When it is desired to analyze the flow at the specific time, or over a certain period, the clamp 36 is closed to stop liquid flow through tube 30. The tube end 32 is then moved relatively through the openings 8 by pulling and sliding the compartments over the retainer 31 of tube 30 in an accordion-like fashion, until the end...
32 of tube 30 protrudes into the last or farthest compartment 15. During this operation, the tube does not slide with respect to the seat at 29. Clamp 36 is then released, and the sample is discharged into compartment 15 only. During the collection of the sample in compartment 15, the retainer 31 holds the end 32 of tube 30 within this compartment. When the desired sample has been collected, clamp 36 is closed, and the outlet end 32 of tube 30 is retracted through the openings back into large compartment 11. Clamp 36 may then be opened to pass the normal liquid flow into this compartment. This procedure maintains the other compartments free of any fluid discharge through tube 30 during movement of outlet end 32 through the various openings.

In order to seal and separate the compartment 15 from the bag 10, two clamps 40 are placed into operative position between their respective guides 45, as best seen in FIGS. 1 and 3. These clamps effectively seal closed the opening between compartments 15 and 14, 20 and the sample may now be removed from the bag 10 by merely tearing or cutting compartment 15 away from compartment 14 along the perforations 9 in the heat sealed strip 19. It is to be understood that the heat sealed strip 19. It is to be understood that the heat sealed strips are wide enough to form effective seals even when the units are torn apart along the perforations. When the compartment 15 has been separated up to the point 21 where the perforations end, the remaining material may be cut between the clamps to complete the separation of the sample.

The sample, completely sealed within compartment 15 by one clamp 40, may be transferred to the laboratory for analysis. The bag 10 remains sealed by virtue of the remaining clamp 40 on what is now the end compartment 14. Successive samples may be obtained by repeating the same procedure. As can be seen, tube end 32 has at no time been exposed to atmosphere.

It can be appreciated that many alternatives may be provided. For instance, after the collection of a sample into a sample compartment and withdrawal of tube 30 therefrom, the opening could be sealed by any suitable means such as modified clamps or by further heat sealing.

In an alternate embodiment, the bag 10 may comprise a plurality of like-sized compartments with the end of the drainage tube disposed in the last. The tube 35 is connected to a patient (through a bypass valve or the like) only when a sample is desired. The sample could then be collected and separated in much the same manner as in the uses of the preferred embodiment, the end of the drainage tube being successively retracted into the next adjacent compartment and the opening sealed before a collected sample is separated.

Thus it can be seen that we have provided a sample collection apparatus which can be utilized for the collection of urine, blood, or the like which is discharged from a patient, the apparatus including a collection system which is constantly sealed against external contamination. The invention also provides a system whereby a single apparatus can be utilized in the collection of successively discharged liquid samples, the system being sealed against external contamination as well as against internal contamination between a plurality of separable sample collection compartments or units.

While we have described preferred and alternate embodiments of the invention, other modifications and variations will become apparent to those of ordinary skill in the art and we intend to be bound only by the appended claims.

We claim:

1. A multiple liquid sample collection apparatus for collecting samples such as urine or the like, from a patient, comprising:
   a collection receptacle,
   a drainage tube for connection to receive a liquid discharged from a patient and having an outlet end positioned within said collection receptacle,
   said receptacle having a plurality of serially joined but separable flexible sample collecting compartments, each with at least one opening to adjacent compartments,
   the said openings being arranged so that the outlet end of said drainage tube is insertable through said openings in sequence to communicate with each of the compartments, and
   means for sealing predetermined ones of said openings subsequent to removal of the outlet end of said drainage tube and prior to separation of said separable sample collecting compartments.

2. Apparatus as in claim 1 including a plurality of heat sealed strips extending from the bottom of the receptacle to points near the top thereof for separating said compartments,
   the said openings being formed through each such strip to permit passage of said outlet end therepast.

3. Apparatus as in claim 2 including perforation means extending from one end to the other end of each heat sealed strip for aiding in the separation of said compartments.

4. Apparatus as in claim 1 wherein said sealing means includes a plurality of clamp means, each clamp means having two legs provided with cooperating projection means for engaging and sealing said openings.

5. Apparatus as in claim 4 including clamp guide means on said receptacle.

6. Apparatus as in claim 5 wherein said clamp guide means include a plurality of longitudinal projections extending across the openings between said compartments.

7. Apparatus as in claim 1 wherein the outlet end of said drainage tube is provided with a retainer means for holding said end within a selected compartment.

8. Apparatus as in claim 7 wherein said retainer means is an enlargement adjacent the end of said tube which restricts free movement of the tube end through said opening.

9. Apparatus as in claim 1 wherein one of said compartments is a reservoir substantially larger than the others and includes vent means and drainage means.

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