May 18, 1971 D. E. PICKERING 3,579,303

SYSTEM FOR HANDLING SPECIMENS AND OTHER SUBSTANCES IN MEDICINE AND PHYSICAL SCIENCES

Filed March 6, 1968 2 Sheets-Sheet 1

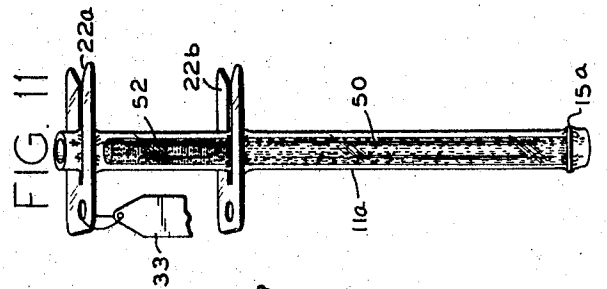


FIG. 11

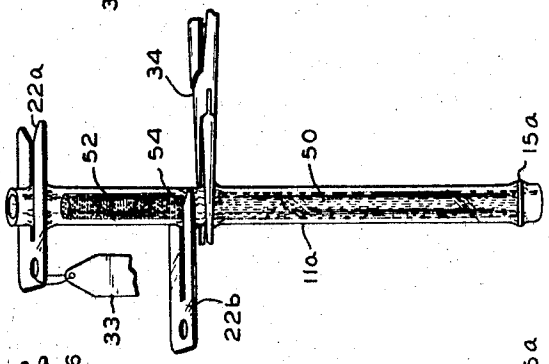


FIG. 10

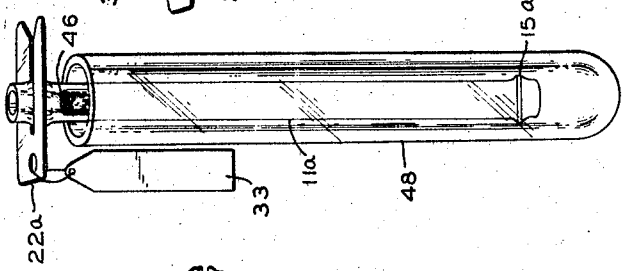


FIG. 9

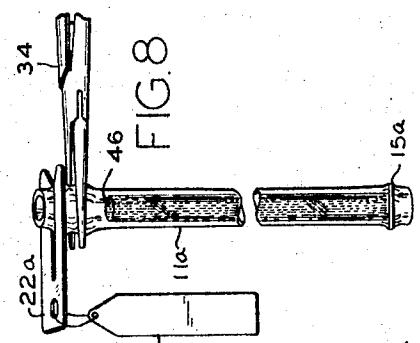


FIG. 8

FIG. 7

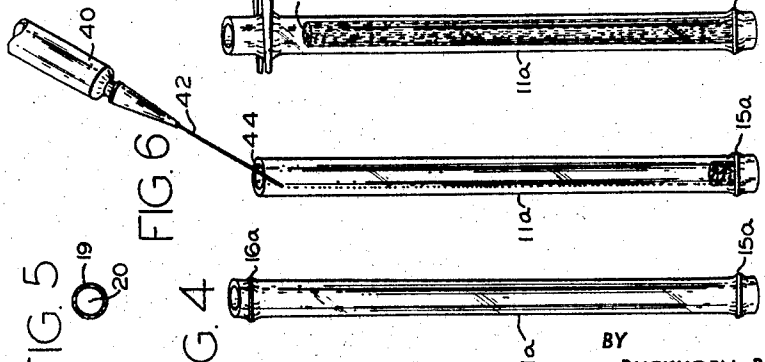


FIG. 6

FIG. 5

FIG. 4

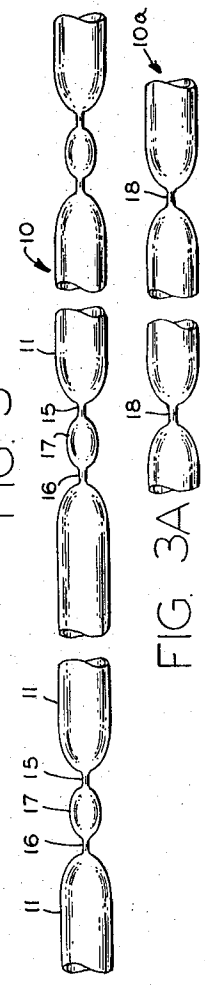


FIG. 3

FIG. 3A

FIG. 2

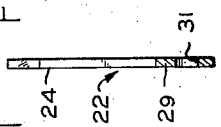
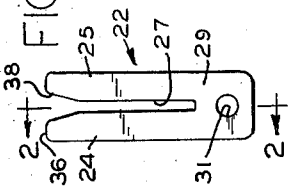


FIG. 1



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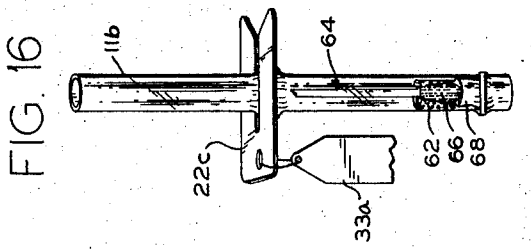

FIG. 16

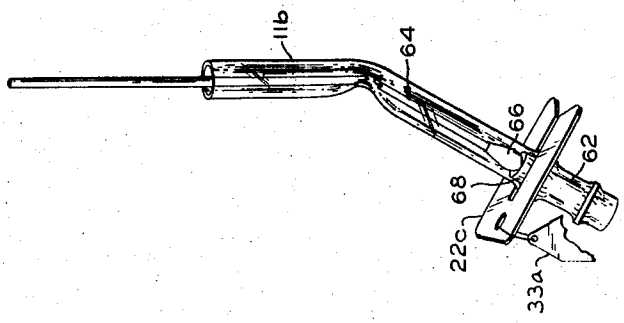

FIG. 15

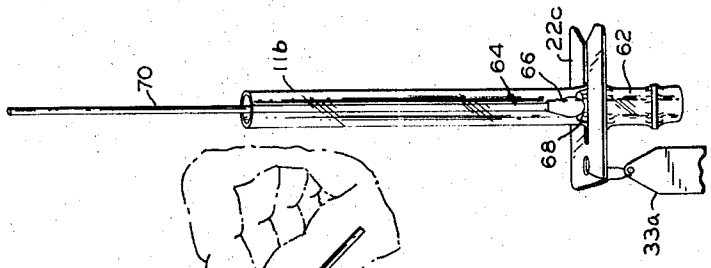

FIG. 14

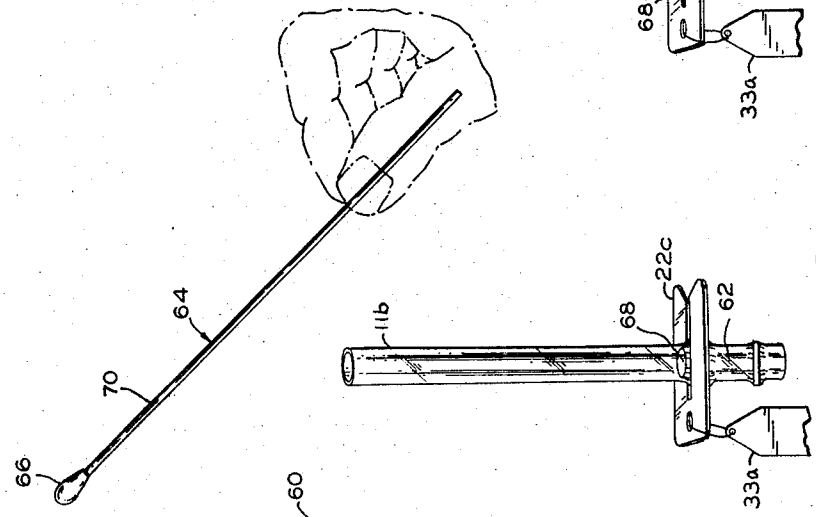

FIG. 13

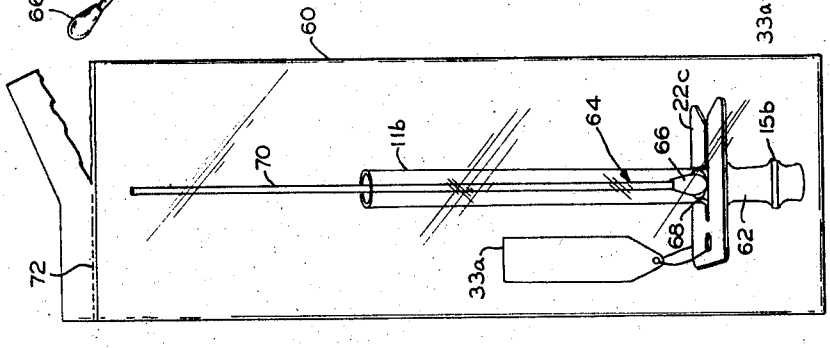

FIG 12

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3,579,303

SYSTEM FOR HANDLING SPECIMENS AND OTHER SUBSTANCES IN MEDICINE AND PHYSICAL SCIENCES

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Int. Cl. G01n 1/00, 33/16
U.S. Cl. 23—230 11 Claims

ABSTRACT OF THE DISCLOSURE

A method of and apparatus for handling, processing, testing, storing, transporting and otherwise using biomedical, biological, chemical and other specimens, reagents and substances from the time of their initial procurement through their transport, storage and ultimate laboratory or other usage and final disposal. The system embodies the use of a length of transparent or translucent, resilient, sterile and disposable tubing divided by heat or other seals into a series of linked and sealed segments. Individual segments are severed from the string of segments as needed, filled with a freshly procured specimen or reagent, and then resealed mechanically with a selectively removable clip to which an identification tag can be attached. Additional temporary or permanent sealing of a tube segment can be achieved as needed for separation of substances through the use of additional clips. A modification of the apparatus includes the use of a swab and transport media to procure, contain and transport or store microbiological specimens.

BACKGROUND OF THE INVENTION

(a) Field of the invention

The present invention relates to the handling, storage and processing of specimens, reagents and other substances used in the laboratory and more particularly to a container system for and methods used in connection with the handling of such specimens, reagents and other substances. The method and system have particular utility in the field of medicine for procuring, handling and processing specimens of body fluids such as blood, urine, spinal fluid and amniotic fluid, although applications in other physical sciences and especially microbiology, bacteriology and biochemistry will also be readily apparent to those skilled in such disciplines.

(b) Description of the prior art

Heretofore, biomedical specimens such as, for example, blood specimens, commonly have been handled in the following manner:

The blood specimen would be obtained from the subject with a hypodermic syringe and then transferred to an ordinary glass test tube, permitted to clot within the tube, then sealed within the tube with a stopper and transferred in the tube to a laboratory for processing with care to prevent breakage. In the laboratory, before the blood specimen could be separated into its plasma and cellular components, the clotted blood specimen would first have to be opened and "rimmed" with a wooden applicator stick or thin glass rod to dislodge the clot. After centrifugation, the plasma fraction of the specimen would be drawn off from the test tube by pipette or other suitable means and transferred to another test tube to maintain separation of the fractions. Any subdivision of either remaining fraction for multiple testing or possible retesting would require further transfers by pipette or otherwise to additional test tubes for storage until use. If preservative or anticoagulant were to be added to the specimen, shaking of the tube would be required to ensure thorough mixing.

The clinical and laboratory handling of other body fluids would be comparable. In any event, the prior practice of transferring specimens or portions thereof from syringe to test tube, from test tube to pipette and from pipette to other test tubes necessarily exposes the specimen excessively to the possibly deleterious effects of atmospheric and bacteriological contamination, creates problems of evaporation, creates frequent opportunity for mistake, miscalculation, breakage and consequent loss of specimen, and is laborious, time consuming and therefore costly.

Because of the foregoing and other factors, there has long been a need for a more efficient manner of handling biomedical, biological and laboratory specimens and other substances.

SUMMARY OF THE INVENTION

In accordance with the present invention, the problems presented by the prior art in the test tube handling of biomedical, biological and other specimens and reagents are overcome by providing initially sealed, segmented lengths of resilient, thermoplastic and sterile tubing of relatively narrow dimension and variable length as required. A specimen or reagent is transferred directly from its primary source into one of such segments, the segment is sealed with a removable compression clip, and the specimen or reagent is retained in the same tube segment through subsequent shipment, storage, laboratory handling and processing, to final disposal. Initial sealing of each tube segment is preferably by heat seal. Additional sealing after the addition of a specimen or reagent can be accomplished by heat seal, hemostat or special removable compression clip especially intended for this purpose.

Centrifugation and other processing and testing procedures can be carried out while the sample remains in the tubing. Physical separation of dissimilar fractions of a specimen following centrifugation can be achieved by subdividing a tube segment at the interface of the fractions with a clip, thereby eliminating the need for transferring fractions to different containers.

Intermixing of different substances, such as a specimen and a reagent, can be accomplished within a single tube segment by initially storing the substances subsequently to be mixed at opposite ends of a segment subdivided intermediate its opposite ends by a removable clip. When intermixing is desired, the central clip is removed to permit the free flow of both substances throughout the segment.

Some of the principal objects and advantages of the present invention are to provide:

(1) A new and improved method of handling medical, biological and other specimens, reagents and substances from initial procurement through subsequent transport, storage and laboratory handling to ultimate disposal;

(2) A new and improved apparatus and system for carrying out the aforementioned method;

(3) An apparatus as aforesaid including a new and improved resilient and compressibly sealable tubular container system for specimens, reagents and other substances which replaces the test tube in the handling of such substances;

(4) A new and improved removable clip for sealing containers as aforesaid;

(5) A new and improved method of producing, storing and handling in bulk resilient containers as aforesaid until their time of use;

(6) A new and improved container system including a series of linked resilient tubular segments interconnected by heat sealed link portions;

(7) A new and improved apparatus for and method of preparing uniform samples of specimens and reagents in multiple units for multiple testing and retesting purposes;

(8) A method and apparatus as aforesaid which are simpler, more efficient, more accurate and less costly than prior methods of and apparatuses for handling specimens, reagents and other laboratory substances;

(9) An apparatus as aforesaid which is simple and inexpensive to manufacture and use, unbreakable during use, and disposable following use;

(10) A method and apparatus as aforesaid which minimize the possibility of contamination of specimens and reagents;

(11) A method and apparatus as aforesaid which simplify the containment, shipment, storage and laboratory handling of body fluids such as blood;

(12) A method and apparatus as aforesaid which simplify the intermixing of specimens, reagents and other laboratory substances;

(13) A method and apparatus as aforesaid which simplify the separation of dissimilar fluids following centrifugation or other fractionating processes;

(14) A container system for specimens, reagents and other substances which is selectively variable depending on the container volume required;

(15) A method and apparatus as aforesaid which maintain sterile conditions during the handling of specimens, reagents and other laboratory substances;

(16) A method and apparatus as aforesaid which simplify the centrifugation of specimens and other substances;

(17) A method and apparatus as aforesaid which minimize evaporation during the handling of body fluids and other specimens and liquid substances;

(18) A method and apparatus as aforesaid which minimize the likelihood of hemolysis during the handling of blood specimens;

(19) A method and apparatus as aforesaid which eliminate the need for rimming blood specimens prior to centrifugation;

(20) A method and apparatus as aforesaid which simplify the introduction of an anticoagulant into a whole blood sample;

(21) A method and apparatus as aforesaid which inherently delay the clotting mechanism of whole blood, thereby permitting a sufficient time for experimentation and centrifugation of the specimen without use of a chemical anticoagulant;

(22) An apparatus as aforesaid which permits the introduction of chemical anticoagulants and preservatives into the tubular container in dry form in a manner so as to provide a natural intermixing of whole blood with the anticoagulant or preservative with a minimum of agitation of the blood;

(23) An apparatus as aforesaid which simplifies the storage of a blood sample under oil to prevent the loss of carbon dioxide from the blood serum.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects and advantages of the present invention will become more apparent from the following detailed description which proceeds with reference to the accompanying drawings:

FIG. 1 is a plan view of a tube sealing clip in accordance with the invention;

FIG. 2 is a longitudinal sectional view taken along a line 2—2 of FIG. 1;

FIG. 3 is a view of a series of linked and sealed tube segments in accordance with the invention;

FIG. 3A is a view similar to FIG. 3 of a modified form of linked tube segments;

FIG. 4 is a view of a single, sealed tube segment separated from the series of FIG. 3;

FIG. 5 is a cross-sectional view taken along the line 5—5 of FIG. 4;

FIGS. 6 through 11 illustrate a typical use of the tube segment of FIG. 4 in containing, storing, shipping, centrifuging and separating the plasma and cellular components of a blood specimen in accordance with a method of the invention; and

FIGS. 12 through 16 illustrate a modification of the method of FIGS. 6 through 11 used in handling microbiological specimens.

DETAILED DESCRIPTION

(a) Tubing

With reference to the drawings, the invention centers around the use of a length of tubing indicated generally at **10** in FIG. 3 or **10***a* in FIG. 3A. The tubing is made of a resilient, plastic material which is preferably transparent, or nearly so, thermoplastic. The tubing material should exhibit a chemical inertness toward biological specimens such as blood, urine, spinal fluid and other body fluids as well as toward bacteria and most chemical solutions for biomedical and biological uses. The tubing should additionally be capable of sterilization by chemicals, steam, heat or electromagnetic radiation (e.g., gamma radiation) without loss of its light perviousness, resilience and other properties mentioned above. Ideally, the tubing material should be capable of prolonged storage at room temperatures, subfreezing temperatures and moderately elevated temperatures without losing its aforementioned characteristics. A suitable tubing material exhibiting the above characteristics and suitable for most biomedical and biological purposes is, for example, "Tygon" brand surgical grade tubing No. S–50–HC manufactured by U.S. Stoneware of Akron, Ohio. This tubing has been found to function satisfactorily at temperatures ranging from −35° C. to +30° C.

The length of tubing **10**, following sterilization, is divided into a series of linked tubing segments **11** of any desired length depending on intended use and required capacity, with each segment being sealed at its opposite ends by a heat seal **15**, **16**. The heat seal **16** at one end of each segment **11** is spaced a short distance from the adjacent heat seal at the opposite end of an adjacent segment **11** so as to define a small bulb portion **17** which together with the adjacent heat seals form a link tying together the sealed tube segments. The linked and sealed tube segments can be maintained in their linked condition until a segment is needed for use, thus providing a convenient means of storage and handling of the empty segments and ensuring that they will be maintained in a sterile condition until use.

If the test or analysis to be carried out is such that air contamination of the reactants would be undesirable, the initial tube segments **11** may be filled with an inert gas such as nitrogen prior to sealing. Then when the substance to be analyzed is added to the tube segment, it will displace the inert gas rather than air. In fact, to minimize the possibility of exposure to air, the substance can be added to a sealed tube segment using a hypodermic syringe inserted through a wall of the closed tube, making certain, however, that the tube is resealed below the puncture after the substance has been injected into the segment in this manner.

When a segment is needed for use or shipment, it can be severed from the string of linked segments at bulb **17** between adjacent heat seals **15**, **16** so that both the severed segment and the adjacent linked segment will remain sealed. A segment **11***a* severed from the linked segments of FIG. 3 is shown in FIG. 4 with heat seals **15***a* and **16***a* at its opposite ends still intact. The tubing is generally annular in cross section as indicated in FIG. 5, having a wall **19** of the aforedescribed resilient thermoplastic material defining a lumen **20** in which specimens, reagents or other substances are received and stored. The tubing may be produced in varying diameters depending on application, but in general an elongate and relatively

narrow lumen is desired to minimize evaporation and bulk.

The tubing **10***a* of FIG. 3A is similar to the tubing of FIG. 3 except that in FIG. 3A only a single heat seal link **18** separates the tube segments. With this link configuration, severance of a segment from the string while maintaining a seal at the severed end is difficult, but will usually not be necessary because for most uses such end must be opened in any event.

(b) Sealing

The heat seals are applied most conveniently by a dielectric process using a device such as, for example, a "Hematron," manufactured by Fenwal Laboratories, Morton Grove, Ill. Other, directly heated instruments such as a pair of forceps heated over an open flame could be used to seal the tubing if desired, but such a technique is not recommended, especially with a substance within the tubing, because of the difficulty in controlling the temperature of the instrument.

Referring now to FIGS. 1 and 2, a sealing clip **22** is provided for use in pinching closed the tube segments as an alternative or supplement to the heat seals. The clip comprises a thin, plate-like member having a pair of broad, flat parallel arms **24**, **25** spaced slightly from one another to define a gap **27** therebetween of predetermined width correlated to the thickness of the tubing used in conjunction therewith. The arms are connected together at their inner ends by a main body portion **29** having a circular opening **31** therethrough for attaching an identification tag **33** as shown in FIG. 8. The clip may be stamped or otherwise manufactured from aluminum alloy or other suitable metal or rigid plastic material.

Clip **22** is applied to the tubing to mechanically seal the latter in the manner shown in FIG. 8. While the tubing is gripped with forceps **34** or other appropriate gripping means, the portion of the tubing to be temporarily sealed is passed into gap **27** between the clip arms to compress opposed wall portions of the tubing together. The outer ends of the clip arms at **36** are rounded to avoid damaging the tubing. The inner edges of the arms taper inwardly from the rounded outer ends to provide an inlet opening **38** of gradually diminishing size leading into the gap **27**, which throughout its major extent is of uniform width. The width of the gap is selected so that it will completely close the tube lumen to prevent the passage of fluid. Thus the gap is no greater in width than twice the wall thickness of the tubing and preferably slightly less, since the tube wall material is somewhat elastic. However, the gap should not be so narrow relative to the tubing that it will injure the tubing wall upon removal of the clip therefrom. The clip may be removed from the tubing to release the seal when desired simply by sliding the tubing from between the arms. Yet the clip will remain in sealing engagement with the tubing until physically removed therefrom. The tubing can also be placed within a mailing envelope with clips attached and shipped by mail without displacing the clips.

The tubing clip is typically used to maintain separation between the cellular and fluid components of blood and other biological fluids following centrifugation. This is accomplished as shown in FIG. 10 by applying a clip **22** to a tube segment at the interface of the two dissimilar fractions between the sealed opposite ends of the segment.

A second use for the clip is to hold the tube segment in its shield within a centrifuge during centrifugation, such application being illustrated in FIG. 9.

A third use for the clip is in intermixing two substances within a common tube segment, which may be explained with respect to FIG. 11. A tube segment is first sealed with a clip at a point intermediate its opposite ends and then filled from one open end with a fluid to be tested and filled from its opposite end with, for example, a reagent. The opposite ends of the tube segments are sealed to retain the two fluids within the segment, and the center clip remains in place to maintain separation of the fluid and reagent until time for testing. Then the center clip is removed, enabling the fluid and reagent to intermix. The reaction can be observed through the transparent walls of the tube segment. Thus, the entire test or experiment can be prepared, stored until testing time, conducted and observed without any transfer of the fluid to be tested or the reagent from one test tube to another, thereby minimizing the opportunity for bacteriological contamination, evaporation or error and therefore increasing the reliability of the test. It will be apparent that any number of liquids, gases or powdered substances could be intermixed in this manner within a single length of tubing separated by releasable mechanical sealing means.

Once applied, the sealing clip may be manually removed from the tubing at any time without damage to the tube wall. Thus use of the clip enables a controlled, delayed mixing of previously separated ingredients as previously explained. The more permanent heat seals may also be removed as desired to insert or remove substances from a tube segment simply by severing an end portion of the tube segment including the seal. The segment may then be resealed when desired either mechanically, using the clip or a hemostat, or by application of heat with a Hematron or other device.

(c) Specific applications

The foregoing system has been devised especially for handling blood and other body fluid specimens for hematological and biochemical analyses. An adaptation is also used in a culture system for handling microbiological specimens. Examples of typical applications of the tube system in the centrifugation of blood specimens and shipment of a microbiological specimen follow:

Example 1.—Centrifugation of blood

Referring to FIGS. 4 through 11, a sterile tube segment **11***a* (FIG. 4) is severed from the linked segments **10** and opened at one end (FIG. 5) by cutting off an upper tube portion including heat seal **16***a*. A fresh blood specimen is procured from a subject with a hypodermic syringe **40**, and then emptied into the tube segment by inserting the needle portion **42** of the syringe within the upper tube opening **44** as shown in FIG. 6. Then, grasping the upper portion of tube **31***a* with hemostat **34** as shown in FIG. 7, a clip **22***a* is applied to the upper end of the tube segment to seal the fresh specimen **46** inside, as shown in FIG. 8. The specimen is identified by applying a suitably marked tag **33** to the clip **22***a*.

With the specimen thus sealed within the tube segment and properly identified, typically at the Physician's office or clinic, the specimen may be then prepared for centrifugation by placing sealed tube segment **11***a* within a centrifuge holding tube or shield **48**, using clip **22***a* to suspend the tube segment from the rim of the shield in the manner shown in FIG. 9.

After centrifugation, the separated plasma or serum friction **50** and cellular fraction **52** of specimen **46** are clearly visible through the transparent or translucent wall of the tube segment as shown in FIG. 10 and define an interface **54**. A second seal clip **22***b* is applied to the tube segment at the interface to separate the fluid and cellular fractions from one another. With the second clip in place as shown in FIG. 11, the plasma and cellular fractions will remain permanently separated. In this condition the specimen may be shipped for later processing in a laboratory.

The foregoing described procedure is carried out entirely within the same tube segment, and in many instances the resulting fractions of the blood specimen may be tested or processed further within the same segment and finally disposed of by discarding the tube segment.

When appropriate, for example in hematology when preparing plasma, an anticoagulant may be placed within

the tube before the specimen is inserted. Suitable chemical preservatives may also be placed within the tube segments. These anticoagulants or chemical preservatives may be added in dry or liquid form, and an anticoagulant such as, for example, potassium versenate or heparin, can be added to the tubing **10** of FIG. 3 before the tubing is sealed into individual segments and before sterilization, if desired.

Processing of blood by the foregoing procedure has been found to have numerous advantages over the prior test tube handling of specimens.

First, the specimen is always handled under sterile conditions. This prevents microbial growth and its deteriorating effect on the chemical constituents of the blood. Many serum chemical constituents are stable at room temperature only if the blood is maintained sterile.

Second, after centrifugation there is no need for the serum to be drawn off from the tube by pipette or other means. A simple application of the second clip between the serum or plasma and the red cell phase is sufficient to ensure permanent separation of the two components.

Third, if separation of serum is delayed for any reason, there is no danger of evaporation because of the small surface area of the specimen exposed to atmosphere.

Fourth, a larger volume of serum is obtainable from a given volume of specimen than with a test tube, and there is less likelihood of hemolysis than with prior test tube processing and handling methods.

Fifth, for the preparation of serum, no "rimming" of the tube with a wooden applicator stick or glass rod is required to ensure complete separation prior to centrifugation, as is required with prior test tube methods.

Sixth, whole blood for hematology work can be prepared easily by introducing freshly drawn blood into the tube containing an anticoagulant without excessive mixing of the specimen and anticoagulant by agitation. Consequently, the cellular components of the blood remain stable for longer periods of time at room temperature than would be the case using prior test tube methods.

Seventh, use of a relatively long, narrow tube segment delays the clotting of whole blood to an extent sufficient to enable centrifugation of the specimen to obtain true plasma without the use of an anticoagulant.

Eight, chemical anticoagulants or preservatives can be pre-introduced into the tube and will be evenly spread throughout the interior wall surface thereby acting upon the blood specimen immediately upon addition of the latter, without requiring excessive agitation of the specimen.

Ninth, the blood specimen may be added to the tube segment displacing mineral oil to completely avoid atmospheric exposure, the oil having been placed in the tube before it was segmented and sterilized.

Example 2.—Handling microbiological specimens

Referring to FIGS. 12 through 16, the procurement and handling of a microbiological specimen is illustrated. With reference to FIG. 12, the apparatus necessary for accomplishing this is shown packaged and sealed within a special envelope **60**. The apparatus includes a tube segment **11***b* disposed vertically within the envelope and heat sealed at its lower end **15***b* and having an open upper end. A suitable transport media **62** such as, for example, Stewart's transport media, for preserving a specimen when obtained, is sealed within the lower portion of the tube and separated from the upper portion of the tube by a clip **22***c* carrying an identification tag **33***a*. An applicator swab **64** is carried within the upper portion of the tube above the clip, with its cotton tip **66** inserted downwardly in the tube and resting against a piece of cotton **68**. The swab includes a long handle portion **70** which extends from the upper end of the tube. The swab is a conventional item well known in the field of medicine, and its handle **70** is usually made of wood or other frangible material.

The entire package as just described is sterilized by gamma radiation. It is marketed within the sealed envelope **60** having a preferred tear line **72** at its upper end to facilitate removal of the tube segment and its appurtenants. When the physician desires to obtain a specimen, he removes tube **11***b* and its contents from the envelope and withdraws swab **64** from the tube to obtain a microbiological specimen on cotton tip **66**, in the manner shown in FIG. 13. The swab is then reinserted into the tube, specimen-bearing cotton tip first, with the tip abutting the cotton piece **68** so that such piece will aid in the adsorption of the specimen and with the clip **22***c* still separating the transport media from the swab as shown in FIG 14. A portion of handle **70** projecting from the upper end of the tube is then broken off from the remainder of the swab at a point above cotton tip **66** but within tube **11***b* by flexing the tube in the manner shown in FIG. 15, after which the projecting portion is discarded.

Finally, clip **22***c* is removed from the tube to immerse the specimen-bearing tip **66** of the swab and cotton piece **68** in transport media **62**. The clip is then reapplied to the tube just above the upper end of the broken handle **70** of the swab so that the clip retains the swab within the transport media and seals the tube. Thereafter the sealed tube containing the preserved specimen may be mailed by the physician to a laboratory for processing.

The foregoing described procedure and apparatus, including the tube, transport media, swab and seal clip, provide the basis for a uniquely reliable, disposable culture system which is designed for ease in handling in the laboratory and in mailing.

(d) Miscellaneous applications

The above described procedures, with suitable modifications which will ocur to the physician and laboratory technician are applicable to the handling and processing of other biological fluid specimens, such as for example, spinal fluid, amniotic fluid, serous fluid and urine, used in clinical medicine. Similarly, the system is equally suited for use in processing any biological specimen.

In addition, certain reagents required by analytical laboratories can be placed in a length of the tubing in bulk and then sealed in separate aliquots of the desired size and stored at room temperatures elevated temperatures or in the frozen state as required. A specific example is the use of substrate solutions which are best prepared in bulk and which require freezing until used in the biomedical laboratory.

From the foregoing it will be apparent that the flexible tubing and clip complex offers innumerable advantages over the common test tube in the handling, shipment, storage, processing and final disposal of biomedical specimens and reagents. It should also be apparent that the tubing and clip system will have comparable application in the handling of specimens, reagents and other substances in other physical sciences and in all sorts of laboratory work.

Having illustrated and described several now preferred embodiments of my invention and typical uses thereof, it should be apparent to those having skill in the arts to which this subject matter pertains that the same permits of modification in arrangement and detail. I claim as my invention all such modifications as come within the true spirit and scope of the following claims.

1. A method of separating specimens, reagents and other substances into dissimilar components for laboratory testing, treatment or other use comprising:

depositing the specimen within a resilient tube closed at least at one point along its length,

with said substance deposited within said tube, pinching said tube closed at another point whereby the substance is sealed between said first-mentioned point and the last-mentioned point,

inserting said tube containing said substance within a separating apparatus,

then operating said apparatus and thereby separating said substance in to at least two dissimilar components,

and segregating said components from each other within said tube by pinching said tube closed at the interface between said components.

2. Apparatus according to claim **1** wherein said specimen is a blood sample.

3. Apparatus according to claim **1** wherein said separating apparatus is a centrifuge.

4. A method according to claim **1** wherein said tube is pinched closed following the insertion of a specimen with a removable mechanical sealing clip.

5. A method according to claim **1** wherein the components are segregated following separation by sliding a removable mechanical sealing clip onto said tubing at the interface between said components.

6. A method according to claim **1** wherein the closure seals are temporarily formed by slidingly removing one-piece mechanical sealing clips.

7. A method according to claim **1** wherein the opposite ends of the tubing are sealed with one-piece mechanical sealing clips and the interface between the separated components are segregated by another one of said clips.

8. A method of collecting, preserving and transporting bacteriological cultures for laboratory testing comprising the steps:

inserting a quantity of a free liquid transport medium into a length of sterile flexible and pliable tubing sealed at one end and open at the other end,

pinching the tubing closed above the level of transport medium therewithin to seal said liquid within said tubing using a removable and reusable mechanical sealing clip applied to the outer walls thereof,

inserting said sealed tubing and contents within an envelope,

inserting a sterile swab having a long frangible handle into said envelope,

sealing said envelope closed with said sterile sealed tubing and said sterile swab inside and maintaining said envelope closed until the contents thereof are ready for use,

unsealing said envelope and removing said contents therefrom,

collecting on said swab a bacteriological culture specimen from its source,

removing said clip from said tubing while retaining said transport medium therewithin,

inserting said swab portion containing said specimen into the transport medium within said tubing,

breaking off any handle portion of said swab at a point between said open end and said trantsport medium by flexing said tubing at said point,

reapplying said clip to said tubing just above the shortened handle portion of said swab within said tubing to reseal said tubing closed and thereby retain said specimen within said transport medium and said transport medium within said tubing for transport to a testing laboratory.

9. A method according to claim **8** including inserting said resealed tubing into an envelope, sealing said envelopc, transporting said sealed envelope to a laboratory and retaining said tubing at said laboratory in its sealed condition until said speciment is tested.

10. A method of collecting, preserving and transporting bacteriological and biological specimens from their source to a laboratory for processing comprising:

pinching a length of sterile flexible tubing closed at spaced positions along said tubing to seal the tubing against liquid and gas using at least one removable and reuseable mechanical sealing clip to effect a seal at one of said positions,

inserting said tubing within an envelope, sealing said envelope and transporting said envelope and its contents to a specimen collecting point,

maintaining said envelope and tubing sealed until ready for use in collecting a specimen,

collecting a bacteriological or biological specimen from its source using a sterile instrument,

removing said tubing from said envelope and unsealing said tubing by removing said clip therefrom,

depositing said specimen into said tubing by inserting said sterile instrument through an open end thereof,

resealing said tubing by reapplying said sealing clip thereto at a level above the level of said specimen to retain said specimen therewithin,

inserting said resealed tubing into an envelope, sealing said envelope and transporting said envelope to a specimen processing laboratory,

maintaining said tubing in its resealed condition at least until said specimen is ready for processing.

11. A system for collecting cultures and the like, transporting and storing said cultures until tested in a laboratory and preserving said cultures in a live sterile condition until tested comprising the combination of:

a container comprising an elongate tube of pliable material sealed closed at one end and being open at its opposite end,

a quantity of a free culture-sustaining liquid transport medium disposed within said tube,

said liquid medium being confined in direct contact with the walls of said tube,

a reusable, removable mechanical sealing clip pinching said tube closed at a position spaced from said closed end and above the level of said liquid medium when said tubing is upright to seal said liquid medium within said tubing,

and a culture-collecting swab having an absorbent tip and an elongate handle, said swab tip being insertable within the open end of said tube and segregated from said liquid medium by said clip prior to the collection of a culture but immersed in said liquid medium after collection of said culture after removal of said clip,

said handle being frangible to permit breaking off and removal of any handle portion protruding from said open end after immersion of said tip,

said tip being held immersed in said liquid medium and sealed with said medium within said tube by said clip reapplied to said tube at a position above said tip and remaining handle portion following collection of said culture.

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