Dec. 8, 1970 S. R. GILFORD 3,545,932

BIOLOGICAL FLUID SAMPLE PROCESSING APPARATUS

Filed Dec. 19, 1967 2 Sheets-Sheet 1

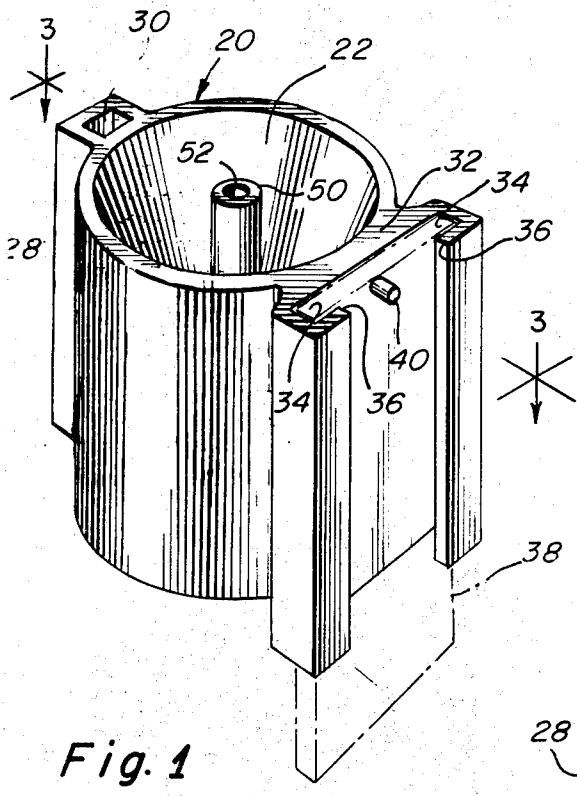

Fig. 1

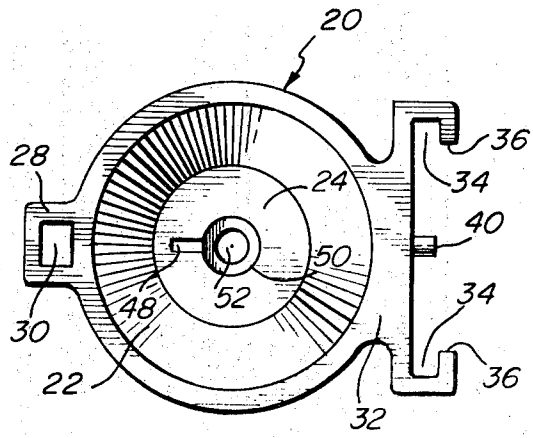

Fig. 2

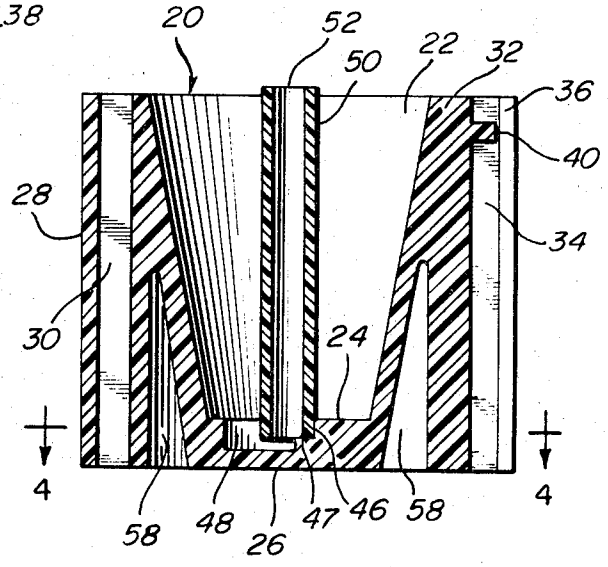

Fig. 3

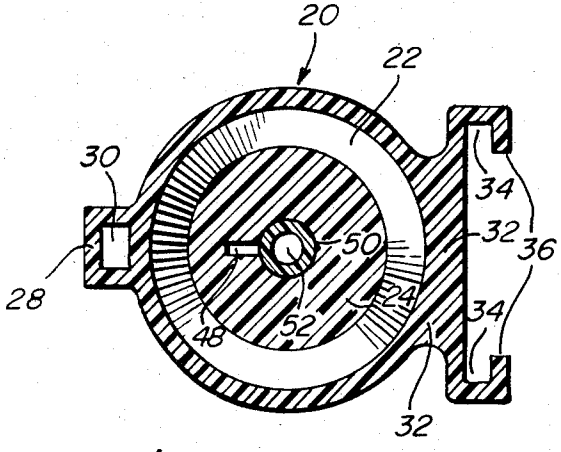

Fig. 4

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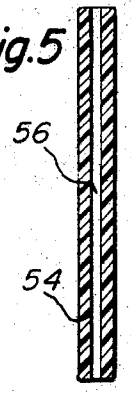
BIOLOGICAL FLUID SAMPLE PROCESSING APPARATUS

Filed Dec. 19, 1967 2 Sheets-Sheet 2

Fig. 5



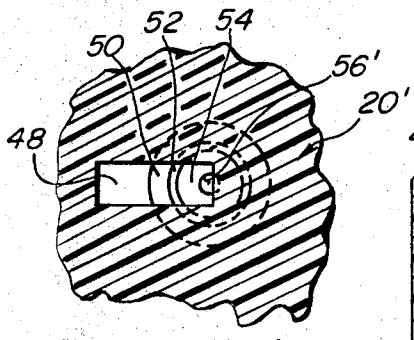


Fig. 8

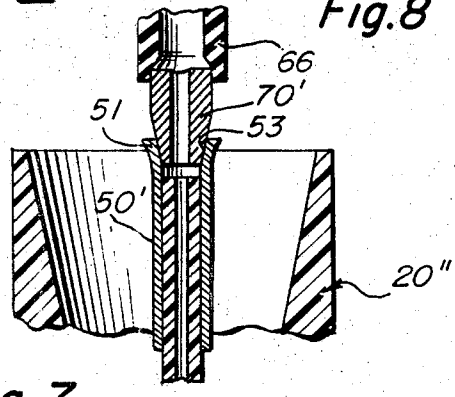


Fig. 7

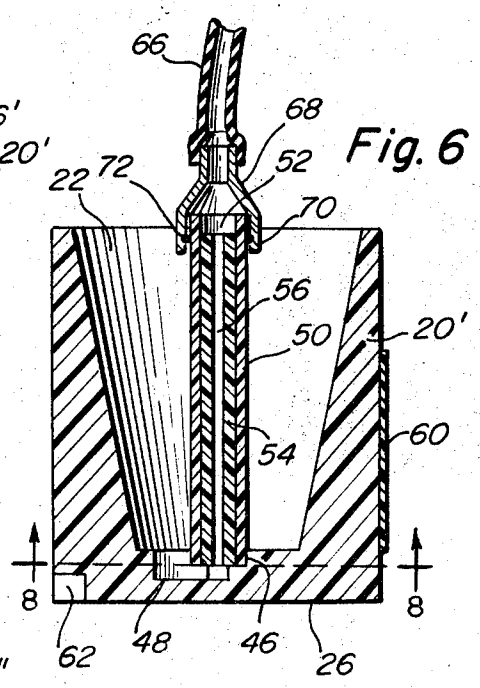
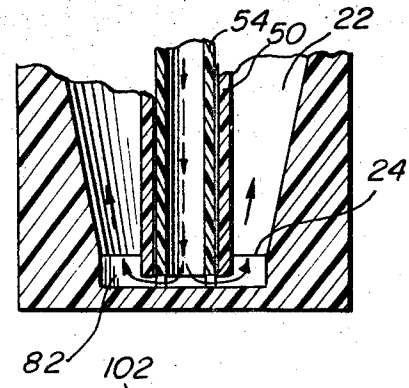


Fig. 6

Fig. 10



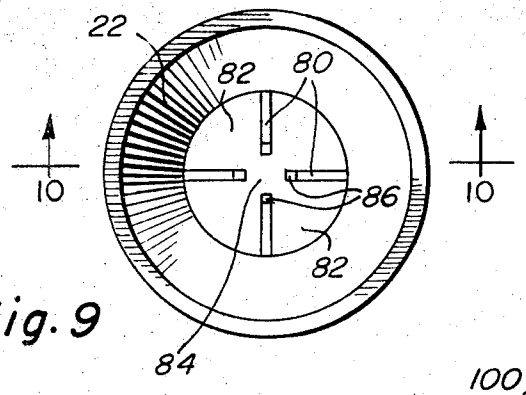


Fig. 9

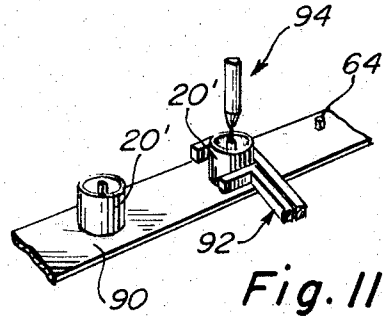


Fig. 11

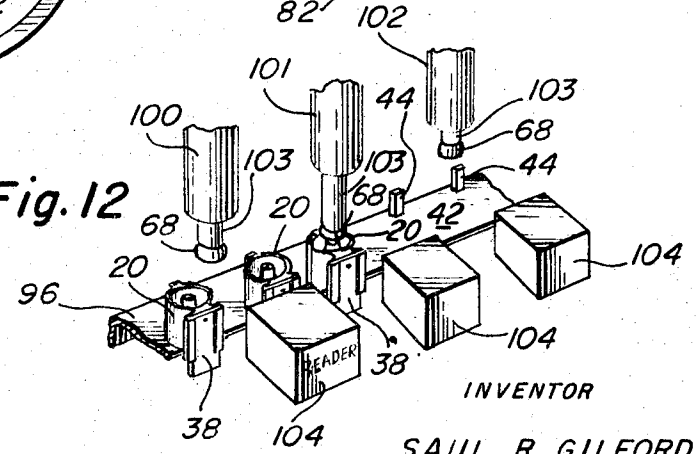


Fig. 12

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United States Patent Office

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BIOLOGICAL FLUID SAMPLE PROCESSING APPARATUS

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Filed Dec. 19, 1967, Ser. No. 691,783
Int. Cl. G01n 1/00, 1/14
U.S. Cl. 23—253 27 Claims

ABSTRACT OF THE DISCLOSURE

A fluid sample container constructed with a central hollow standard into the barrel of which there is introduced a section of capillary tubing having a precise volume of entrained raw fluid, the bottom end of the standard being open to the interior of the cavity of the container at the bottom thereof and the top end adapted to receive a connector so as to enable liquid reagent to be introduced into the barrel of the standard. The flow of reagent dilutes the raw fluid and washes the same out of the capillary tube section, mixing the same with the reagent within the cavity so that sampling of the diluted raw fluid may proceed thereafter. Well or gallery means are provided at the bottom of the cavity connected to the barrel and serving the functions of supporting the standard and the section of capillary tubing while permitting ready flow of the reagent and raw fluid.

The container as above having the additional structure which enables indexing of the container relative to a carrier or rack, and which also permits attachment of identifying members to the container.

Structure for feeding lengths of capillary tubing into the barrel of the standard and for supplying the reagent to the container, the latter including means for conveying the containers past reagent supply stations and means for connecting desired stations to containers.

RELATED APPLICATIONS

Two applications which are co-pending with this one and which are owned by the assignee of the applicant herein will be referred to hereinafter. One application is entitled "Biological Fluid Measuring Method and Apparatus," Ser. No. 472,294, filed July 15, 1965, now Pat. No. 3,475,127 in the name of the applicant herein. The second application is entitled "Test Sample Identifying System and Apparatus for Use in Connection Therewith," Ser. No. 691,751, filed Dec. 19, 1967, and in which the applicant herein and Robert J. Emary are the applicants.

The first of these applications will be termed the "capillary tube" application, and the second of these will be termed "sample identification" application.

BACKGROUND OF THE INVENTION

The invention herein is intended as one aspect of a type of sample testing system for use in hospitals and laboratories where small quantities of raw fluids are processed as, for example, by dilution with different reagents and then tested. The most common fluid which comes to mind is blood, most hematology laboratories being required to perform from several to more than six independent tests on any given patient's blood. The invention is not so limited, but may be applied to other types of testing. Consideration of the problems involved in the testing of blood will be readily appreciated and give an understanding of the invention.

Clinical tests conducted routinely in hospital laboratories today have become more and more important in the diagnosis and treatment of disease, and are also widely

used in the prevention of disease. Accordingly, large numbers of samples must be processed daily in most laboratories, and of late so-called automatic chemistry devices have become available which perform a plurality of tests on a plurality of samples on a more or less production line basis. Of the many approaches to the problem of handling plural samples, several have involved flow-through systems, but the immediately obvious difficulty in such cases is the identification of samples, the problem of contamination, these being added to the difficulties inherent in complex and expensive apparatus.

The batch method of handling samples inherently suggests the use of simplified apparatus as compared to that required for flow-through systems, but additionally has advantages which seem to point the way to greater acceptance by the average and smaller size hospitals and laboratories. It is believed that even large establishments can benefit by the invention. The opposite is not necessarily true, because in the case of complex and expensive flow-through systems, the smaller institutions are not financially able to take advantage of the so-called benefits which may be derived.

The batch method enables the positive identification of samples, and this is explained and disclosed in considerable detail in the sample identification application above referred to. The progress of samples through the system can be watched closely, and the apparatus needed to handle the sample containers is relatively simple. Further, in the batch method, automatic or semi-automatic equipment already owned by the laboratory may be used with little or no change or readily modified to fit in with a high-speed system, and without sacrificing the advantages of the identification structures described in said application.

The applicant's solution of the problem of handling many samples depends upon the use of a capillary tube to gather and/or hold the raw fluid. This is disclosed in the co-pending capallary tube application. Basically, the raw fluid, for example, blood, is drawn or forced into a length of capillary tubing of precise internal diameter bore, so that the length of the fluid blood column in the length of tube can be measured linearly and related to volume.

To use the raw liquid sample, one merely scores the glass of the capillary tube between any two measured points and breaks the tube and coincidentally the column of blood at those points. This can be done manually or automatically, and the end product is a piece of capillary tubing with an entrained precise volume of the raw fluid. The entire section of tubing is placed in a receptacle with the needed quantity of diluent or reagent needed to make the test sample, and the receptacle is agitated to cause the blood to be diluted and mixed.

The invention herein combines the concept of using the capillary tubing to measure out the raw sample liquid, together with a special type of cup or container, so that instead of depending upon the agitation of the container for mixing the raw liquid with the reagent, the reagent is forced through the section of capillary tubing, washing it out and mixing the resulting dilution thoroughly within the receptacle or container. Since there is no actual need for shaking or agitating the container, it may be fixed to a carrier and moved in paths taking it to various stations for functions to be performed on it. These functions could be first the introduction of the length of capillary tubing (which is disclosed in a much simplified structure in said co-pending application relating to capillary tubing), next the introduction of the reagent from a fixed reagent station, next the movement of the container with resulting dilution to a testing position, and finally the movement or handling of the container after the testing has occurred. In this latter instance, the cup or container

may be separated from its identification member and discarded, or may be moved to a reading device which will read the data from the identification member before separation from the cup. Situations where the cup itself has magnetic material incorporated therein as the identification member, and the test results are recorded and afterward required to be magnetically "read," are not excluded from this concept.

The principal advantage and object of the invention is to achieve a degree of automation in the testing of biological and other fluids through the use of the batch method, in which the basic material to be diluted is contained in a section of capillary tubing, and the dilution of this basic material is accomplished in a manner which forces the material from the section of tubing and washes same clean, while mixing the fluid and retaining it in the sample container or cup. An important element of the structure of the invention comprises means for holding the section of capillary tubing in such a manner that the reagent may be flowed through the tubing in a simple manner and with simple apparatus.

The container of the invention advantageously can be constructed in accordance with the teachings of the sample identification application, with the result that it may carry identification of the source, test and test results, and additionally may be indexed in mounted condition on a carrier or rack so that a plurality of sample containers may be handled together. The structure for introducing reagent advantageously may include a reading apparatus responsive to the information carried on the identification card of the container. When the container passes a given reader that identifies that type of test requiring the reagent that is dispensed at that same station, the apparatus automatically will stop the movement of the carrier and the reagent will be dispensed into the container.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a test sample container constructed in accordance with the invention;

FIG. 2 is a top plane view of the container of FIG. 1;

FIG. 3 is a vertical median sectional view through the container of FIG. 1 taken along the line **3—3** and viewed in the indicated direction;

FIG. 4 is a horizontal sectional view taken along the line **4—4** of FIG. 3 and looking in the indicated direction;

FIG. 5 is a sectional view through a section of capillary tubing showing the manner in which a quantity of raw fluid is entrained therein in accordance with the teachings of the capillary tubing co-pending application;

FIG. 6 is a vertical sectional view similar to that of FIG. 3 but illustrating a simplified form of the container, and having a section of capillary tubing disposed in the hollow standard and a fitting from a source of reagent connected to the standard to enable discharge of the liquid into the standard and through the capillary tube to produce a properly diluted liquid sample;

FIG. 7 is a fragmentary vertical sectional view taken through a modified form of the sample container illustrating the manner in which a fitting may be piloted into connection with the top of the hollow standard;

FIG. 8 is a fragmentary sectional view taken generally along the line **8—8** of FIG. 6 and in the indicated direction;

FIG. 9 is a top plane view of a modified form of the sample container but shown with the standard not in place to enable consideration of the details of the bottom of the cavity;

FIG. 10 is a fragmentary vertical sectional view taken generally along the line **10—10** of FIG. 9 and in the indicated direction, but in this case the standard is in place and a section of capillary tubing is also shown in the barrel of the standard;

FIG. 11 is a diagrammatic perspective view showing a conveyor or other carrier having sample containers thereon and in the process of receiving sections of capillary tubing into their hollow standards; and

FIG. 12 is a diagrammatic perspective view showing a carrier or rack having sample containers disposed thereon in the process of being filled with reagent directed through their standards and the capillary tubing disposed in the barrels of the respective standards.

DESCRIPTION OF PREFERRED EMBODIMENTS

The sample container of the invention provides the key to many advantages which are achieved, and principally depends for its usefulness upon the concept of the capillary tube co-pending application. The container has a central vertical hollow standard forming a barrel into which the section of capillary tubing is inserted as a cartridge. The barrel is connected by an unobstructed fluid passageway with the interior of the container utilizing a structure that supports the standard and the section of tubing without blocking the lower end of the capillary section. The upper end of the standard will be connectible with a fitting for introducing the reagent and may have pilot means to enable a fluid-tight connection in an automated system. Likewise, the advantages of automation may be achieved by integrating the concept of the container with capilary-holding standard into a conveyor or carrier to handle plural numbers of such containers.

As previously mentioned, the structure of the sample identifying co-pending application may be advantageously incorporated into the container of this invention for the benefits to be derived therefrom, and this is illustrated in several of the views. In FIG. 1 there is illustrated a container or cup **20** which may be molded of some suitable synthetic resin that is compatible with the fluids it is intended to carry. The container **20** is disposable, and hence any economical material may be used for its manufacture. A central cavity is formed in the container at **22** terminating on its lower end at the level **24** which may be considered the bottom of the cavity, although, as will be seen, structure is provided for fluid to be disposed below this level. In the illustrated structure, the walls forming the cavity are conically tapered, but any configuration of convenience may be utilized. The base **26** of the container is flat to permit the mounting of the same upon a table or flat surface, as will be seen.

There are two formations integral with the container **20**, one being the formation **28** which provides a vertical rectangular cross section slot or passageway **30**, and the other being a channel configured bracket **32** having a channel **34** with inwardly directed flanges **36** within which an identification card or other member **38** is adapted to be disposed. The member or card **38** is shown in phantom in FIG. 1 and somewhat diagrammatically in FIG. 12, but the details are not needed for an understanding of the invention herein. Suffice to say that the identification member **38** is held in the channel **34** by frictional engagement, is indexed therein by means of a suitable perforation formed in the member engaging the integral pin **40** and is substantially longer than the vertical height of the container **20** so that when the container is mounted on a surface as the surface **42** in FIG. 12, the identification member will depend from the edge of the surface **42**. Note this dependence in FIG. 1.

The purpose of the passageway or socket **30** is to enable the container to be secured to one of the posts such as shown at **44** in FIG. 12, thereby fixing and positioning the container along with several others for consecutive processing or testing.

In the center of the bottom of the cavity **22** there is a shallow recess **46**, there being a lateral rectangular well **48** which connects with the bottom **24** of the cavity at its upper end and which is deep enough to extend below the recess **46**. A central standard **50** is set into the recess **46** the standard being hollow whereby to provide a barrel or bore **52** for reception of a section of capillary tubing as will be explained. It will be seen that there is direct

communication between the well **48** and the barrel **52** so that liquid introduced in the barrel **52** will be conducted to the cavity **22**. During use the liquid will actually be forced from the barrel **52** into the cavity **22**.

The standard may be formed of glass or synthetic resin or other inert material, and conveniently may be a length of commercially available plastic tubing, preferably stiff enough to be pressed into the recess **46**.

No capillary tubing is shown in any one of FIGS. 1 through 5, but it will be obvious that the inner diameter of the barrel **52** will be slightly larger than the diameter of the capillary tube being used, so that it may readily be inserted. Likewise, the construction of the recess **46** and the well **48** must be such that the lower end of a section of capillary tubing inserted into the barrel all the way to the bottom thereof will not engage axially against any surface fully blocking the bore of the section of tubing. There should be very little clearance between the capillary tubing section and the inner surface defining the barrel.

In FIG. 5 there is illustrated a section of capillary tubing **54** of a predetermined length cut to entrain a known volume of raw test liquid **56** in its bore. In FIG. 6 there is illustrated a simplified form of the container, designated **20'** but otherwise using the same reference characters as the container **20** previously described. The only differences are that the formations **28** and **32** are not shown, nor is the holow **58** illustrated, this latter being the result of application of the conventional techniques for economical molding. The bottom surface of the container **20'** is shown at **26**; the standard **50** is secured in the recess **46** so that its barrel **52** may connect with the well **48** to provide direct passageway for liquid from the barrel to the cavity **22**.

In this case, since the formulation **32** is not used, other means for handling and identification may be used, such as, for example, magnetic. A coating of magnetic material is symbolically shown at **60** to receive identification information, and a notch at **62** may be used with a suitable lug or projection, such as shown at **64** in FIG. 11 for indexing the containers **20'** in case a plurality are being automatically handled, as, for example, on a conveyor or in a rack. The principal purpose for this illustration is to expalin the manner in which the standard serves to receive the section of capillary tubing and cooperates with a reagent-injecting apparatus.

Assuming that a section of capillary tubing **56** has been inserted into the barrel **52** of the standard **50**, either in a container such as **20** or a container **20'** as shown in FIG. 6. It is now desired to make the necessary dilution which the test calls for. Such test identification will be carried on the card **38** or on the magnetic surface **60** in human and machine sensible indicia. A flexible conduit **66** connects from a source of reagent, such as a flask of suitable diluent specified for the test to be made. A fitting **68** serving as a coupler is connected to the conduit **66** and has a hood or flared part **70** that fits closely over the upper end of the standard **50** so that liquid which will be introduced through the conduit **66** will be forced through the barrel **52** and will wash the raw liquid **56** through the core of the capillary tubing **54** and enter the cavity **22** of the container **20** or **20'**. In this manner the exact volume of diluent may be forced into the container, and in order to assure that there is complete dilution and mixing, after the liquid has emerged from the source of reagent, a quantity of gas, such as air, may be forced through the conduit **66**. This serves to blow all of the liquid out of the capillary bore, and if air blowing is continued, the air will bubble through the liquid in the cavity **22** to mix the same. Since the dimensions of the structure are quite small, the pressures used, not only for the liquid but for the gas as well, must be low enough to accomplish the desired functions and not great enough to blow the liquid out of the container. A typical container would be less than one inch high and about $1\frac{1}{16}$" in diameter interior of the container at the upper end thereof, tapering to a bottom diameter at the level **24** of about $\frac{3}{8}$". This size of cavity will readily handle a liquid volume of about 2–3.

Packing may be used to assure that the connection or coupling between the coupler **68** and the free end of the standard **50** is completely tight, this taking the form of a small O-ring **72** set into a suitable groove formed on the interior of the hood **70**.

The coupler **68** may be built into a plunger which depends from a reagent source that is provided with a metering device and some automatic means for injecting the diluent, as will be explained hereinafter.

The arrangement for introduction of liquid into the container after the section of capillary tubing has been placed in the barrel **52** which is shown in FIG. 6 requires no special form of the central standard **50**. It may be a simple cut section of commercially available plastic tubing set into the recess **46**. The container is molded in one piece, either in a simple form as container **20'** or in the more complex form of container **20**, both with a recess. The piece of plastic tubing should be stiff enough to enable it to be pressed into the recess, and will remain in place without the need for cementing. Glass can also be inserted in this same manner. Obviously, it would be best to mold the standard in the container in one step, but this cannot be done economically at the present time due to complexity of molds required.

In FIG. 7 a modified form of the standard is shown. In this case, the standard **50'** differs from those previously described in that it has a flared mouth formed at **51**. In all other respects, the container **20''** may be identical to the other two described. This flared mouth provides a flared pilot entrance **53** which can receive a tapered male coupler member **70'** which is on the end of a conduit **66** that leads diluent to the container **20''**. The entrance recess **53** pilots the coupler member **70'** and seats it. This arrangement is convenient because it need not require gasketing to prevent leakage. The tapered fit may be enhanced by suitable grinding or by other techniques to guaranty accurate engagement. Another advantage of the flared mouth **51** is that it enables more facile introduction of the section of capillary tubing into the standard. In other words, it serves as a pilot for this function as well. In the case of handling a large number of containers and inserting sections of capillary tubing into each, providing a pilot formation enables this to be done by machinery more readily, as will be explained.

In the containers **20** and **20'** the well **48** is formed as a lateral branch of the recess **46**, but is lower than the recess so that liquid will freely pass from the barrel **52** into the well. The dimensions are chosen so that the bottom floor **47** of the recess **46** will have the well **48** intersect only a portion thereof, providing sufficient support for the bottom end of the standard and the capillary tube while still leaving passageway for the liquid. In FIG. 8 a sectional view is illustrated on a large scale looking up through the well **48**. One can see the bottom end of the standard **50**, the barrel **52**, the bottom end of the section of capillary tubing **54**, and an opening at **56'**, this being the bore of the capillary tubing **54** which normally will be filled with some raw fluid such as the blood **56** previously mentioned. From this view it can be appreciated that there is support for the bottom end of the section of capillary tubing **54** and in addition its bore **56'** is in no way blocked so that fluid can flow readily into the well **48** and thence into the cavity **22**.

If a given pressure is applied to reagent which is introduced into the capillary tubing section **54**, all of this pressure is relieved at the well **48** in the structures described thus far. If the capacity for transport of liquids by the well **48** is increased, there is less likelihood of liquid being forced out of the container. Preferably, a structure such as shown in FIGS. 9 and 10 is used. In

this case, radial feet **80** are molded in the bottom of the cavity **22** of the container, such as container **20**, **20'** or **20''**. The top surface of these feet may lie in a plane which in the previous structures would have defined the bottom level **24** of the cavity **22**, although in this case, since the resulting quandrant shaped wells **82** have a much greater bottom area than the top surfaces of the feet **80**, this forms the practical bottom of the container.

The feet **80** do not meet at the center of the container, but instead are shortened to provide a central generally square area **84** freely communicating with the wells **84**. The radially inner tips of the feet **80** are stepped at **86** to provide a seat for the bottom end of the standard, equivalent to the recess **46** previously described. In this case, there are four points for support of the lower axial end of the standard **50**. This is not shown in FIG. 9, but it is shown in FIG. 10. The length of the feet **80** is chosen so that the steps **86** extend radially inward a sufficient distance to provide support for the axial end of the capillary tubing **54** when inserted and moved to the bottom of the barrel **52** without obstructing its bore. In FIG. 10, the paths of flow of liquid from the bore of the capillary tubing **54** into the wells **82** and thence into the cavity **22** are illustrated. It will be seen that the pressure of liquid is decreased in each of the wells **82**; the liquid divides into four paths and hence mixes much better; and when air is injected, it produces bubbles in four different locations also causing additional efficient mixing. There is less likelihood of splashing with this structure.

In FIG. 11, a plurality of containers **20**, **20'** or **20''** is mounted on a conveyor or rack **90** indexed by the structure described as lugs **64** on the conveyor cooperating with notches **62** in the containers. The structure generally illustrated at **92** may be some form of positioning device or holder to be used in lieu of or in addition to the indexing means. The purpose of this illustration is to show how a plurality of sections of capillary tubing **54** of suitable length (and hence holding predetermined volumes of entrained liquid respectively) may be inserted into the standards of a plurality of containers passing relative to an injecting device. Here the device is indicated at **94** and it feeds sections of capillary tubing one at a time into the standards of passing containers. The station is properly indexed relative to the passing conveyor **90** and the containers carried on the conveyor. These will stop at the station long enough to receive their respective sections of tubing and then pass on. A structure such as illustrated in FIG. 7 is of great advantage in this case because it pilots the insertion of the section of capillary tubing and hence indexing of the movement of the conveyor **90** relative to the insertion station and the apparatus **94** need not be so accurate.

It will be appreciated that a predetermined number of containers may receive sections of tubing containing raw liquid from the same source for a variety of tests, or the sections may each be from a different source. It is important to ensure identification of the source with the container carrying the raw sample derived respectively therefrom.

In FIG. 12, there is illustrated a form of apparatus in which the sample containers **20** are substantially as shown in FIGS. 1 through 4, each being secured to a post **44** carried on a rack **96**. Each has an identification card **38** depending from its holder to move relative to printing apparatus when tested, as explained in said co-pending sample identification application. Accordingly, there will be information carried on the cards in the form of indicia, both human and machine sensible. In practice a rack **96** will contain samples from the same or several sources, but in each case, the container is readily identifiable both as to source and as to the type of test to be made. The rack is arranged in a structure which moves the rack relative to a plurality of stations, with a supply of different reagent at each station. It is required that the proper reagent be introduced into each sample container in accordance with the test performed.

At the three stations represented diagrammatically in FIG. 12 by three illustrated cylinders **100**, **101** and **102**, it is intended that three different reagents will be injected into certain ones of the containers which require the same. Each cylinder may be a part of a liquid injecting apparatus, not much different from those to be found in bottle filling machines of known construction, but energized according to a system described. The machines connect with sources of reagent of different variety (not shown) and in operation will have a tube carrying a coupler descend to engage the free end of the standard which is in the container suitably located below the coupler. In FIG. 12 the couplers are shown at **68** on the bottom ends of reciprocable plungers **103**. The center plunger is down, but the other two are still retracted.

In the structure illustrated in FIG. 12, each station has, in addition to its liquid filling mechanism, a reader **104** which is sensible to the indicia carried on the identification cards **38**. Each reader is constructed to respond only to the test description which requires the reagent which can be introduced at that station. Thus, unless an identification card carries the particular indicia to which the reader is responsive, nothing occurs at the station, irrespective of whether the rack **96** is moving or stationary. When a test description produces a response in the reader, the movement of the rack is stopped with the container indexed at the station controlled by the reader. Thereafter, the liquid filling machine operates to fill the container, the plunger bringing the coupler **68** down to the standard and forcing the liquid through the barrel **52** of the standard and thereby producing the proper diluted testing sample in the container. After the liquid has been introduced, the plunger retracts the coupler **68**, and the rack is free to move further. Racks may be arranged to move past single or plural stations. The positive identification of samples and sources makes it unnecessary to install the containers on the racks **96** in any special order.

Considerable variations can be made in the invention without departing from its spirit or scope as defined in the appended claims.

What it is desired to secure by Letters Patent of the United States is:

1. A fluid sample container for receiving therein a section of capillary tubing to enable diluent to be introduced through the bore of the capillary tubing into the container, comprising:

(a) a cup member open at its top end and closed at its bottom end and providing an internal liquid carrying cavity,

(b) a hollow standard mounted interior of the cup member and having a barrel open at its upper end,

(c) said cup member having liquid passage means at its bottom end communicating with said cavity and said barrel,

(d) means for supporting a section of capillary tubing deposited in the barrel without obstructing the bore of said section.

2. A container as claimed in claim **1** in which there are means for mounting said standard comprising a recess in the bottom of the container and the bottom end of the standard being secured in said recess, and said liquid passage means comprise at least one well opening to the interior of said recess and to said cavity.

3. A container as claimed in claim **1** in which there are means for mounting said standard comprising a socket and the standard is a hollow tube engaged in said socket, and in which said liquid passage means comprise a slot in the bottom of said container opening to the interior of said hollow tube and to the cavity.

4. A container as claimed in claim **1** in which said liquid passage means comprise a well in the container extending below the standard and connecting with the bottom end of the barrel and having a portion opening to the cavity.

5. A container as claimed in claim 4 in which said supporting means comprise an upwardly facing surface adjacent at least a portion of the well and aligned with the axial end of the barrel.

6. A container as claimed in claim 1 in which the cavity is symmetrical about a vertical axis, the standard is a central tube coaxial with the cavity and there is a socket in the bottom of the container, the central tube being engaged in the socket and extending a substantial distance up the center of the cavity.

7. A container as claimed in claim 6 in which said liquid passage means comprise a lateral well communicating between the cavity and socket and having a portion opening to the interior of the tube while same is engaged in the socket.

8. A container as claimed in claim 1 in which the cavity is generally symmetrical about a vertical axis, the standard is a central tube coaxial with the cavity, there are a plurality of radial feet in the bottom of the cavity and each having a central formation defining in cooperation with one another a generally circular support with the standard engaged therein, the circular support spacing the axial end of the standard above the bottom of the cavity, said radial feet defining segment-shaped wells, said liquid passage means comprising the apices of said wells, said apices communicating with the barrel of said standard when said standard is engaged in said circular support.

9. The container as claimed in claim 8 in which said supporting means for a section of capillary tubing comprise a portion of said central formations extending into alignment with said barrel.

10. A container as claimed in claim 1 in which means are provided on a lateral exterior of said container for securing an identification card thereto.

11. The combination with a container of cup formation having a central cavity and having a central hollow tube mounted in the cavity and having an interior barrel open at the top and liquid passage means communicating between the bottom end of the barrel and the central cavity, of a section of capillary tubing having an entrained quantity of test fluid therein, said section being engaged deposited in the barrel whereby to enable washing diluent through the section of tubing and into the cavity to dilute the test fluid and produce a diluted test liquid in the cavity.

12. The combination of claim 11 with a source of diluent, a conduit extending from the source of diluent and having a coupler thereon, said coupler engaging with the upper end of the hollow tube in liquid tight engagement to enable introduction of diluent into said barrel.

13. The structure of claim 12 in which said coupler is a female member engaged over the upper end of the hollow tube.

14. The structure of claim 12 in which said coupler is a male member adapted to engage on the interior of the upper end of the barrel.

15. The structure of claim 6 in which the upper end of the central tube is flared to provide a pilot entrance to said barrel.

16. The combination of a container as claimed in claim 1 with a carrier for the same, said container and carrier having cooperative means for indexing the container to a predetermined position relative to the carrier.

17. Apparatus for injecting diluent into containers which comprises:

(a) a plurality of containers, each container
  (1) being of cup shaped formation with a central cavity,
  (2) having a central hollow standard providing a barrel,
  (3) a liquid passageway between the bottom of the barrel and the bottom of the cavity, and
  (4) a section of capillary tubing having a test fluid entrained therein disposed in the barrel,

(b) a carrier having the containers spaced along and supported thereon
  (1) the carrier and containers having cooperating means for mounting the containers in spaced identical disposition on said carrier,
  (2) each container having indicia thereon identifying a type of reagent to be injected therein, said indicia being disposed in a location to be read by a reading device,

(c) a plurality of reagent injecting stations,
  (1) each station having a reagent vessel with a particular kind of reagent therein, means for connecting said vessel to said hollow standard, and means operating the connecting means in response to a filling signal,
  (2) a reading device at each station arranged to read the indicia moving relative to the same and adapted to produce a filling signal only when the indicia which it reads is of a predetermined nature related to the reagent of the vessel at said station, whereby to energize said operating means thereby,

(d) means for moving said carrier relative to said reading devices to bring the containers carried thereon into filling positions relative to said connecting means, consecutively.

(e) the operation of any reading device in producing a filling signal serving to stop movement of the carrier at a station for a time sufficient to permit the filling of the container brought into filling position at the related station from the reagent vessel associated with the last mentioned reading device, and the connecting means being operated to effect filling during said time.

18. The apparatus of claim 17 in which said connecting means for each reagent vessel comprise a movable tube and a coupler adapted to be clear of the line of containers when not operated but adapted to be moved to bring the coupler into engagement with the standard of a container stopped in filling position relative thereto when a filling signal is produced by the associated reading device.

19. A fluid sample container for receiving a sample for the addition thereto and mixing therewith a reagent in predetermined relative volume: comprising, a cup member open at its top end and closed at its bottom end and providing an internal liquid carrying cavity; socket means at the bottom end of the cavity for mounting a barrel-defining standard interior of the cup, which standard is capable of receiving disposed therein a section of capillary tubing containing the sample; liquid passage means at the bottom end of the cup communicating with the cavity; and means for supporting the capillary tube section in the barrel without materially obstructing the bore of said section.

20. A sample container for use in mixing fluid contained in a hollow cartridge with a liquid reagent to produce a dilution of said fluid which comprises, a cup-like body having a liquid carrying cavity opening to the top thereof and closed at the bottom, a hollow standard secured in the cavity and providing a barrel on its interior, said standard being open at its upper end and adapted to receive a cartridge therein, a liquid passageway from the bottom of the barrel into the bottom of the cavity so that fluid forced from the cartridge inward of the barrel will enter the cavity.

21. The combination of claim 1 with a cartridge, said cartridge having a capillary bore and fluid to be diluted entrained in said bore, said bore being open at both ends and the diameter of the cartridge being slightly less than the barrel diameter to enable insertion of the cartridge into the barrel, and formation at the bottom of the barrel to prevent the bottom opening of the cartridge from being blocked.

22. A sample container for use in mixing fluid contained in a hollow separate cartridge with a liquid reagent to produce a dilution of said fluid which comprises, a body having a liquid carrying cavity closed at the bottom, a hollow member secured to the cavity and providing a barrel on its interior, said member being open at one end adapted to receive a cartridge disposed therein, a liquid passageway from the second end of the barrel into the cavity so that fluid forced from the cartridge inward of the barrel will enter the cavity.

23. A fluid sample container for receiving a concentrated sample for the addition thereto and mixing therewith a reagent in predetermined relative volume: comprising, a member providing an internal liquid carrying cavity; barrel means connected with said member capable of receiving therein a section of capillary tubing containing the concentrated sample; liquid passage means at the end of the barrel means communicating with the cavity; and means for supporting the capillary tube section in the barrel means without materially obstructing the bore of said section.

24. A method of preparing a liquid sample for testing, said sample comprising a known dilution of a concentrated liquid, a predetermined volume of concentrate having previously been entrained in a length of capillary tubing, and which utilizes a container having a small chamber and a large chamber with an inter-connecting passageway, which comprises: disposing the length of capillary tubing with entrained concentrated liquid in the small chamber, forcing a predetermined volume of diluent into the small chamber so that at least a portion flows through the hollow bore of said length of capillary tubing to flush the bore, and then passes through said passageway into the large chamber and mixing the resulting sample in the large chamber to achieve substantial homogeneity of sample and withdrawing a quantity of the sample from the large chamber.

25. The method as claimed in claim 24 in which the diluent and flushed concentrated liquid are introduced into the large chamber at the bottom of said chamber so that an effective mixing is produced in said large chamber during such introduction.

26. The method as claimed in claim 24 in which withdrawal is effected from the top of said large chamber.

27. The method as claimed in claim 25 in which withdrawal is effetced from the top of said large chamber.

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