

[54] **DISPOSABLE CUVETTES FOR COLORIMETRY**
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Related U.S. Application Data

[63] Continuation of Ser. No. 808,437, March 19, 1969, abandoned.
 [52] U.S. Cl.....**356/246**
 [51] Int. Cl.....**G01n 21/16**
 [58] Field of Search.....356/72, 39, 208, 246, 186; 250/218

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[57] **ABSTRACT**

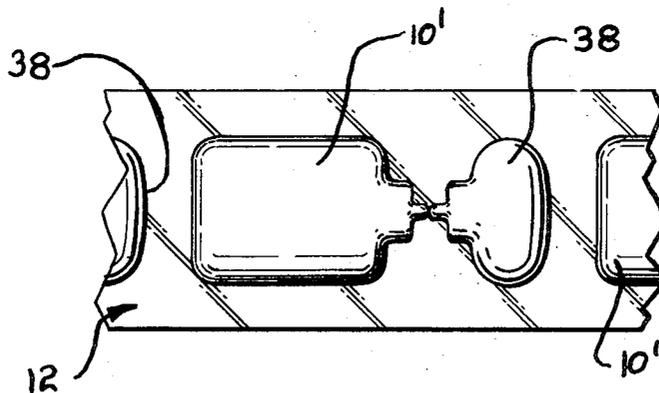
Colorimeter cuvettes in the form of sealed transparent flexible plastic envelopes containing or adapted to receive samples of substances to be colorimetrically analyzed. Means are provided for introducing sample reagents into the envelopes. Mixing of the envelope contents may be effected by kneading prior to testing and the flexibility of the cuvettes allows for adjustment of optical path lengths therethrough.

2 Claims, 7 Drawing Figures

[56] **References Cited**

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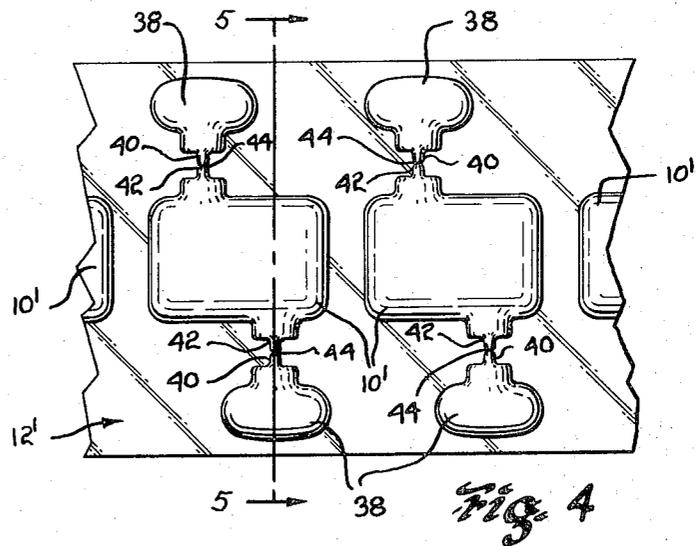
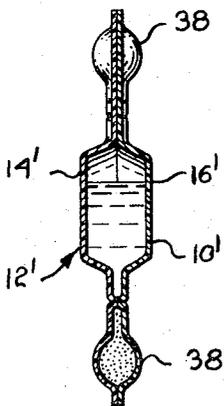
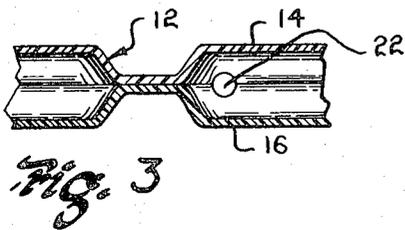
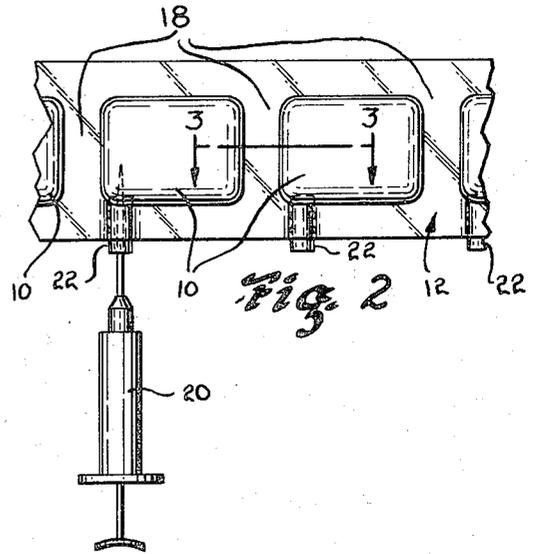
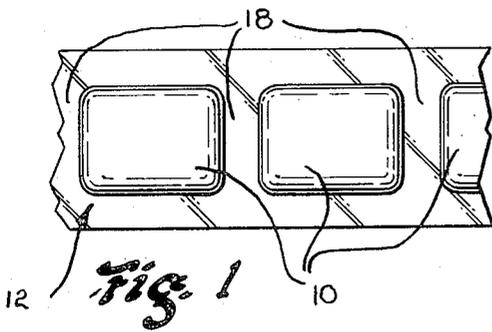


Fig. 5

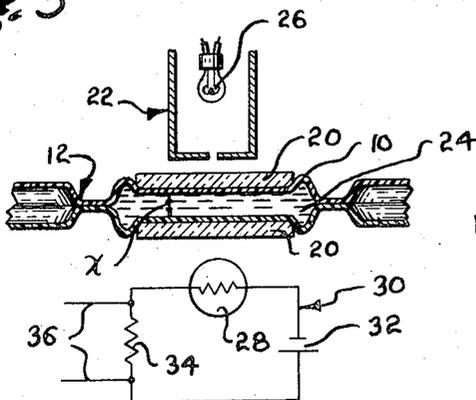


Fig. 7

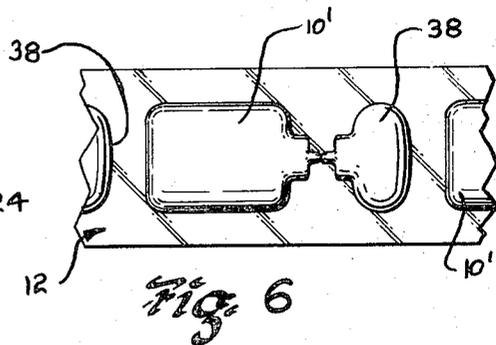


Fig. 6

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DISPOSABLE CUVETTES FOR COLORIMETRY

This is a continuation of application Ser. No. 808,437, filed Mar. 19, 1969 and now abandoned.

BACKGROUND OF THE INVENTION**1. Field of the Invention**

Colorimetry with particular reference to improvements in cuvettes for supporting samples in colorimetric testing.

2. Description of the Prior Art

In colorimetric testing, particularly in instances where great numbers of liquid samples are to be tested in a colorimeter, there is the problem of having to continually clean the colorimeter cuvette or stock a large number of cuvettes at considerable expense. In the latter case, the cleaning operation may be delayed until the completion of a series of tests, but not avoided.

Furthermore, in colorimetric testing with conventional cuvettes particularly in instances where the optical path length through the sample being tested may be a critical factor in the accuracy of test results, there is the requirement that considerable care and precision be exercised in measuring the volume of the sample placed in the cuvette or in filling the cuvette to a specified level. Also, in instances where reagents must be added to samples before or during testing, the resulting increase in volume of the samples and corresponding increases in optical path lengths therethrough may require special attention and consideration in the test results either by computation, adjustment of the colorimeter apparatus or removal of some of the sample-reagent media from the testing cuvettes. In instances where a thorough mixing of reagents in a sample is required before testing, removal of the cuvette from the test apparatus for stirring or the incorporation of stirring devices in the test apparatus incur delays in multiple test operations and introduce additional time consuming cleaning operations wherein the stirring apparatus may require cleaning after each use in order to prevent contamination of other samples to be subsequently mixed with particular reagents and tested.

The present invention overcomes the aforementioned and related drawbacks in colorimetric testing.

SUMMARY OF THE INVENTION

In its relationship to colorimetric testing, the present invention provides novel disposable cuvettes in the form of thin pliable sheet plastic envelopes containing samples requiring colorimetric testing or in the more usual case, containing a prepackaged sample diluent or suspension medium into which a sample to be tested may be injected immediately prior to testing thereof.

The invention contemplates the formation of a system of interconnected individually sealed sample containing or receiving envelopes in the form of an elongated plastic ribbon adapted to be cut transversely between any preselected pair of envelopes in the succession thereof so as to form a series test strip containing a preselected number of test sample envelopes. It is also contemplated that auxiliary individually sealed pockets or compartments be formed in the ribbon or test strip along one or both sides of each sample receiving envelope or intermediately of successive envelopes. A sealed but easily rupturable septum is provided between each auxiliary compartment and its adjacent

sample containing or receiving envelope. Thus, one or more sample reagents placed in one or more of the auxiliary compartments may be introduced into a test sample prior to or during colorimetric testing simply by squeezing together opposite sides of the auxiliary compartment whereby the septum will become ruptured and the sample reagent simultaneously forced into the sample containing envelope. Mixing of the sample and reagent may be effected simply by kneading the pliable plastic envelope.

By placing the envelopes between parallel transparent rigid plates in colorimetric test apparatus, the path length of light directed through a sample therein may be established or adjusted according to the spacing provided between such parallel plates. Thus, a completely sealed test sample may be examined colorimetrically any desired number of times with the same or different optical path lengths and with one or more reagents added thereto before or during testing. Furthermore, upon completion of the testing of a particular sample, the sample need not be removed from its envelope (i.e. cuvette) for disposal but, instead, neatly and cleanly transported in the envelope and finally disposed of, envelope and all.

DESCRIPTION OF THE DRAWING

FIG. 1 is a plan view of one embodiment of the invention;

FIG. 2 is a view similar to FIG. 1 of a modification of the invention;

FIG. 3 is a fragmentary cross-sectional view taken generally along line 3—3 of FIG. 2;

FIG. 4 is a fragmentary plan view of another modification of the invention;

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

FIG. 6 is a fragmentary plan view of still another modification of the invention; and

FIG. 7 is a partially cross-sectioned diagrammatic illustration of colorimeter apparatus wherewith a use of disposable cuvettes according to principles of the present invention is illustrated.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIGS. 1 and 2 there are illustrated embodiments of the present invention in its simplest form wherein disposable test sample cuvettes in the form of a system of envelopes 10 each containing or adapted to receive liquid and/or other types of sample substances or diluents are formed of thin pliable plastic sheet materials which are thermally welded or heat sealed together about the envelopes to form ribbon 12.

In the arrangement of ribbon 12, FIGS. 1 and 2, the superimposed sheets 14 and 16 of thin pliable plastic material which make up the ribbon are heat sealed or otherwise similarly fused to each other along their respective opposite edges and discriminately along paths 18 transversely of their longitudinal dimension whereby a continuous succession of test sample envelopes results.

Liquid test samples or sample diluents may be introduced into envelopes 10 during the formation of ribbon 12 or, as illustrated in FIG. 2, the sample or diluting medium and/or a reagent may be injected into a

particular envelope 10 with a hypodermic syringe 19 or the like.

In the case where injection into envelopes 10 is contemplated, a self-sealing plug 22 of elastomeric material such as a soft surgical rubber or the like is preferably heat sealed into the structure of ribbon 12 between sheets 14 and 16 thereof in the manner illustrated in FIGS. 2 and 3, for example. It should be understood however that plugs 22 may be in the form of patches of self-sealing material fused or otherwise adhered to one or both sides of envelopes 10, preferably adjacent a corner thereof, or one or the other or both of the sheets 14 and 16 may be formed of a transparent elastomeric self-sealing material.

In colorimetric testing wherein light is projected through a sample and a measurement of the transmittance of the sample is used for clinical evaluation, the path length of light through substances being so tested may be critical to the test results. Shorter or longer path lengths may result in greater or lesser amounts respectively of light transmitted through a given one or a number of identical specimens whereby the test results may vary according to the thickness or depth of specimen being so transilluminated. Consideration of path lengths as a factor in test results may be eliminated according to the present inventive concept by positioning a selected sample containing envelope 10 between rigid parallel transparent plates 20 which are so constructed and arranged in a test apparatus 23 (see FIG. 7) as to be spaced one from the other at a given distance X at the time of testing. One or the other or both of plates 20 may be arranged so as to be moveable toward and away from each other and thus freely receive an envelope 10. With an envelope 10 in this testing position, movement of plates 20 one toward the other to an extent controlled by stop or spacer means (not shown) therebetween for establishing the distance X provides a given path length through a test sample 24. Envelopes 10 being formed of the aforesaid thin and pliable sheet materials and each being only partially filled with a test sample such as 24 will comply with adjustment of their thickness dimension by displacement of the liquid test sample 24 therein when positioned between plates 20 in the manner just described.

Apparatus 23 being illustrated schematically in FIG. 7 does not include a showing of simple mechanical expedients which may be employed for effecting the foresaid operation of plates 20 in receiving and positioning envelopes 10 for testing purposes. Such expedients would be well known to the artisan and are not intended to form a part of the present invention.

Colorimetric testing with apparatus such as is illustrated in FIG. 7, for example, is performed by projecting light from a source 26 through plates 20 and envelope 10 upon photodetector 28. The amount or intensity of light impinging upon photodetector 28, being a factor which is related to the type and/or condition of sample 24 under test, is recorded for clinical or other evaluations by an electrical measuring circuit 30.

Circuit 30 having a source of electrical energy such as battery 32 and load resistor 34 connected in series with photodetector 28 also has leads 36 connected across resistor 34. A conventional galvanometer or other recording device may be connected to leads 36

for providing an indication of electrical current variations produced in circuit 30 by the effect of light impinging upon photodetector 28 which, in turn, provides an indication of the transmittance of sample 24.

It is pointed out that envelopes 10 may be individually separated from ribbon 12 at any time prior to, during or after testing in apparatus 23 or the ribbon may be kept intact.

In FIG. 4 there is shown a modification of the invention wherein ribbon 12', being formed of thin and pliable plastic sheet materials 14' and 16' (FIG. 5), has main sample receiving or containing envelopes 10' which are generally similar to envelopes 10 of FIGS. 1 and 2. While means such as plugs 22 of FIGS. 2 and 3 or similar arrangements for injecting sample materials into packets 10' have not been shown, it should be understood that such may be incorporated in the structure of ribbon 12'.

The embodiment of the invention represented by FIGS. 4 and 5 is directed more particularly to the provision of auxiliary pockets or sample diluent or reagent containing compartments 38. Compartments 38 have reduced neck portions 40 leading toward similarly formed and contoured neck portions 42 extending laterally from envelopes 10'. A rupturable septum 44 between compartments 38 and their respective envelopes 10' separate materials contained within each. Septums 44 may be in the form of a thin superficial seal along a line between sheets 14' and 16' so that, by squeezing together opposite sides of compartments 38, pressure exerted against their contents will force the septums to rupture and thereby inject said contents into a respective envelope 10'. The contents of compartments 38 may be in a form of gas, liquid or powder reagents which are required to be added to particular samples within envelopes 10'. Forced mixing of such reagents with the samples may be accomplished by kneading of the pliable opposite sides of envelopes 10'.

It should be understood that auxiliary compartments such as 38 may vary in number with respect to the number of envelopes 10' and may be located at various points or positions relative to envelopes 10' other than those illustrated in FIG. 4. For example, one other arrangement of envelopes 10' and compartments 38 is illustrated in FIG. 6 wherein compartments 38 are located successively intermediately of envelopes 10' of ribbon 12'.

I claim:

1. The method of colorimetrically testing a fluid specimen substance in an environment isolated from ambient atmospheres and contaminants and extraneous matter comprising the steps of:

placing the specimen substance in a completely circumferentially sealed cuvette compartment formed between superimposed pliable transparent plastic sheet materials;

positioning said compartment in the path of a beam of light for transillumination of said specimen substance therein; and

compressing said compartment sufficiently to produce a predetermined thickness of said specimen substance in said light path by displacement thereof in said compartment whereby a measure of the intensity of light transmitted through said thickness of transparent plastic sheet materi-

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als and said thickness of said specimen substance may be used for clinical evaluation of said specimen substance.

2. A closed system of disposable colorimeter cuvettes comprising:

a ribbon formed of a pair of superimposed strips of thin and pliable transparent plastic sheet material, said strips being sealed together along their corresponding opposite edges and further sealed together along paths extending across said ribbon from one edge to the other to form a succession of individually circumferentially sealed envelopes and said strips further being sealed together along lines adjacent to at least one side of each of said sealed envelopes to form auxiliary compartments along said ribbon, each envelope and at least one

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auxiliary compartment constituting a specimen testing unit, and said envelopes comprising said cuvettes within which light-transmitting substances may be colorimically tested by transillumination through said plastic sheet material; said testing units each including a rupturable septum normally sealing the auxiliary compartment from its corresponding envelope whereby specimen reagents and other media sealed inside said compartments may be injected into said corresponding envelope by rupturing said septum with pressure applied to opposite sides of said compartment, each of said units being permanently peripherally sealed from communication with adjacent other units.

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