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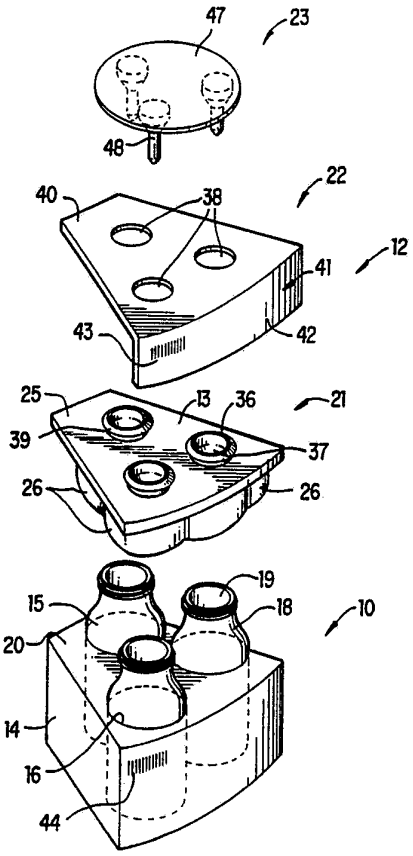
(54) Title: REUSABLE SEAL FOR DIAGNOSTIC TEST REAGENT PACK

(57) Abstract

A reusable seal assembly (12) for sealing a plurality of containers (15) arranged in close proximity to one another. The seal assembly (12) includes a subassembly comprising a pliable sealing component (21) having a plurality of spaced protrusions (26) positioned to seal openings (19) of the containers (15), and a substantially rigid supporting component (22) for supporting the sealing component (21) and for effecting the substantially simultaneous sealing of the openings (19) of the containers (15) by the plurality of protrusions (26) when the subassembly is mounted on the containers (15), and the substantially simultaneous withdrawal of the plurality of protrusions (26) from the openings (19) when the subassembly is removed from the containers (15). The seal assembly (12) also includes a shipping component (23) adapted to be mounted to the subassembly to strengthen the seal between the protrusions (26) and the containers (15) for use particularly during shipping of the containers (15) when rough treatment may be expected. The seal assembly (12) of the present invention is particularly designed to seal multi-vial, multi-dose reagent packs for clinical analyzer apparatus, and also includes a surface (42) thereon for carrying indicia (43) to identify a seal assembly (12) with its particular reagent pack.



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REUSABLE SEAL FOR DIAGNOSTIC TEST REAGENT PACK

Background of the Invention

1. Field of the Invention

The present invention relates generally to an apparatus for sealing a plurality of containers arranged in close proximity to one another. More particularly, the present invention relates to a reusable seal assembly for sealing a group of reagent-containing vials arranged in a unitary reagent pack for use with clinical analyzer apparatus.

2. Description of the Prior Art

In many scientific fields including biology, chemistry, physics, medicine and pharmacology, various fluid materials are maintained in small, necked containers often referred to as vials. These vials frequently require closure means that will provide a safe, reliable seal while, at the same time, permit easy access to the fluids in the vials whenever required.

Heretofore, such vials have typically been sealed with threaded, screw-on caps or similar closure devices. Such closure devices can be unreliable, however; and, particularly when the vials are very small, can be quite difficult to handle and manipulate.

In many applications, a plurality of vials containing related fluids are maintained in close proximity to one another. For example, in the field of diagnostic testing of biological fluids for the presence of drugs, viral diseases, bacterial infections and the like, samples are collected and reacted with reagents, and the results of the reactions are analyzed using well-known techniques. The reagents used in such tests are often purchased in and drawn from vials which are arranged in pre-formed packs having a plurality of

vials containing all the reagents required for a particular test.

In the diagnostic testing of biological fluids, samples of body fluids such as serum, plasma, urine and the like are assayed for the presence of analytes such as drugs, viruses or bacteria by reacting the samples according to a specific test protocol with specific reagents which are selected to identify a particular analyte. The protocol specifies the sequence in which the sample and reagents are to be introduced, the timing for the introduction of sample and reagents, the volumes of each to be used and other conditions to be controlled. The resulting reaction mix is typically allowed to incubate for a predetermined time and is then read, optically or otherwise, to determine the presence and concentration of the specific analyte which the assay is designed to identify. In general, procedures and apparatus for preparing and reading immunoassays are well-known and are not described in detail herein.

Frequently, the diagnostic testing of biological fluids is carried out in automated clinical analyzer apparatus which are capable of performing immunoassays on a plurality of samples simultaneously. In some automated analyzers, a batch of sample containers is supported around the circumference of a rotatable carousel together with a corresponding number of reaction containers. The carousel is then mounted inside the analyzer, and in the analyzer, the carousel is caused to rotate stepwise to move each corresponding sample container and reaction container pair first to a position adjacent a preparation station, and then to a second position adjacent a reading station. Mechanical apparatus having pipette means and typically operating under program control is located in proximity to the preparation station together with a reagent pack which contains vials of the reagents required to perform a

specific immunoassay on the batch of samples contained in the sample containers.

At the preparation station, the mechanical apparatus and pipette means operate to access and transfer volumes of samples from a sample container and reagents from the reagent vials into a reaction container according to the protocol established for the specific assay. After preparation of the reaction mix, the carousel rotates to position the next corresponding sample container and reaction container pair adjacent the preparation station and moves the previous pair toward the reading station.

Many analyzers are capable of performing only one assay at a time on a batch of samples and, in order to perform a different assay, it is necessary to physically remove the reagent pack from the analyzer and replace it with a different reagent pack for the different assay. More recently, automated analyzers have been provided which can perform a plurality of different assays on a batch of samples. In such analyzers, a plurality of different reagent packs can be mounted on a carousel to flexibly provide reagents for performing different assays on the same or different samples. Such multi-dose reagent packs, multi-sample carousel analyzer apparatus, however, still require that the reagent packs be frequently handled so as to mount the packs on the carousel to perform the required series of tests and to remove them for storage or replacement with other reagent packs for different tests. Typically, a multi-dose reagent pack contains sufficient amounts of each reagent to test a large number of samples, e.g., up to one hundred or more; and thus it is common for such packs to be inserted into an analyzer for use and removed from an analyzer for storage many times during its useful life.

In general, whether an analyzer is designed to receive a single reagent pack or a plurality of packs,

a problem exists that once the vials of the reagent pack are opened, the reagents therein may become contaminated or otherwise damaged. For example, the properties of certain reagents may be affected by exposure to light or air or exposure to other reagents or contaminants. The vials of such packs could be individually reclosed using separate threaded closures as are typically provided with such vials; however, such individual closures can be easily misplaced or lost when separated from their respective vials. Also, particularly in analyzer apparatus which are designed to hold a plurality of different reagent packs simultaneously, there is a possibility of having a large number of reagent specific caps removed from vials at the same time; and the probability of mixing these caps and incorrectly replacing them on the vials is high, resulting in a high probability of cross-contamination of the reagents. In addition, the closeness of the vials to one another in the packs hampers the removal of their caps; and it is both time-consuming and inconvenient to individually open and reclose each vial with a separate closure.

Summary of the Invention

The present invention provides a reusable seal assembly for diagnostic test reagent packs and for other applications for sealing the openings of a plurality of containers which are positioned in close proximity to one another.

The reusable seal, according to one aspect of the invention, comprises a pliable sealing component including a plurality of spaced protrusions for engaging the plurality of containers and for sealing the openings thereof, and a substantially rigid supporting component for supporting the pliable sealing component and for effecting the substantially simultaneous sealing of the openings of the plurality

of containers by said plurality of protrusions when the seal assembly is mounted to the plurality of containers, and the substantially simultaneous withdrawal of the plurality of protrusions from the openings when the seal assembly is removed from the plurality of containers.

In use, the reusable seal assembly of the invention is positioned against the plurality of containers with the plurality of protrusions aligned with the openings of the containers. The user then presses the assembly against the containers to close and seal each of the openings. The substantially rigid supporting component provides sufficient rigidity to the assembly to cause each of the containers to be closed and sealed substantially simultaneously in a single pressing operation.

To remove the seal assembly to provide access to the containers, the assembly is grasped at an edge thereof and pulled away from the containers. Again, the rigidity of the supporting component causes each of the protrusions to be pulled away from the containers as a unit thus opening each of the plurality of containers substantially simultaneously. The rigid supporting component, in effect, restricts the natural stretching tendency of the pliable sealing component thereby reducing the likelihood of liquid being flung from the containers or from the surface of the protrusions during removal of the seal assembly.

In accordance with a presently preferred embodiment, the seal assembly of the invention is especially designed for use with containers having necked openings. The protrusions of the pliable sealing component include button portions positioned to extend into the openings of the containers with an interference fit with the inner walls of the container necks to establish a radial seal therebetween. In addition, the protrusions preferably also include

annular portions positioned to surround the outer walls of the necks.

The pliable sealing component preferably comprises a thin, pliable, molded rubber web having a plurality of integral spaced protrusions extending downwardly from the lower surface thereof. The supporting component preferably comprises a thin plate of a molded, substantially rigid plastic and is affixed to the upper surface of the web. The support plate is preferably sufficiently thin to provide the assembly with a degree of flexibility to facilitate opening and closing of the containers.

The reusable seal assembly of the present invention is particularly designed for use with multi-dose reagent packs for clinical analyzer apparatus, and typically includes three or more protrusions for sealing the openings of three or more reagent vials supported adjacent one another in the pack. The rigid support plate preferably also includes a downwardly extending flange defining a surface to which indicia may be applied for identification of a seal assembly to its respective reagent pack. This feature is especially important in analyzers which are capable of receiving a plurality of reagent packs at the same time to reduce the risk of remounting seal assemblies to the incorrect reagent packs after their removal from the analyzer.

According to a further aspect of the invention, the seal assembly also includes a shipping component for enhancing the radial seal against the inner walls of the container necks. More particularly, each button portion of the protrusions of the sealing component includes a tapered axial cavity extending downwardly thereinto from the top end thereof, and the shipping component comprises a rigid plate having a plurality of spaced, tapered pegs extending downwardly therefrom which are positioned to extend into the cavities when

the shipping component is incorporated into the assembly. When the shipping component is incorporated into the assembly, the pegs push the button portions outwardly more firmly against the inner walls of the container necks to strengthen the radial seal therebetween.

The shipping component is particularly designed for use during shipping of the reagent packs to the user when the reagent packs may be subjected to especially rough handling. The shipping component is generally not required once the reagent packs are delivered to the user as the subassembly consisting of the sealing component and the supporting component will normally provide an effective and reliable seal for normal handling in the laboratory.

The seal assembly of the present invention will reliably prevent leakage or contamination of a plurality of reagent-containing vials both during shipping and during normal handling in the laboratory making the use of conventional threaded closures or the like unnecessary. The seal assembly can be used again and again throughout the useful life of the reagent pack. With the invention, also, the risk of cross-contamination or of mounting a seal assembly to the incorrect reagent pack is minimized so as to increase reliability of the assay.

Further advantages and specific details of the invention will be set forth hereinafter in conjunction with the following detailed description of a presently preferred embodiment.

Brief Description of the Drawings

Fig. 1 is a partially exploded perspective view of a multi-vial reagent pack and a reusable seal assembly therefor according to a presently preferred embodiment of the invention;

Fig. 2 is a side view, partially in cross-section, of the reagent pack and seal assembly of Fig. 1;

Fig. 3 is a cross-sectional side view of the seal assembly of Fig. 1 in assembled form and mounted to a reagent pack;

Fig. 4 is a cross-sectional side view similar to Fig. 3 with the shipping component removed; and

Fig. 5 is an enlarged cross-sectional view illustrating details of the sealing component of the seal assembly of the invention.

Detailed Description of the Preferred Embodiment

Figs. 1-4 illustrate a multi-vial reagent pack 10 and a reusable seal assembly 12 therefor according to a presently preferred embodiment of the invention.

The reagent pack 10, which, in and of itself, does not form a part of the present invention, comprises a generally wedge-shaped package consisting of a molded plastic housing 14 having a plurality of wells or cavities 16 for receiving and supporting a plurality of reagent containing containers or vials 15. The vials 15 may be identical and may conveniently be formed of thin, flexible plastic by conventional molding techniques or be of glass or other suitable material as known in the industry. The vials are of generally cylindrical shape and have an upper neck portion 18 defining an opening 19 at the top thereof to provide access to the vials, and have a vertical dimension sufficient to elevate the neck portion and opening of the vials above the top surface 20 of the housing as illustrated in the Figs. The elevated neck portion provides for ease of access to the vials when the vials are mounted in the housing. As shown, the outer wall of the neck portions 18 of the vials is threaded to permit the vials to be closed by a conventional threaded cap. As will be described hereinafter, however, the reusable seal assembly of the present

invention generally makes the use of threaded caps unnecessary.

Although the vials may be formed integrally with the reagent pack housing if desired, it is generally preferred that the two components be manufactured separately because separate vials are easier to fill and avoids the risk of contaminating the reagent in one vial with reagent from an adjacent vial during the filling process. When the vials are secured in the housing, however, the reagent pack becomes a single integrated unit for use and handling. When the reagents in the vials are expended, the individual vials or the reagent pack as a whole are intended to be disposable.

As is known to those skilled in the art, a supplier of reagents provides reagents for specific assays to the user of a clinical analyzer apparatus in unitary reagent packs such as illustrated at 10. Thus, for example, the user can purchase reagent packs for various drug tests and a single reagent pack will contain all the necessary reagents for a particular assay.

Generally, a three vial reagent pack, as illustrated in the Figs., is best suited for use in assays of the type which require a pretreatment reagent, usually used to bind analytes of interest from certain proteins in a sample, an analyte complement for binding the unbound analyte, and a specifically tagged or labeled tracer reagent for indicating the presence of the analyte of interest. Each of the required reagents is contained in one of the three vials of the pack.

For other types of assays, a four vial reagent pack is preferred. For example, in assays which are particularly sensitive to carry over of any reagent, for example, by pipetting means of an analyzer, from one reagent vial to another, the fourth vial is

advantageously provided to contain a wash or buffer reagent that can be used to rinse a pipette heading means after it accesses such reagent.

The seal assembly of the present invention is not intended to be limited to use with three vial reagent packs, but can be readily designed for use with other reagent packs or with any assembly of a plurality of vials or other containers that require sealing.

A multi-dose reagent pack 10 such as illustrated in Figs. 1-4 is particularly adapted to be mounted on a carousel for use in an automated clinical analyzer apparatus along with several other reagent packs. For example, in a typical application, eight or more different reagent packs can be mounted around the circumference of the carousel. This provides the operator of the analyzer with the ability to perform an entire battery of drug tests and other biological fluid tests which can be automatically carried out on the same or different samples. Many arrangements of combinations of samples, groupings of samples and groupings of reagent packs can be made within the apparatus depending on the particular tests that are to be performed. With such multitude of arrangements, the need for a reusable seal apparatus for closing and sealing reagent vials during periods of nonuse is a necessity.

The reusable seal assembly 12 of the present invention is highly effective in achieving the above-described goals. The assembly comprises three components: a sealing component 21 of a pliable molded rubber or the like, a substantially rigid, molded plastic supporting component 22 and a molded, rigid plastic shipping component 23. The sealing component 21 comprises a thin, flat generally wedge-shaped web 13 of approximately the same dimensions as the top surface 20 of the reagent pack housing, having three integral protrusions 26 which extend downwardly from the lower

surface 24 thereof. The protrusions 26, which are shown in greater detail in Fig. 5, each comprise an outer, generally tubular-shaped annular portion 28 and an inner, generally cylindrical button portion 29 defining an annular space 31 therebetween. The outer tubular-shaped portion 28 is sized to fit around the outside surface of a neck 18 of a vial while the inner button portion 29 is adapted to extend into the opening 19 of the vial with an interference fit to establish a radial seal between the button and the inner wall 50 of the vial neck. The button portion 29 is preferably also formed to define a first, relatively wide upper portion 32 adjacent the top end thereof, and a second, narrower portion 33 of reduced diameter adjacent the bottom end thereof.

The sealing component 21 also includes three portions 36 which extend upwardly from the upper surface 25 of the web in alignment with the button portions of the protrusions, and a central tapered cavity 37 extends into the button portions from the top of the upwardly extending portions to near the bottom of the button portions.

The supporting component 22 comprises a generally wedge-shaped, thin, flat plate 40 also having generally the same dimensions as the top surface 20 of the reagent pack housing; and is provided with three circular openings or apertures 38 therein for receiving the upwardly extending portions 36 on the web 13. More particularly, as illustrated in Figs. 3-5, the upwardly extending portions 36 include annular flanges 39 which are adapted to be pushed up through the apertures 38 in the support plate 40 and, thereafter, to expand outwardly to attach and retain the web affixed to the support plate with the support plate positioned against the upper surface 25 of the web.

The rigid plastic plate 40 also includes a downwardly extending flange 41 on the curved end

thereof. Flange 41 defines a surface 42 upon which indicia can be placed to identify the reagent pack with which it is used or to provide other important information. For example, a label or the like may be affixed to surface 42 and contain both human readable and machine readable indicia 43, as shown in Fig. 1, for identifying a seal assembly to its particular reagent pack. Such information is especially important when the reagent pack is used in analyzers which are capable of receiving a plurality of reagent packs simultaneously to help reduce the risk of remounting a seal assembly to the incorrect reagent pack after it is removed from the analyzer. As shown in Fig. 1, the reagent pack will normally have corresponding indicia 44 thereon for ease in matching a seal assembly with a reagent pack.

The supporting component 22 functions to assist the user in mounting and removing the seal assembly on and from a reagent pack. In particular, when the seal assembly is mounted on or removed from a reagent pack, the supporting component will provide sufficient rigidity to the assembly to cause each of the three vials to be sealed or opened substantially simultaneously. The supporting component, in effect, restricts the natural stretching tendency of the pliable sealing component to prevent any significant deflection of the protrusions; and, particularly during the removal process, reduces the likelihood of the contents of one or more of the reagent vials being flung from the vials or from the surface of the protrusions.

Shipping component 23 comprises a rigid, circular-shaped plate 47 having three spaced, tapered pegs 48 extending downwardly from the lower surface thereof. The shipping component is adapted to be mounted to the subassembly consisting of the sealing component 21 and the supporting component 22 such that

the three pegs will extend into the tapered cavities 37 in the button portions 29 of the web as shown in Fig. 3. When fully inserted, the pegs will push the sidewalls of the buttons outwardly and more firmly against the inner walls 50 of the neck portions of the vials to enhance and strengthen the radial seal between the button portions and the inner walls.

The shipping component is particularly designed for use when shipping a reagent pack to a user during which time the reagent pack is liable to receive particularly rough handling. The shipping component is normally not required after the reagent pack has been delivered to the user as the subassembly consisting of the sealing component 21 and the supporting component 22 will provide a fully effective seal of the vials in the laboratory.

In using the seal assembly of the present invention, reagent packs are shipped to the user in a disposable container with one seal assembly mounted thereon. The seal assembly includes the shipping component incorporated into the assembly as shown in Fig. 3. With the shipping component in place, a strong, reliable seal of the vials is provided that can effectively withstand any rough treatment that the reagent pack may encounter during the shipping process. With the present invention, therefore, threaded caps or the like for the vials are unnecessary, even during shipping of the reagent pack.

After delivery and prior to initial use of the reagent pack, the user will remove the shipping component and may dispose of it. The sealing component/supporting component subassembly can be retained in position on the reagent pack to provide a seal which is fully sufficient for normal handling within the laboratory.

When the subassembly is mounted to a reagent pack, an interference fit is provided between the button

portions 29 and the inner walls 50 of the necks of the vials to provide a strong radial seal therebetween as indicated above, and a secondary seal is also provided against the top edge of vial around the opening 37.

When the reagent pack is to be used, the subassembly is grasped at an edge thereof and pulled away from the reagent pack, substantially simultaneously withdrawing the protrusions out of the openings of the vials and opening all three vials. The subassembly is preferably temporarily stored in a tray provided for that purpose while the reagent pack is in an analyzer or otherwise in use.

After a desired test or series of tests has been completed, the reagent pack is removed from the analyzer and the seal subassembly is repositioned on its appropriate reagent pack, utilizing the indicia provided on the seal and on the reagent pack for proper matching; and the subassembly is pressed downwardly to insert the three buttons 29 into the vials to close and seal the vials for storage until needed again. Because of the rigid supporting component, the buttons will also all be inserted into the openings of their respective vials substantially simultaneously to minimize possible spilling or spraying of the contents of the vials.

The seal assembly of the present invention is designed to be used over and over during the life of the reagent pack with which it is used. A typical reagent pack may contain enough reagent for 100 tests or more, and the seal assembly can reliably be mounted on and removed from a reagent pack more than 100 times without loss of effectiveness.

The seal assembly of the invention is also especially suitable for vials which include a chimney 51 therein as schematically illustrated in one vial in each of Figs. 2-4 which, as known to those skilled in the art, is sometimes used to reduce the rate of

evaporation of the contents of an opened vial. In particular, the reduced diameter portion 33 at the lower end of the button portion provides an enlarged annular space for receipt of the chimney without interfering with the sealing ability of the button in any way as shown in Figs. 3 and 4.

While what has been described constitutes a presently preferred embodiment of the invention, it should be understood that the foregoing description and accompanying illustrations are intended to be exemplary only and are not to be taken as limitations on the scope of the invention which is defined solely by the appended claims and their equivalents. Various changes and modifications to the preferred embodiment will be apparent to those skilled in the art, and such changes and modifications can be made without departing from the spirit and scope of the invention. Accordingly, it is to be understood that the invention should be limited only insofar as is required by the scope of the following claims.

I claim:

1. A reusable seal assembly for sealing openings in a plurality of containers which are positioned in close proximity to one another comprising:

a pliable sealing component including a plurality of spaced protrusions for engaging said plurality of containers and for sealing the openings thereof; and

a substantially rigid supporting component for supporting said pliable sealing component and for effecting the substantially simultaneous sealing of the openings of the plurality of containers by said plurality of protrusions when said seal assembly is mounted on said plurality of containers, and the substantially simultaneous withdrawal of the plurality of protrusions from the openings when the seal assembly is removed from the plurality of containers.

2. The seal assembly of claim 1 wherein said plurality of protrusions include button portions positioned to extend into the openings of said plurality of containers with an interference fit with inner walls of said containers to establish a radial seal therebetween.

3. The seal assembly of claim 2 wherein each of said button portions includes a cavity extending axially thereinto, and wherein said sealing assembly further includes a shipping component having a plurality of spaced pegs positioned to extend into said cavities when said shipping component is incorporated into the assembly for pushing the button portions outwardly and more firmly against the inner walls of the containers for strengthening the radial seal between the button portions and the inner walls of the containers.

4. The seal assembly of claim 3 wherein said shipping component comprises a rigid plate having said plurality of spaced pegs extending from a surface thereof.

5. The seal assembly of claim 2 wherein said plurality of protrusions further include annular portions positioned to extend around outer walls of said containers.

6. The seal assembly of claim 1 wherein said pliable sealing component also includes a thin web portion, and wherein said plurality of spaced protrusions extend from one side of and are integral with said web portion.

7. The seal assembly of claim 6 wherein said supporting component comprises a thin, rigid plate positioned against the opposite side of said web portion from said one side.

8. The seal assembly of claim 7 wherein said rigid plate includes a plurality of spaced apertures, and wherein said sealing component further includes a plurality of extending portions extending from said opposite side of said web portion and extending through said apertures for attaching said sealing component to said plate.

9. The seal assembly of claim 1 wherein said assembly includes a surface thereon for carrying identifying indicia thereon.

10. A reusable seal assembly for a reagent pack used in clinical analyzer apparatus, the reagent pack including a plurality of reagent containing vials

having necked openings to provide access to the vials, the seal assembly comprising:

a pliable sealing component including a plurality of spaced protrusions for engaging the necks of said plurality of vials and for sealing the openings thereof; and

a substantially rigid supporting component for supporting said pliable sealing component and for effecting the substantially simultaneous sealing of the openings of the plurality of vials by said plurality of protrusions when the seal assembly is mounted on said reagent pack and the substantially simultaneous withdrawal of the plurality of protrusions from the openings when the seal assembly is removed from the reagent pack.

11. The seal assembly of claim 10 wherein said plurality of protrusions include button portions positioned to extend into the openings of said plurality of vials with an interference fit with inner walls of said vial necks to establish a radial seal therebetween.

12. The seal assembly of claim 11 wherein each of said button portions includes a cavity extending axially thereinto, and wherein said sealing assembly further includes a shipping component having a plurality of spaced, tapered pegs positioned to extend into said cavities when said shipping component is incorporated into the assembly for pushing the button portions outwardly and more firmly against the inner walls of the neck portions for strengthening the radial seal between the button portions and the inner walls of said neck portions of the vials.

13. The seal assembly of claim 12 wherein said shipping component comprises a rigid plate having said

plurality of spaced, tapered pegs extending from a surface thereof.

14. The seal assembly of claim 11 wherein said plurality of protrusions further include annular portions positioned to extend around outer walls of said neck portions of said vials.

15. The seal assembly of claim 10 wherein said pliable sealing component also includes a thin web portion, and wherein said plurality of spaced protrusions extend from one side of and are integral with said web portion.

16. The seal assembly of claim 15 wherein said supporting component comprises a thin rigid plate positioned against the opposite side of said web portion from said one side, said rigid plate including a plurality of spaced apertures, and wherein said sealing component further includes a plurality of extending portions extending from said opposite side of said web portion for extending through said apertures for attaching said sealing component to said plate.

17. The seal assembly of claim 16 wherein said rigid plate includes a surface thereon for carrying identifying indicia thereon.

18. The seal assembly of claim 11 wherein said button portions include a lower portion of reduced diameter for defining an annular space for receipt of chimneys in said vials.

19. A multi-dose reagent pack for clinical analyzer apparatus, the reagent pack including

a housing;

a plurality of reagent containing vials supported by said housing, each of said vials having an opening to provide access to the vials; and

a reusable seal assembly, said seal assembly comprising a subassembly including a pliable sealing component having a plurality of spaced protrusions for engaging said vials and for sealing the openings therein; and

a supporting component comprising a substantially flat plate for supporting said sealing component, and for effecting the substantially simultaneous sealing of the openings of the plurality of vials by said plurality of protrusions when the subassembly is mounted on the reagent pack, and the substantially simultaneous withdrawal of the plurality of protrusions from the openings when the subassembly is removed from the reagent pack.

20. The reagent pack of claim 19 wherein said plurality of protrusions include button portions positioned to extend into the openings in said vials with an interference fit with inner walls of the vials to establish a radial seal therebetween.

21. The reagent pack of claim 20 wherein said seal assembly further includes a shipping component adapted to be mounted to said subassembly, said shipping component including a plurality of pegs adapted to extend into axial cavities in said button portions to push said button portions outwardly and more firmly against said inner walls to strengthen the radial seal between said button portions and the inner walls of the vials.

22. The reagent pack of claim 19 wherein both said housing and said subassembly each include a surface for carrying indicia thereon for identifying a

reagent pack and the seal subassembly associated therewith.

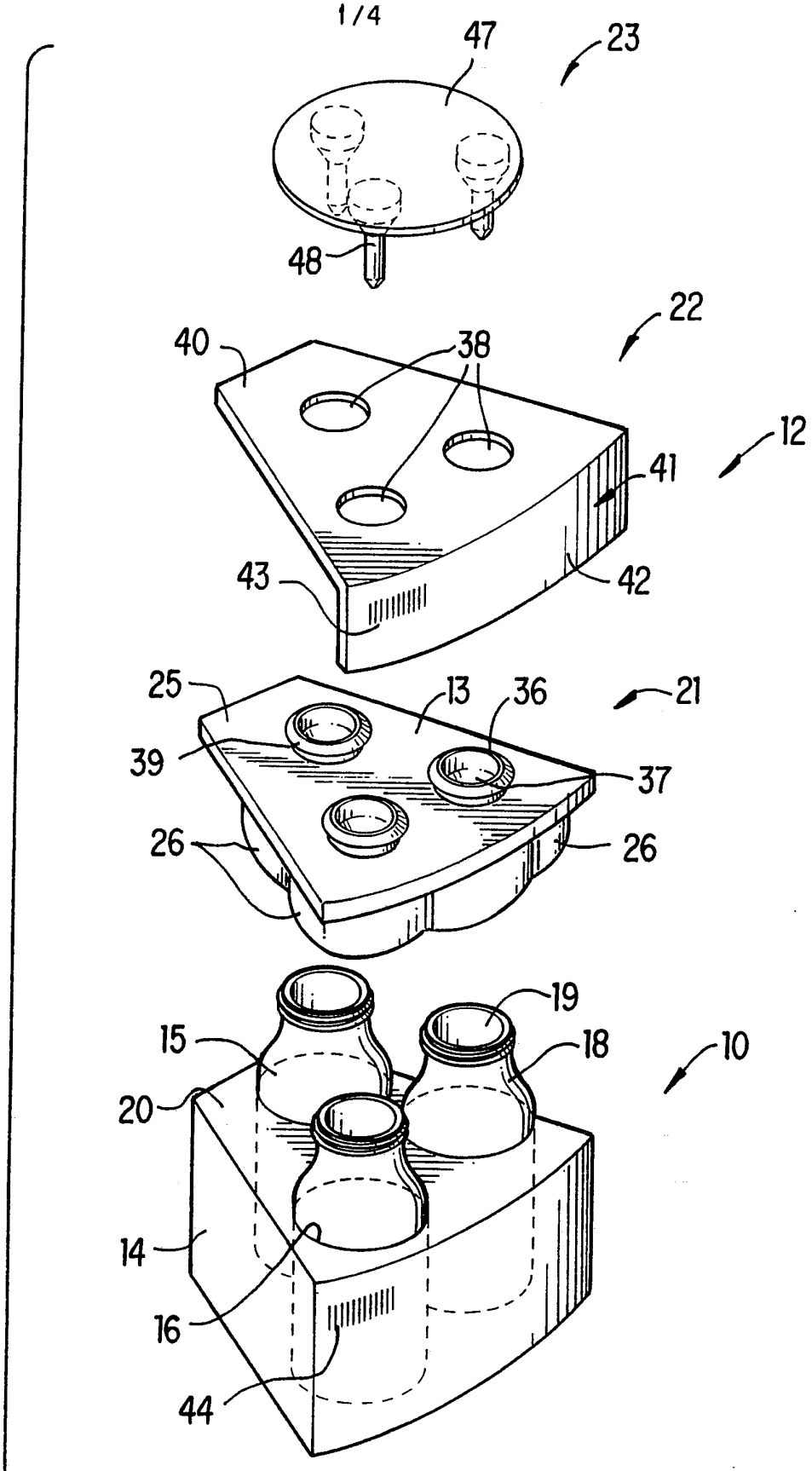
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FIG. 1

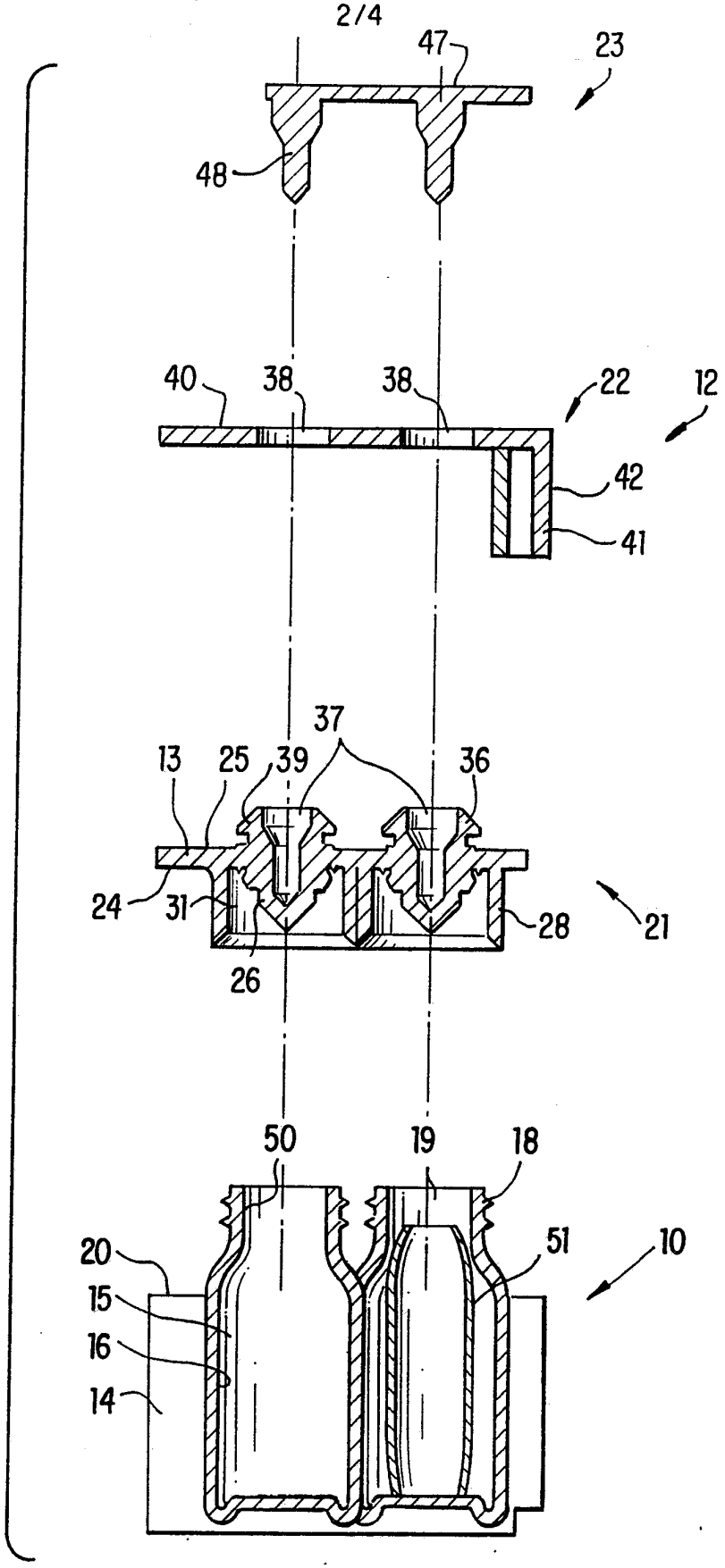
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FIG. 2

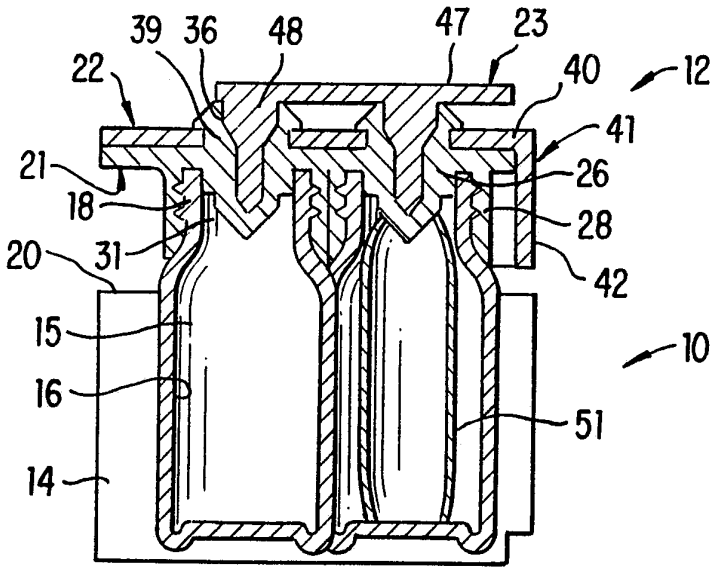
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FIG. 3

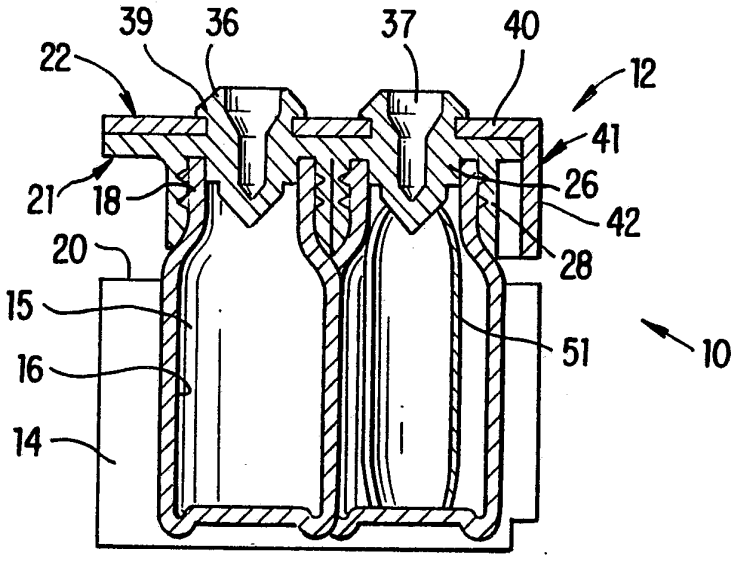
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FIG. 4

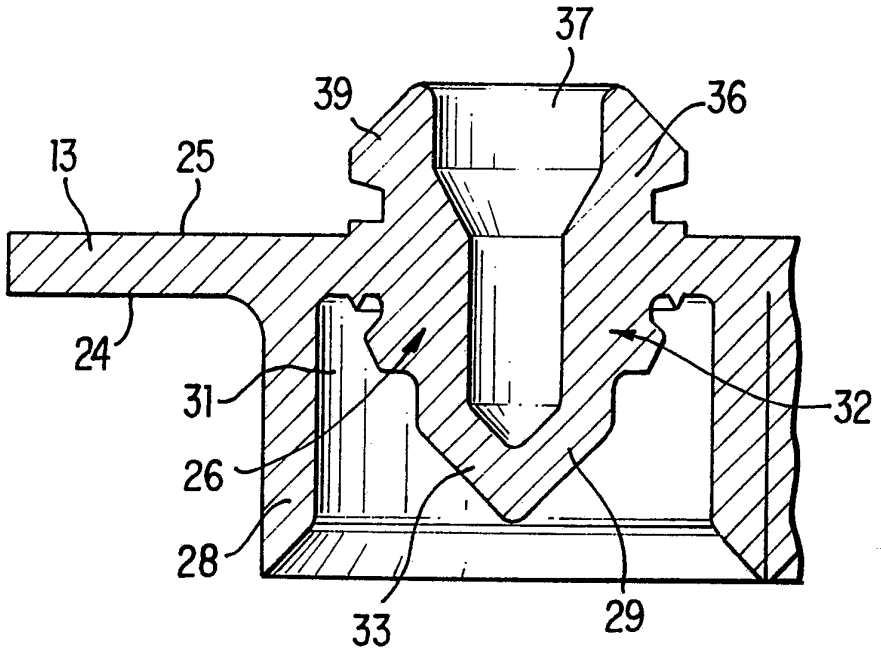

FIG. 5

INTERNATIONAL SEARCH REPORT

Int. .tional application No.
PCT/US92/06023

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :A47G 19/00; B01L 3/00, 11/00; C12M 1/00, 1/18
US CL :422/102; 215/341; 220/23.4, 307, 344
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 422/63, 64, 72, 102; 215/341; 220/23.4, 307, 344, DIG 19; 494/16, 34; 356/246

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, A, 4,290,550 (CHULAY ET AL) 22 SEPTEMBER 1981,	1-22
Y	US, A, 4,902,270 (COMEAU ET AL) 20 FEBRUARY 1990, SEE ENTIRE DOCUMENT	3-4,12-13,18,21
X Y	US, A, 5,005,721 (JORDAN) 09 APRIL 1991, SEE ENTIRE DOCUMENT.	1-2,5-11,14-17,19-20,&22 3-4,12-13,18,21
A,P	US, A, 5,112,574 (HORTON) 12 MAY 1992, SEE ENTIRE DOCUMENT.	1-22

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be part of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 19 AUGUST 1992	Date of mailing of the international search report 25 AUG 1992
Name and mailing address of the ISA/ Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. NOT APPLICABLE	Authorized officer L. KUMMERT Telephone No. (703) 308-0196

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