

Aug. 15, 1972

K. KERELUK ET AL

3,684,660

MICROBIOLOGICAL SURFACE SAMPLER

Filed May 28, 1969

2 Sheets-Sheet 1

FIG. 1

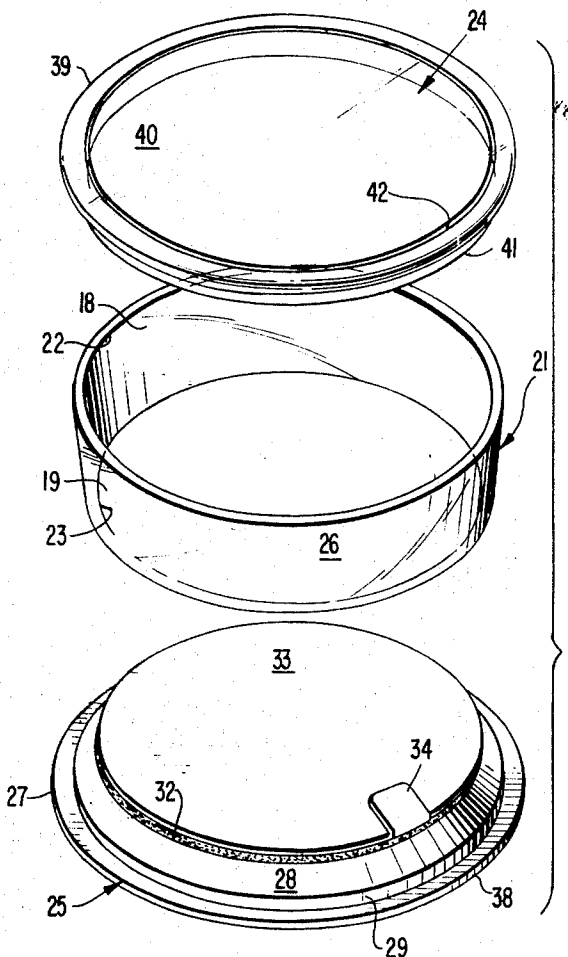


FIG. 2

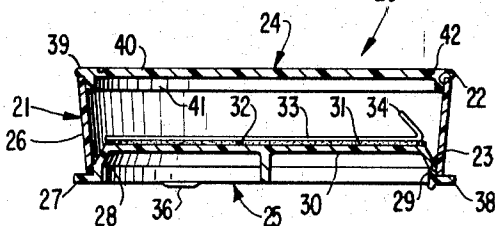


FIG. 3

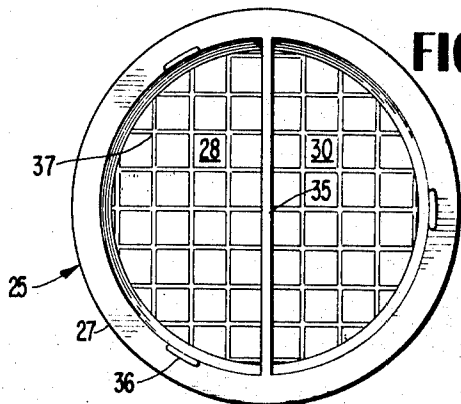


FIG. 4

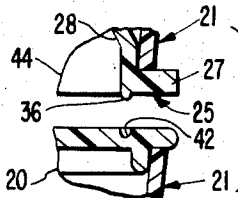


FIG. 5

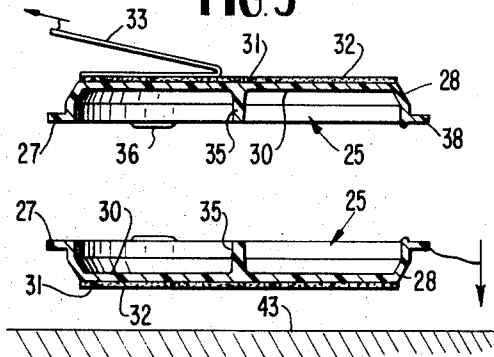
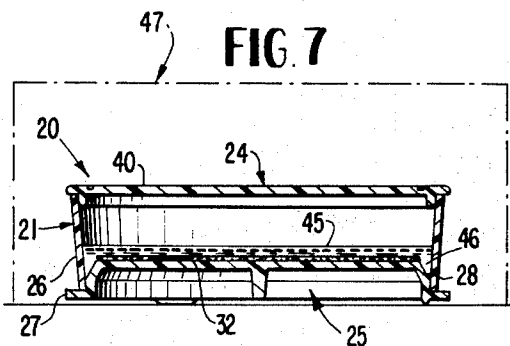


FIG. 6

FIG. 7



INVENTORS
KARL KERELUK
ROBERT S. LLOYD

BY *Shawley & O'Neil*
ATTORNEYS

Aug. 15, 1972

K. KERELUK ET AL

3,684,660

MICROBIOLOGICAL SURFACE SAMPLER

Filed May 28, 1969

2 Sheets-Sheet 2

FIG. 8

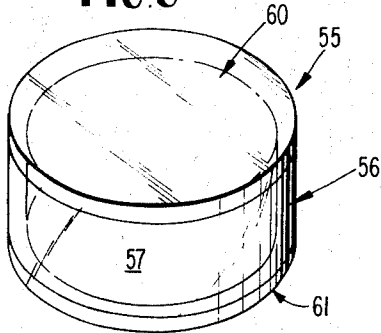


FIG. 11

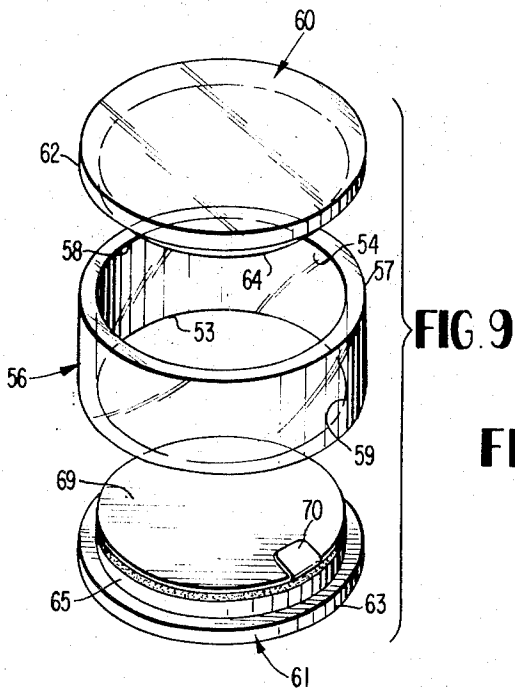
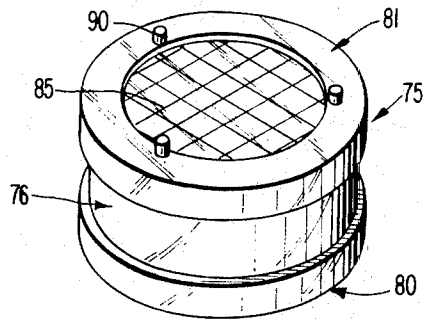


FIG. 12

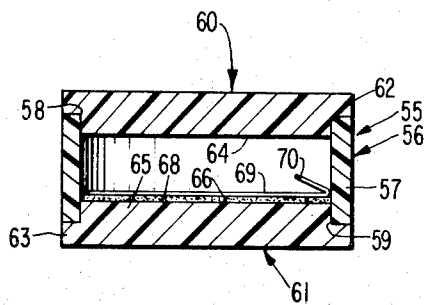
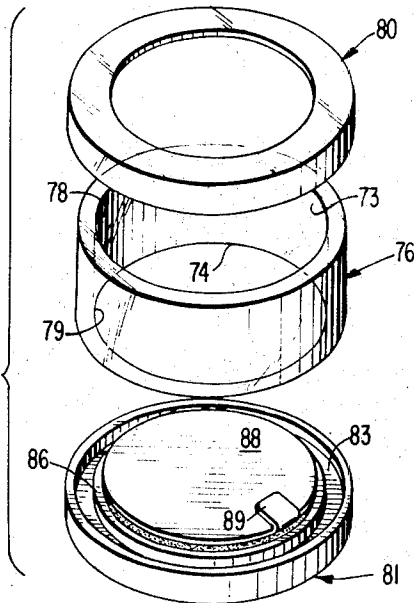


FIG. 10

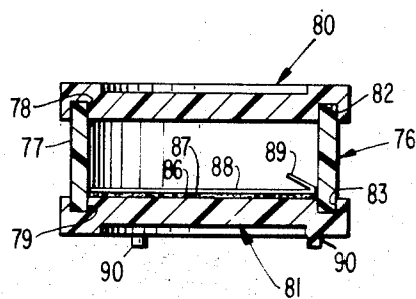


FIG. 13

INVENTORS
KARL KERELUK
ROBERT S. LLOYD

BY

Shanley & O'Neil

ATTORNEYS

1

3,684,660

MICROBIOLOGICAL SURFACE SAMPLER

Karl Kereluk, Fairview, and Robert S. Lloyd, Erie, Pa.,
assignors to American Sterilizer Company
Filed May 28, 1969, Ser. No. 828,593

Int. Cl. C12b 1/00

U.S. Cl. 195—139

11 Claims

ABSTRACT OF THE DISCLOSURE

An improved construction is provided for a microbiological surface sampler which includes a sampling surface, culture dish and receptacle therefor. The improved construction enables an operator to sample a surface area for microbes and to transfer the sample of microbes thus obtained directly to the receptacle where culture medium is added and the microbe sample is incubated, thereby eliminating the necessity for sterile storage and/or transportation of the microbe sample with subsequent culturing. The invention further provides a novel method of sampling surface areas for microbes in which the microbes on a surface area to be sampled are collected on a nontoxic adhesive coated surface, a layer of a culture medium is deposited over the adhesive coating containing the microbe sample, and thereafter the microbes are incubated in the vicinity of the interface between the adhesive coating and the layer of culture medium.

BACKGROUND OF THE INVENTION

This invention broadly relates to an improved construction for a microbiological surface sampler, and to a novel method of determining the type and number of microorganisms on surface areas.

It is often desirable to sample surface areas when determining the contamination level of microbes thereon. It is especially important to periodically sample surface areas in hospitals where microbe contamination is highly detrimental such as on floors, walls, ceilings, tables, lights and other accessory equipment located in sterile rooms, operating rooms, nursery isolettes and laboratories. It is also desirable to determine microbe contamination levels in restaurants and industries handling or processing foods, pharmaceutical industries, "clean" rooms, and on surface areas found in various other industries.

Two methods are commonly used at the present time for sampling surfaces for microbes. One of the methods involves collecting a microbe sample by rubbing a swab, which may be in the form of a cotton applicator stick, over a given surface area to be sampled for a designated period of time. The presence or absence of microbes may be determined by immersing the swab in a tube of bacteriological culture broth, incubating the tube, and observing the results at the end of the incubation period. Alternatively, the cotton swab is placed in a tube of sterile distilled water, buffer solution, or physiological saline solution, the contents of the tube are agitated by shaking, and serial dilutions of the diluent are plated out to obtain a quantitative estimate of the number of organisms which originally adhered to the cotton swab. It is widely recognized, and it has been shown by a number of investigations, that the swab method of determining surface microbe contamination is not precise and/or reproducible. It is very difficult to ascertain the number of microorganisms retained in the swab during the shaking period, and also the swab does not always remove all of the microorganisms from the sampled surface area.

A second method of sampling surface areas for microbes involves the use of the Rodac plate. This method

2

is somewhat more precise and reproducible than the cotton swab method, but it has a number of disadvantages. For example, a skilled technician is required for the preparation of the Rodac plate and it may be used only in sampling flat smooth surfaces such as stainless steel, glass, and glazed ceramic materials which are free of oil, grease and other water insoluble films. Also, the surfaces must have relatively few microorganisms per unit of surface area in order to obtain reliable results.

For the foregoing and still other reasons, the apparatus and methods available heretofore for sampling surface areas to determine the presence or absence of microorganisms have not been entirely satisfactory. The present invention overcomes the above deficiencies of the prior art, and provides for the first time an entirely satisfactory apparatus and method for determining microbe contamination.

The improved construction for the microbiological surface sampler of the present invention incorporates an adhesive coated sampling surface, culture dish, and receptacle therefor into one easily used assembly. It is possible for an operator to remove the sampling surface from sterile storage in the receptacle, and use the same to collect microbes from flat or contoured surface areas. A given sample of microbes thus collected may be transferred directly to the receptacle by replacing the sampling surface therein. Culture medium is added to the receptacle to form a layer over the inoculated adhesive coated sampling surface, and the microbe sample is incubated thereafter by subjecting the assembled receptacle and its contents to conditions favorable for the growth of microbes. The necessity for sterile storage under carefully controlled conditions and/or transportation of the microbe sample with subsequent culturing are eliminated.

In the novel method of the invention, the microbes are collected on a nontoxic adhesive coated surface and then a layer of culture medium is applied over the adhesive coating containing the microbe sample. The resulting assembly including the adhesive coated surface, the sample of microbes, and the superimposed layer of culture medium is subjected to conditions favorable for the growth of the microbes for a desired period of time. At the end of the incubation period, the microbes are counted and identified following conventional practices in this respect.

The apparatus and method of the invention may be used by unskilled personnel to obtain precise, reproducible and dependable results. It is possible to sample surface areas which contain high or low concentrations of microbes, irregularly shaped or contoured surface areas as well as flat, smooth surface areas, and surface areas which have grease or oil films thereon. The microbiological surface sampler is inexpensive to manufacture and is disposable after use, but it is sturdy and may be cleaned, sterilized and reused if this should be desirable.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded perspective view of one presently preferred embodiment of the microbiological surface sampler of the invention;

FIG. 2 is a cross sectional view taken through the microbiological surface sampler illustrated in FIG. 1 after assembly;

FIG. 3 is a plan view of the bottom of the microbiological surface sampler illustrated in FIG. 1;

FIG. 4 is an enlarged fragmentary cross sectional view of the top and bottom side edge portions, respectively, of two superimposed assembled microbiological surface samplers of the type illustrated in FIG. 2, which illustrates the manner in which the samplers can be stacked;

FIG. 5 is a cross sectional view in elevation of the bottom of the microbiological surface sampler illustrated

3

in FIG. 1, which illustrates the stripping of the protective sheet from the adhesive coated surface thereof;

FIG. 6 is a view illustrating the manner in which the adhesive coated surface on the bottom of the microbiological surface sampler illustrated in FIG. 1 is pressed against a surface to be sampled for microbes after removal of the protective sheet therefrom;

FIG. 7 is a partially diagrammatic cross sectional view further illustrating a layer of culture medium over the microbes collected on the adhesive coated surface and the incubation thereof;

FIG. 8 is a perspective view of a modification of the microbiological surface sampler of FIGS. 1-7 inclusive;

FIG. 9 is an exploded perspective view of the microbiological surface sampler of FIG. 8;

FIG. 10 is a cross sectional view of the microbiological surface sampler of FIG. 8;

FIG. 11 is a perspective view of another modification of the microbiological surface sampler of the invention;

FIG. 12 is an exploded perspective view of the microbiological surface sampler of FIG. 11; and

FIG. 13 is a cross sectional view in elevation of the microbiological surface sampler of FIG. 11.

DESCRIPTION OF THE INVENTION

A preferred embodiment of the microbiological surface sampler of the invention, indicated generally at 20, is illustrated in FIGS. 1 through 7 of the drawings. The sampler 20 comprises a side wall section, indicated generally at 21, in the form of a hollow truncated cone, marginal portion 22 defining a top opening 18 and a marginal portion 23 defining a bottom opening 19. A top closure member indicated generally at 24 closes off the top opening and a bottom closure member, indicated generally at 25, closes off the bottom opening. It will be noted that closure members 24 and 25 form part of the wall structure of sampler 20. Wall 26 of the side wall section flares outwardly and upwardly. As a result, top opening 22 has a larger diameter than bottom opening 23 and this aids in readily distinguishing the top of the sampler from the bottom.

Bottom closure member 25 comprises an annular base member 27 and a disk-like body portion 30, base member 27 and body portion 30 being interconnected by an annular wall portion 28. Annular wall portion 28 includes a substantially cylindrical closure joint portion 29 for closing engagement with the side wall marginal portion 23.

Body portion 30 has a surface 31 which is in communication with the interior of the sampler when the bottom closure member 25 is in closing position. This internal surface 31 of the bottom closure, because of the taper of annular wall portion 28, is substantially smaller in diameter than base member 27 whereby the bottom closure member can be held by the edges of base member 27 without the fingers of the operator coming in contact with another part of the bottom closure member and particularly not in contact with internal surface 31. Internal surface 31 is provided with an adhesive coating 32 which may be protected by unitary sheet 33 having a pull tab 34. The bottom closure member 25 is shown with a strengthening rib 35 on the side of body portion 30 facing away from the interior of the sampler, and a plurality of depending stacking tabs 36 are also shown on base member 27. The internal surface 31 can be visually subdivided into portions of known surface area by means of a grid 37 to aid in counting the number of microbe colonies thereon per unit of surface area.

The top closure member 24 includes a disk-like body portion 40 carrying a depending flange portion 41 which projects therefrom and is extendable into the top opening formed by wall portion 22. Body portion 40 has a circular groove 42 which, as is best seen in FIG. 4, is arranged and has a depth to receive the stacking tabs 36 of a superimposed similar sampler 44.

Closure joint portion 29 of bottom closure member 25 is dimensioned to make frictional engagement with the

4

marginal wall portion 23 to close the bottom opening 19, and flange 41 is dimensioned to make frictional engagement with marginal wall portion 22 to close the top opening 18. Although the dimensions of the parts are such as to frictionally hold the top and bottom closure members in place against accidental displacement, the closure members may be readily removed by the fingers of an operator. Closure joint portion 29 and marginal wall portion 23 and flange 41 and marginal wall portion 22 thus coact to form engageable and disengageable closure joints between the closure members 24 and 25 and side wall section 21. The base and upper disk portions 27 and 40 are circular in plan view and the portions 28 and 41 which project therefrom are also circular in transverse cross section and are axially aligned therewith.

As is best seen in FIGS. 2, 5, 6, and 7, the interior of sampler 20 is normally closed off from the surrounding atmosphere to prevent contamination by undesired microbes and to provide sterile storage for the adhesive coating 32. At the time of use, the bottom closure member 25 is pulled downward by means of base member 27 which allows the bottom closure 25 to be readily removed and held without touching the adhesive coating 32. The sheet 33 covering the adhesive coating 32 is removed by pulling on tab 34, the freshly exposed adhesive coating 32 is pressed against a surface area 43 to be sampled, and then the adhesive coating 32 is withdrawn from the surface area 43. The microbes originally on the surface 43 are removed by the adhesive coating 32, and the microbe sample thus obtained is transferred into the interior by replacing closure member 25 in its initial position in sampler 20. The top closure member 24 is removed by pulling upward on body portion 40 to provide access to the interior. A fluid hardenable nutrient medium is added to the interior of sampler 20 where it forms a layer 45 over the inoculated adhesive coating 32. The nutrient medium is allowed to harden and the microbes are retained in the vicinity of the interface between the layer 45 and the adhesive coating 32. As is best seen in FIG. 7, the taper of annular portion 28 provides a recess 46 filled with the nutrient medium which anchors the layer 45. The resulting assembly which includes the bottom and top closure members 24 and 25, side wall section 21, the inoculated adhesive coating 32 and the nutrient medium layer 45, is placed in the incubator 47 illustrated in FIG. 7 and is subjected to conditions which are favorable for the growth of the microbes. The microbes are allowed to incubate over the usual period of time, and then the microbe colonies are counted and/or identified following conventional practices in this respect.

A modification of the microbiological surface sampler of the invention is illustrated in FIGS. 8, 9 and 10 of the drawings. The modified sampler indicated generally at 55 includes a side wall section indicated generally at 56 in the form of an upright tubular section, the wall 57 of which has a marginal portion 58 defining a top opening 54 and a marginal portion 59 defining a bottom opening 53. The tubular section 56 has a transverse cross section which is annular in configuration, and the top and bottom openings 54 and 53 are sealed off by a top closure member and a bottom closure member indicated generally at 60 and 61, respectively. The top and bottom closure members 60 and 61 are integrally constructed and each include disk-like body portions 62 and 63 and second portions 64 and 65 respectively, of reduced annular cross section which project therefrom and are axially aligned therewith. As is best seen in FIG. 10, the second portions 64 and 65 are inserted into the top and bottom openings 54 and 53, respectively, and have diameters whereby they form engageable and disengageable closure joints with marginal portions 58 and 59 respectively, and are frictionally held in place. The disk-like portions 62 and 63 have diameters substantially larger than the internal diameter of tubular section 56, and rest upon the top and bottom ends of wall 57 outside of the openings 54 and 53, respectively.

The portion 65 has a surface 66 in communication

5

with the interior of sampler 55 that is provided with a nontoxic adhesive coating 68. A unitary sheet 69 of paper, plastic or similar material is provided over the adhesive coating 68 for the purpose of protecting the same. The unitary sheet 69 may be removed by pulling on tab 70.

The sampler 55 may be used in the general manner of sampler 20. For instance, the bottom closure member 61 is removed by pulling downward thereon, the sheet 69 is stripped from adhesive coating 68 by pulling tab 70, the adhesive coating is pressed against a surface area to be sampled and is removed with the microbe sample adhering thereon, and the bottom closure member 61 is then returned to its initial position in sampler 55 with the adhesive coating and the microbe sample being in communication with the interior. The interior of sampler 55 is sealed off from the atmosphere by means of tubular section 56 and closure members 60 and 61 to prevent contamination by undesired microbes. Access to the interior 67 is provided by pulling upward on top closure member 60, a fluid hardenable nutrient medium is added to form a layer over the adhesive coating 68, and the top closure member 60 is replaced. The layer of nutrient medium is hardened, the resulting assembly is incubated over the usual period of time, and the microbe colonies are counted and/or identified at the end of the incubation period.

A further modification of the microbiological surface sampler of the invention is illustrated in FIGS. 11, 12 and 13 of the drawings. The further modification indicated generally at 75 includes a side wall section indicated generally at 76 in the form of an upright tubular section, the wall 77 of which has a marginal portion 78 defining a top opening 73 and a marginal portion 79 defining a bottom opening 74.

The top opening 73 and bottom opening 74 are sealed off by a top closure member 80 and a bottom closure member 81, respectively.

The top and bottom closures 80 and 81 have annular grooves 82 and 83 formed therein for receiving the top and bottom ends respectively of tubular section 76. As is best seen in FIG. 13, the top and bottom ends of tubular section 76 are inserted into the annular grooves 82 and 83 respectively. The grooves 82 and 83 have a width and depth such that engageable and disengageable closure joints are formed with the surfaces of wall 77 in the vicinity of marginal portions 78 and 79, respectively, and are held by frictional engagement therewith. The tubular section 76 and top and bottom closure members 80 and 81 close off the interior from the atmosphere and prevent contamination by undesired microbes.

The bottom closure 81 is visually subdivided by grid 85 into portions of known surface area. The internal surface 86 has an adhesive coating 87, and a unitary protective sheet 88 including pull tab 89 is provided thereover. Stacking tabs 90 depend from the under surface of bottom closure 81 and aid in stacking the samplers 75 for shipment or incubation in an oven. The sampler 75 may be used in the general manner previously discussed for samplers 20 and 55.

The interior of the microbiological surface sampler of the invention preferably is sterilized and hermetically sealed off from the surrounding atmosphere. In forming the engageable and disengageable closure joints, in some instances it is desirable to coat the cooperating surfaces with a sealant such as petroleum jelly or a silicone lubricant which is available commercially for this purpose. A sealant aid is not essential in most instances as the closure surfaces may be molded with a sufficiently high degree of accuracy to form a hermetic seal.

The types of microbes to be sampled need not differ from those sampled by the prior art practices which utilize the swab and Rodac plate methods. Also, the manner of incubating the microbes, determining the number of colonies in the incubated sample, and/or isolating and identifying the microbes need not differ from the prior

6

art practices. In most instances, the microbes are incubated at a temperature between approximately 0° C. and 70° C., but any suitable thermal environment for incubating a given type of microbe may be employed. The preferred temperature range for incubation of psychrophiles is usually about 0-45° C. and is approximately 45-70° C. for thermophiles.

The materials for use in constructing the sampler preferably should be nontoxic to the microbes, and inert to the adhesive composition and/or culture medium to be employed. Preferably, the materials should transmit light, i.e., be transparent or translucent. Examples of materials of construction include glass or moldable plastics, such as polystyrene, polyolefins, including polyethylene and polypropylene, and polymethacrylates. Materials sold under the trademarks "Lucite" and "Plexiglas" are very satisfactory, but polystyrene usually gives the best results and is preferred. It is understood that the above materials are given by way of example only, and that numerous other thermoplastic materials may be employed.

The biological adhesive for application on the sampling surface should be nontoxic to the microbes to be sampled, and it is also preferably transparent or translucent. Permanently tacky materials give better results in most instances. Examples of specific adhesives include collagen derived materials such as glue and gelatine, natural or synthetic gums including gum arabic, agar agar, and gum tragacanth, semi-liquid to solid tacky synthetic non-rubbery polymers, natural rubber and synthetic rubbery polymers, and especially when in the unvulcanized or semi-vulcanized state, and silicone polymers including the silicone adhesives. The adhesive may be applied by any suitable convenient method. The adhesive may be contained upon a 1 mil thickness of Mylar prior to application on the sampler for ease of handling, but in most instances it is preferred to dissolve the adhesive in a solvent and apply a coating of the solution which is then allowed to dry. The specific solvent to be employed will vary with the nature of the adhesive. For instance, when glue, gelatine or a water soluble natural gum is the adhesive, then water is a satisfactory solvent. In instances where natural rubber, synthetic rubber, or other synthetic high molecular weight polymer is used as an adhesive, then suitable organic solvents may be used such as volatile hydrocarbons including benzene, toluene, etc., and ketones such as methylethyl ketone. In many instances, water insoluble adhesives may be applied in the form of an aqueous emulsion such as natural or synthetic rubber latex. Upon evaporation of the water content, the latex yields a tacky film which is suitable for the purposes of the present invention. The adhesive coating may be very thin such as $\frac{1}{64}$ - $\frac{1}{8}$ inch or less as it is only necessary to cover the sampling surface with the adhesive.

The protective sheet material applied over the adhesive coating may or may not be used depending upon the nature of the adhesive coating material. The protective sheet material may be any suitable pliable material which is sterile or capable of being sterilized, and does not adhere tightly to the adhesive or may be provided with a parting agent. Examples of sheet materials include paper and flexible organic films prepared from polyesters, polyamides and polyolefins in general, and specifically polyethylene, polypropylene, polyvinyl chloride, copolymers of vinyl chloride with ethylenically unsaturated monomers such as vinyl acetate and vinylidene chloride, polyvinylidene chloride, polyvinyl acetate, polyvinyl fluoride, polyvinyl alcohol, terephthalic acid esters, cellophane, nylon, and laminates prepared from two or more of the foregoing materials. The sheet material preferably is nontoxic to the microbes to be sampled and incubated. Examples of parting agents which may be applied to the surfaces of the sheet materials include paraffine, natural and synthetic waxes or waxy materials, liquid or liquefiable silicone parting agents, and other substances which do not adhere tightly to the specific adhesive that is employed. Often

7

glassine paper is preferred, but other types of paper coated with paraffine, wax, waxy materials, or silicone polymers produce very satisfactory results.

Suitable nutrient media of the prior art may be used in practicing the present invention. Preferably, the nutrient medium should be fluid initially and hardenable to produce a solid layer over the adhesive coating. Culture media which are satisfactory include agar, bouillon and gelatine, and other collagen derived materials, meat infusion, beef serum and carbohydrates such as dextrose or glucose. In instances where it is desired to produce a solidified layer of a prior art broth for propagating microbes, then a gelatinous material such as agar or gelatine may be added thereto in an amount of about 1½ % by weight. The layer of the nutrient medium may have a thickness of, for example, approximately ¼ to ¾ inch, and preferably about ⅛ to ⅜ inch; however, much thinner or thicker layers may be used as it is only necessary to provide a suitable nutrient medium for the propagating microbes. In instances where the microbes to be cultured require a gaseous constituent for propagation which is present in the atmosphere within the interior of the sampler, then preferably the nutrient medium is maintained at a minimum thickness so as to allow more rapid diffusion therethrough to the microbes.

In one preferred embodiment, a portion of the sampler which allows the microbes to be observed during incubation may be constructed from transparent or translucent material. In most instances it is preferred that at least the bottom closure member 25 of the sampler 20 the adhesive coating 32, and the layer of nutrient medium 45 be transparent or translucent.

We claim:

1. A microbiological surface sampler comprising wall means defining a receptacle having top and bottom portions, the wall means having means defining first and second openings therein which provide access to the interior of the receptacle, the said first opening being formed in the top portion of the receptacle and the said second opening being formed in the bottom portion thereof, first closure means for closing the first opening, second closure means for closing the second opening, the interior of the receptacle being normally closed off from the atmosphere by the wall means and the first and second closure means to reduce contamination by undesired microbes, the first closure means including a removable and replaceable first closure portion, closure joint means associated with the first closure means, cooperating closure joint means associated with the wall means adjacent the first opening, the last two means coacting to form an engageable and disengageable closure joint, the said first closure portion being removable to provide access to the interior of the receptacle through the first opening for introducing fluid nutrient medium therein and being replaceable thereafter to close off the first opening, the second closure means including a removable and replaceable closure member in the bottom portion of the receptacle, the closure member having a base portion and a raised portion, the bottom of the base portion facing outward of the receptacle and the raised portion extending upward through the second opening and having an internal surface area in communication with the interior of the receptacle, said internal surface area of the raised portion being shaped to conform to a surface area to be sampled for microbes, and at least a portion of said internal surface area of the raised portion being provided with adhesive means forming an adhesive surface to which microbes adhere when the adhesive surface

8

is pressed against a microbe contaminated surface area to be sampled, the adhesive surface being substantially nontoxic to the microbes to be sampled, closure joint means associated with the second closure means,

cooperating closure joint means associated with the wall means adjacent the second opening,

the last two means coacting to form an engageable and disengageable closure joint, the closure member being removable to sample a surface area for microbes and replaceable in the second opening thereafter with said internal surface area on the raised portion in communication with the interior of the receptacle,

the said raised portion of the closure member adjacent the base member cooperating with the wall means adjacent the second opening to form a closure, and the raised portion extending upward past the closure thus formed and being tapered inward therefrom, the said internal surface area being substantially smaller than that of the second opening.

2. The microbiological surface sampler of claim 1 wherein a plurality of downwardly projecting means are carried on the underside of the said base portion of the closure member, and the said first closure means has recessed areas formed in the upper surface thereof for receiving the downwardly projecting means whereby a plurality of the microbiological surface samplers may be stacked together.

3. The microbiological surface sampler of claim 1 wherein projecting means is carried by the base portion of the closure member to provide finger grips to aid in removing and holding the closure member from the second opening without touching the interior of the receptacle.

4. The microbiological surface sampler of claim 1 wherein a transverse cross section taken through the wall means intermediate the top and bottom portions of the receptacle has a generally annular configuration, and the first and second openings are generally circular.

5. The microbiological surface sampler of claim 1 wherein the said wall means transmits light and the said internal surface area on the raised portion is visible when the closure member is in place in the second opening.

6. The microbiological surface sampler of claim 1 wherein means is provided for visually subdividing the said internal surface area on the raised portion into portions of known surface area.

7. The microbiological surface sampler of claim 1 wherein the adhesive surface has a protective unitary sheet thereon, the sheet being removable as a unit from the adhesive surface prior to sampling a surface area for microbes.

8. The microbiological surface sampler of claim 1 wherein means is provided for visually subdividing said internal surface area on the raised portion into units of known surface area, and

the wall means and the first and second closure means transmit light, said internal surface area on the raised portion being visible when the closure member is in place in the second opening without removing the closure member from the second opening.

9. The microbiological surface sampler of claim 4 wherein

the wall means include an upright tubular section, the first and second openings are the open top and bottom ends respectively of the tubular section, the first and second closure means each include integrally constructed closures comprising a first portion and a second portion which projects therefrom, the said first portion and the second portion projecting therefrom each have a generally annular transverse cross section and are axially aligned,

the said second portions of the first and second closures which project from the first portions are inserted into the first and second openings respectively in the

9

tubular section and have diameters whereby they are retained therein by frictional engagement with the internal surface thereof, and

the first portions of the first and second closures have diameters substantially greater than the internal diameter of the tubular section. 5

10. The microbiological surface sampler of claim 4 wherein

the wall means include an upright tubular section, the first and second openings are the open top and bottom ends respectively of the tubular section, 10
the first and second closure means include a disk-like member having a diameter substantially larger than the external diameter of the tubular section, each of the disk-like members has an annular groove 15
formed therein,

the top and bottom ends of the tubular section are inserted into the grooves in the disk-like members of the first and second closure means respectively, and the grooves have a width and depth whereby the disk-like members are retained in place by frictional engagement with surfaces on the top and bottom ends of the tubular section inserted therein. 20

11. The microbiological surface sampler of claim 4 wherein

the wall means include a hollow open ended inverted truncated cone section, the said first and second openings are the top and bottom open ends respectively of the truncated cone section, 25

10

the first and second closure means each include integrally constructed closures comprising a base portion and a portion which projects therefrom, the base portion and the portion projecting therefrom each have a generally annular transverse cross section and are axially aligned,

the portions of the first and second closures projecting from the base portions are inserted into the top and bottom openings respectively in the truncated cone section and have diameters whereby they are retained therein by frictional engagement with the internal surface thereof, and

the base portions of the first and second closures have diameters substantially greater than the internal diameter of the truncated cone section at the top and bottom openings respectively.

References Cited

UNITED STATES PATENTS

3,203,870	8/1965	Andelin	195—139
3,308,039	3/1967	Nelson	195—139 LE

ALVIN E. TANENHOLTZ, Primary Examiner

U.S. Cl. X.R.

195—103.5