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[54] **CULTURE CHAMBER**

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[52] **U.S. Cl.** ..... **195/139**; 220/55 AN

[51] **Int. Cl.** **C12b 1/00**

[58] **Field of Search** ..... 195/139, 127; 206/503, 206/508, 509, 512; 220/55 AN, 40 R, 40 S; 215/206

[56] **References Cited**

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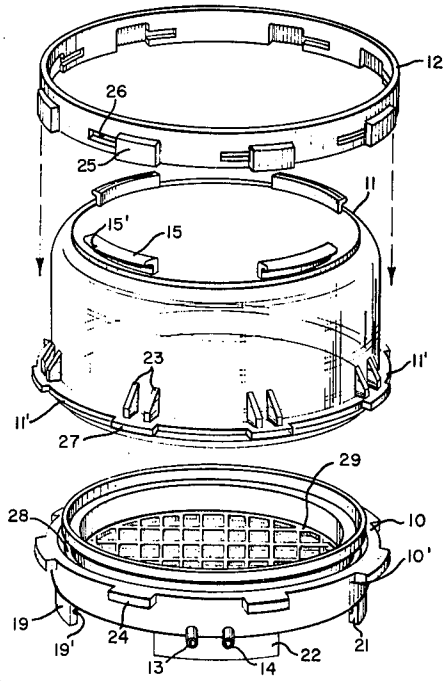
[57] **ABSTRACT**

An improved culture box is designed as a chamber with a circularly shaped base and lid with smoothly rounded concave interior surfaces for easy cleaning and added strength under pressure differentials. The base and lid are secured together by a single locking ring arranged to telescope over the lid and surround in overlapping relationship the engaged opposed portions of the base and lid. A slight rotation of the ring serves to lock cooperating portions on the base and lid together.

5 Claims, 5 Drawing Figures



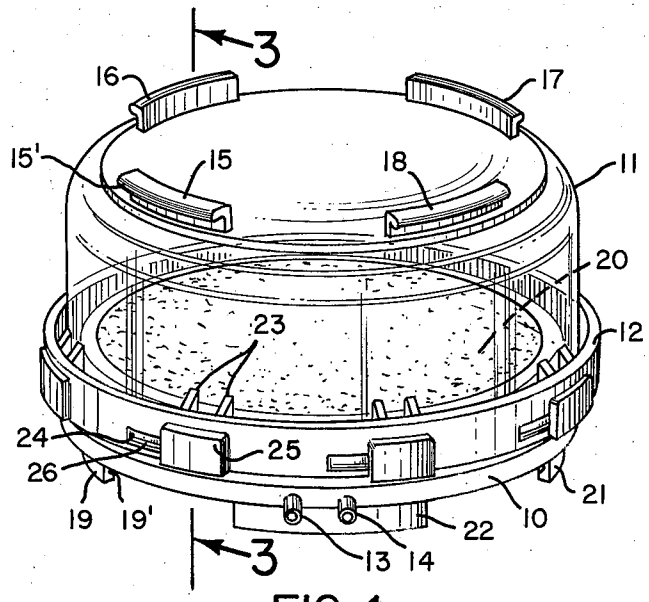

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FIG. 1

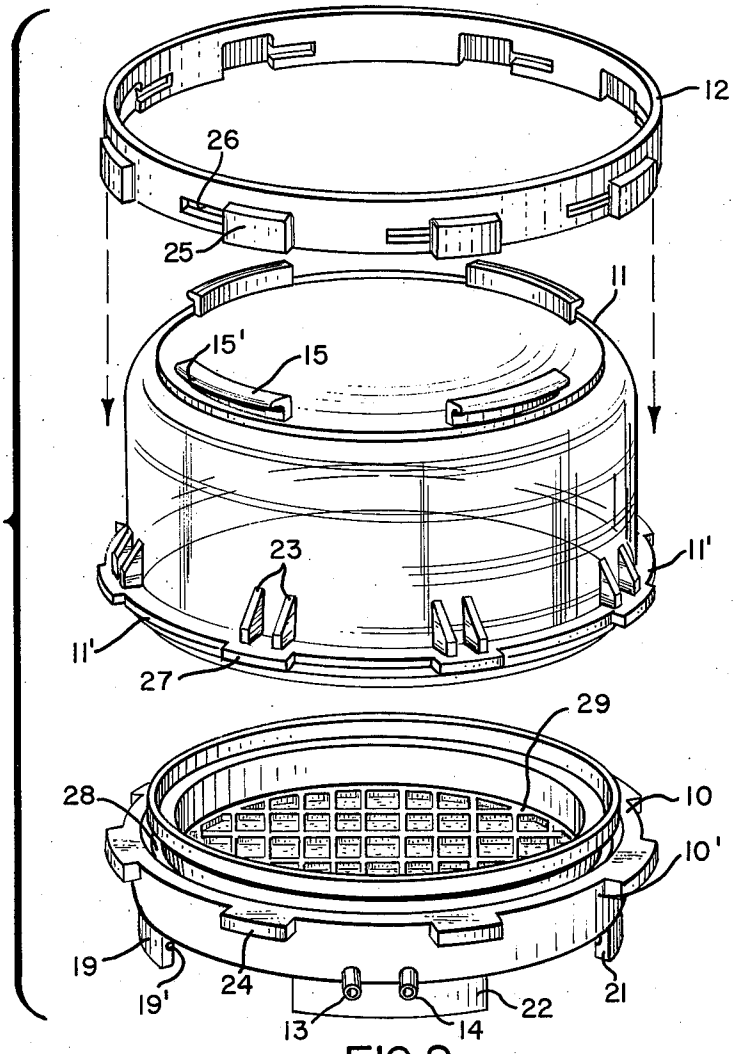
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FIG. 2

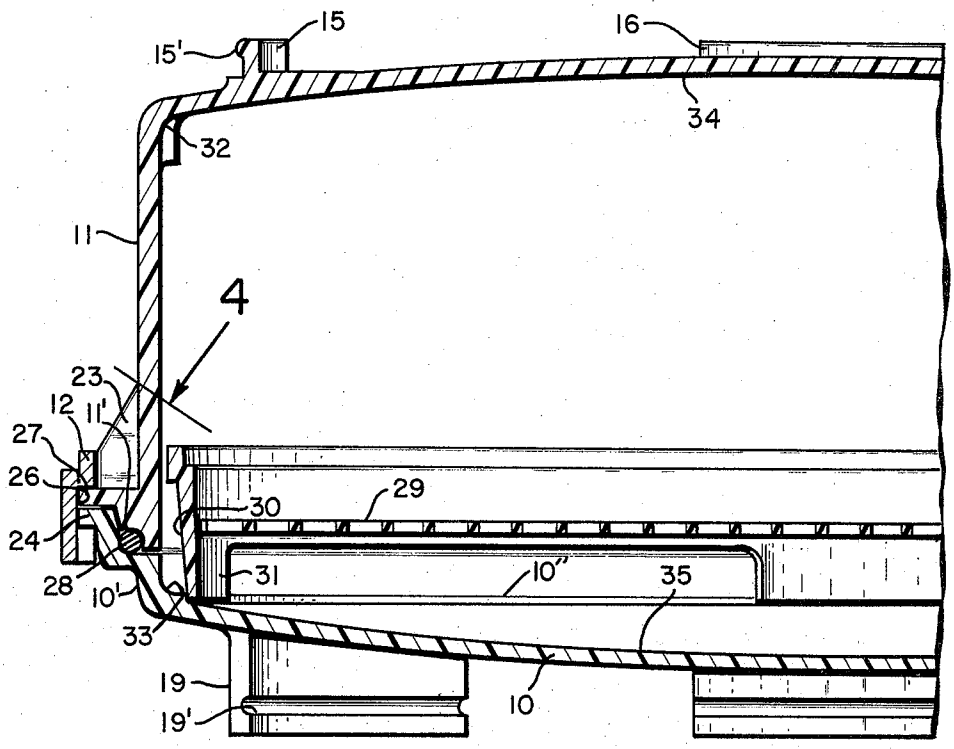

FIG.3

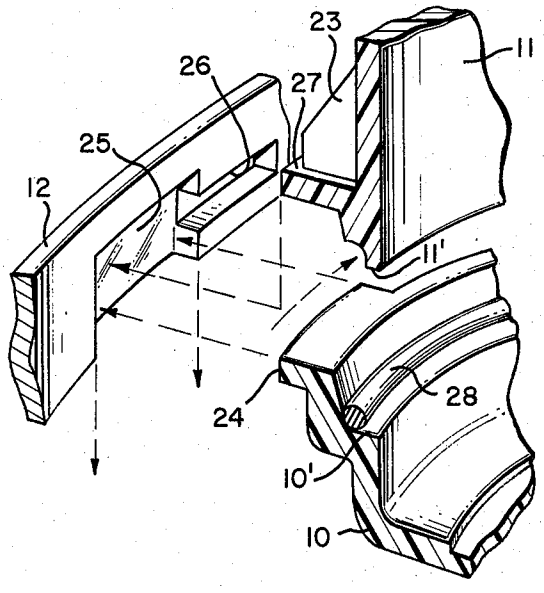

FIG.4

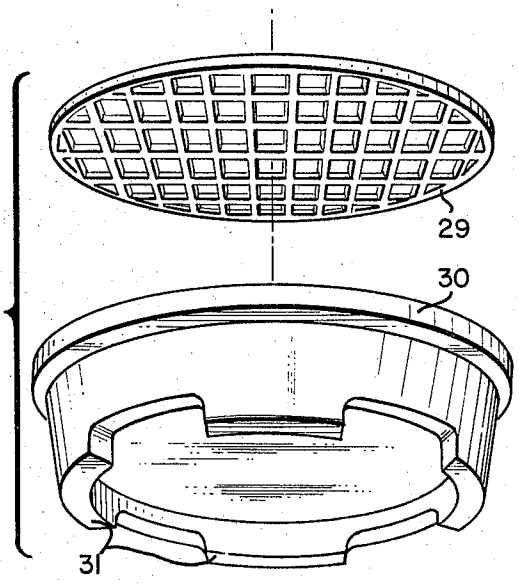

FIG.5

CULTURE CHAMBER

This invention relates to an improved structural arrangement for a culture box as used in biological laboratories for culture growth under controlled atmospheres.

BACKGROUND OF THE INVENTION

Present day culture boxes are generally of square or rectangular shape and usually include a door which may be opened or separated for inserting cultures for growth under a controlled environment. Usually, the door must be hermetically sealed so that a controlled atmosphere can be provided. Normally, this atmosphere is brought in and circulated through suitable inlet and outlet tubes in the box. Generally, the door and box are transparent so that the culture may be observed.

Some of the annoying problems encountered with prior art culture boxes such as described above include the following:

First, because of the generally square or rectangular configuration, the interior of the box has corners which are very difficult to clean. Moreover, the corners do not define as efficient a passage for circulating desired gases making up the controlled atmosphere.

Second, the box and door are normally fastened together by multiple clamps which require several hand motions to release or fasten. The seal normally used is of the surface seal type so that a fairly secure clamping is necessary. Even under these conditions, leaks can develop between the interior and the exterior of the box as a consequence of deformation of the box material.

Third, it is not feasible to stack in a static manner the present day culture boxes, and thus it is not possible to agitate them more than one at a time. Any attempt to agitate two boxes one stacked on top of the other could easily result in the upper box sliding from the lower box.

Fourth, because of the types of clamps for surface sealing, the box and door structure must be made of relatively heavy material. As a consequence, the present day boxes are bulky and heavy.

Fifth, present day culture boxes cannot withstand large pressure differentials.

BRIEF DESCRIPTION OF THE PRESENT INVENTION

With the foregoing considerations in mind, the present invention contemplates a vastly improved structural design for a culture box in the form of a culture chamber wherein the foregoing problems are substantially overcome.

More particularly, the culture chamber comprises circularly shaped base and lid members having concave lower and upper interiors respectively for positioning in opposed relationship to define a smoothly contoured closed interior. A single locking ring making up a third element of the assembly is arranged to telescope over the lid to assume a position surrounding in overlapping relationship the engaged opposed portions of the base and lid. Cooperating means on the base and lid opposed portions and the ring provide a separable securing means for the base and lid which functions in a manner similar to a bayonnet type coupling.

The generally rounded interior of the chamber provides for easy cleaning as well as excellent circulation of a controlled atmosphere. This same feature also permits thinner walled sections to be used since the rounded configuration can withstand greater pressure differentials.

In addition to the foregoing, the top of the lid and the bottom of the base are provided with intercoupling arcuate sections enabling a locking of the chambers in a stacked array to be realized so that a stable static stacking results and further, such stack may be agitated without coming apart.

Finally, accurate and reliable hermetic sealing is realized by utilizing a gland type of O-ring arrangement rather than simply a surface pressure seal.

BRIEF DESCRIPTION OF THE DRAWINGS

A better understanding of the invention will be had by now referring to a preferred embodiment as illustrated in the accompanying drawings in which:

FIG. **1** is a perspective view of a culture chamber in assembled, sealed relationship in accord with the present invention;

FIG. **2** is an exploded perspective view of the basic members making up the chamber of FIG. **1**;

FIG. **3** is an enlarged, fragmentary cross section taken in the direction of the arrows **3—3** of FIG. **1**;

FIG. **4** is an exploded, fragmentary perspective view of a portion of the locking structure looking in the direction of the arrow **4** of FIG. **3**; and,

FIG. **5** is an exploded perspective view of a culture support which may be received within the culture chamber of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. **1**, the culture chamber comprises a circularly shaped base **10**, a circularly shaped lid **11**, and a locking ring **12**. The base **10** may be provided with inlet and outlet gas tubes **13** and **14** as shown.

In order that the newly-designed culture chambers of this invention may be easily stacked, and simultaneously agitated, the lid **11** is provided on its top with circumferentially spaced arcuate top coupling sections **15, 16, 17** and **18**. Each of these sections includes an exterior bead such as indicated at **15'** for the section **15**. Where four sections are provided, their arcuate extent is preferably about thirty degrees (**30°**) and by circumferentially spacing them at equal intervals, the space between adjacent sections will cover about sixty degrees (**60°**).

The bottom of the base **10**, in turn, is similarly provided with circumferentially spaced arcuate bottom coupling sections **19, 20, 21** and **22**. Each of these sections includes an interior groove such as indicated at **19'** for the section **19**. The arrangement is such that the top sections of one culture chamber may be interdigitated with the bottom sections of another chamber stacked on top of the one chamber and then by a relative rotation, the grooves on the bottom sections receive the beads on the top sections, thereby locking the stacked chambers together.

Referring now to both FIGS. **1** and **2**, further details of the culture chamber will become evident. As shown, the locking ring **12** is arranged to telescope over the lid **11** as indicated by the dashed arrows in FIG. **2**. The lid itself includes inclined guide surfaces **23** for facilitating the radial positioning of the ring **12** in a manner to surround the opposed engaged portions of the base and lid when in assembled relationships.

Referring, for example, to the base **10**, it will be noted that its upper annular base edge designated **10'** includes a plurality of circumferentially spaced radially extending lips **24**. These lips are arranged to cooperate with a plurality of circumferentially spaced radially extending pockets **25** formed on the locking ring **12**. Each of the pockets has associated with it a slot **26** formed in an adjacent portion of the ring. In conjunction with the foregoing, the sloping guide surfaces **23** on the lid terminate on the lower annular edge of the lid designated **11'** in a plurality of circumferentially spaced radially extending lips such as indicated at **27**. The arrangement is such that the lips **24** in the base and the lips **27** in the lid may receive the pockets of the ring and then by a rotation of the ring, the slots **26** slide over the lips **24** and **27** to thereby effect a thorough locking of the base and lid together.

Hermetic sealing of the base and lid is effected by an O-ring **28** of the gland type in that it is interposed between the opposed annular base edge **10'** and annular lid edge **11'**.

The foregoing as well as a better understanding of the locking ring operation will be had by now referring to the enlarged cross section of FIG. **3**.

As shown in FIG. **3**, the lip **24** of the base and lip **27** of the lid are shown locked in the slot **26** formed in the locking ring **12**. It will also be noted that the O-ring **28** is sandwiched between opposed walls forming part of the base and lid annular edges so that it can "roll" with minor changes in the vertical positioning of the lid. Further, the sealing becomes more positive with increased interior pressure.

In FIG. **3**, as well as FIG. **2**, there is shown a culture support in the form of a flat perforated disc **29**. This culture support in turn may be properly positioned at a desired level as by a support **30** preferably formed with arcuate leg segments such as indicated at **31**. These arcuate leg segments fall on a circle of a given diameter corresponding to an annular step **10''** formed in the base in a concentric relationship. Thus, it is assured that the support **30** will be indexed to a center position in the base. The step **10''** is smoothly rounded as are other interior portions. If desired, the disc **29** may be made integral with the support **30** and several such supports may be stacked in the culture chamber by making the upper edge of the support with a circular step corresponding to **10''**. Proper atmospheric circulation obtains because of the spacing between the arcuate legs.

As clearly shown in FIG. **3**, the upper interior corners of the lid and lower interior corners of the base are smoothly rounded as indicated at **32** and **33**. Moreover, the upper interior surface of the lid and lower interior surface of the base are of general concave configuration as indicated at **34** and **35**. By providing smoothly rounded interior surfaces the box is not only easy to clean but reduces resistance to gas flow and the inherent deformation resistance is greatly increased because of the curvature thereby permitting thinner walled sections to be used.

In the fragmentary perspective view of FIG. **4**, the relationship between the pocket **25** and associated slot **26** formed in the locking ring **12** with the lips **24** and **27** on the base **10** and the lid **11**, respectively will be clear. Thus, as indicated by the dashed lines, when the ring **12** is lowered over the assembled base and lid, the locking ring **12** will be guided by the sloping guide surfaces **23** into proper radial position and then the ring can be circumferentially rotated so that the pockets **25** will slide over the lips **27** and **24**. Thereafter, a simple rotation of the locking ring moves the slot **26** over the lips **27** and **24** so that a thorough locking takes place. It should be noted in FIG. **4** that the entrance of the pocket **25** is slightly wider, this effect being accomplished by sloping slightly one of the sides of the pocket as shown. Making the pocket entrance slightly wider facilitates positioning the locking ring over the lips **27** and **24**.

FIG. **5** illustrates more clearly the support **30** and culture support disc **29** as well as the arcuate arrangement of the legs **31**. The manner in which a culture is supported within the culture chamber does not really form a part of the present invention, except insofar as the provision of the annular step **10''** described in FIG. **3** which facilitates proper central indexing of a suitable culture support.

OPERATION

In operation, and with reference to FIGS. **1** and **2**, with the locking ring **12** removed and the lid **11** lifted from the base **10**, suitable culture receptacles may be positioned on the culture support disc **29**. As mentioned heretofore, several culture supports may be stacked on the base. The lid **11** is then placed over the base **10** with the annular lid edge **11'** in opposed engaged relationship with the annular base edge **10'** and the lips **27** in alignment with the lips **24** of the base.

Thereafter, the locking ring **12** is simply telescoped over the top of the lid **11** and circumferentially positioned so that the various pockets receive the lips **27** and **24**. Thereafter the locking ring **12** is rotated to cause the slots **26** to receive the lips **27** and **24** so that a thorough locking of the base and lid together results.

A controlled atmosphere may then be circulated throughout the interior of the culture chamber at a desired temperature and pressure by means of the tubes **13** and **14** described in FIG. **1**.

Disassembly of the chamber is easily accomplished by simply rotating the locking ring **12** in a reverse direction in a manner to align the pockets **25** with the lips **27** and **24**. Thereafter, with the lips removed from the slots the locking ring **12** can readily be lifted over the top of the lid **11** and the lid then separated.

As already mentioned, in the event it is desired to agitate the culture within the chamber, several culture chambers may be simultaneously agitated as a consequence of the unique locking sections on the top and bottom of the various chambers.

In its preferred design, the lid is simply molded as an integral unit with the various top sections **15**, bead **15'** and the guiding surfaces **23** and lips **27**, all integrally formed as a part of the mold. Thus, there are no seams as in prior culture boxes. Preferably the lid base and culture support are formed of a transparent material so that the culture growth can be observed.

Similarly, the base **10** can be molded as an integral unit. As a consequence, there are only three basic members making up the entire culture chamber which members are easy to handle, assemble, and disassemble.

From the foregoing, it will thus be evident that the present invention has provided a greatly improved culture chamber design which overcomes many of the problems associated with prior culture boxes.

What is claimed is:

1. A culture chamber comprising, in combination:

a. a circularly shaped base having a smoothly rounded concave lower interior and upper annular base edge;

b. a circularly shaped lid having a smoothly rounded concave upper interior and lower annular lid edge dimensioned to seat on said base edge; and

c. a locking ring arranged to telescope over the top of said lid to circumferentially surround in overlapping relationship the upper annular base edge and lower annular lid edge, said upper annular base edge including a plurality of circumferentially spaced radially extending lips and the lower annular lid edge including a plurality of circumferentially spaced radially extending lips, said locking ring having a plurality of circumferentially spaced pockets and associated slots, the pockets extending radially outwardly from the ring and the slots being formed in adjacent portions of the ring so that the pockets receive the opposed lips, rotation of the locking ring causing the slots to receive circumferentially the lips to thereby lock the base and lid together by means of the locking ring.

2. A chamber according to claim 1, including an O-ring of the gland type between the opposed base edge and lid edge to provide an hermetic seal between the base and lid.

3. A chamber according to claim 1, in which said lid includes on its top, circumferentially spaced arcuate top coupling sections, each section including an exterior bead, and in which said base includes on its bottom circumferentially spaced arcuate bottom coupling sections, each section including an internal groove whereby a plurality of culture chambers may be stacked one on top of the other and coupled together by interdigitating the top and bottom coupling sections and then effecting a relative rotation of the chambers to cause the grooves to receive the beads.

4. A chamber according to claim 1, in which said base includes an annular smoothly-rounded step in its concave lower interior surface for indexing to a central position a culture support.

5. A chamber according to claim 1, in which said lid and base are transparent.

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