United States Patent

Gordon et al.

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[54] INCUBATOR

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[52] **U.S. Cl.** **195/139**, 195/127

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

[58] **Field of Search** 195/139, 127, 103.5

[56] **References Cited**

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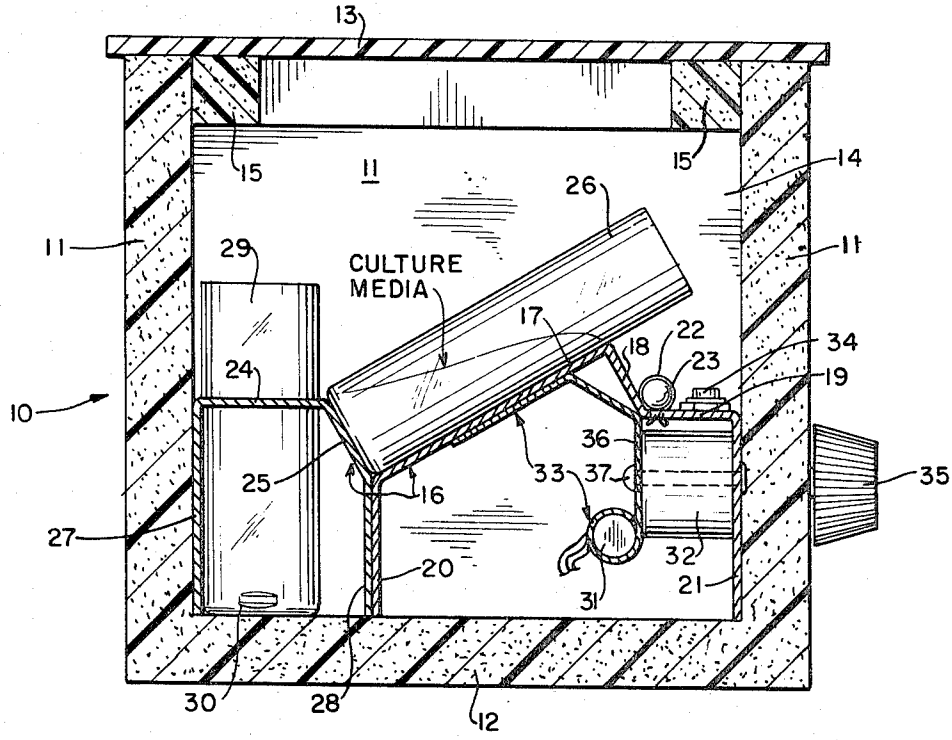
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[57] **ABSTRACT**

An incubator is described that comprises an insulated chamber in which heating of a culture media takes place by conduction and the incubator is designed to prevent overheating of the culture media and provide uniform temperature control. The incubator has a broad field of application and is particularly adapted because of its compactness for use in a physician's office.

7 Claims, 2 Drawing Figures



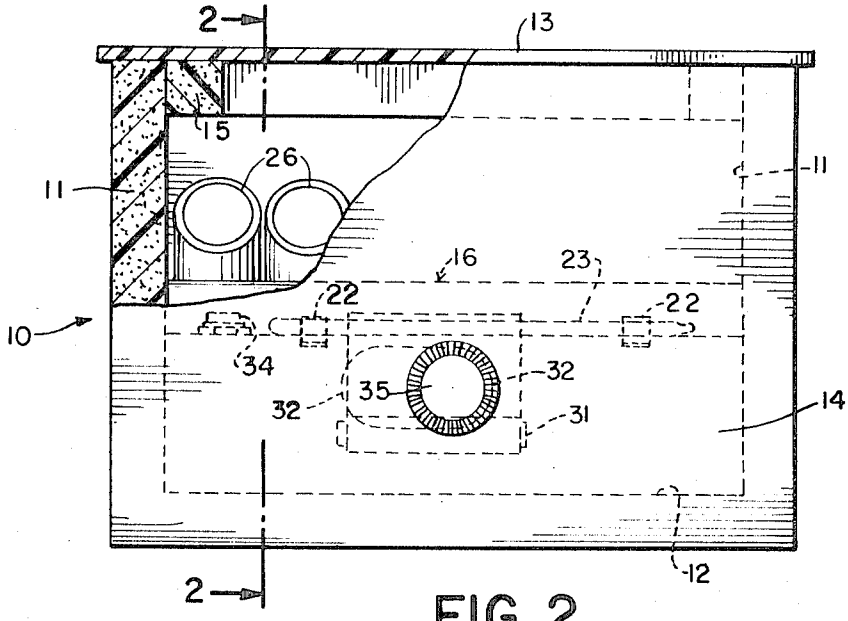
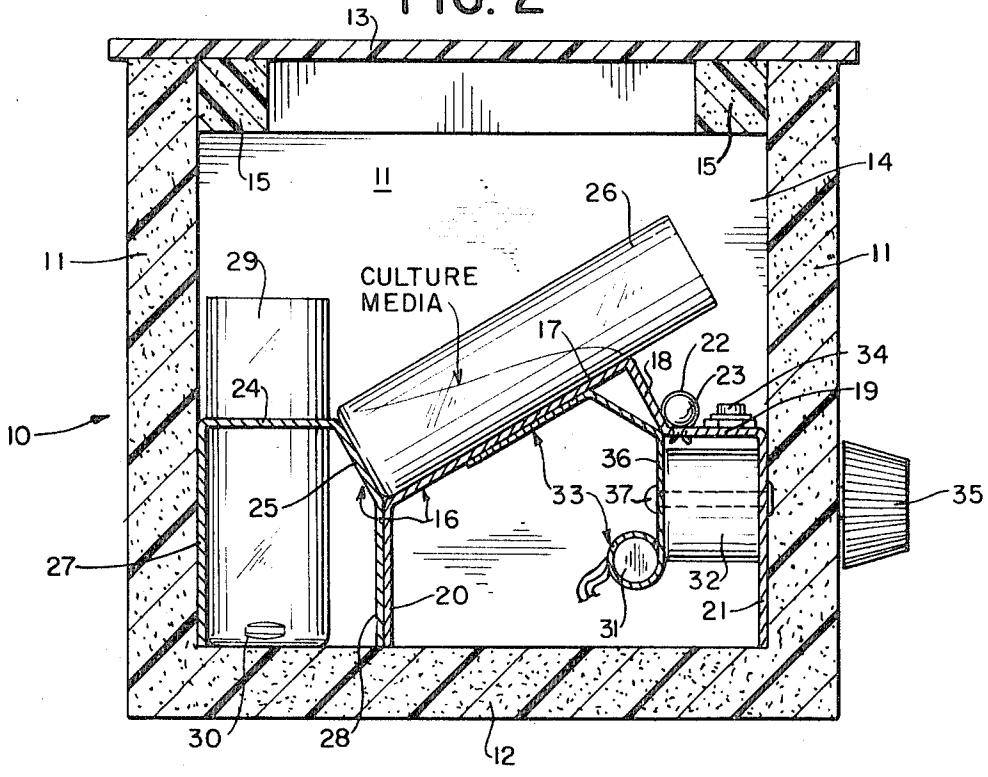


FIG. 1

FIG. 2



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INCUBATOR

This invention relates to an incubator unit.

Incubators are in use today for a variety of purposes including hatching eggs, growing bacteria in a suitable media, etc. Many of the incubators now available have a variety of shortcomings including: non-uniform temperatures throughout the incubator which makes it difficult to determine accurately whether the culture is being maintained at the critical temperature level; non-uniform heating of the culture media; overheating of the culture media; poor design and construction which makes it difficult to maintain a specific gas atmosphere tension (e.g. CO_2 tension) required for the bacterial growth; and poor visibility of the culture media from outside of the incubator thereby hindering the accurate determination of the presence or absence of bacterial growth without opening the incubator.

Accordingly, the present invention provides for an incubator that overcomes the deficiencies of prior art incubators.

One object of the present invention is to provide an incubator in which the culture media is heated by conduction rather than convection.

Another object of the present invention is to provide an incubator that provides substantially uniform heating of the culture media.

A still further object of the present invention is to provide an incubator in which overheating of the culture media is avoided.

An additional object of the present invention is to provide an incubator that is particularly adapted for growth of bacteria requiring a CO_2 atmosphere such as used in testing for gonorrhea.

Other objects and advantages of the present invention will be apparent from the following detailed description and accompanying drawings which set forth the principles of the invention in which

FIG. 1 shows a front elevation in section of the incubator of the present invention; and

FIG. 2 is a detailed cross-sectional view taken along the line 2—2 of FIG. 1.

Referring to the drawings for a more detailed description of the structure and operation of the incubator of the present invention, FIG. 1 shows an incubator **10** comprising flat vertical side walls **11**, a flat bottom wall **12** and a flat removable cover **13** which is at least partially transparent and forms with walls **11** and **12**, chamber **14**. Since it is essential that the incubator be insulated to maintain a selected incubation temperature, side walls **11** and bottom wall **12** are constructed of suitable insulation material such as, for example, a foamed polyurethane. Transparent top cover **13** may be constructed of any suitable transparent material (e.g. glass, a rigid plastic such as "Plexiglass" etc.) to permit clear visibility of the culture media to determine the presence of any bacterial growth without opening the incubator. Cover **13** has secured to it, by adhesive or other suitable means, lip **15** constructed, for example, of a foamed polyurethane which seals the chamber **14** when cover **13** is in place as shown in FIG. 1. This provides a tight fit that will permit the maintenance of a specific gas atmosphere tension (e.g. CO_2 atmosphere) in the chamber **14** over the desired time period.

Referring now to FIG. 2, the insulated chamber **14** is provided with a two piece platform **16** designed to permit rapid assembly of the incubator and its heating unit and to fit firmly within the four corners of chamber **14**. Platform **16** comprises one section having oppositely slanted surface portions **17** and **18**, flat horizontal surface area **19** joined with slanted surface **18** and vertical leg members **20** and **21** extending to the inside face of bottom wall **12**, with leg member **21** contacting the inside face of one of vertical side walls **11**. Slanted surface portion **18** and flat surface area **19** form a bed for a thermometer **23** placed in a horizontal position in insulated chamber **14**, the thermometer being secured to flat surface area **19** by conventional means such as a bracket **22** or the like. Having thermometer **23** in a horizontal position permits easy sighting of the incubator temperature through transparent cover **13**. The

second section of platform **16** comprises a flat horizontal surface area **24**, a slanted surface portion **25** which forms with adjacent slanted surface **17** a bed for receiving and retaining one or more culture containers **26** in an inclined position from the horizontal, and leg members **27** and **28** extending to the inside face of bottom wall **12** with leg member **27** bearing against leg member **20** of the other section of platform **16**. Horizontal surface area **24** is provided with an opening for receiving and holding in a vertical position container **29** (e.g. a glass vial) in which a gas releasing agent **30**, such as a CO_2 tablet, is placed together with water or other suitable liquid. Platform **16** is preferably constructed of a light material that is a good heat conductor, such as aluminum, so that heating of the culture in container **26** is by conduction through slanted surface **17** as will be explained hereafter in connection with the design of the heating unit for incubator **10**.

As shown in FIG. 2, the heating unit comprises a heating element **31** such as a resistor, a thermostat **32** and a heat conducting plate **33** each of which is located within insulated chamber **14** and under platform **16**. A pilot light **34** is provided on horizontal surface area **19** which goes on when the temperature is below the desired level and cuts off when the incubator temperature reaches the desired level and a heat control knob **35** is provided on the exterior of incubator **10** for regulating the incubator temperature. The control knob **35** is marked with an indicator to permit selection of the desired temperature that is calibrated on a scale on the outside face of the side wall **11** opposite the heat control knob. Heat conducting plate **33** is designed so that at its one end it is wrapped around and in contact with heating element **31** and at its other end it is in contact with slanted surface **17** constructed of a heat conductive material, as previously indicated. Intermediate its ends, heating plate **33** has a vertical section **36** that is secured to a face of thermostat **32** by conventional means such as bolt **37** which also secures thermostat **32** to vertical leg **21**. Therefore thermostat **32**, heat conducting plate **33** and one section of platform **16** are bolted together as a unit.

The design of platform **16** and the heating unit arrangement described in the preceding paragraph permits for accurate and uniform heating of container **26** in that a larger surface area of the solid culture media in container **26** is exposed to heating by conduction because such container is in an inclined position rather than in the conventional vertical position. Overheating of the culture media is avoided through a temperature control that will maintain an accuracy of plus or minus one half a degree between 95° to 105° F. In operation the heat generated from heating element **31** is conducted along heat conducting plate **33** and transferred by conduction to slanted surface portions **17** and **18** and horizontal surface **19** through the contact between heat conducting plate **33** and slanted heat conductive surface **17**. Overheating of the culture media is avoided because heat from the heating element **31** must pass by thermostat **32** along heat conducting plate **33** before it reaches slanted surface portion **17**. This permits an accurate control of the temperature at slanted surface **17** inasmuch as this surface cannot become heated to a temperature above the preselected level because thermostat **32** cuts out when the desired temperature is reached at the thermostat thereby preventing excess heat transfer along heat conducting plate **33** to slanted surface **17**.

In operation the heating element can be plugged into any 110 volt AC outlet and because of its compactness carried from one point to another with no effort. It is ideal for use in a doctor's office, a hospital, laboratory or research facility. Another advantage of the incubator of the present invention is its flexibility of use. For example, horizontal surface **24** may be provided with a plurality of openings for receiving and retaining in a vertical position vials containing a liquid culture media where such a culture media is required for a particular test such as the detection of trichomonas.

The incubator of the present invention has been found to be ideal for use in detection of neisseria gonorrhea where careful temperature control and uniform heating of a solid culture media is important for accurate results.

Other modifications and variations will be apparent to those skilled in the art and it is accordingly intended that the scope of the invention not be limited to those embodiments particularly illustrated or suggested but that the scope of the invention be defined by reference to the appended claims.

We claim:

1. An incubator for warming a culture container to a desired temperature comprising an insulated housing defining a chamber, culture container support means of a heat-conductive material located within said chamber, said support means shaped to hold a culture container thereon in a position inclined with respect to the vertical so that a fluid culture medium in the container will be disposed therein and said support means will contact both the bottom wall and an inclined surface of the container resting on said support to conduct heat to the container to heat the medium contained therein, transparent material comprising a portion of said chamber to permit viewing of a culture container within the chamber, electrically operated heating means, heat conducting means between said heating means and said support means and in physical contact with both said heating means and said support means to conduct heat from said heating means to said support means to heat said support means, and heat regulating means electrically connected to said heating means and in

heat conductive relationship with said support means for sensing the temperature of said support means and for controlling the operation of said heating means to maintain said predetermined temperature.

2. An incubator according to claim 1 wherein said heating means and said container support means are in contact with said heat conducting means at opposed ends of said heat conducting means.

3. An incubator according to claim 2 wherein said heat regulating means is in contact with said support means at a position intermediate the ends of said heat conducting means.

4. An incubator according to claim 3 wherein said heat regulating means comprises a thermostat.

5. An incubator according to claim 1 which includes means for holding a gas releasing agent within said insulated chamber.

6. An incubator according to claim 3 further comprising means for retaining a heat measuring device in a substantially horizontal position in said insulated chamber at a location viewable through said transparent portion.

7. An incubator according to claim 1 further comprising means for holding another culture media container in a substantially vertical position.

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