

[54] **LYOPHILIZED SPORE DISPENSER**
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 195/142; 239/227; 134/113, 167

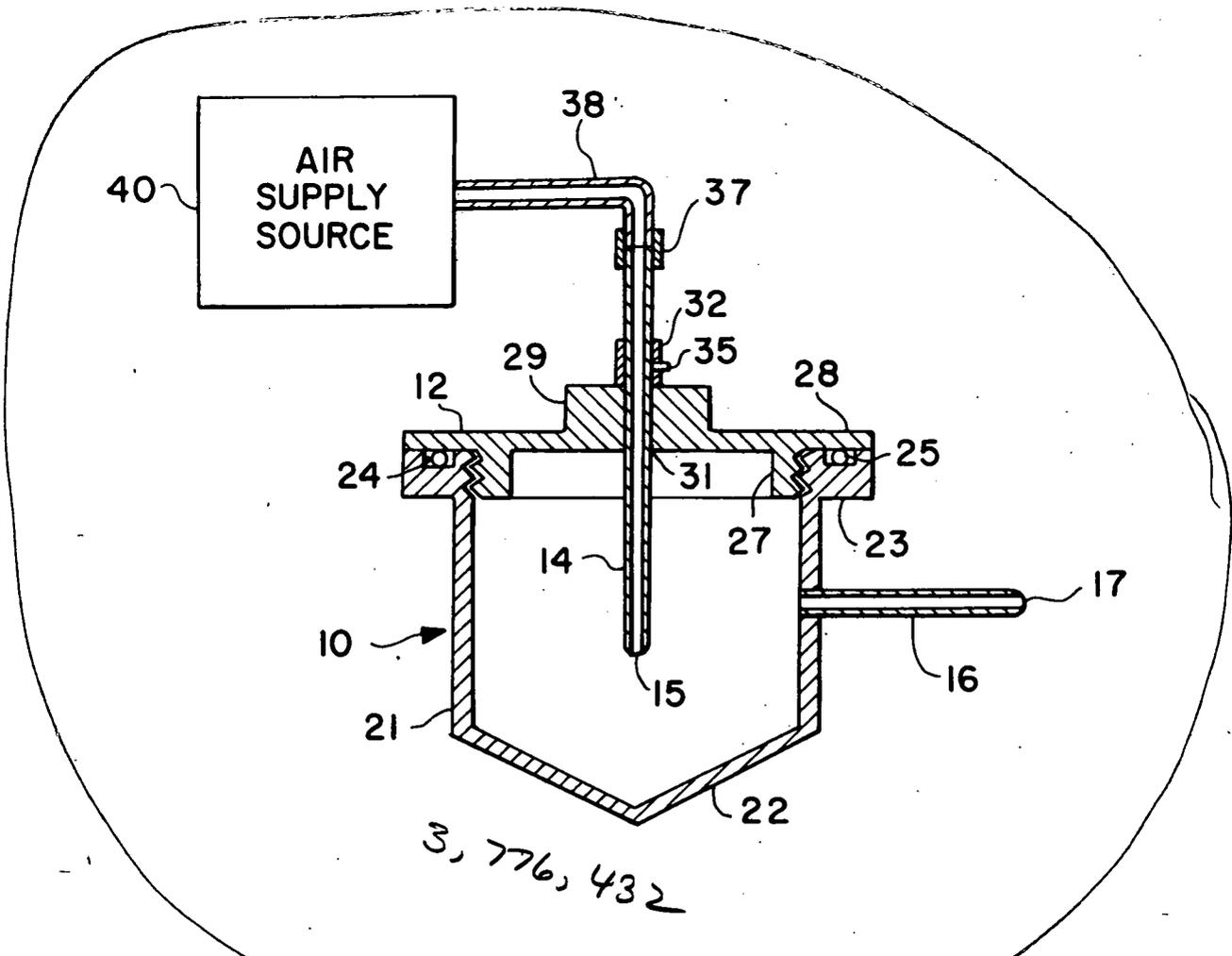
[57] **ABSTRACT**

A lyophilized spore dispenser is provided which produces a finely divided, monoparticulate cloud of bacterial spores. The spores are contained within a tightly sealed chamber and a turbulator orifice connected to an air supply source provides a jet of air which stirs up the spores and causes the spores to be suspended in eddy currents within the chamber. This air jet also produces a positive pressure within the chamber which forces the spores out of an injection orifice.

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2 Claims, 2 Drawing Figures



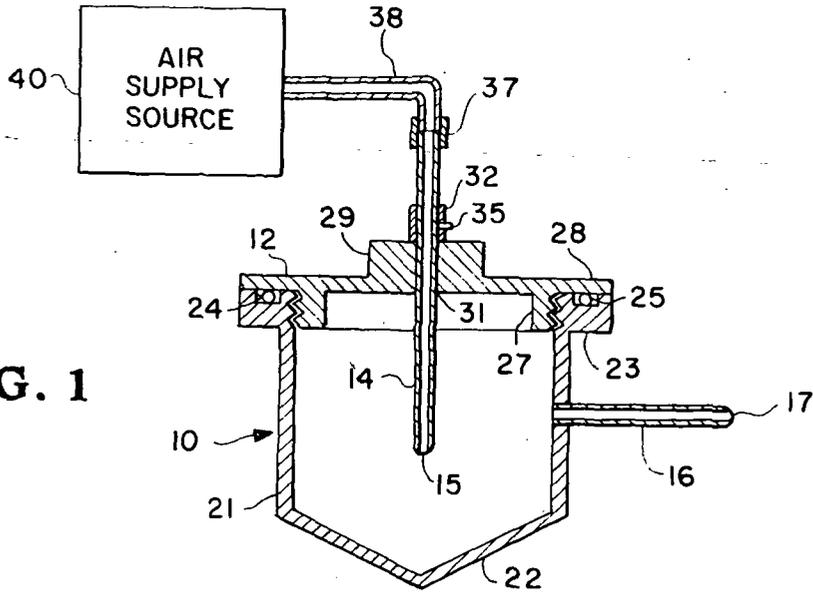


FIG. 1

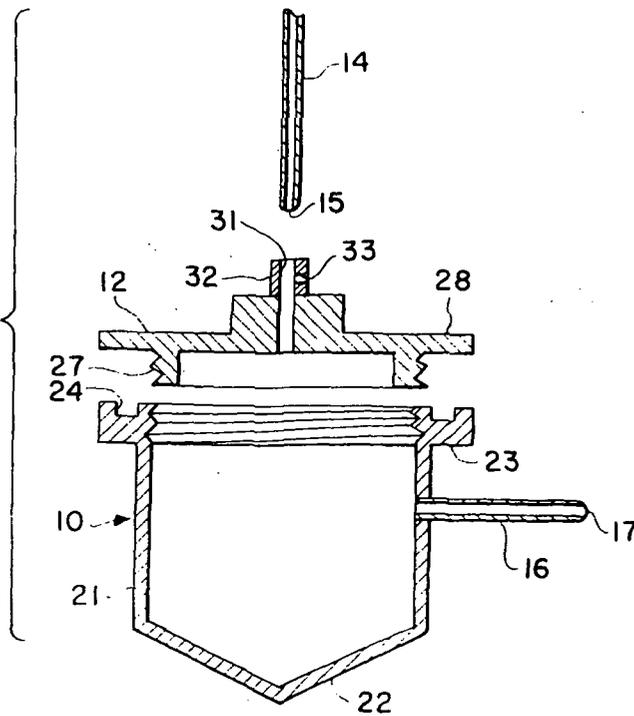


FIG. 2

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LYOPHILIZED SPORE DISPENSER

ORIGIN OF THE INVENTION

The invention described herein was made by an employee of the United States Government and may be manufactured and used by or for the Government for governmental purposes without the payment of any royalties thereon or therefor.

FIELD OF THE INVENTION

The present invention relates to the dispensing of dry spores and more particularly to a lyophilized spore dispenser for dispensing such spores in a finely divided, monoparticulate cloud.

BACKGROUND OF THE INVENTION

The dispensing of lyophilized or freeze-dried spores for laboratory and other purposes presents a number of difficulties particularly where the spores are to be dispensed in a finely dispersed monoparticulate cloud. For example, the dried spores are difficult to handle and it is difficult to prevent the formation of a multiparticulate, in contrast to monoparticulate, output spray.

In accordance with a technique used in the past, a modified spray can, such as used for insect spray, has been utilized with distilled water as the conveying medium, the spores being suspended in the water within the spray can and dispensed therewith. This technique suffers several serious disadvantages. Firstly, the lyophilized spores are afforded undesired protection from degrading elements because of the moisturizing effect of the water conveying medium. Further, when the aerosol of spores and water comes into contact with a surface, tiny droplets are formed which tend to puddle and run. In addition, multiparticulate aerosols or clouds are produced.

SUMMARY OF THE INVENTION

In accordance with the present invention, a dispenser for lyophilized spores is provided which overcomes these and other disadvantages of the prior art. The dispenser of the invention permits the formation of a finely divided, monoparticulate cloud or spray of bacterial spores which can be sprayed into an atmosphere or onto a surface at a desired rate.

According to a presently preferred embodiment thereof, the dispenser comprises a hopper chamber wherein the spores to be dispensed are contained, the chamber being formed by an open-receptacle preferably having a screw-on cap or cover and being sealed by an O-ring captured in a groove between the receptacle and the cap when the cap is screwed on. A "turbulator" orifice formed in a tube which extends into the chamber is connected to a supply of a gas, such as air, under pressure. The gas is released through the orifice in the form of a jet which causes the spores to become suspended in the eddy currents produced within the chamber. Further, the jet also provides the necessary positive pressure within the chamber to force the spores out of an outlet or injector orifice.

The depth to which the turbulator extends into the chamber may be varied and wrenching flats provided on the cap ensure, together with the O-ring, that the chamber is tightly sealed.

Other features and advantages of the invention will be set forth in or apparent from the description of a preferred embodiment thereof found hereinbelow.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional view of a spore dispenser in accordance with a presently preferred embodiment; and

FIG. 2 is a sectional view similar to FIG. 1 but is exploded to illustrate the various components of the dispenser.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring to FIGS. 1 and 2, a spore dispenser particularly useful in dispensing lyophilized spores is shown. The dispenser comprises a hopper chamber generally designated by reference numeral 10 having an associated screw cap or cover 12 and including an inlet or turbulator tube 14 and an outlet or injector tube 16.

Hopper chamber 10 is preferably generally cup-shaped in cross section and in the specific embodiment under consideration includes a cylindrical side wall 21 and conical base 22. An outwardly extending peripheral flange 23 includes an O-ring groove 24 in the upper surface thereof whereas the upper portion of the internal chamber of cylindrical side wall 21 is threaded as shown to permit cap 12 to be screwed onto chamber 10.

Cap 12 includes a downwardly extending generally cylindrical flange 27 which is externally threaded so to provide engagement between cap 12 and hopper 10 as mentioned above. An outwardly extending portion 28 of cap 12 covers O-ring groove 24 and an O-ring 25 received in groove 24 provides sealing between cap 12 and hopper 10. A shoulder 29 on screw cap 12 is machined to provide "flats" so as to facilitate wrenching of cap 12, thereby ensuring that cap 12 is tightly screwed onto chamber 10.

A central bore 31 through cap 12 is adapted to receive turbulator tube 14 therein. Bore 31 extends through an upper tube guide 32 which is drilled and tapped at 33 to permit insertion of a set screw 35 therein. It will be appreciated that tube 14 is movable within bore 31 and set screw 35 enables tube 14, and hence orifice 15 thereof, to be fixed in a desired position within hopper 10.

As illustrated in FIG. 1, turbulator tube 14 may be provided with a suitable fitting, indicated schematically at 37, to permit connection of tube 14 to a supply hose 38 of an air supply source indicated at 40. In a specific example, turbulator tube 14 has an outside diameter of one-eighth inch and orifice 14a is 0.020 inch in diameter.

Injector tube 16 extends outwardly from the side wall 21 of hopper 10 and terminates in an orifice 17 through which spores from within hopper chamber 10 are dispensed. In an exemplary embodiment, the dimensions for injector tube 16 may be the same as those given for turbulator tube 14.

Considering the operation of the spore dispenser of the invention, hopper chamber 10 is filled with suitable spores and cap 12 is screwed thereon, O-ring 25, as mentioned, providing sealing fit. Air supplied through turbulator 14 is released through orifice 15 in the form of a high velocity jet so as to cause the lyophilized spores to become suspended in the chamber 10. This jet of air also provides positive pressure within chamber 10 so that the spores are forced into injector tube 16. The orifice 17 of injector tube 16 regulates the flow from chamber 10 into or onto the desired medium.

In an alternative embodiment of the invention the turbulator tube could be located on the side of the hopper chamber with the orifice tangent to the inside wall thereof, so as to promote turbulence within the chamber. Further, multiple turbulator orifices fed from a common manifold could be utilized to possibly improve the suspension of the spores within the chamber. It will be understood that these examples are in no way intended to be exhaustive and, of course, variations and modifications other than these specific examples can also be effected without departing from the scope and spirit of the invention.

I claim:

- 1. A spore dispenser particularly for use in dispensing lyophilized spores in a finely dispersed monoparticulate output spray comprising:
 - a cylindrical hopper containing the spore material to be dispensed;
 - said cylindrical hopper being sealed at one end thereof and having a removable cover at the other end thereof to permit ready access to the hopper interior for inserting the spores therein that are to be dispensed;
 - said removable cover being provided with at least one opening therethrough;
 - a turbulator tube having a first open end extending through said removable cover into said hopper and a second open end exterior of said hopper and in fluid connection with a source of pressurized gas;
 - means for adjusting the depth to which said first open end of said turbulating tube extends into said hopper;
 - said means for adjusting the depth to which said first open end of said turbulator tube extends into said hopper includes a tube guide circumferentially disposed about said turbulator tube exterior of and in intimate contact with said removable cover;
 - said tube guide being provided with at least one set-screw therein for selective contact with said turbulator tube to permit the adjustment thereof within said hopper, and

an injector tube extending outwardly from the side wall of said hopper with one end thereof being an open nozzle for dispensing spores and the other end thereof extending through and communicating with the interior of said hopper;

whereby when lyophilized spores are introduced into said hopper and said removable cover is secured thereto said turbulator tube is connected to said source of pressurized gas such that the gas flowing through said turbulator tube forms a high velocity jet causing the spores to become suspended within said hopper and creates a positive pressure within said hopper forcing the suspended spores out through said injector tube nozzle in a finely dispersed monoparticulate output spray.

- 2. A method for dispensing lyophilized spores in a finely dispersed monoparticulate output spray comprising:
 - confining the spores to be dispensed within a dispensing hopper;
 - providing a high pressure gas source leading into the dispensing hopper and an outlet orifice leading out of the dispensing hopper; and,
 - dispensing the spores out of the dispensing hopper through the outlet orifice by the introduction of high pressure gas into the dispensing hopper so as to cause a turbulent movement of the confined spores and so as to create a positive pressure within the dispensing hopper and thereby force the spores out the outlet orifice in a finely dispersed monoparticulate output spray.
 - dispensing the spores out of the dispensing hopper through the outlet orifice by the introduction of high pressure gas into the dispensing hopper so as to cause a turbulent movement of the confined spores and so as to create a positive pressure within the dispensing hopper and thereby force the spores out the outlet orifice in a finely dispersed monoparticulate output spray.

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