

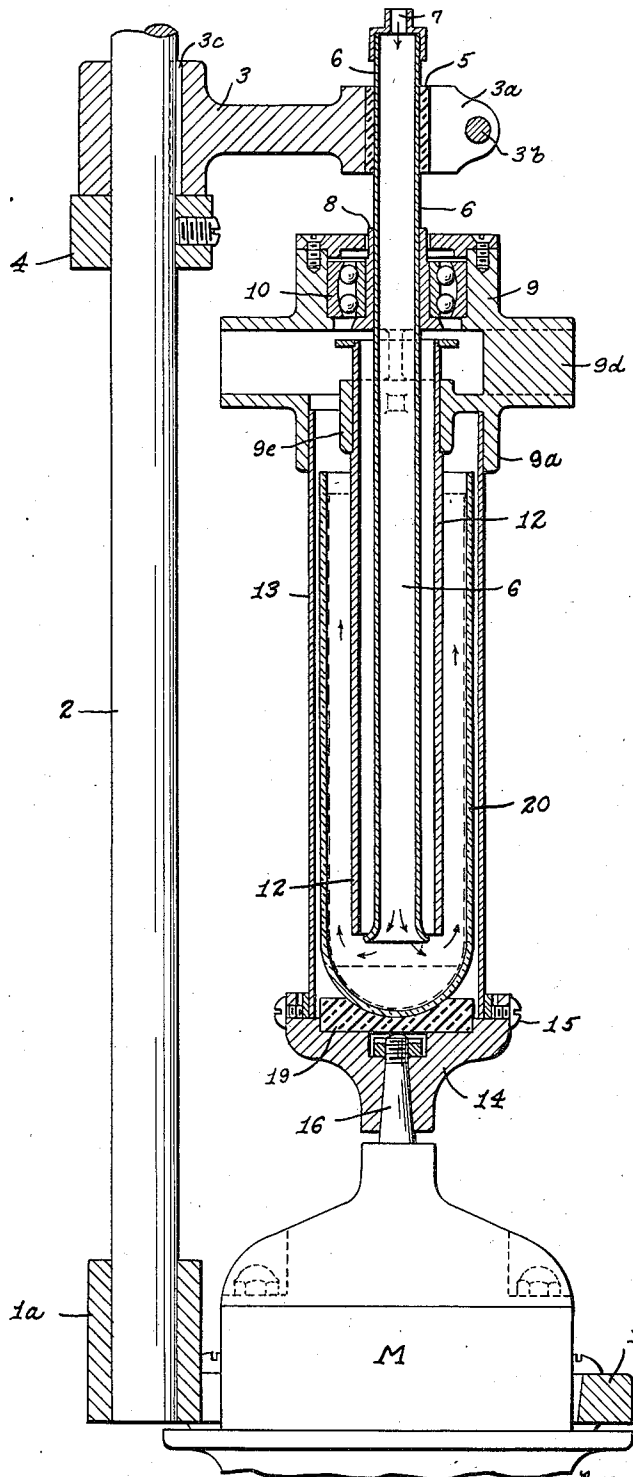
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BACTERIAL ANALYSIS OF GASEOUS BODIES

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BACTERIAL ANALYSIS OF GASEOUS BODIES

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1 Claim. (Cl. 209—144)

This invention relates to the analysis of air or other gaseous bodies containing bacteria or other minute foreign bodies or particles which it is desired to separate from the gaseous body, either for the purpose of obtaining a quantitative count or for other purposes of examination, comparison and analysis.

Methods heretofore used for attempting such analyses have been relatively slow, cumbersome and inefficient beside requiring the setting up of cumbersome apparatus in locations that were often inconvenient for the purpose. The present improvement is intended to expedite the making of such tests or analyses and the collecting of a higher percentage of bacterial content and is so simple in character that it can be readily carried out by a simple self-contained portable apparatus capable of use in any locality where it may be desired to analyze or test the solid content of the air present.

Generally speaking, the present improvement is characterized by the flowing of a measured volume of air that is subjected to centrifugal force along the inside of a tubular collecting medium or film and depositing, through centrifugal action, upon successive areas of said collecting medium, selectively distributed heavier-than-air particles in a fixed arrangement that permits their being subjected to subsequent examination and analysis. When it is desired to ascertain the bacterial count, the collecting medium or film will preferably be in the nature of a cultural medium, such for example as a gelatinous body or substance that is more or less fluid when heated, but which stiffens as it cools into a substantially fixed or jelly-like film. A very common cultural substance for such purpose is the well known agar. This kind of substance has the advantage of becoming fluid when heated so that when placed in a revoluble container like a test tube, for example, it will build up under the action of centrifugal force due to the revolution of the container into a thin layer or film against which the centrifugally expelled particles present in the air are expelled, while owing to the loss of heat the substance congeals or sets into a thin sheet or film which retains the particles in fixed position and relationship convenient for later examination and study. But it will be understood that I do not confine myself to this particular type of collecting medium. Since in a quantitative analysis not only must the quantity of deposited material be known but also the volume of air from which the extracted material is taken must be known, it will be un-

derstood that the volume of air must be measured or controlled for the purpose of effecting the desired analysis. Hence, the volume of air subjected to analysis is conveniently determined by the use of a calibrated intake of known capacity.

These and other features of the invention will be described in the following specification and will be defined in the claim hereto annexed.

To conveniently and expeditiously carry out my improved process I have devised a special form and construction of centrifuge which forms the subject matter of a companion application and in the accompanying drawing there is illustrated such an apparatus shown in central vertical section.

It should be understood that the process involves not merely the centrifugal separation of the foreign particle content from the air, but also the deposit of such particles in such an arrangement that they may be conveniently subjected to further study and experiment and this is a very important characteristic of the present invention.

Accordingly, the apparatus designed for facilitating the desired analysis embraces a central air intake tube 6, which for convenience is mounted in a supporting bracket 3 which has a splined connection at 3^c to permit vertical adjustment and which is maintained at the desired elevation on the standard 2 by means of an adjustable supporting collar 4, which has a set screw for clamping it at any desired level on the standard 2, which standard is mounted in a socket 1^a of a base member 1 in which is positioned the driving motor M. The laterally projecting portion of the bracket 3, that engages the air intake tube 6, is provided with a vertical bore and has its outer end split to form clamping jaws 3^a, the bore being provided with a packing ring or bushing 5 which can be securely clamped around the intake tube by means of the clamping screw 3^b which draws together the jaws 3^a. As the intake tube is to form the support for the centrifuge it is provided near its upper end with a flanged collar 8, which carries an antifriction bearing element 10 which in turn revolubly carries the hollow head 9 provided with radiating vanes 9^d and a downward annular extension 9^a which receives the upper end of a cylindrical casing 13, whose lower end is clamped by means of set screws 15 inside of a driving head 14, which is mounted on and fastened to the upwardly projecting driving spindle 16 of the motor.

As it will often be desired to use a container in the form of a glass test tube 20, the driving

and supporting head 14 is provided with a shock-absorbing cushion 19 upon which the bottom of the container may rest, the container being slightly smaller than the surrounding casing 13 to facilitate easy insertion.

The revoluble vane-carrying head 9 is provided with a centrally bored spider 9^e in which is secured a tubular member 12, which surrounds the air intake tube 6 and thus provides an elongated annular space for the passage of the column of air along the inside wall of the container 20.

Since any quantitative analysis of the foreign particle content of the air being tested necessitates knowledge as to the quantity of air examined, as well as the quantity and character of the material extracted therefrom, I have provided a calibrating nozzle 7, which is detachably fixed to the intake end of the air inlet conduit 6, thus permitting the use of calibrating nozzles of different capacity. With a known speed of revolution of the motor and the known capacity of the intake nozzle, an accurate determination of the volume of air being tested in a given period of time can be made.

In practice the clamping screws 15 are released and the bracket 3 is raised carrying with it the revoluble head and the cylindrical casing 13. The test tube or container 20 is then inserted through the lower end of the casing 13, following which the centrifuge is dropped and the lower end of the casing 13 again coupled or fastened to the driving head 14. The collecting film or lining, if of permanent form, will have been inserted in the container before the container is inserted in the centrifuge, but when it is desired to use a cultural medium of fusible material the material in melted condition or liquid form is poured hot into the bottom of the test tube and as soon as the motor is started this fluid material builds up in a thin film on the inside wall of the container, as illustrated in the drawing, care being taken to introduce the proper quantity to form a film for practically the entire length of the inside wall of the container.

The air vanes 9^d of the revolving head create a suction drawing air through the calibrating nozzle 7 of the intake tube 6 through the open lower end thereof, which column of air in tubular form passes through the annular space separating the tube 12 from the inside of the container. Since both the partition tube 12 and the container 20 revolve together, the inflowing air is given a whirling or revolving movement so that the

heavier-than-air particles are centrifugally thrown against the collecting film or sheet on the inside of the container. Furthermore, since the speed of revolution of the air particles accelerates as they rise toward the open end of the container, it is evident that the greatest centrifugal force is exerted on the column of air and its content at the upper end of the container, while the centrifugal action is weakest at the bottom of the container. The result is that the larger or heavier particles are deposited in the lower area of the collector, while increasingly finer particles will be deposited progressively on successive areas from the bottom to the top, thus giving a selective distribution of the particles graded substantially according to the mass of the individual particles.

When the centrifuge has been operated for the desired period of time, the machine is stopped, uncoupled from the motor and the container and collector is removed to permit microscopic or other study and analysis of the particles that have been deposited on the different areas of the collecting film.

Where bacterial growth is to be studied and analyzed, a glass test tube with the collector in the form of a film of cultural material on its inside is well adapted to that purpose, since the bacterial growth and count can be observed through the transparent glass. In other cases, however, a thin film of celluloid or other suitable material may be slipped inside the container to serve as a collector for the centrifugally expelled particles and after its removal from the centrifuge such container may be laid out flat and subjected to microscopic analysis and study.

What I claim is:

The improvement in the art of air analysis which comprises forming a predetermined volume of normally congealable material while in a liquid state by centrifugal action into a tubular collecting film, passing a tubular column of air in an axial direction through said tubular film while rotating said film at sufficiently high speed to impart sufficient revolution to said column of air to centrifugally expel heavier than air particles carried by said air column and collecting in a fixed distribution such particles upon said film, thereby permitting the subsequent examination and count of said particles after any desired interval of time.

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