

[54] MICROPIPETTING APPARATUS

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[51] Int. Cl. B011 3/02

[58] Field of Search 222/263; 73/425, 4 R, 73/425.4 P, 425.6; 141/21, 25, 26, 27

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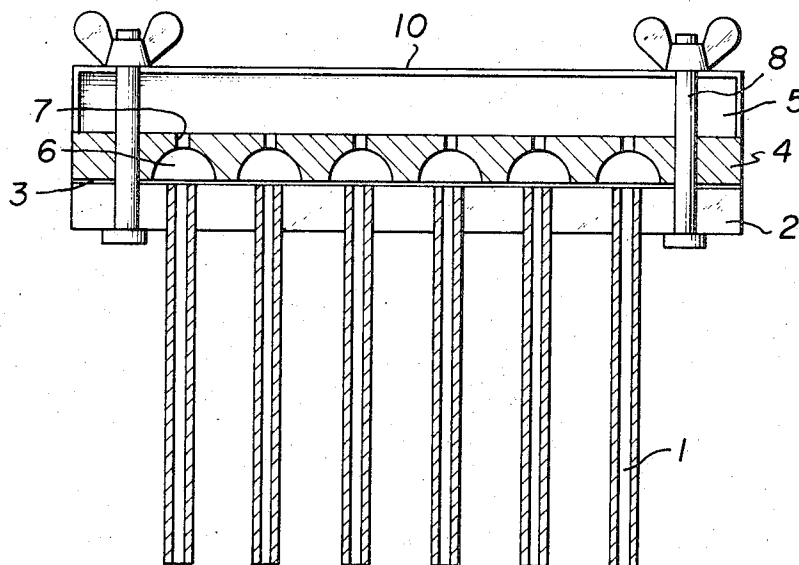
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ABSTRACT

Apparatus for withdrawing minute quantities of a liquid medium into a liquid collecting apparatus. The so-obtained liquid medium is then transferred from the liquid collecting apparatus into a vessel containing another medium which interacts with the liquid medium collected to give information about the latter.

7 Claims, 3 Drawing Figures



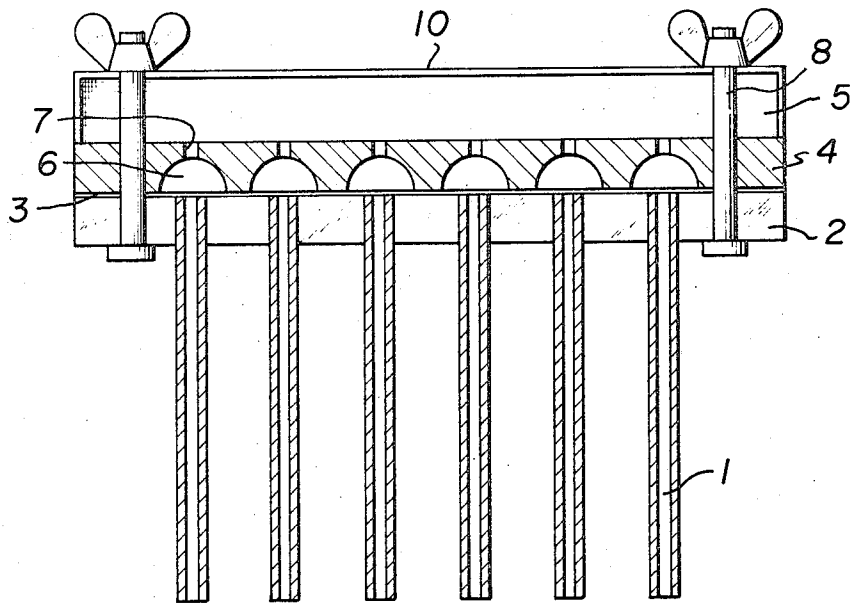


FIG. 1

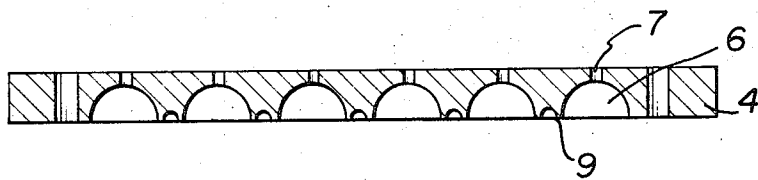


FIG. 2

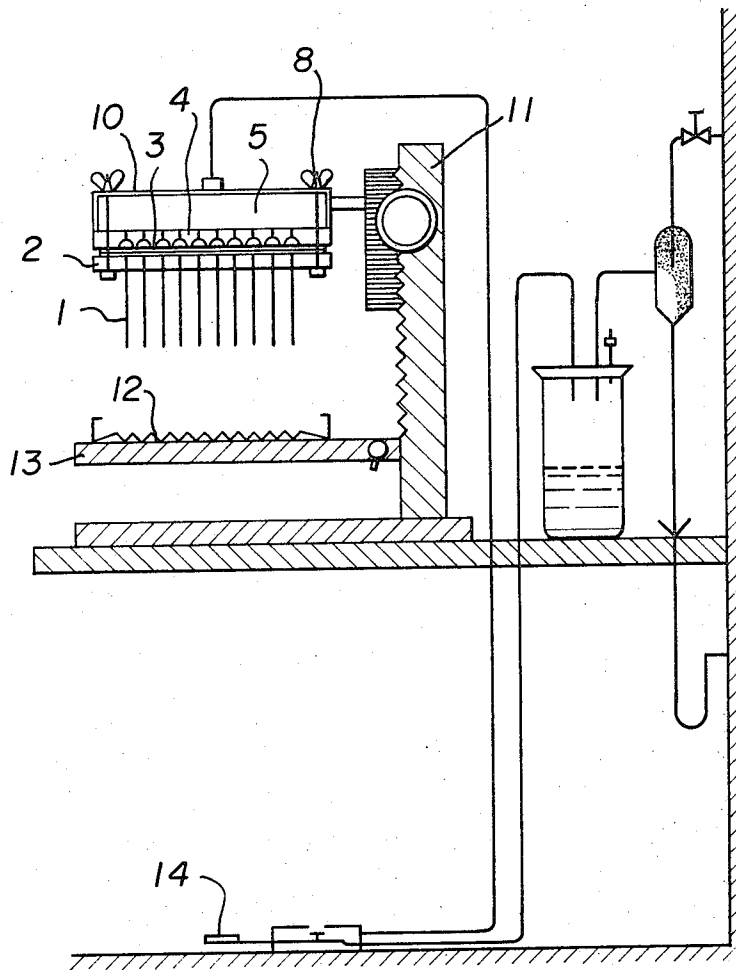


FIG. 3

MICROPIPETTING APPARATUS

DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to a micropipetting apparatus. More particularly, it relates to a micropipetting apparatus adapted to simultaneously withdraw from a liquid containing vessel, very small samplings of a liquid, which samplings are substantially all of equal volume and are of a very small magnitude, i.e., of the order of a microliter.

Pipetting apparatuses which are capable of simultaneously withdrawing a plurality of samples of liquid to be pipetted are known. Such known apparatuses, however, are generally suitable for withdrawing amounts of liquid in excess of 25 microliters. In many instances, 25 microliters is much more than the amount needed and, thus, more liquid is withdrawn from the liquid-containing medium than is needed for an intended purpose. Hence, waste of liquid and inefficiency result.

The disadvantages in utilizing more liquid than is needed for study is particularly apparent in such fields as, for example, research with tissue cultures. In this field, because of the high expenses incurred in obtaining the liquids, amounts in the order of magnitude of a microliter are most preferably utilized for study.

With the general desire for miniaturization, there now exists the need for a pipetting apparatus of simple construction and yet which is suitable for the simultaneous pipetting of a plurality of equal amounts of liquid in the order of magnitude of about a microliter.

This desideratum is achieved by the micropipetting apparatus provided by the present invention which comprises a number of cannulas fastened to a carrier plate and a pump membrane fitted over the carrier plate, the pump membrane being in communication with a suction chamber by means of a perforated plate provided with indentations which are disposed in such a way that they each register with a cannula and determine the volume of the liquid which is to be pipetted.

The micropipetting apparatus provided by the present invention will now be described with reference to the accompanying drawings in which:

FIG. 1 is a sectional view of the cannula plate;

FIG. 2 is a sectional view of a part of a cannula plate;

FIG. 3 is a complete view of the micropipetting apparatus.

The micropipetting apparatus comprises a cannula plate 10 shown in FIG. 1 made of stainless steel material which consists of a carrier plate 2 having 60 cannulas 1 secured thereto. The cannulas are all of equal dimensions and are disposed on plate 2 in staggered relationship in six rows, each containing 10 cannulas.

Over the carrier plate 2, there is situated a flat pump membrane 3 which is made, for example, of rubber or of any suitable elastic synthetic material. The membrane 3 is supported on a plate 4 having 60 indentations 6. The transverse axis of each indentation 6 and the longitudinal axis of each of the cannulas are disposed along substantially the same line. In communication with each indentation is an opening 7. Opening 7 is disposed between pump membrane 3 and suction chamber 5. The indentations 6 are all of the same volume, i.e., of the order of magnitude of a microliter.

Fastening means is utilized to secure membrane 3 between plates 2 and 4 and section chamber 5 to plates 2 and 4 as shown in FIG. 1. Any suitable securing means of the type shown in FIG. 3 may be utilized as the fastening means.

In order to withdraw samples, the suction chamber 5 is placed under vacuum in a conventional manner, whereby an adjacent portion of the membrane is sucked into each indentation 6. An aliquot of liquid, which corresponds to the volume of an indentation 6 is withdrawn from a liquid containing vessel into each cannula.

In order to deliver the liquid samples to a liquid receiving vessel, it is sufficient to place the suction chamber under pressure again.

In a preferred embodiment of the micropipetting apparatus provided by this invention (FIG. 2), the plate 4 is provided with small additional indentations 9 which serve to improve the separation of the protrusions produced in the membrane by the suction.

FIG. 3 is a view of a preferred embodiment of the micropipetting apparatus provided by the present invention. The micropipetting apparatus shown in FIG. 3 can be operated as follows:

The microtitration plate 12, which has 60 recesses filled with 60 culture media, is placed on a carrier plate 13. The cannulas 1 of the cannula plate are then lowered until they are each immersed in the culture media. By means of a foot pedal 14, the suction chamber 5 is placed under vacuum and 60 samplings are drawn into each of the respective cannulas. The microtitration plate 12 is removed and an agar plate or a plate having another nutrient medium thereon, is placed under the cannula plate 10. The vacuum condition which have been imparted to the suction chamber 5 is removed, whereby the liquid in the cannulas is discharged under the influence of gravity onto an agar plate or the like.

We claim:

1. A micropipetting apparatus for pipetting a liquid comprising a liquid receiving cannula secured to a carrier plate and extending downwardly from the underside thereof, the upper end of said cannula extending to the upperside of the carrier plate, a pump membrane disposed over the upperside of said carrier plate, a second plate provided with an opening overlying the pump membrane, said opening being in registry with said upper end of said cannula, said opening being provided by an indentation and a bore in a second plate in axial alignment and in communication with each other, said indentation extending from the surface of the side of said second plate overlying the pump membrane to a point between the last mentioned surface and the surface of the upperside of the second plate, said bore extending from the surface of the upper side of said second plate to said point, the diameter of the portion of the bore at the surface of the upper side of the second plate being less than the diameter of the portion of the indentation at the surface of the side of the second plate overlying the pump membrane, means for moving the pump membrane so that a portion thereof is drawn into said indentation in the second plate whereby withdrawal of a predetermined amount of said liquid into said cannula occurs.

2. A micropipetting apparatus as defined in claim 1 which comprises a plurality of cannulas and openings whereby a plurality of substantially equal amounts of

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said liquid is withdrawn from said vessel containing said liquid.

3. A micropipetting apparatus as defined in claim 2 wherein the means for moving the pump membrane is provided by a suction chamber overlying the pump membrane.

4. A micropipetting apparatus as defined in claim 3 wherein the plurality of cannulas are disposed in a staggered relationship.

5. A micropipetting apparatus for pipetting a liquid comprising a liquid receiving cannula secured to a carrier plate and extending downwardly from the underside thereof, the upper end of said cannula extending to the upperside of the carrier plate, a pump membrane disposed over the upperside of said carrier plate, a second plate provided with an opening overlying the pump membrane, said opening being in registry with said

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upper end of said cannula, means for moving the pump membrane so that a portion thereof is drawn into said opening in the second plate whereby withdrawal of a predetermined amount of said liquid from a vessel containing said liquid into said cannula occurs and wherein the opening in the second plate comprise a large opening in the side of the plate adjacent the pump membrane and a smaller opening extending therefrom, the upper end of said smaller opening being in communication with a suction chamber.

6. A micropipetting apparatus as defined in claim 5 wherein the magnitude of the liquid drawn into the cannula is of the order of a microliter.

7. A micropipetting apparatus as defined in claim 5 wherein the magnitude of the liquid drawn into the cannula is of the order of a microliter.

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UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 3,807,235
DATED : April 30, 1974
INVENTOR(S) : IVAN LEFKOVITS AND OTTO KAMBER

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Cover page, after "[21] Appl. No.: 295,646" insert:

[30] Foreign Application Priority Data

October 13, 1971

Switzerland

No. 14,907/71

Signed and Sealed this

twenty-second Day of June 1976

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

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