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Strande

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[54] **DEVICE FOR TAKING SAMPLES OF THE CONTENTS OF CAPILLARY TUBES**

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[52] **U.S. Cl.** ..... **73/423 A,** 23/253, 23/259, 141/65

[51] **Int. Cl.** ..... G 01n1/14

[58] **Field of Search** ..... 141/7, 8, 65, 66, 141/130; 23/253, 259; 73/422 GC, 423 A

[56] **References Cited**

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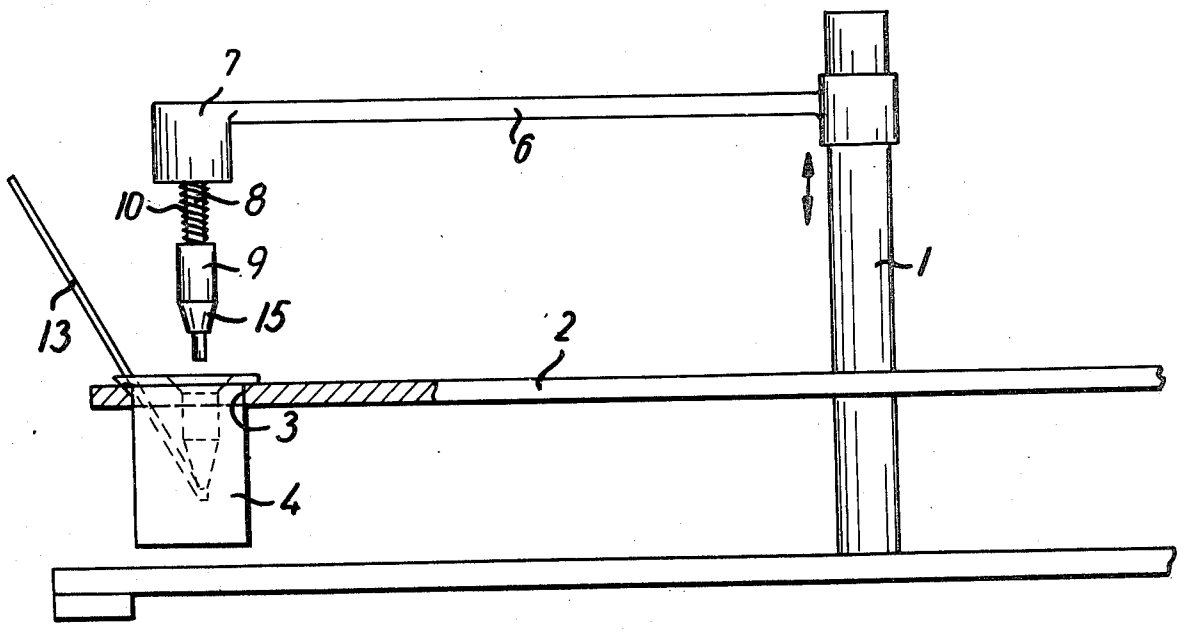
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Primary Examiner—Houston S. Bell, Jr.
Attorney—Richard K. Stevens et al.

[57] **ABSTRACT**

When taking samples of liquids contained in capillary tubes a block is used having a first bore of a diameter corresponding substantially to the external diameter of the capillary tubes and a second bore of a greater diameter. The two bores terminate in the block at the same position where they are in communication with each other. The capillary tube is introduced into the first bore and sealed in relation to the block and a suction tube is introduced into the second bore, where this tube is also sealed in relation to the block, which functions as a coupling member between the capillary tube and the suction tube the ends of which are very close to each other in a very small cavity within the block. Sealing rings may be present in the bores or the block may be of an elastic rubber-like material, whereby this material in itself provides the required sealing.

8 Claims, 5 Drawing Figures



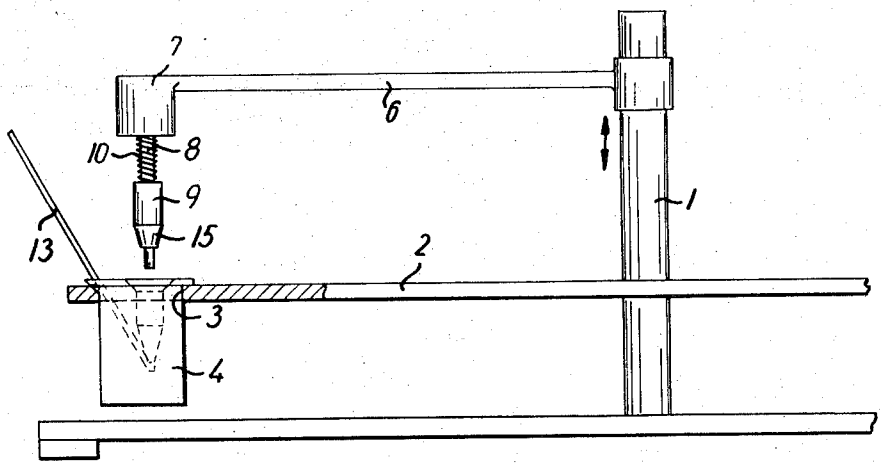


FIG. 1

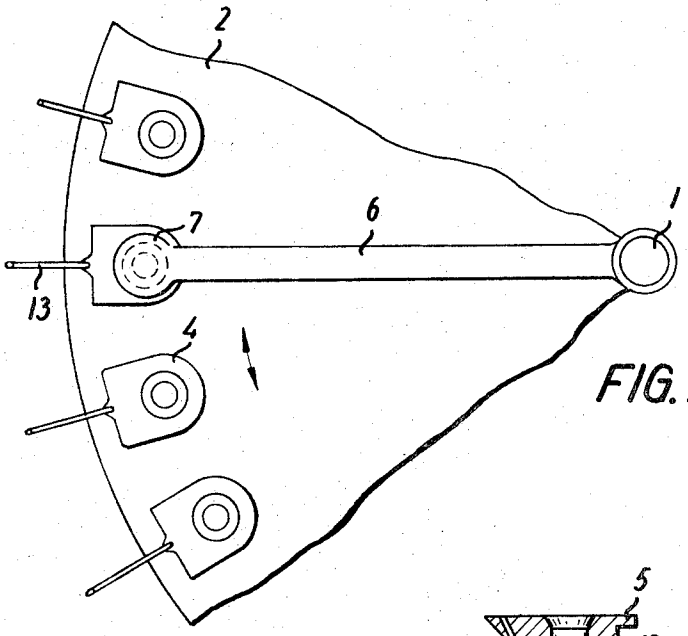


FIG. 2

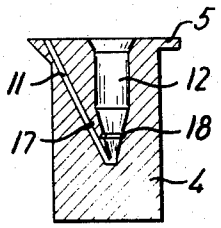


FIG. 5

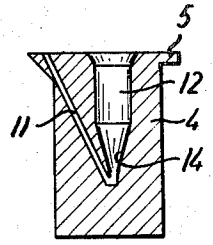


FIG. 3

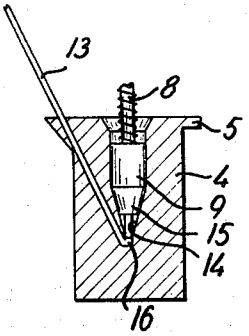


FIG. 4

DEVICE FOR TAKING SAMPLES OF THE CONTENTS OF CAPILLARY TUBES

The present invention relates to a device for taking samples of the contents of capillary tubes.

In the past such samples have normally been taken by introducing the sampling device into the capillary tubes. This is a troublesome and time-consuming procedure which does not lend itself well to automation.

Another possibility is to blow the sample out of the tube, but in that case it is difficult to obtain a prescribed volume of the sample and it does not either lend itself well to automation.

It is an object of the present invention to provide a device by which an exact volume of the liquid present in the capillary tube can easily be extracted from the tube.

It is another object of the invention to provide a device which can easily be automated so that the extraction of samples can be made more or less without human intervention.

It is a further object of the present invention to facilitate manual sampling and alleviate the risk of breaking the capillary tubes.

To obtain these objects and further objects described more in detail below use is made of a block having a first and a second bore. The first bore is of a diameter corresponding substantially to the external diameter of the capillary tubes and it terminates in the interior of the block. The second bore likewise terminates in the block and its end is positioned at the same place as the end of the first bore. A suction tube of a suction device is introduced into the second bore and there is provided a tight sealing between the suction tube and the material of the block either by means of a sealing ring or by virtue of the fact that the block is of an elastic rubber-like material. Such a tight sealing is also provided between the capillary tube and the block, either by means of a sealing ring or because of the material of the block. The ends of the capillary tube and the suction tube are very close to each other in the interior of the block and are surrounded by a coupling space of very small dimensions provided in the block at the place where the first and second bores meet. When a sub-atmospheric pressure is provided in the suction tube, a volume of the liquid present in the capillary tube will be sucked into the suction tube.

The present invention will now be described more in detail with reference to the accompanying drawing, showing embodiments of the device and block according to the invention.

In the drawing

FIG. 1 shows a part of a device according to the invention as seen from the side and partly in section,

FIG. 2 shows a plan view of the same device,

FIG. 3 a resilient block to be used in the device,

FIG. 4 the same block in which the capillary tube and the suction tube have been introduced, and

FIG. 5 a block having sealing rings.

The device shown in FIGS. 1 and 2 comprises a column 1 around which a turn-table 2 is rotatable. Along the circumference of the turn-table are a number of rectangular apertures 3 to accomodate resilient blocks 4 shown in greater detail in FIGS. 3 and 4.

Each block has an upper flange 5 which comes to rest on the upper surface of the turn-table 2, when the blocks are inserted in the apertures 3.

The column 1 also carries a jib 6 movable vertically in the column 1. At the other end of the jib 6 there is a suction device 7 comprising a suction tube 8 having near its lower end a suction head 9. The suction tube protrudes a short distance below the suction head.

The suction tube 8 is movable upwards in the suction device 7 against the action of a spring 10. Therefore, if upon movement downward of the jib 6 in the column 1 the movement on the suction tube or the suction head is impeded by some element or other then upon a continued movement downward of the jib 6 the suction tube or suction head will engage that element elastically.

Each block 4 has two bores 11 and 12. The bore 11 has a diameter corresponding to the external diameter of capillary tubes 13 containing a liquid from which samples are to be taken. The blocks are made from a material which will provide a tight sealing between the capillary tube inserted in the bore 11 and the block. The material which is preferably mouldable, may be an elastic rubber-like material, e.g., silicone rubber.

The second bore 12 is of a diameter which is slightly greater than the diameter of the suction head 9. It ends in a conical surface 14 and the suction head 9 has a corresponding conical surface 15, and when the two conical surfaces are pressed against each other by means of the spring 10 a tight sealing is provided.

The device described functions in the following way.

The capillary tube 13 containing the liquid from which samples are to be taken, is introduced into the bore 11 of the block 4, which is placed in one of the apertures 3 of the turn-table 2.

The turn-table 2 is now rotated in either direction until the first aperture containing a block with a capillary tube is below the suction device 7. The rotation of the turn-table may be effected manually or by driving means not shown on the drawing. In the latter case the stepwise rotation of the turn-table may be effected automatically.

When the first block 4 is below the suction device 7 the jib 6 and thereby the suction device 7, the suction tube 8 and the suction head 9 are lowered, whereby the suction head 9 is introduced and guided in the bore 12 until the conical surface 15 engages the conical surface 14 on the block, after which the continued movement downward of the jib 6 will have the effect that the two conical surfaces are pressed against each other by means of the spring 10.

The ends of the capillary tube 13 and the suction tube 8 situated in the block 4 are now very close to each other and are in open connection with each other via a very small coupling space 16 limited by the material of the block.

When a sub-atmospheric pressure is produced in the tube 8 liquid will be sucked from the capillary tube 11 into the suction tube 8 via the coupling space 16.

The movement up and down of the jib 6 and the suction device 7 may be effected automatically. Instead of moving the jib 6 vertically this element may be stationary on the column 1 and the suction device 7 may be moved up and down. Furthermore, the suction device 7 may be stationary and the suction tube 8 moved in relation thereto. In that case the means for providing an elastic engagement of the two conical surfaces, which is here constituted by the spring 10, may take any other form. Also the turn-table may be moved up and down with the suction device remaining stationary.

In the embodiment described the turn-table **2** is rotatable around the column **1**. As an alternative the "turn-table" may be stationary and the suction device may rotate around the column. Furthermore, the relative movement of the blocks and the suction device need not be a rotation, but can be a linear movement.

If the liquid being sampled is of a type which contaminates the capillary tubes and the blocks, these elements may be used as disposable elements which are discarded after use.

FIG. **5** shows another embodiment of the block which, in this case, need not be of an elastic rubber-like material. Sealing is obtained by means of two sealing rings **17** and **18** embedded in the block and surrounding the axes of the bores **11** and **12** respectively. This block can be used in exactly the same way as the block illustrated in FIGS. **3** and **4**. Thus, it can also be used in the device according to FIGS. **1** and **2**. The modifications above and other modifications obvious to an expert can be made without deviating from the scope of the appended claims.

What I claim is:

1. A device for taking samples of the contents of capillary tubes, comprising a block having a first bore of a diameter corresponding substantially to the external diameter of the capillary tubes and terminating in the interior of the block and having a second bore terminating in the interior of the block at the same place as the first bore and being in communication therewith, suction means to extract the sample from the capillary tube, a suction tube forming part of the suction means, means to introduce the suction tube into the second bore, first sealing means to provide a tight sealing of the capillary tube in relation to the block, and second sealing means to provide a tight sealing of the suction tube in relation to the block.

2. A device as claimed in claim **1**, wherein the first and second sealing means are constituted by sealing rings embedded in the material of the block.

3. A device as claimed in claim **1**, wherein the block is of an elastic rubber-like material, whereby this material in itself constitutes the first and second sealing means.

4. A device as claimed in claim **1**, wherein the suction tube has a first conical surface pointing towards the end of the tube, and wherein the second bore has a correspondingly shaped second conical surface.

5. A device as claimed in claim **4**, further comprising spring means in the suction means to provide an elastic engagement of the first and second conical surfaces when the suction tube is introduced into the second bore.

6. A block to be used when taking samples from the contents of a capillary tube, having a first bore of a diameter corresponding substantially to the external diameter of the capillary tube and terminating in the block, and a second bore of greater diameter than the first bore, terminating at the same place as the first bore and being in communication herewith, comprising a first sealing ring embedded in the block and surrounding the axis of the first bore, and a second sealing ring embedded in the block and surrounding the axis of the second bore.

7. A block of an elastic rubber-like material to be used when taking samples from the contents of a capillary tube, having a first bore of a diameter corresponding to the external diameter of the capillary tube and terminating in the block, and a second bore of greater diameter than the first bore, terminating at the same place as the first bore and being in communication herewith.

8. A block as claimed in claim **7**, wherein the second bore has a conical surface terminating the second bore in the interior of the block.

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