

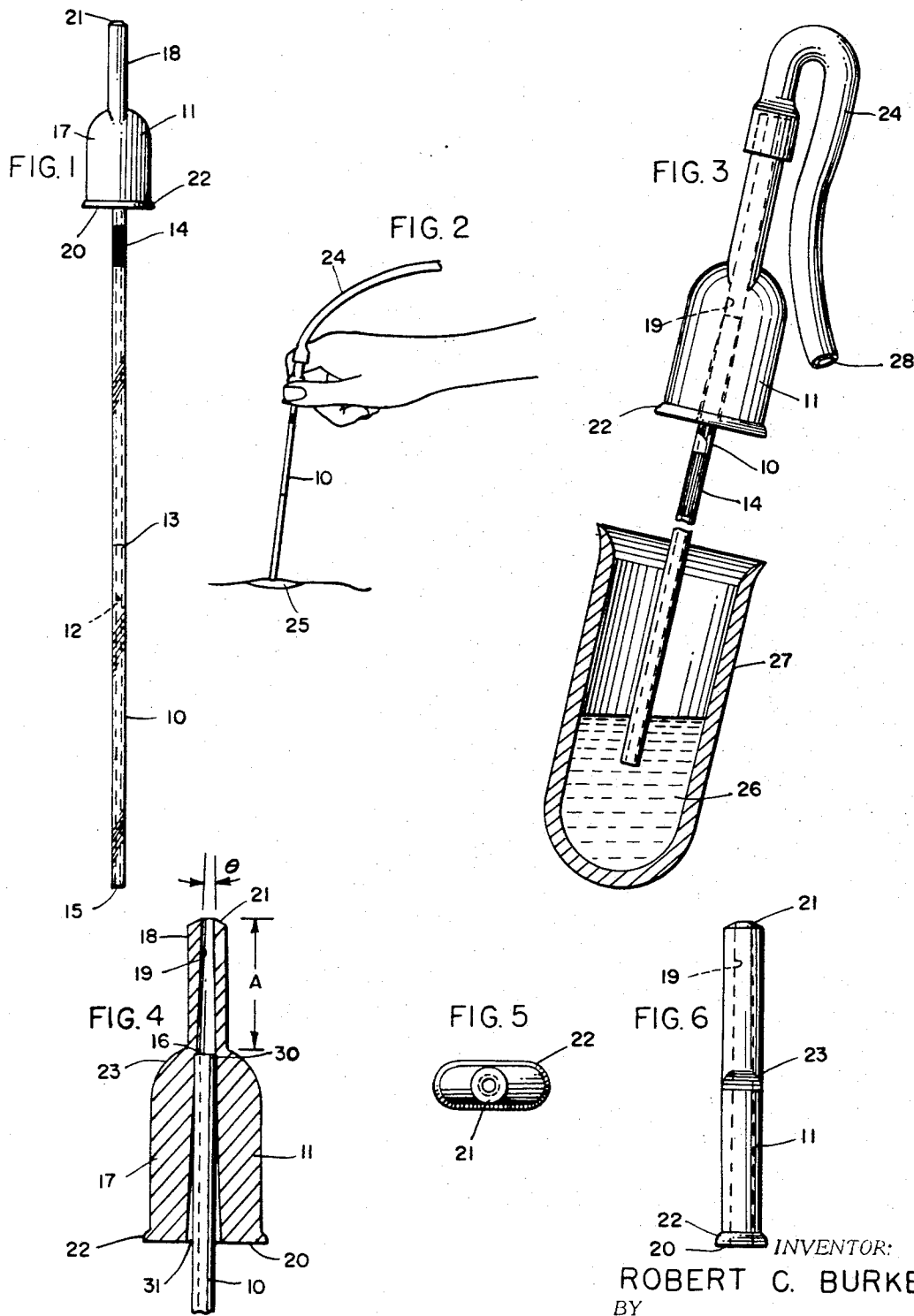
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R. C. BURKE

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CAPILLARY PIPETTE AND ADAPTER-HOLDER THEREFOR

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INVENTOR:
ROBERT C. BURKE
BY

Dawson, Tilton, Falloy, Lungmuir & Alexander
ATT'YS

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3,406,573 CAPILLARY PIPETTE AND ADAPTER- HOLDER THEREFOR

Robert C. Burke, Miami, Fla., assignor to Dade Reagents, Inc., Miami, Fla., a corporation of Delaware
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ABSTRACT OF THE DISCLOSURE

An adapter-holder to be used in combination with capillary pipettes. The adapter is provided with a central tapered bore which receives and frictionally grips the pipette, and the configuration of the adapter facilitates holding of the adapter and pipette in operative positions. The end of the adapter opposite the pipette-receiving end is of relatively small diameter and is received within a piece of flexible tubing. After the pipette is filled with the fluid to be tested, the fluid may be discharged and the pipette rinsed by alternately blowing and sucking on the tubing.

Background of invention

Pipettes are used for a variety of applications where it is desired to draw a measured quantity of liquid and thereafter analyze the liquid. For example, pipettes are used for radioisotope studies, mechanized coagulation techniques, and hematology and clinical chemistry procedures such as hemoglobin and glucose tests and the like. Such pipettes are frequently provided with small diameter bores so that they may be filled by capillary action.

Capillary pipettes are usually either "to-contain" or "to-deliver" pipettes, the former type being calibrated to measure the amount of fluid in the pipette before the fluid is discharged, and the latter type being calibrated to measure the amount of fluid that may be discharged from the pipette. Calibrating "to-deliver" pipettes must therefore require an estimation of the amount of residual fluid which clings to the side of the pipette after the rest of the fluid is discharged.

Good technique in the use of "to-contain" pipettes suggests that the pipette should be rinsed after expelling the sample. The sample is dispelled into a vessel containing a diluent, and thereafter the pipette is rinsed by alternately drawing and discharging a quantity of the diluent-sample solution several times until the concentration of the fluid remaining in the pipette is substantially the same as that of the fluid in the vessel. The number of times the pipette is rinsed is dependent upon the viscosity of the initial sample.

However, the required rinsing step has presented a problem, particularly when the sample is toxic, as is frequently the case in radioisotope or hematological tests. Rinsing is usually accomplished by blowing and sucking on the pipette, and, in order to avoid contamination, it is desirable to attach a length of flexible tubing to one end of the pipette. Capillary pipettes are preferably made of glass, and their outside diameter usually falls within the range of about 1.4 to about 2.2 millimeters. As a result the pipettes are extremely fragile, and not only is inserting them into the rubber tubing difficult and time-consuming, they can easily break during this step. The chance that a technician's hand may be cut by the jagged edge of a broken pipette is particularly hazardous when the sample is toxic.

Further, each different sized capillary pipette would require a different size flexible tubing, and the hospital or clinic would be required to have all of the various sizes of tubing on hand, thereby greatly increasing its inventory cost. It would be particularly advantageous if

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standard medical rubber tubing which is usually available in large quantities wherever the test is to be performed could be used.

Summary of invention

Applicant's invention permits a single sized standard rubber tubing to be used with all sizes of capillary pipettes. The relatively long tapered bore of the resilient holder-adapter receives and grips all capillary pipettes within the usual range of pipette sizes. One end of the adapter is of relatively small diameter and is adapted for ready insertion into a length of flexible tubing and the tubing may be connected to the pipette quickly and without danger of breakage. The technician may grasp the adapter rather than the pipette during the various manipulative operations that are performed during a test, and the possibility of breakage is thereby reduced.

Description of drawing

FIG. 1 is an elevational view of a capillary pipette received within the adapter;

FIG. 2 is an elevational view illustrating the step of drawing a test sample into the pipette;

FIG. 3 is a broken elevational view illustrating the rinsing step;

FIG. 4 is an enlarged fragmentary view of FIG. 1 schematically illustrating the pipette received within the adapter;

FIG. 5 is a top plan view of FIG. 4; and

FIG. 6 is a side view of the adapter of FIG. 4.

Description of preferred embodiment

Referring now to FIG. 1, the numeral 10 designates a transparent glass capillary pipette inserted into an adapter 11. The pipette 10 is provided with a bore 12 and is marked with a calibration line 13. The diameter of bore 12 is such that the pipette may be filled by capillary action. When the fluid that is to be drawn into the tube reaches calibration line 13, the desired quantity of fluid has been drawn. The capacity of the pipette may be varied according to the position of calibration line 13 or the size of bore 12, and the capacity of a particular tube may be identified by a color code band 14 or other indicia imprinted on the pipette.

Pipette 10 includes a bottom or filling end 15 and a top end 16 (see FIG. 4), and both ends may be slightly beveled in order to eliminate any dangerous sharp edges. The color code band 14 is advantageously positioned between the calibration line 13 and the top end 16 so that the filling end may readily be identified.

Referring now to FIGS. 4-6, adapter 11 essentially comprises an elongated plastic member having an enlarged, flattened gripping portion 17 and a narrowed neck portion 18. A central bore 19 extends axially through the adapter and tapers inwardly from gripping end 20 to neck end 21. The taper of the bore 19 is gradual and uniform, the sides of the bore defining an included angle within the range of approximately 1 to 4 degrees. Preferably, such angle should fall within the range of 2 to 3 degrees, to insure that various sized pipettes 10 may be received within the bore and be frictionally retained therein during normal use. Such gradual taper also substantially eliminates the possibility of ridging or scratching of the surface of the bore which might otherwise occur after numerous insertions and withdrawals of various pipettes which might prevent secure engagement of additional pipettes. The adapter material should be durable enough to prevent undesirable wear but also resilient and flexible enough to permit firm engagement of the pipette in the bore without breakage. Polyethylene, polypropylene, or any other material having similar properties of hardness, flexibility and resiliency are suitable.

The outside diameter of capillary pipettes usually range from about 1.4 millimeters to about 2.2 millimeters, and the diameter of bore 19 at both gripping end 20 and neck end 21 must be sized to accommodate this range of capillaries. That is, the gripping end of the bore must pass the largest pipette that would be used, and the neck end must not pass the smallest pipette that would be used.

The length of bore 19 is also important since the various sized pipettes will become frictionally engaged at different points of the bore. A long enough bore must be provided to engage the smallest pipette which will be used, and it has been found that the length of the bore, or dimension A in FIG. 4, is preferably at least one inch. In one embodiment of the adapter 11, the length A of bore 19 was 1.160 inches, the diameter of the bore at the gripping end 20 was 0.095 inch, the diameter of the bore at the neck end 21 was 0.045 inch, and the included angle defined by the sides of the bore was approximately $2^{\circ}28'$.

As can be seen best in FIGS. 4-6, the gripping portion 17 of the adapter is relatively flat and is generally elliptical in transverse cross section. The end of the gripping portion may be provided with a perimetric flange 22. The gripping portion narrows at rounded shoulders 23 and merges smoothly with the neck portion 18 which is seen to be generally cylindrical in shape. Neck portion 18 is adapted to be inserted into standard rubber hospital tubing 24 (see FIG. 3), and for this reason the neck end 21 may advantageously be beveled or slightly rounded. The dimensions of neck portion 18 should be such that the neck is easily inserted into the rubber tubing but at the same time forms a fluid-tight seal therein. For this purpose, the length B of the neck portion may be about 0.5 inch and the outside diameter of the neck portion may be about 0.156 inch.

In the use of the pipette and adapter, a doctor, nurse, or other technician grasps the pipette as shown in FIG. 2 and places the bottom or filling end 15 of the pipette into a drop or body 25 of blood or other liquid to be collected. A sample of blood can be obtained from a patient by puncturing the tip of a finger with a lancet or other sterile skin-piercing instruments. Before the pipette and adapter are positioned as in FIG. 2, the neck portion 18 of the adapter is first inserted into a length of rubber tubing 24 and the desired size pipette may be inserted into the bore of the adapter and frictionally engaged therein, although the ease with which the pipette may be inserted into the adapter permits insertion after the sample is drawn. The flattened sides of the adapter presented by its elliptical shape provide relatively thin wall portions for the bore on opposite sides of the adapter as at 29 (see FIG. 6). The flexibility of the bore wall is increased at these portions, and the pipette may be securely but safely inserted by exerting a rather firm force.

The pipette is held in an almost horizontal manner when its filling end is inserted into the drop 25, and the liquid flows upwardly into the capillary passage 12 by capillary action. The flow of the fluid into the pipette may be controlled by varying the angle of inclination of the pipette from the horizontal. When the pipette is filled to the calibration mark 13, the flow of fluid into the pipette is stopped by removing the filling end 15 of the pipette from the drop 25.

After the sample has been taken, the technician wipes the end of the pipette with dry gauze or cloth and flushes the sample into a measured quantity of water or other diluent liquid 26 contained within tube 27. The sample is easily discharged from the pipette by blowing gently on the free end 28 of rubber tubing 24.

The adapter 11 is particularly useful for techniques in which to-contain pipettes are used. Any pipette usually retains a certain amount of residual fluid on the sides of the pipette bore, and in order to insure that the composition of the solution of the diluent 26 and sample is substantially identical to the composition of the fluid remaining within the pipette, a to-contain pipette is usually

rinsed several times depending upon the viscosity of the sample. The rinsing operation is performed by the technician by alternately sucking and blowing on the rubber tubing in order to flush the capillary passage with the solution in tube 27. If the adapter and rubber tubing were not used, there is a chance that the sample may become contaminated by contact with the technician's mouth, and, more importantly, there is a chance that the technician may become contaminated if the fluid sample is toxic or radioactive. Plastic tubing may be used in place of the rubber tubing, but plastic tubing has a tendency to kink when suction is applied.

During the rinsing operation and subsequent manipulative steps the pipette and adapter may be held by gripping the gripping portion 17 of the adapter. The relatively flat gripping portion allows a more secure hold to be obtained, and the frictional engagement of the pipette within the adapter prevents the pipette from dropping. It is especially convenient to grip the adapter during the rinsing operation since the majority of the pipette will ordinarily be inserted within the tube 27 containing the diluent. The technician also has an unobstructed view of the pipette and can observe when the fluid level approaches the adapter. The perimetric flange 22 at the gripping end 20 enhances the ability of the technician to securely grasp the adapter and also serves to act somewhat as a shield for the technician's fingers when the pipette is inserted within the adapter bore. The fragile pipette could easily break and puncture the skin of the technician if the pipette should happen to miss the adapter bore and the flange were not provided during the insertion step. The relatively wide gripping end 20 provided by the elliptical shape of the gripping portion also contributes to the shielding affect. It is to be understood, however, that the adapter 11 may be provided in a variety of shapes and sizes, and may even be provided in a generally cylindrical shape.

While the pipette is being manipulated it is retained within the relatively flexible adapter which tends to absorb shocks received by the pipette and decreases the possibility of breakage. Also, as can be seen in FIG. 4 the pipette is gripped by the sides of the bore at 30, and the portion of the bore tapering outwardly from that point is spaced from the pipette as at 31. The pipette is thus enabled to pivot slightly about its top end 16 when jarred. If the pipette were gripped firmly in cantilever fashion over a substantial portion of its length, it would not be able to pivot and even a slight jar could snap the fragile glass tube.

The capillary pipette 10 is usually thrown away after the rinsing operation in order to avoid cross-contamination if the pipette were used to draw other fluid samples. It has also been found that it is usually cheaper to throw away the capillary pipettes rather than to wash and sterilize them after each use. The adapter and rubber tubing are retained, however, and the adapter may be used with as many as several hundred capillary pipettes.

While in the foregoing specification a detailed description of an embodiment of the invention was set forth for the purpose of explanation, it is to be understood that many of the details herein given may be varied considerably by those skilled in the art without departing from the spirit and scope of the invention.

I claim:

1. In combination, a capillary pipette and a holder-adaptor therefor, said pipette being formed of glass and being sized for filling by capillary action, said holder-adaptor comprising an elongated plastic member having a gradually tapered bore extending axially therethrough, one end of said pipette being received within the enlarged end of said bore and frictionally engaging the sides thereof, the end of said holder-adaptor opposite the end receiving said pipette being of generally cylindrical tubular shape and being adapted to be received within a piece of flexible tubing.

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2. The combination of claim 1 in which said holder-adapter includes an enlarged gripping portion extending about the enlarged end of said bore.

3. The combination of claim 2 in which said gripping portion is provided with a perimetric flange at said pipette-receiving end. 5

4. The combination of claim 1 in which the outside diameter of said pipette is between about 1.3 millimeters and about 2.3 millimeters, the sides of said tapered bore defining an included angle of between about 1° and about 4°. 10

5. The combination of claim 4 in which the length of said bore is at least about 1 inch.

6. A holder-adapter for use with capillary pipettes, said holder-adapter comprising an elongated plastic member 15 having a gradually tapered bore extending axially there-through, the enlarged end of said bore being adapted to receive a capillary pipette, the sides of said bore being adapted to frictionally retain said pipette, the end of said holder-adapter opposite the enlarged end of said bore being adapted to be received within a piece of flexible tubing.

7. The holder-adapter of claim 6 in which the holder-

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adapter includes an enlarged gripping portion extending about the enlarged end of said bore.

8. The holder-adapter of claim 7 in which said gripping portion is provided with a perimetric flange.

9. The holder-adapter of claim 6 in which the diameter of the enlarged end of said bore is at least 2.2 millimeters and the diameter of the reduced end of said bore is less than 1.4 millimeters, the sides of said bore defining an included angle within the range of about 1° to about 4°.

10. The holder-adapter of claim 9 in which the length of said bore is at least about 1 inch.

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20 DAVID SCHONBERG, *Primary Examiner*.

S. CLEMENT SWISHER, *Assistant Examiner*.