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M. G. BROWN ET AL

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HEMOLYZING APPARATUS

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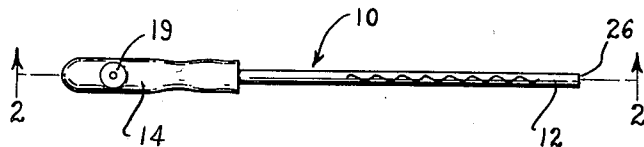


Fig. 1

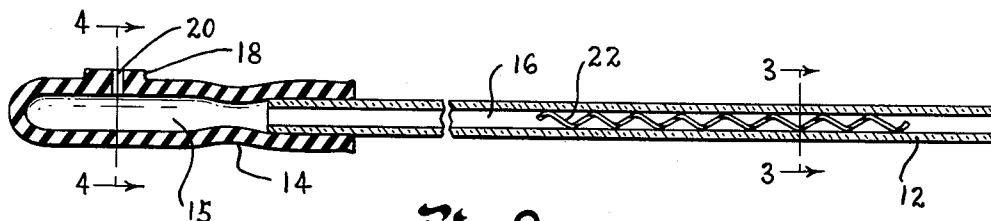


Fig. 2

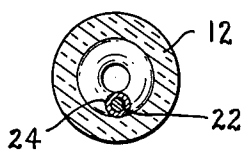


Fig. 3

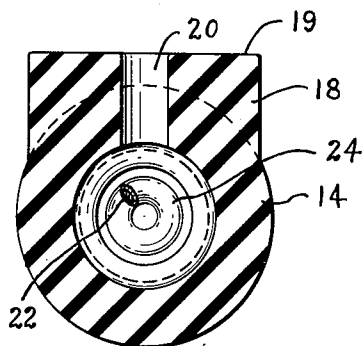


Fig. 4

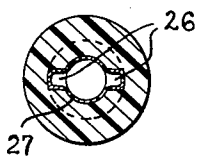


Fig. 5

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HEMOLYZING APPARATUS

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2 Claims. (Cl. 23—253)

This invention relates to hemoglobinometers and the like, and more particularly to a syringe-like device for use as an accessory with such instruments.

In United States Patent No. 2,481,567, there is disclosed a hemoglobinometer for use in determining the hemoglobin concentration of blood samples. The instrument of this patent is provided with a removable light-transmitting specimen holder into which individual samples of blood may be placed for evaluation by the instrument. However, in order to properly carry out the intended method of use of instruments of this type, it is necessary to hemolyze the blood before the specimen holder and sample are placed in the instrument. Otherwise, the sample will not be of uniform light-absorbing characteristics throughout and matching thereof with that portion of an optical wedge of the instrument providing like light-absorbing characteristics cannot as easily and accurately be made.

The normal use of the instrument of the above-mentioned patent involves the extracting of a small quantity of blood (a drop or so), from the finger tip or ear lobe of a patient and placing same (as described more particularly in United States Patent No. 2,519,997) upon the specimen surface of a first plate of the specimen holder. This blood sample is then hemolyzed by stirring with a small specially prepared rod or stick having a measured quantity of saponin, or like hemolytic agent, adhered thereto. (The purpose of the saponin is to affect the membranes of the individual red corpuscles of the blood sample and thereby allow the pigment of the individual cells to spread uniformly throughout the sample.) After hemolyzing the sample, a second plate is placed upon the first plate and used to cover the sample as well as limit the depth thereof to a known thickness while in the holder.

It has been found that while very acceptable results may be obtained by the use of the apparatus of the two patents mentioned above, additional advantages may be obtained by use of the device of the present invention, as will appear from the following description. During dry atmospheric conditions, for example, it has been found that some evaporation or drying effect of the sample may take place particularly if the extracted sample is not used immediately. The device of the present invention, on the other hand, is of such construction and arrangement that the minute sample extracted from the patient is so immediately enclosed and so nearly completely enclosed from the ambient air that atmospheric conditions have substantially no material affect thereon; and this is so even though the sample may be retained for an appreciable period of time therein before being used. It would be possible, for instance, to keep a blood sample from one day to the next should such be the desires or requirements of the physician taking the sample.

It will be appreciated, therefore, that should a doctor desire, he could obtain samples of blood from a number of house patients during his routine calls and thereafter examine the samples at his own convenience, or even

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send same to a laboratory for examination without fear that the samples might alter their conditions during the delay which would naturally occur during such treatment of the blood samples. Furthermore, the device of the present invention is of such small size, light-weight and economical construction that said devices could be easily packaged as individual sterilized items and after use, thrown away. Also the device is of such size and construction that a single drop of blood is sufficient for carrying out all necessary steps needed for the examination of a patient's blood.

Other objects and advantages of the present invention will become apparent from the detailed description which follows when taken in conjunction with the accompanying drawing, in which:

Fig. 1 is a side elevational view of a syringe-like device made in accordance with the present invention;

Fig. 2 is an enlarged longitudinal sectional view of the device taken substantially upon section line 2—2 of Fig. 1 and looking in the direction of the arrows;

Figs. 3 and 4 are cross-sectional views taken substantially upon section line 3—3 and 4—4 of Fig. 2 and looking in the direction of the arrows; and

Fig. 5 is a cross-section of a modified form of the invention.

Referring to the drawing in detail, it will be seen that the numeral 10 indicates generally a syringe-like device comprising an elongated straight-sided tubular member 12 to one end of which is attached a flexible or elastic bulb-like member 14. The tubular member 12, which is preferably about two or three inches in length, has a small bore 16 of uniform cross-section extending longitudinally therethrough. The tubular member 12 may be formed of any suitable rigid inert material so that it may be used for manipulation purposes and so that it will, in no way, effect the blood sample when enclosed in said bore. However, from the standpoint of economy and convenience as well as general utility, it is preferred to form the tubular member 12 of glass tubing, and a size of bore which has been found to be very satisfactory therein is approximately .04 of an inch in diameter.

The flexible elastic bulb-like member 14, preferably formed of latex rubber, is elongated somewhat to provide an air space 15 of suitable size therein and is frictionally held upon an end of the tubular member 12 in known manner. For purposes which will be later explained, the member 14 is provided with a raised finger grip portion 18 having a flattened outer surface 19 thereon and an air opening 20 extending centrally therethrough so as to communicate with the air space 15.

Within the bore 16 in tubular member 12 is positioned a suitable element 22 which, for convenience, may be termed a hemolyzer, since this element is preferably made in the form of a thin piece of helically coiled wire, preferably stainless steel or the like, and upon at least a portion of which is adhered a coating 24 (see Fig. 3) of hemolyzing material. The wire may be prepared by first dipping an end portion thereof into a hemolytic solution (preferably containing saponin and an anticoagulant, such as sodium oxalate, sodium citrate, potassium citrate or Sequestrene) and then inserted in the bore 16 of the member 12. Since the end of the wire 22 can be dipped into the solution to any depth desired, it is an easy matter to exactly regulate or control the quantity of hemolyzing material being retained on the wire when placed into the bore 16.

The wire may be helically coiled into such a size as to have frictional engagement with the interior surfaces of the tubular member 12 after insertion, or it may be held in place in said bore merely by the adhesive effect

of the saponin on the wire contacting the surface of the tubular member.

When the device 10 is to be used by a physician or technician, one manner in which it may be loaded and used would be to place the open end 26 of the member 12 in contact with a drop of fresh whole blood upon the fingertip or ear lobe of a patient while the bulb-like member 14 is held compressed. Thereafter allowing the member 14 to expand while the air opening 20 is covered by the user's finger will draw a portion of the blood sample into the bore 16 and since it must flow over and between the coated coils of the wire, it will be subjected to the hemolyzing action of the saponin. In fact, if the member 14 is "worked" somewhat by the user's fingers at this time to move the sample back and forth in the bore, such aspiration or agitation thereof will tend to completely hemolyze the blood.

The purpose of the air opening 20 mentioned above is to enable the user to have better control of the blood sample while being taken into the tube and also while in the tube. By merely rolling the bulb 14 slightly between his fingers while manipulating the bulb, he may cover or uncover the opening 20 as desired.

Thereafter, when the blood sample is to be analyzed in a hemoglobinometer, such as referred to in the above-mentioned patents, it is merely applied to the lower plate of the specimen holder, the cover plate applied thereover and the "loaded" holder inserted in the instrument.

However, since the syringe-like device 10 nearly completely encloses and protects the sample from the surrounding atmosphere at all times until the sample is analyzed, very, very little change, if any, occurs in the sample and, accordingly, the sample may be kept in the device for a considerably longer time than has been possible by use of other types of equipment heretofore.

While a preferred form of the device has been described above as comprising a tubular member 12 formed of glass and a bulb-like member 14 formed of flexible rubber or the like and fitting thereover, it should be appreciated that the device of the present invention could have, if desired, its tubular portion and its resilient bulb-like portions both formed of suitable plastic material in an integral manner. Preferably, in such an arrangement, the bulb-like portion would have thinner wall sections so as to allow easy flexing thereof. However, when this modified form of the device is assembled and ready for use with the hemolyzer positioned therein, it will function equally well in carrying out the hemolyzing method desired.

Instead of dipping the coiled wire 22 into the saponin as suggested above, it would be possible to suitably coat the interior of the tubular member with the wire therein by allowing saponin to flow into and out of the tubular member.

Furthermore, when the tubular member or portion 12 is formed of molded plastic, as suggested above, it would be possible to provide (see Fig. 5) a helical groove or grooves 26 in and extending lengthwise of the interior wall surface of the tubular part 12. This could easily be done by employing a pair of die members having a separate core member provided with a screw threaded outer surface for forming the bore of the elongated tubular part 12 during the molding operation. Thus, when this core is removed, an internal integral threaded surface will be present in said bore; and this groove will function in place of the coiled wire of Figs. 1 and 2 in receiving and retaining sufficient saponin in adherence with

the bore and the groove therein. This threaded interior surface will also serve to cause turbulence in blood during agitation or hemolyzing thereof.

While it is possible to take blood into the tubular member 12 by manipulation of the bulb 14, as mentioned above, it is also possible and fully as easy, if not easier, to load the device by merely holding the bulb-like end thereof in a lowered position and allow the sample to flow by capillary action into the other end of the tube. Of course, the opening 20 can be controlled at this time, if desired, to govern the amount of blood being taken in.

Having described our invention, we claim:

1. A small compact inexpensive disposable device for use in collecting directly from a patient's finger tip, ear lobe or the like a small sample of whole blood and for use in hemolyzing same, said device comprising a thin elongated relatively rigid tubular member of transparent material having a central capillary-like passageway extending longitudinally therethrough from one end thereof to the other, a hollow flexible bulb-like member carried by one end of said tubular member and having its interior in communication with said passageway, said bulb-like member having a small air opening extending through a wall portion thereof and arranged so as to be closed by a finger of the user of the device, when desired, during loading and unloading of a blood sample in said device and during agitation of said sample therein, means extending longitudinally in said tubular member and shaped so as to define a relatively thin elongated helical path communicating with and constituting a part of said central capillary-like passageway throughout the greater part of the length of said tubular member, and a very thin coating of a hemolytic material adhered to substantially all exposed surface portions of the means defining said helical path so as to be contacted by the blood sample being drawn into said passageway during loading of said tubular member, whereby said sample may be readily observed through said transparent material and the correct amount desired in said tube readily controlled by covering and uncovering the opening in said bulb during said loading, and whereby hemolyzing of said sample may be readily accomplished thereafter by covering said opening and manipulating said bulb slightly to cause said sample to move back and forth along said passageway and helical path while in contact with said hemolytic material.

2. The combination defined in claim 1 and wherein the means defining said relatively thin elongated helical path is in the form of a relatively long thin coiled element of inert material within said passageway and engaging wall portions thereof and having said coating of hemolytic material adhering to exposed surface portions thereof.

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