Dec. 9, 1958 M. H. McLIN 2,863,319

CAPILLARY PIPETTE

Filed Feb. 4, 1958

FIG. 1

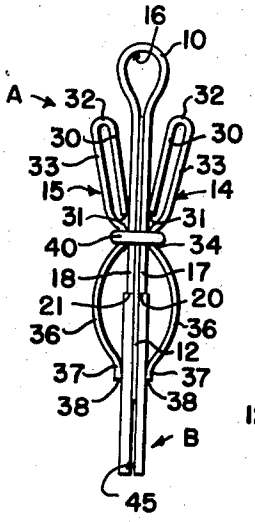


FIG. 2

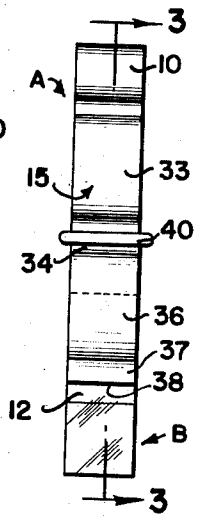


FIG. 3

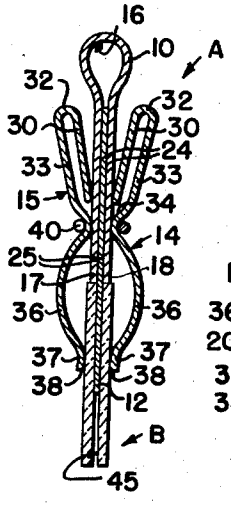


FIG. 4

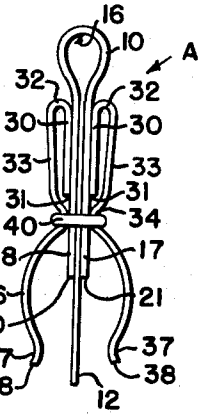


FIG. 5

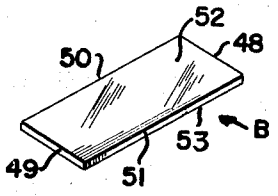
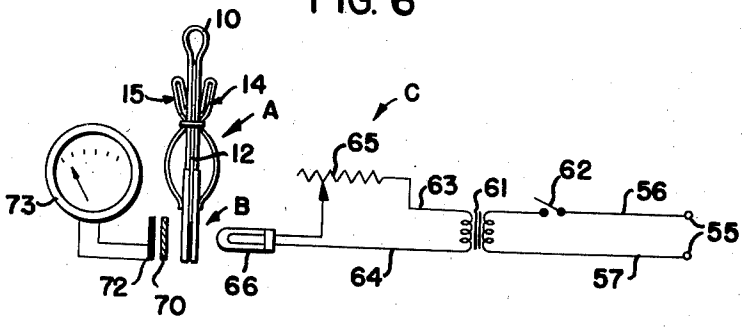


FIG. 6



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CAPILLARY PIPETTE

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3 Claims. (Cl. 73—425.4)

This invention relates to improvements in capillary pipettes and more particularly to improvements in capillary pipettes for use in hemoglobinometers for determining the hemoglobin content of whole, untreated blood.

It has long been the desire of persons in the medical profession to have equipment handy, such as in their offices, whereby they might quickly and accurately determine the hemoglobin content of a person's blood. The only equipment presently on the market, that can be used in the office, yields only sufficient information so that an estimate can be made as to the hemoglobin content of a blood sample. Such equipment is commonly known as a "colorimeter" and involves the visual comparison of blood samples with colored standards of varying shades of red, each shade being calibrated to indicate that a sample matching that shade has a certain hemoglobin content. This visual comparison of color shading is extremely inaccurate in view of the fact that the light intensity may be varied between the standard and the sample; the person reading the sample may have a degree of color blindness; and also because it is impossible to accurately match infinitesimally differing shades of color visually.

This estimating of the hemoglobin content of the blood has sought to be eliminated by the use of electrical measuring devices, such as those shown in Patent 1,938,544, granted to V. A. Shoenberg, dated December 5, 1933; Patent 1,978,096, granted to M. White, dated October 23, 1934; and Patent 2,621,557, granted to F. W. Kavanagh, dated December 16, 1952. These devices are limited by the fact that they require that the bood be first treated, in solution, with some liquid such as hydrochloric acid, which changes the hemoglobin of the whole blood to acid hematin, resulting in a brown solution. The technician testing the blood sample then waits five or ten minutes for the solution to become stable enough to be accurately measured and then the solution is inserted in a specimen holder, placed into the hemoglobinometer and a reading taken. This method of determining hemoglobin content is very objectionable, due to the fact that it requires a long period of time to accurately take a reading; it involves the liability of spillage while mixing; and is particularly susceptible to errors during the treating of the blood either by not having properly diluted the blood sample, or failure to wait the required length of time for the acid hematin to become stable. A doctor, whether he is a general practitioner or a specialist, does not have the time to run these lengthy hemoglobin tests, nor do they feel secure in the results as run by the laboratory technicians.

While it has been recognized that the basic electrical circuitry for hemoglobinometers, such as described in the patents above mentioned, will render an accurate reading provided that the instrument is properly calibrated for a blood sample having a predetermined thickness so that the light passing through the blood sample will have its intensity varied only by the color of the blood and not by the thickness of the blood sample itself, the blood sample

is properly mixed and has become stable, these devices have not fulfilled the requirements of the medical profession.

I have devised a capillary pipette for use in holding a blood sample utilizing whole, undiluted, untreated blood that is drawn into the pipette by capillary attraction and renders a blood sample having an accurate thickness so that by inserting the pipette into a hemoglobinometer it is possible to obtain an accurate hemoglobin determination in a matter of thirty seconds, or less, and eliminates completely the human errors of dilution, stabilization, etc. Such accurate and quick readings are important to a doctor in that the accurate hemoglobin content of a person's blood can be detemined during an office visit, requiring very little of the doctor's time, and is of extreme importance in the hospital where it may be used, for instance, in determining whether a person is hemorrhaging internally by taking a series of readings spaced a short time apart, so that it can be determined if there is a sharp decline in the hemoglobin content of the blood which indicates that the person is hemorrhaging internally.

The primary object of my invention is the provision of a specimen holder in the nature of a capillary pipette that will fill itself by means of capillary attraction and provide a sample having a predetermined, accurate thickness.

A further object of this invention is the provision of a capillary pipette for use as a specimen holder in a hemoglobinometer wherein the human factor of error is reduced to a minimum.

A further object of this invention is the provision of a capillary pipette that is rugged, durable, easy to clean, and cheap to manufacture.

A further object of this invention is the provision of a capillary pipette that will accurately render a blood sample of predetermined thickness at all times, within normal ranges of heat and cold, and will not discolor so that its ability to transmit light is uneffected by heat or cold.

Other objects and advantages of this invention will be apparent during the course of the following detailed description, taken in connection with the accompanying drawing, forming a portion of this specification and in which drawing:

Fig. 1 is a front view of my capillary pipette

Fig. 2 is a side elevation of the pipette of Fig. 1.

Fig. 3 is a longitudinal sectional view taken substantially on the line 3—3 of Fig. 2.

Fig. 4 is a side view of the clamping means of my capillary pipette in an open position.

Fig. 5 is a perspective view of one of the plates used in my capillary pipette.

Fig. 6 is a schematic showing of my capillary pipette in position, in a conventional circuit used in hemoglobinometers.

In the drawings, wherein for the purpose of illustration is shown a preferred form of the invention, and wherein similar reference characters designate corresponding parts throughout the several views, the letter A designates generally my improved clamping means; B plate means having a high degree of transparency and held in a spaced relationship by the clamp means A; and C an electrical circuit for measuring the intensity of light passing through the sample held between the spaced plate means B.

The clamp means A preferably comprises a frame, or handle 10, to which is secured a separator, or spacing plate 12 and which supports a pair of spring arms 14 and 15.

The frame, or holder 10, is preferably made of a relatively thin strip of metal that is folded over upon itself, providing a bight portion 16 and side portions 17 and 18,

each terminating in ends 20 and 21 in the same horizontal plane.

The separator, or spacing plate 12 is inserted between the side portions 17 and 18, of the frame or holder 10 in a position so that the separator 12 extends between the side plates 17 and 18 for substantially the entire length thereof, terminating short of the bight portion 16 at the uppermost portion thereof and extending below the ends 20 and 21 of the frame 10 and below the ends of the spring arms 14 and 15, for a distance of slightly less than one-half the total length of the separator. The separator plate 12 may be held in position between the side portions 17 and 18 by spot welds 24 and 25. This separator, or spacer plate 12 must be of an accurately machined thickness of corrosive resistant material, such as stainless steel, as this separator 12 will determine the thickness of the blood sample to be held by the capillary pipette. I have found that a thickness of .008 of an inch renders an ideal thickness. The thickness of the blood sample is critical, as this thickness must be the same in order to permit the same intensity of light to pass through samples of identical texture and must be the same from pipette to pipette and should not be readily susceptible to heat or cold. By utilizing a very thin length of metal I have reduced the contraction or expansion of the separator to an infinitesimal minimum so that the amount of error that may be introduced by the expansion or contraction of the separator will be negligible.

The spring arms 14 and 15 preferably comprise two lengths of springy material, such as metal, of substantially the same width as the frame or holder 10, one each of these spring arms being secured to either side of the frame 10. As these spring arms 14 and 15 are of identical configuration, identical reference characters have been applied to designate corresponding parts of these spring arms. The arms 14 and 15 preferably comprise an inner downwardly extending side portion 30, terminating in an end 31, an upper bight portion 32, an outer downwardly extending side portion 33, a sharply curved or arched central portion 34, an outwardly bowed lower portion 36, and lowermost flattened portions 37, terminating in an end 38. These arms 14 and 15 are secured to the frame 10 by means of a split ring-like support 40 that passes about the arms at the central arched portions 34, holding these arched portions against the frame 10, so that the arms 14 and 15 can rock, with respect to the frame 10, about the arches 34 which form pivotal points for the arms 14 and 15. The ends 31 of the arms 14 and 15 press against the outermost side of the side portions 17 and 18, forcing the bight portion 32 of the arms 14 and 15 away from the frame 10, so that when the plates B are placed on either side of the separator 12 the flattened portions 37 of the arms will hold these plates B securely in position. As has hereinbefore been described the ends 38 of the arms 14 and 15 terminate short of the lowermost portion of the separator plate 12, so that the flattened portions 37 of the arms 14 and 15 extend for a short distance parallel to the separator plate, when the plates B are in place, thus securely holding the plates B in position.

The clamp is opened, as shown in Fig. 4, by pressing against the outer side portions 33, of the arms 14 and 15, which compresses the side portions 33 toward the side portions 30 and lifts the flattened portions 37 out of contact with the plates B.

The plates B preferably comprise relatively short lengths of some material having a high degree of transparency, such as glass, and are of a width substantially equivalent to that of the separator plate 12. These plates B are of a sufficient length so that they may be placed to either side of the separator plate 12 with one of the ends of each of the plates B abutting against the ends 20 and 21 of the frame 10, and extend downwardly along the separator plate and therebeyond, providing a small aperture or space 45 therebetween into which the blood sample is drawn by capillary attraction. I have shown the plates B, in Fig. 5, as being of a rectangular shape and having ends 48 and 49, sides 50 and 51, an upper surface 52, and a lowermost surface 53, however, it is to be understood that the plates may be of any configuration.

The typical electrical circuit C preferably comprises terminals 55, that may be secured to any conventional source of alternating current which flows through the lines 56 and 57 to the transformer 61. A switch 62 may be provided in the line 56 for easy activation and deactivation of the transformer 61. Lines 63 and 64 lead from the transformer 61 and carry low voltage current through a potentiometer 65 to a light 66. The potentiometer 65 is provided in the line so that the intensity of the light 66 may be easily regulated. A filter 70 is provided, spaced from the light 66 a sufficient distance so that the capillary pipette may be inserted therebetween; a photoelectric cell being provided at the opposite side of the filter 70 from the light 66, so that the light will pass through the pipette and blood sample, thence through the filter 70, activating the photoelectric cell 72, which is connected to a microammeter 73 that is calibrated to show directly the hemoglobin content of the blood sample held in the pipette.

When it is desired to assemble the pipette the spring arms 14 and 15 are compressed against the frame 10, in a position as shown in Fig. 4; the glass plates B are inserted, one in either side of the separator plate 12, with one of the ends thereof abutting against the ends 20 and 21 of the frame 10; the spring arms 14 and 15 are then released and the spring action of the side portions 30 of the spring arms 14 and 15 will force the flattened portions 37 against the plates B, securely holding the plates B in position with respect to the clamp A; the open end of the plates B is then placed upon a drop of blood and the blood will be drawn into the space 45, between the plates B, by means of capillary attraction; the pipette is then inserted within the hemoglobinometer, so that the light passes directly through the plates B and the blood sample held therebetween, and the hemoglobin content of the blood can be directly read from the markings upon the microammeter 73. All of this can be done, from the pricking of the patient's finger to obtain a blood sample, to the final reading on the meter 73, in a matter of thirty seconds or less.

When it is desired to disassemble the pipette, such as for the cleaning of the plates B, it is only necessary to compress the spring arms 14 and 15 into the position as shown in Fig. 4 whereupon the plates B will be released from the clamp A and may be individually washed.

It will thus be seen that I have provided a capillary pipette that is easy to manufacture, the parts of which are cheaply and easily replaced, and which can be easily and quickly disassembled and assembled. By the use of my pipette it is possible to obtain quick and accurate readings of the hemoglobin content of a blood sample with a minimum of variance, such as human error.

Various changes may be made to the form of invention herein shown and described without departing from the spirit of the invention or scope of the claims.

I claim:

1. In a specimen holder for receiving a test sample the combination of a frame, a separator plate secured to said frame and extending therebelow, clamping means secured to said frame, to either side of said separator plate, and a pair of plates positioned to either side of said separator plate and held in position by said clamping means, said plates extending downwardly beyond the terminus of said separator plate in a spaced relationship proportional to the thickness of said separator plate, the spaced relationship of said plates below said separator plate providing an aperture for the reception of a test sample.

2. The combination as specified in claim 1 wherein said frame includes downwardly depending side portions

terminating in the same horizontal plane to each side of said separator plate, forming an abutment for the positioning of said plates upon said separator plate.

3. In a capillary pipette for receiving a test sample the combination of a frame, a separator plate secured to said frame, a pair of spring arms secured to said frame and extending to either side of said separator plate, a pair of plates mounted to either side of said separator plate and secured in position by said spring arms, said plates extending downwardly beyond the terminus of said separator plate and terminating therebelow, the extension of said plates below said separator plate forming an opening the thickness of the separator plate and having one end thereof open for the capillary attraction of the test sample to within the opening.

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