Dec. 21, 1937. C. BROOKS 2,102,785

METHOD OF AND APPARATUS FOR SEDIMENTATION TESTING OF BLOOD

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Fig. 1.

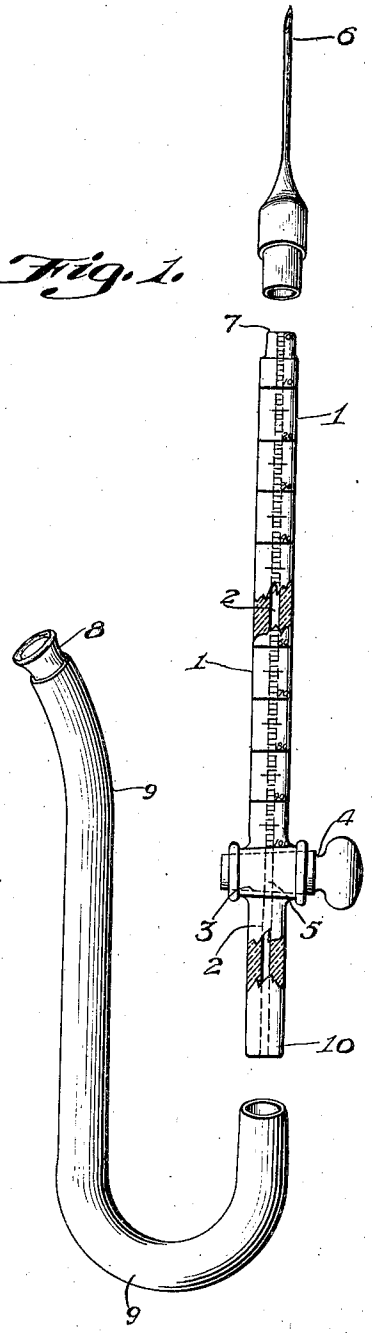
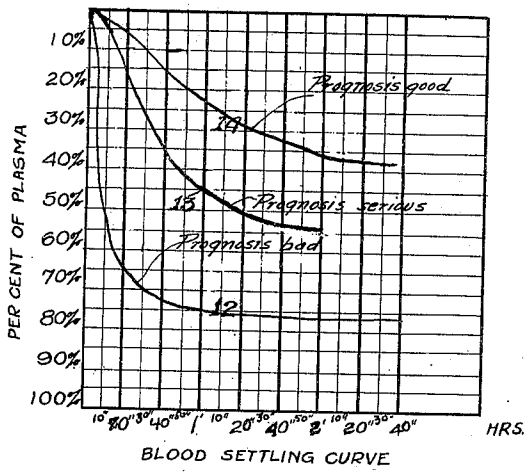
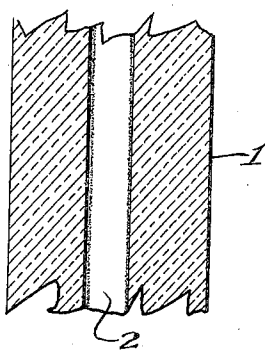


Fig. 3



BLOOD SETTLING CURVE

Fig. 2.



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METHOD OF AND APPARATUS FOR SEDIMENTATION TESTING OF BLOOD

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4 Claims. (Cl. 23—230)

My invention relates to the making of medical prognosis from the rate of settlement of red corpuscles of blood, and it is designed to provide a method and an apparatus by which such settlement or sedimentation can be efficiently effected and measured, even by technicians with but little training.

The rate of settling of the red blood corpuscles is a well known clinical phenomena, enabling a physician to make a prognosis in many diseases as well as in operative cases, but this method of prognosis has been relatively little used due to the high probability of error and the difficulties and complexities involved in making such tests heretofore.

By my invention, such tests may be made accurately with a minimum quantity of blood, which is tested in a substantially undiluted and normal condition without danger of coagulation, without affording any opportunity for settlement of the red corpuscles in the test sample before the beginning of the test, and without the transfer of the test sample from one container to another.

My improved blood sedimentation tester comprises a transparent tube, preferably of glass, containing an axial bore extending the full length thereof and having a settling section of substantially uniform small diameter which has a coating of an anti-coagulant applied thereto immediately before each test.

A diametral conical valve seat is formed in the tube transversely to the axial bore for the reception of a rotatable glass cock or valve which contains a passage movable, by the rotation of the cock, into and out of registration with the tube bore.

The settling section of the tube is preferably graduated from the bottom thereof, where its bore opens into the valve seat, toward the distal end of the tube, which may be conically ground for the attachment of a hollow needle. The proximal end of the tube, below the valve seat, is provided with a mouth piece for applying suction or pressure to the bore when the valve is open and which is cut off from the settling section when the valve is closed to cut off the lower portion of a blood column in the instrument so as to leave in the settling section a column of accurately measured length extending from the valve to the mouth of the tip.

In accordance with my improved method, the blood is introduced into the proximal end of the tube bore, with the valve passage in registration therewith, until it fills and projects in a solid column slightly beyond the anti-coagulant coated settling section. The flow of blood may be caused by inserting the hollow needle into a vein or artery and permitting the pressure of the blood therein to cause flow of blood into the instrument, or the distal end of the tube bore may be applied to drop the blood formed by pricking the finger, or other convenient part, and the blood drawn into the instrument by suction applied to the mouthpiece at the proximal end of the tube.

The characteristic features and advantages of my improvements will further appear from the following description and the accompanying drawing in illustration thereof.

In the drawing, Fig. 1 is an exploded elevational view of a blood sedimentation tester or pipette embodying my invention, parts being shown in section; Fig. 2 is a fragmentary sectional view, on an enlarged scale, of a portion of the pipette shown in Fig. 1 as prepared for use by coating the inner surface of the bore with anti-coagulant; and Fig. 3 is a chart showing the type of data determinable by my invention and the prognosis indicated thereby.

In the embodiment of my apparatus shown in Figs. 1 and 2 of the drawing, the glass pipette tube 1 contains a substantially uniform axial bore or lumen 2 extending the full length thereof, and also contains a transverse conoidal ground valve seat 3. A ground glass valve or cock 4 is rotatable in the seat 3 and is provided with a bore 5 similar to and adapted to register with the bore 2 in one position of the valve.

The bore section between the valve seat and distal point of the tube forms a settling chamber and the blood content and corpuscular settling therein may be readily measured by means of a graduated millimeter scale etched on the tube with a datum, such as a 100 millimeter mark, placed exactly at the intersection of the settling chamber formed by the upper bore section with the valve seat. The zero point of the scale is preferably at the mouth of the tip of the bore.

A hollow needle 6 may be fitted on the tapered distal tip 7 of the tube 1 and a mouth-piece 8 may be connected by the flexible tube 9 with the proximal end 10 of the tube.

I have found that coagulation of blood, in quantities suitable for tests of the rate of settling of red corpuscles in accordance with my invention, can be prevented by a mere film of anti-coagulant on the inner surface of the wall of the bore in which the sedimentation is effected.

In carrying out my process in a preferred man-

ner and by means of the illustrated apparatus, there should be prepared a suitable anti-coagulant solution, such as a sterile solution of sodium or potassium or ammonium oxalate, a sodium citrate, or hirudin, which may be conveniently put up in a sterile condition in a rubber capped vial.

The blood sedimentation pipette is sterilized, a suitable sterile hypodermic needle fitted on the ground glass tip of the pipette, and a piece of rubber tubing with mouth piece fitted on the opposite end of the pipette.

After sterilizing the surface of the rubber cap of the vial of anti-coagulant solution, the needle, which is attached to the tip of the pipette, is inserted through the cap into the solution. With the cock open, the oxalate solution is sucked by means of the mouthpiece through the needle and up into the bore of the pipette, filling it completely as far as, or a little beyond the 100 mark. The cock is then turned to close the lumen of the pipette, and the needle is withdrawn from the vial or oxalate solution and the filled pipette placed on some sterile surface.

A rubber band is adjusted around the patient's arm and an antiseptic rubbed over the skin covering the veins at the inner side of the bend of the elbow.

The cock of the pipette is now opened and the oxalate solution blown out, leaving a thin film covering the inside of the pipette. The needle is quickly inserted into the lumen of the vein and the blood allowed to flow up through the needle into the lumen of the pipette, filling it completely as far as the 100 mark or a little beyond that point. The cock is then closed, thereby cutting off the crest of the column and the needle withdrawn from the vein. The tip of the pipette is then turned upward to the vertical position, the needle is removed from the ground glass tip and the tip wiped clean. This leaves the pipette completely and precisely filled from the very mouth of the tip (zero mark) to the point where the stop-cock cuts the lumen of the pipette (100 mark). Thus a column of fresh blood is cut off and held in the pipette, which column of blood is precisely 100 mm. in length. This measurement is automatically effected by the closing of the cock and the removal of the needle.

The pipette is set in a holder with the tip pointing vertically upward, and the settling of red corpuscles observed; the settling being read from the scale and the time from a stop watch. The settling should be noted, say, every minute in rapidly settling cases, and every five minutes in slower ones. The observations should be kept up for two hours and the results recorded and plotted in the form of curves on coordinate paper.

The graphs shown on the chart in Fig. 3 illustrate, by way of example, the three stages of a case of pneumonia. The lower curve **12** shows rapid sedimentation, during the period of severe illness; the next curve **13** shows a moderately rapid rate of sedimentation during the period of convalescence; and the upper curve **14** shows a normal healthy rate of sedimentation after recovery.

By sterilizing the pipette and needle, when used, the whole test may be conducted under aseptic conditions so that any test may be extended, if desired, for twenty-four hours or longer, to permit complete settling of the red corpuscles.

By my improvements the blood is allowed to flow directly from the blood vessel of the patient into the pipette, where it is immediately set up and the observation of sedimentation at once begun. This simplifies the procedure and avoids any dilution or mixing of the blood and there is no settling of the blood corpuscles before the actual observations have been started.

The operation of the pipette automatically cuts off the column of blood precisely at the 100 mark and the removal of the hypodermic needle leaves the upper meniscus of the column exactly at the mouth of the tip of the pipette, so that the column of blood is exactly 100 mm. long. This measurement being automatic is always uniform and precise, even in the hands of inexpert laboratory workers. The results of measurements of rate of blood sedimentation are so accurate that very slight alterations in blood sedimentation can be determined with certainty.

There is no possibility of leakage because the stop-cock effectively closes the lower end of the graduated portion of the pipette. No air can get into the blood in the lumen of the pipette since the blood flows into the pipette under its own pressure. If the needle does not fit the ground glass tip quite nicely, there may be some blood leaking out but no air will pass into the pipette. No leakage can occur with the pipette and no air bubbles can enter the lumen of the pipette and get mixed with the blood.

Having described my invention, I claim:

1. A blood sedimentation pipette comprising a transparent tube and a stop cock intercepting said tube intermediate the ends thereof, said tube containing a capillary bore of substantially uniform cross-section extending from said stop cock to one end of the tube, said tube being graduated from said stop cock to said end, said graduations reading from the end toward the stop-cock, said tube containing a bore extending from the stop cock oppositely to the first bore, a mouthpiece communicating with the second bore for drawing blood by suction into the capillary bore in one position of the stop cock, said stop cock being movable to cut off the suction of the capillary bore when the latter is filled with blood.

2. A blood sedimentation pipette comprising a transparent tube and a stop cock intercepting said tube intermediate the ends thereof, said tube having a tapered end and containing a capilliary bore of substantially uniform cross section extending from said stop cock to said tapered end, said tube having a scale extending along said bore and providing graduations reading the entire distance from said end toward the stop cock, said tube containing a second bore extending from said stop cock, a flexible tube communicating with the second bore and having a mouthpiece for drawing blood by suction into the capillary bore in one position of the stop cock, said stop cock being movable to cut off suction from the first named bore when the latter is filled with blood.

3. A blood sedimentation pipette comprising a transparent tube and a stop cock intercepting said tube intermediate the ends thereof, said tube containing a capillary bore of substantially uniform cross-section extending from said stop cock to one end of the tube, a hollow needle removably fitted on the end of said tube and communicating with said bore, said tube containing a second bore extending from the stop cock, a mouthpiece communicating with the second bore for drawing blood by suction into the needle and capillary bore in one position of the stop cock, said stop cock being movable to cut off the suc-

tion from the first named bore when the latter is filled with blood, and said tube having a scale reading from its distal end toward the stop-cock by which settling of said corpuscles may be observed over the entire distance from the distal end to the stop-cock.

4. The method of sedimentation testing of blood which consists in forming a capillary film of anti-coagulant, drawing blood from living tissue directly into the capillary by suction to form a blood column of uniform cross section, cutting off the blood column intermediate its ends, and positioning the major portion of the blood column so that the point at which it was cut off is lowermost until the corpuscles have settled.

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