

Nov. 7, 1950

P. M. NEUDA

2,528,704

METHOD FOR TESTING BLOOD

Filed June 20, 1946

Fig. 1.

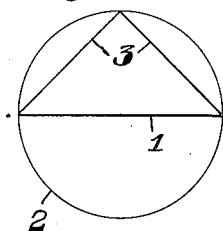


Fig. 2.

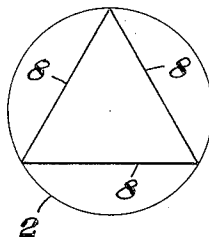


Fig. 3.

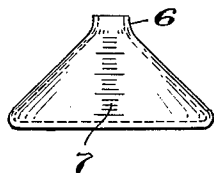


Fig. 4.

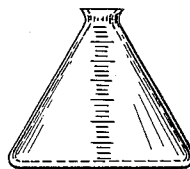
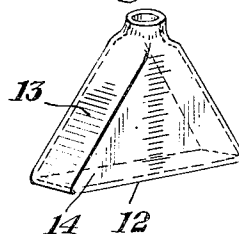


Fig. 5.



INVENTOR.

Paul M. Neuda

BY

Richard J. Michalek
attys.

UNITED STATES PATENT OFFICE

2,528,704

METHOD FOR TESTING BLOOD

Paul M. Neuda, New York, N. Y., assignor to The Robinson Foundation, Inc., New York, N. Y., a corporation of New York

Application June 20, 1946, Serial No. 677,981

1 Claim. (Cl. 73—53)

1

This invention relates to the treatment, more especially for testing purposes, of biological liquids, for instance blood, which are subject to separation into their constituents. In the case of blood which is a physical mixture of plasma and cells called erythrocytes, separation takes place by so called sedimentation, the cells settling more or less quickly in the liquid. The speed at which this settling down occurs and which is called the Sedimentation Rate, is indicative of the absence or presence of certain latent diseases, and therefore this test is universally used as a diagnostic means for such diseases as coronary thrombosis, tuberculosis, rheumatic fever, malignancy of tumors (cancer), anaemia, the pelvic inflammatory disease of women, etc. and also of pregnancy.

The sedimentation rate is ascertained by observing the sedimentation of the incoagulable blood in cylindrical tubes, in which the blood liquid forms a cylindrical column. Tubes of widely differing length and diameter are in use and therefore the results obtained at different times and places of observation are often not directly comparable. No standard test method is known, though the need for it is generally recognized.

As to the circumstances which cause settling of the erythrocytes, it has long been known that the blood plasma plays a decisive role.

According to Best and Taylor (*The Physiological Basis of Medical Practice*, The Williams & Wilkins Co., Baltimore 1945, 2nd ed., p. 82) "... the character of the plasma and not that of the cells is the determining factor."

I have now found in a great number of experiments that the so-called sedimentation rate, upon which the diagnostic calculation is based, is greatly influenced and affected by the shape of the body of liquid tested. I further found that the settling of the cells (erythrocytes) is preceded by two phenomena which for best performance depend on the shape of the body of blood under test. They are: the release of the plasma from the solid-fluid mixture (blood) and the ensuing rise of the plasma which enables the cells to descend and settle down.

Obviously, now, a cylindrical column of a solid-fluid mixture like blood, confined between the circular walls of a narrow tube, does not offer the most favorable conditions for the separation of the two constituents of this mixture, one of which must rise in order that the other may settle down. In such a body both essential movements, the ascent of the fluid and the descent of the solids, are delayed due to the unfavorable shape of the space within which these two movements take

2

place, and this delaying effect constitutes a source of non-uniform or inaccurate test results.

I have now found that the highest separation speed, i. e. the quickest rising of the plasma, freed from its intimate physical association with the blood cells, and the subsequent settling of the erythrocytes, takes place in a body of liquid which gradually widens from its top to the bottom to such an extent that a wide zone of separation of the fluid-solid mixture is provided at the bottom, while, simultaneously, both a quick transfer of the plasma through narrowing spaces toward the surface and a subsequent speedy sedimentation of the erythrocytes through spaces widening towards the bottom is secured.

Obviously a body of predetermined triangular vertical section will answer these conditions in the most favorable manner. The triangle may be a rectangular triangle, the baseline of which is the diameter of the circle passing through the corners, or, better still, an equiangular triangle which presents the most favorable balance of forces acting on the test body.

The choice of the shape to be imparted to the body of biological liquids is determined in practice by the inner shape of the vessel into which the liquid is filled. The drawing affixed to this specification and forming part thereof illustrates graphically the ideal conditions of sedimentation according to this invention, and forms of different vessels particularly suited for carrying through the sedimentation tests, the showing being purely diagrammatic and only by way of example.

In the drawing

Figure 1 illustrates graphically a body of rectangular triangle section the baseline of which is the diameter of the circle passing through the three corners, while

Figure 2 is a similar view of a body of equiangular triangle section in a similar circle.

Figure 3 is an elevation of a conical test vessel corresponding to a liquid body as shown in Figure 1.

Figure 4 is a similar view of a conical vessel, corresponding to the body of Figure 2.

Figure 5 is a perspective view of a vessel which has a triangular section in the direction of one diameter and a quadrangular section at right angles thereto.

Referring to the drawings and first to Figure 1, 1 is the baseline of a triangle forming also the diameter of the circle 2. The two equal sides 3 of the triangle meet at right angles in the point 4 of the same circle. A body having the

3

vertical section of this triangle widens downwardly and offers favorable conditions for the ascent of the liquid plasma from the bottom up and for the descent of the solid cell mass in the direction towards the bottom.

A test vessel having a corresponding section is shown in Figure 3, being preferably formed with a short neck 6. 7 is the graduation which permits reading the rate of sedimentation.

Figure 2 illustrates a triangular body offering still better conditions for sedimentation, all sides of this triangle being chords of equal length of the circle 2. This form offers ideal conditions for sedimentation, and the corresponding vessel is in Figure 4.

Figure 5 illustrates another form of vessel which may be considered as being a middle section of the vessel shown in Figure 4. The two diverging walls 13 are parts of a cone or pyramid, the two other walls 14 extend vertically in parallel relation. In this vessel the graduation 7 is preferably arranged on a wall 14.

Obviously, since only small quantities of blood, as a rule less than 2-3 cubic centimeters, are used for the test, the graduated test vessel will as a rule not exceed 2-5 ccms. in inner volume.

I wish it to be understood that I do not desire

4

to be limited to the details of shape and construction of the bodies of liquid and the vessels shown and described, for obvious modifications will occur to a person, skilled in the art.

5 I claim:

In the method of testing the blood sedimentation rate, the step of introducing the quantity of blood to be tested into a substantially flat transparent container whose vertical section is bordered by a triangle, the vertical angle of which is not materially narrower than 60°.

PAUL M. NEUDA.

REFERENCES CITED

15 The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
20 D. 23,381	Tatum	June 19, 1894
512,874	Fraser	Jan. 16, 1894
2,104,525	Proskouriakoff	Jan. 4, 1938
2,362,523	Armstrone, Jr., et al.	Nov. 14, 1944

OTHER REFERENCES

25 Corning Glass Works, Catalog LP24, Corning, N. Y. (1944), page 55.