CLAIMS

1. Apparatus to determine erythrocyte sedimentation rate and other connected parameters, comprising:

- a sampling member (11) to take the blood sample to be analyzed disposed in test tubes (22);

- a pipe (12) inside which the blood sample is able to be introduced, transparent to electromagnetic radiations in a field comprised between 100 and 2000 nm;

- a circuit (13) that connects said sampling member (11) to said pipe (12) and inside which the blood sample circulates;

- a pump (14) associated with said circuit (13) and cooperating with means to create an air bubble between two successive blood samples;

- a discharge pipe (15) to discharge the blood sample after the analysis;

- a measuring instrument comprising a radiation emitter device (16) associated with a mating detector device (17), together defining a measuring zone;

- a control and processing unit (20) able to manage the functioning of said apparatus, and

- an interface unit (18) by means of which said devices (16 and 17) are connected to said control and processing unit (20),

wherein said pump (14), with each measuring cycle, is configured to take a quantity of blood in a range from 30 microliters to 180 microliters, and wherein said measuring instrument is configured to perform the measurement on a quantity equal to about 1 final microliter of said initial sample quantity,

the apparatus also comprising means (23) to make the test tubes (22) rotate or tilt before the sampling in order to perform programmed mixing cycles of the blood contained in the test tubes (22),

wherein said sampling member comprises means (11, 11a) to take the blood sample from the test tubes (22) both oriented with the stopper facing upward and also oriented with the stopper facing downward,

wherein said detector device (17) is configured to perform at least one of the functions of detecting the temperature values of the blood sample so as to discard samples below a predetermined threshold value, of detecting the hematocrit values of the sample so as to discard samples with a hematocrit value below 25%

and of detecting the position of said air bubble between two successive blood samples in order to establish a fixed point where movement starts.~~.~~

2. Apparatus as in claim 1, **characterized in that** it comprises a reading chamber (50) associated with said at least one pipe (12), said reading chamber (50) being at least partly transparent to radiations in a certain field of wavelengths, and having at least one substantially rectilinear segment of reduced size inside which the blood sample to be analyzed is introduced, **and in that** the reading chamber (50) consists of a tube (51) made of plastic material, or glass, defining a capillary channel coupled in fluidic continuity with said pipe (12).

3. Apparatus as in claim 2, **characterized in that** said reading chamber (50) is configured to allow to read the blood sample also in conditions of absence of gravity.

4. Apparatus as in claim 2 or 3, **characterized in that** said reading chamber (50) and/or said capillary (51) have a section of $0.8\mu m^2$.

5. Apparatus as in any claim from 2 to 4, **characterized in that** said reading chamber (50) is associated with thermostat means.

6. Apparatus as in any claim hereinbefore, **characterized in that** it comprises means to mix the sample before it is analyzed, of the tilting or rotary type.

7. Apparatus as in any claim hereinbefore, **characterized in that** said detector device (17) is configured to detect electromagnetic waves with a wavelength comprised between 700nm and 1mm.

8. Apparatus as in any claim hereinbefore, **characterized in that** said pump (14) is a peristaltic pump, configured to move the blood sample to the established reading point.

9. Apparatus as in any claim hereinbefore, **characterized in that** said control and processing unit (20) is configured to compare the values detected by said detector device (17) with preset values, and to signal to the user the possible non-suitability of the blood sample.

10. Apparatus as in any claim hereinbefore, **characterized in that** it comprises a second external sampling member (11a) provided with another circuit (13a), independent from said first circuit (13), said second sampling member (11a) being able to take the blood sample from a test tube from the top downward.

11. Method to determine erythrocyte sedimentation rate and other connected

parameters, performed by means of the emission, by emitter means (16), of radiations that pass through a sample being examined disposed in test tubes (22), and the detection, by detector means (17), of radiations after the passage through said sample, wherein the sample is introduced into a pipe (12) which passes through a measuring zone thanks to the action of a pump (14), said detector means (17) defining a reading and measuring point, **characterized in that** it provides to create an air bubble in the pipe (12) between two successive blood samples, to determine a zero detection point starting from the passage of said air bubble through a detection point, and to drive the pump (14) in a controlled manner in order to obtain a detection by said emitter means (16) and detector means (17) on a final fraction of a known and preset quantity of the blood sample, and **in that** the method provides, by means of said detector means (17), to perform at least one of the functions of detecting the temperature values of the blood sample so as to discard samples below a predetermined threshold value, of detecting the hematocrit values of the sample so as to discard samples with a hematocrit value below 25% and of detecting the position of said air bubble between two successive blood samples in order to establish a fixed point where movement starts.~~.~~

12. Method as in claim 11, **characterized in that** it provides that the reading and measuring point is located in a position such that, with respect to the measuring zone, a preset quantity of microliters of blood, downstream of said air bubble, passes and is made to flow through the measuring zone as an inert passage, without any measuring of said quantity, and the reading of the sample is started for a portion of 1 microliter in volume.

13. Method as in claim 11 or 12, **characterized in that** said method is performed with a volume of whole blood taken from a test tube of the EDTA/citrate type and/or with a volume of native blood just taken from a patient.

14. Method as in any claim from 11 to 13, **characterized in that** it provides to use three-level turbidity latexes to calibrate the accuracy of the measurement.

15. Method as in any claim from 11 to 14, **characterized in that** it provides to perforate the stopper of the test tube (22) before the analysis, in order to air the sample.

16. Method as in any claim from 11 to 15, **characterized in that** it provides to

detect radiations by a plurality of detector devices (17) during a single reading of the sample, so as to improve possible compensations.

17. Method as in any claim from 11 to 16, **characterized in that** it provides to detect the aggregation of red cells, and hence the measurement of the ESR, by actuating variable mixes of the sample in relation to the quantity of blood contained in said test tubes (22).

18. Method as in any claim from 11 to 17, **characterized in that** it provides, following mixing, to overturn said test tube (22) so as to dispose the part provided with the stopper facing downward.

19. Method as in any claim from 11 to 18, **characterized in that** it provides to detect the aggregation of red cells, and hence the measurement of the ESR, by using electromagnetic radiation at 1000 pulses per second, by means of said emitter means (16) and said detector means (17).

20. Method as in any claim from 11 to 19, **characterized in that** it provides a statistical control of the population based on the values comprised in a database (27).