

PATENT SPECIFICATION

816,443



Date of filing Complete Specification Sept. 20, 1957.

Application Date June 20, 1956.

No. 19112/56.

Complete Specification Published July 15, 1959.

Index at acceptance:—Class 106(1), B5(B:F:GX).

International Classification:—G05g.

COMPLETE SPECIFICATION

Improvements in and relating to Calculating Devices

5 I, JACK WILMOT NICHOLAS, a British Subject, of Essex County Hospital, Colchester, Essex, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 This invention relates to improvements in calculating devices of the kind generally known generically as slide rules and is more particularly concerned with calculating devices for use in hæmatology.

15 In carrying out tests on a sample of blood in normal routine hæmatology certain basic information is initially determined and from this information various specific quantitative data, which together represent a complete analysis of the blood sample, are obtained by mathematical calculation. In particular, initial 20 tests are made to determine,

(a) Hæmoglobin Content (Hb), usually as a percentage of an arbitrary British Standard,

25 (b) Red Cell Count (R.B.C.) in millions per mm³, and

(c) Packed Cell Volume (P.C.V.) as a percentage of the original volume of the blood occupied by the cells after centrifuging.

30 From these three basic determinations, the following data are then obtained, namely,

(1) Hæmoglobin Content (Hb) in gm/100 ml.

35 (2) Mean Corpuscular Volume (M.C.V.) in µ³.

(3) Mean Corpuscular Hæmoglobin (M.C.H.) in µ µ g.

(4) Mean Corpuscular Hæmoglobin Concentration (M.C.H.C.) as a percentage, and

40 (5) Colour Index (C.I.) as a pure member.

The calculations required to obtain the above data involve simple, but somewhat lengthy and time wasting sums in long division, as will be readily appreciated from a consideration of the following formulæ:—

$$\text{M.C.V.} = \frac{\text{P.C.V.}}{\text{R.B.C.}} \times 10^7$$

$$\begin{aligned} \text{M.C.H.} &= \frac{\text{Hb (gm/100 ml.)}}{\text{R.B.C.}} \times 10^7 & 45 \\ \text{M.C.H.C.} &= \frac{\text{Hb (gm/100 ml.)}}{\text{P.C.V.}} \times 100 \\ \text{C.I.} &= \frac{\text{Hb (as \% of standard)}}{\frac{\text{R.B.C. (as \% of standard)}}{\text{Hb (as \% of standard)}} \times 10^5} \\ &= \frac{\text{Hb (as \% of standard)}}{2 \times \text{R.B.C.}} \end{aligned}$$

50 The last value has a linear relationship with the value of M.C.H.

The required calculations can, of course, be speedily made by suitably skilled persons by the use of an ordinary logarithmic slide-rule but its use, in the hands of an inexperienced person, is liable to result in reciprocal values being inadvertently noted, which may escape detection as both the M.C.H. and M.C.H.C. values are normally in the region of 30, the M.C.V. value in the region of 100 and the C.I. value in the region of 1; thus the reciprocals as read from a slide rule would be close to the numbers themselves.

65 The principal object of this invention is to provide a simple calculating device by means of which some or all of the above data can be readily and rapidly obtained once the aforesaid initial determinations have been made.

70 Another object of the invention is to provide a calculating device for use in routine hæmatology by means of which, given the initial Hb, R.B.C. and P.C.V. values, specific quantitative data can be instantly and simultaneously read after one simple adjustment or setting of the device has been made.

75 A further object of the invention is to provide a calculating device for use in making tests of samples of blood which is simple and efficient in use and which requires no mathematical knowledge on the part of the operator.

80 According to one feature of the invention, therefore, a calculating device for use in

- hæmatology comprises essentially a normally stationary base and two movable members mounted in said base so as to be movable relatively thereto and to one another, the stationary base carrying a logarithmic scale representing either (a) Hæmoglobin content (Hb) as % of British or other recognised Standard or (b) Hæmoglobin content in gm/100 ml. or carrying both scales (a) and (b) in spaced relation to one another and one movable member carrying a logarithmic scale representing Red Cell Count (R.B.C.) and the other movable member carrying a logarithmic scale representing Packed Cell Volume (P.C.V.) and one of said movable members also carrying a logarithmic scale representing Mean Corpuscular Volume (M.C.V.) and the other carrying a pre-set index mark directed towards said M.C.V. scale, and a logarithmic scale representing Mean Corpuscular Hæmoglobin concentration (M.C.H.C.) and an index mark directed towards said M.C.H.C. scale being carried respectively on the stationary base and the P.C.V. scale-carrying-movable member or *vice versa*, the arrangement being such that when the said movable members carrying the R.B.C. and P.C.V. scales have been correctly set on the device according to their predetermined values in relation to a predetermined Hb value, the M.C.V. and M.C.H.C. values are instantly and simultaneously indicated by said index marks and the other Hb value, if both Hb scales are present, being also readily ascertainable.
- The stationary base or the R.B.C. scale-carrying movable member may, if desired, also carry a logarithmic scale representing Colour Index values (C.I.), an appropriate index mark directed towards this scale being provided on the said movable member or the stationary base, as the case may be.
- Advantageously also, the member carrying the C.I. scale may carry a further logarithmic scale representing Mean Corpuscular Hæmoglobin values (M.C.H.).
- If desired, the stationary base may also carry a displaceable member carrying a logarithmic scale representing colorimeter readings, which member is pre-set on the device relative to one of the Hb scales according to a previously determined linear relationship between said scales.
- In a preferred construction the calculating device is of the elongated flat shape with straight scales, similar to the well-known slide rule in common usage, the stationary base including upper and lower longitudinal members so disposed as to provide a guideway therebetween in which the movable members are slidably located in side-by-side relation to one another.
- The upper stationary member carries at the left hand side thereof the Hb % scale and the lower stationary member carries, also at the left-hand side thereof, the Hb gm/100 ml. and at the right-hand side thereof the M.C.H.C. scale.
- The upper movable member carries, at the left-hand side thereof, the R.B.C. scale and at the right-hand side thereof an index mark directed towards the lower movable member. The latter itself carries at the left-hand side thereof the P.C.V. scale and at the right-hand side thereof the M.C.V. scale and an index mark directed towards the M.C.H.C. scale on the lower stationary member. The upper stationary member also carries at the right-hand side thereof a C.I. scale and in parallel relation thereto a M.C.H. scale, the upper movable member carrying at its right-hand side an index mark directed towards the C.I. and M.C.H. scales.
- Preferably a further movable member is slidably mounted on the stationary base and carries a logarithmic scale representing colorimeter readings.
- A single line cursor may also be provided.
- According to a further feature of the invention, a calculating device for use in hæmatology comprises a normally stationary base and two movable members mounted thereon to move relatively to the stationary base and to one another, the stationary member having hereon a number of logarithmic scales, arranged in spaced relation to one another and representing respectively (a) Hæmoglobin content (Hb) as % of British or other recognised Standard, (b) Hæmoglobin content (Hb) in gm/100 ml., (c) Mean Corpuscular Hæmoglobin (M.C.H.), (d) Mean Corpuscular Hæmoglobin Concentration (M.C.H.C.) and (e) Colour Index (C.I.) and, if desired, a further logarithmic scale representing colorimeter values and one movable member carrying a logarithmic scale representing Red Cell Count (R.B.C.) and two pre-set oppositely directed index marks and the other movable member carrying a logarithmic scale representing Packed Cell Volume (P.C.V.) and in spaced relation thereto a logarithmic scale representing Mean Corpuscular Volume (M.C.V.) and a pre-set index mark, and said base also carrying a slidable cursor, the arrangement being such that, when the movable members have been correctly set on the device according to predetermined values in relation to a predetermined Hb value, or colorimeter value, if such a scale be present, employed at a datum point to perform the requisite division sums, the quotients representing M.C.H., M.C.V., M.C.H.C. and C.I. values and the other Hb value or both Hb values are instantly and simultaneously indicated without further adjustment being necessary, by the said index marks and the cursor line respectively.
- In order that the invention may be fully understood and readily carried into effect, one embodiment thereof will now be described, by way of example, by reference to the accompanying diagrammatic drawings, in which:

Figure 1 is a plan view of an elongated flat type calculating device embodying the invention, the component parts of the device having been pre-set according to certain initial determinations to be referred to hereafter; and

Figure 2 is a section on the line I—I of Figure 1.

Referring to the drawing, the calculating device comprises a base 1 of rectangular shape having raised longitudinal edges 1a and 1b, each of which is formed with a recess or guideway 1c. On the base 1 are arranged in spaced relation to one another two parallel stationary longitudinal members 2 and 3 forming between them a guideway 4 in which are slidably mounted upper and lower longitudinal members 5 and 6 respectively, so as to be slidable relatively to one another and to the base 1.

The upper stationary member 2 carries at the left-hand side thereof a logarithmic scale 7 representing Hæmoglobin Content as a percentage of British Standard (Hb%) in a range of values from 10 to 170 and at the right-hand side thereof along the opposed longitudinal edges thereof an upper logarithmic scale 8, representing Colour Index values (C.I.) ranging from 0.3 to 1.6 and a lower logarithmic scale 9 representing Mean Corpuscular Hæmoglobin values (M.C.H.) in a range of values from 10 to 50.

The lower stationary member 3 carries at the left-hand side thereof, and beneath and parallel to the Hb% scale 7 on the upper member 2, a logarithmic scale 10 representing values for Hæmoglobin Content in gm/100 ml. ranging from 1.5 to 26 and at the right-hand side thereof, and beneath and parallel to the aforesaid scales 8 and 9 on the upper member, a further logarithmic scale 11 representing values for Mean Corpuscular Hæmoglobin Concentration (M.C.H.C.) ranging from 10—50.

The upper movable member 5 carries at the left-hand side thereof a logarithmic scale 12 representing Red Cell Count values (R.B.C.) ranging from 0.5 to 10 million and at the right-hand side thereof an upwardly directed index mark or arrow 13 pointing towards the C.I. and M.C.H. scales 8 and 9, and a downwardly directed index mark or arrow 14 pointing towards the lower movable member 6.

The lower movable member 6 carries at its left-hand side a logarithmic scale 15 representing values for Packed Cell Volume (P.C.V.) ranging from 5—100 and at the right-hand side thereof along the upper longitudinal edge thereof a logarithmic scale 16 representing values for Mean Corpuscular Volume (M.C.V.) ranging from 40—180 and beneath this scale 16 and downwardly directed index mark or arrow 17 pointing towards the M.C.H.C. scale 11 on the lower stationary member 3.

The upper stationary longitudinal member 2 is spaced from the upper edge 1a of the base 1 and in the space provided therebetween

is slidably arranged a further movable member 18 carrying on its upper face a logarithmic scale 19 representing colorimeter readings ranging in value from 3 to 100.

This scale is pre-set relative to one of the Hb scales in accordance with a predetermined value obtained from a specimen of blood, the hæmoglobin content of which is known, provided the colorimeter is such that there is a linear relationship between the two values.

Slidably mounted in the guideways 1c of the edge portions 1a and 1b of the base 1 and above the aforesaid scale carrying members 2, 3, 4, 5, 6 and 18 is a sheet of transparent material 20, such as glass or plastic material carrying a single transverse line marking 21 extending transversely across the sheet 20. This sheet 20 serves as a single line cursor for giving a datum line in accordance with a determined colorimeter reading or Hb value, and at the same time serves as a covering for protecting the scale markings.

In order, however, to allow for cases where the British or other Standard for which the rule is intended is not used to define the Hb% value, a further short datum line extending, if desired, only across the Hb% scale, may be provided on the cursor to give the correct reading on the Hb% scale in accordance with the particular standard employed, it being understood that the full datum line is used for setting the colorimeter, R.B.C., P.C.V. and Hb (gm/100 ml.) scales, but the short line is used for setting or reading the Hb%. The M.C.H., M.C.V. and M.C.H.C. values are read at the index marks as before, but the C.I. value is read by setting the full cursor line to C.I. and M.C.H. index mark and reading off the colour index under the short datum line.

The above described calculating device is used in the following manner:—

Assuming the initial determinations have been made, namely the Hb value, either as % of British or other Standard, as gm/100 ml. or simply in the form of a colorimeter reading, and the R.B.C. and P.C.V. values, the cursor 20 is first set so that the line marking 21 coincides either with the determined colorimeter reading on the colorimeter scale 19, (which has been pre-set as above described), or with the determined Hb value 7 or 10 on the upper or the lower stationary member 2 or 3 depending on which unit system has been chosen. Thereby, if the colorimeter reading is used, the Hb value in both unit systems is directly indicated on the upper and lower scales 7 and 10 respectively, or, if the Hb value in one unit system has been used, the value thereof in the other system is immediately available.

The two movable members 5 and 6 are then moved to bring the predetermined R.B.C. and P.C.V. values on the scales 12 and 15 respectively under the cursor line 21, whereby

5

10

15

20

25

30

35

40

45

50

55

60

65

70

75

80

85

90

95

100

105

110

115

120

125

130

all the other required values are instantly ascertainable from the positions of the three index marks or arrows 13, 14 and 17 on the movable members 5 and 6 relative to their cooperating scales. Thus, the arrow 17 on the lower movable member 6 indicates the required reading on the Mean Corpuscular Hæmoglobin Concentration (M.C.H.C.) scale 11 on the lower stationary member 3, the arrow 14 on the upper movable member 5 indicates the required reading on the Mean Corpuscular Volume (M.C.V.) scale 16 on the lower movable member 6, whilst the other arrow 13 indicates the readings for both the Mean Corpuscular Hæmoglobin (M.C.H.) scale 9 and the Colour Index (C.I.) scale 8 on the upper stationary member 2. It will, of course, be appreciated that the M.C.V. and M.C.H. values obtained must each be multiplied by 10^7 and the M.C.H.C. value by 100. If desired, the scales may be such as automatically to allow for this.

Thus, all the required calculations have been effected by one initial setting of the calculating device in a simple and rapid manner.

The result of a typical series of calculations from initial hæmatological determinations is illustrated in Figure 1.

Initial determinations on a sample of blood gave the following figures, namely:—

Red Cell Count		
(R.B.C.) - - -	5.2 million/cu.mm.	
Packed Cell Volume		
(P.C.V.) - - -	45	
Colorimeter reading -	31	

The cursor 20 was first set so that the line marking 21 registered with the given colorimeter reading on the scale 19 and then the upper movable member 5 was moved to bring the R.B.C. value under the cursor line 21. Similarly the lower movable member 6 was adjusted to bring the P.C.V. value also under the cursor line 21. No other adjustments were made and the following results as shown in Figure 1 were read on the various scales, namely:—

Hb % - - -	91 on scale 7.
Hb gm/100 ml.	13.5 on scale 10
M.C.V. - - -	86.5 μ^3 on scale 16
M.C.H. - - -	26 μ g. on scale 9
M.C.H.C. - - -	30% on scale 11
C.I. - - -	0.88 on scale 8

Whilst in the above, one specific embodiment of the invention has been described by way of example, it is to be understood that modifications may be made therein without departing from the scope of the invention.

For example, the slidable member carrying the colorimeter scale may be omitted, in which case the cursor will be set against the predetermined Hb value on the upper or the lower stationary scale, as the case may be, which will also enable the other Hb value on the lower or the upper stationary scale to be directly read. If the colorimeter scale be

provided, it will, of course, not be necessary to predetermine the hæmoglobin content as a percentage. This member may also be made reversible in position so as to give reciprocal scale readings for cup-and-plunger type colorimeters. The opposite side of this member may be used, if desired, to carry a special scale in the event of the colorimeter calibration being non-linear.

Moreover, if the Hb% scale be omitted, the Colour Index (C.I.) scale would also not be provided.

Again, although in the above the calculating device has been described as of flat slide-rule-like construction, it is to be understood that it may be of any other suitable form, such as flat disc shape with concentric circular scales, tubular with the scales running circumferentially around the tube or any other suitable geometric shape.

The ranges of values covered by the various scales may differ to a greater or lesser extent from those cited above provided only that each covers, without it being necessary to reset the device, the likely range of normal and pathological values for the quantity in question. It is further to be understood that the position of the index marks and scales may be varied from those given above, for example, if a reciprocal scale be used, the positions of the scale and its cooperating index mark will be interchanged on the respective members.

WHAT I CLAIM IS:—

1. A calculating device for use in hæmatology comprising a normally stationary base and two movable members mounted in said stationary base so as to be movable relatively thereto and to one another, the stationary base carrying a logarithmic scale representing either (a) Hæmoglobin Content (Hb) as % of British or other recognised Standard or (b) Hæmoglobin Content in gm/100 ml. or carrying both scales (a) and (b) in spaced relation to one another, and one movable member carrying a logarithmic scale representing Red Cell Count (R.B.C.) and the other movable member carrying a logarithmic scale representing Packed Cell Volume (P.C.V.) and one of said movable members also carrying a logarithmic scale representing Mean Corpuscular Volume (M.C.V.) and the other carrying a pre-set index mark directed towards said M.C.V. scale, and a logarithmic scale representing Mean Corpuscular Hæmoglobin Concentration (M.C.H.C.) and an index mark directed towards said M.C.H.C. scale being carried respectively on the stationary base and the P.C.V. scale-carrying-movable member or *vice versa*, the arrangement being such that when the said movable members carrying the R.B.C. and P.C.V. scales respectively have been correctly set on the device according to their predetermined values in relation to

- a predetermined Hb% or Hb gm. value, the M.C.V. and M.C.H.C. values are instantly and simultaneously indicated by said index marks and the other Hb value, if both Hb scales are present on the device, being also readily ascertainable.
2. A calculating device as claimed in Claim 1 wherein the stationary base or the R.B.C. scale-carrying-movable member carries a logarithmic scale representing Colour Index (C.I.) values and an appropriate index mark directed towards said scale being carried by the said movable member or the stationary base, as the case may be.
3. A calculating device as claimed in Claim 2 wherein the member carrying the C.I. scale also carries a further logarithmic scale representing Mean Corpuscular Hæmoglobin (M.C.H.) values.
4. A calculating device as claimed in any of the preceding claims wherein said device is of elongated flat shape with straight scales.
5. A calculating device as claimed in Claim 4 wherein the stationary base includes upper and lower spaced longitudinal members so disposed as to provide a guideway therebetween in which said movable members are slidably located in side-by-side relation to one another.
6. A calculating device as claimed in Claim 5 wherein the upper longitudinal member carries the Hb% scale at the left-hand side thereof and the lower member carries the Hb gm/100 ml. scale at the left-hand side thereof and the M.C.H.C. scale at the right-hand side thereof.
7. A calculating device as claimed in Claim 6 wherein the upper movable member carries at the left-hand side thereof the R.B.C. scale and at the right-hand side thereof an index mark directed towards the lower movable member.
8. A calculating device as claimed in Claim 7 wherein the lower movable member carries at the left-hand side thereof the P.C.V. scale and at the right-hand side thereof the M.C.V. scale and an index mark directed towards the M.C.H.C. scale on the lower stationary member.
9. A calculating device as claimed in Claims 2, 3 and 6 wherein the upper stationary member carries at the right-hand side thereof the C.I. scale and in parallel relation thereto the M.C.H. scale.
10. A calculating device as claimed in Claims 7 and 9 wherein the upper movable member also carries at the right-hand side thereof an index mark directed towards the C.I. and M.C.H. scales.
11. A calculating device as claimed in any of the preceding claims wherein a further movable member is slidably mounted on the stationary base, said member carrying a logarithmic scale representing colorimeter readings.
12. A calculating device as claimed in any of the preceding claims wherein a single line cursor is also provided.
13. A calculating device as claimed in Claim 12 wherein the cursor also carries a further datum line for the purpose specified.
14. A calculating device for use in hæmatology comprising a normally stationary base and two movable members mounted thereon to move relatively to the stationary base and to one another, the stationary member having thereon a number of logarithmic scales arranged in spaced relation to one another and representing respectively (a) Hæmoglobin content (Hb) as % of British or other recognised Standard, (b) Hæmoglobin content (Hb) in gm/100 ml. (c) Mean Corpuscular Hæmoglobin (M.C.H.), (d) Mean Corpuscular Hæmoglobin Concentration (M.C.H.C.) and (e) Colour Index (C.I.) and, if desired, a further logarithmic scale representing colorimeter values, and one movable member carrying a logarithmic scale representing Red Cell Count (R.B.C.) and two pre-set oppositely directed index marks and the other movable member carrying a logarithmic scale representing Packed Cell Volume (P.C.V.) and in spaced relation thereto a logarithmic scale representing Mean Corpuscular Volume (M.C.V.) and a pre-set index mark and said base also carrying a slidable cursor the arrangement being such that when the movable members have been correctly set on the device according to predetermined values in relation to a predetermined Hb value, or colorimeter value if such a scale be present, employed as a datum point to perform the requisite division sums, the quotients representing M.C.H., M.C.V., M.C.H.C. and C.I. values are instantly and simultaneously indicated without further adjustment being necessary, by the said index marks, and the other Hb value or both Hb values by the cursor line.
15. A calculating device for use in hæmatology constructed and arranged and adapted to be used substantially as hereinbefore described with reference to and as illustrated in the accompanying diagrammatic drawing.

CHARLES K. REDFERN,
Chartered Patent Agent,
78, Hatton Garden, London, E.C.1,
Agent for Applicant.

PROVISIONAL SPECIFICATION

Improvements in and relating to Calculating Devices

I, JACK WILMOT NICHOLAS, a British Subject, of Essex County Hospital, Colchester, Essex, do hereby declare this invention to be described in the following statement:—

5 This invention relates to improvements in calculating devices of the kind generally known generically as slide rules and is more particularly concerned with calculating devices for use in hæmatology.

10 In carrying out tests on a sample of blood in normal routine hæmatology certain basic information is initially determined and from this information various specific quantitative data which together represent a complete
15 analysis of the blood sample, are obtained by mathematical calculation. In particular, initial tests are made to determine,

(a) Hæmoglobin content (Hb), usually as a percentage of an arbitrary British Standard

20 (b) Red Cell Count (R.B.C.) in millions per mm^3 , and

(c) Packed cell volume (P.C.V.) as a percentage of the original volume of the blood occupied by the cells after centrifuging.

25 From these three basic determinations, the following data are then obtained, namely:—

(1) Hæmoglobin content (Hb) in gm/100 ml.

30 (2) Mean Corpuscular Volume (M.C.V.) in μ^3 .

(3) Mean Corpuscular Hæmoglobin (M.C.H.) in μug .

(4) Mean Corpuscular Hæmoglobin Concentration (M.C.H.C.) as a percentage, and

35 (5) Colour Index (C.I.) as a pure number.

The calculations required to obtain the above data involve simple, but somewhat lengthy and time wasting sums in long division,
40 as will be readily appreciated from a consideration of the following formulæ:—

$$\text{M.C.V.} = \frac{\text{P.C.V.}}{\text{R.B.C.}} \times 10^7$$

$$\text{M.C.H.} = \frac{\text{R.B.C.}}{\text{Hb (gm/100 ml)}} \times 10^7$$

$$\text{M.C.H.C.} = \frac{\text{R.B.C.}}{\text{Hb (gm/100 ml)}} \times 100$$

$$45 \quad \text{C.I.} = \frac{\text{P.C.V.}}{\text{Hb (as \% of standard)}} \\ = \frac{\text{R.B.C. (as \% of standard)}}{\text{Hb (as \% of standard)}}$$

$$= 2 \times \text{R.B.C.}$$

The last value has a linear relationship with the value of M.C.H.

50 The required calculations can, of course, be speedily made by suitably skilled persons by

the use of an ordinary logarithmic slide-rule, but its use, in the hands of an inexperienced person, is liable to result in reciprocal values being inadvertently noted, which may escape
55 detection as both the M.C.H. and M.C.H.C. values are normally in the region of 30, the M.C.V. value in the region of 100 and the C.I. value in the region of 1; thus the reciprocals as read from a slide rule would be close
60 to the numbers themselves.

The principal object of this invention is to provide a simple calculating device by means of which some or all of the above data can be readily and rapidly obtained once the
65 aforesaid initial determinations have been made.

Another object of the invention is to provide a calculating device for use in routine hæmatology by means of which, given the initial Hb, R.B.C. and P.C.V. values, specific
70 quantitative data can be instantly and simultaneously read after one simple adjustment or setting of the device has been made.

A further object of the invention is to provide a calculating device for use in making
75 tests of samples of blood which is simple and efficient in use and which requires no mathematical knowledge on the part of the operator.

With these objects in view, therefore, my improved calculating device comprises, according to one aspect of the invention, a normally stationary base member and two movable
80 members mounted to move relatively to the fixed member, the stationary member carrying a logarithmic scale representing either (a) Hæmoglobin content (Hb) as % of British Standard or (b) Hæmoglobin content in gm/100 ml. or carrying both scales (a) and
85 (b) in spaced relation to one another and one movable member carrying a logarithmic scale representing Red Cell Count (R.B.C.) and the other movable member carrying a logarithmic scale representing Packed Cell Volume (P.C.V.) and one of said movable members
90 also carrying a logarithmic scale representing Mean Corpuscular Volume (M.C.V.) and the other carrying a pre-set index mark, a logarithmic scale representing Mean Corpuscular Hæmoglobin concentration (M.C.H.C.) and an index mark being carried respectively on the
95 fixed member and the P.C.V. scale carrying movable member or *vice versa*, said index marks being so located that when the movable members carrying the R.B.C. and P.C.V. scales have been correctly set on the device according to their predetermined values in relation to a predetermined Hb value, the
100 M.C.V. and M.C.H.C. values are instantly and simultaneously recorded by said index marks.

If desired, additional data, such as Colour

55

60

65

70

75

80

85

90

95

100

105

110

Index (C.I.) and Mean Corpuscular Hæmoglobin (M.C.H.) scales and an appropriate index mark may also be provided.

5 According to a more limited aspect of the invention, my improved calculating device comprises a normally stationary base member and two movable members mounted to move relatively to the fixed member, the stationary member having thereon a number of logarithmic scales arranged in spaced relation to one another and representing respectively (a) Hæmoglobin content (Hb) as % of British Standard, (b) Hæmoglobin content in gm/100 ml., (c) Mean Corpuscular Hæmoglobin (M.C.H.), (d) Mean Corpuscular Hæmoglobin Concentration (M.C.H.C.) and (e) Colour Index (C.I.) and one movable member carrying a logarithmic scale representing Red Cell Count (R.B.C.) and two pre-set index marks and the other movable member carrying a logarithmic scale representing Packed Cell Volume (P.C.V.) and in spaced relation thereto a logarithmic scale representing Mean Corpuscular Volume (M.C.V.) and a pre-set index mark, said index marks being so located in relation to the R.B.C. and P.C.V. scales that, when the movable members carrying the R.B.C. and P.C.V. scales have been correctly set on the device according to their predetermined values in relation to a predetermined Hb value employed as a datum point to perform the requisite division sums, the quotients representing M.C.H., M.C.V., M.C.H.C. and C.I. values are instantly and simultaneously recorded, without further adjustment being necessary, by the said index marks.

10 In one suitable construction of calculating device in accordance with the invention, the device is of the elongated flat type, similar to the well-known slide rule in common usage. In this form the stationary base member comprises two spaced-apart longitudinal members, hereinafter referred to as upper and lower members respectively, providing an intermediate guideway in which are slidably mounted two movable longitudinal members displaceable relatively to one another.

15 One of the fixed spaced-apart members, namely the upper member, carries at the left-hand side thereof a logarithmic scale representing Hæmoglobin content as percentage of British Standard (Hb) in a range of values from 10 to 200 and at the right-hand side along the opposed longitudinal edges thereof, two logarithmic scales representing respectively Mean Corpuscular Hæmoglobin Values (M.C.H.) in a range of values from 10 to 70 and Colour Index Values (C.I.) ranging from 0.3 to 2.

20 The other or lower of said spaced-apart members carries at the left-hand side thereof a logarithmic scale representing values for Hæmoglobin content in gm/100 ml. ranging from 1.5 to 30 and at the right-hand side thereof a logarithmic scale representing Mean

Corpuscular Hæmoglobin concentration values ranging from 10 to 50.

25 One of the movable members, namely that located immediately adjacent the upper fixed member and hereinafter referred to as the upper movable member, carries at the left-hand side thereof a logarithmic scale representing Red Cell Count Values (R.B.C.) ranging from 0.5 to 10 million and at the right-hand side thereof two distinct index marks or arrows pointing respectively towards the opposite longitudinal edges of the member.

30 The other movable member, that is to say, that located between the aforesaid movable member and the lower fixed member and hereinafter referred to as the lower movable member, carries at its left-hand side a logarithmic scale representing Packed Cell Volume (P.C.V.) values ranging from 5 to 100 and at the right-hand side thereof a logarithmic scale representing Mean Corpuscular Volume (M.C.V.) values ranging from 40 to 200 and an index mark or arrow pointing towards the M.C.H.C. scale on the lower fixed member.

35 Along the free edge of the fixed member, namely that carrying the (Hb) and M.C.H. and C.I. scales, is detachably and slidably fixable a further longitudinal member carrying on one face thereof a logarithmic scale representing colorimeter readings ranging in value from about 3 to 100. This member, which may be set in any desired position to suit different colorimeters, is also preferably made reversible in position so as to give reciprocal scale readings for cup-and-plunger type colorimeters. The opposite side of this member may be used, if desired, to carry a special scale in the event of the colorimeter calibration being non-linear.

40 A single line cursor is provided to give a datum line in accordance with the colorimeter reading.

The above described calculating device is used in the following manner:—

45 Assuming the initial determinations have been made, namely the Hb value, either as % of British Standard, as gm/100 ml. or simply in the form of a colorimeter reading, and the R.B.C. and P.C.V. values, the cursor is first set to the determined colorimeter reading on the colorimeter scale or to the determined Hb value on the upper or the lower fixed member depending on which unit system has been chosen. Thereby, if the colorimeter reading is used, the Hb value in both unit systems is directly indicated on the upper and lower fixed scales respectively, or if the Hb value in one unit system has been used, the value thereof in the other system is immediately available.

50 The two movable members are then moved to bring the predetermined R.B.C. and P.C.V. values under the cursor line, whereby all the other required values are instantly ascertainable from the positions of the three arrows on the movable members relative to their co-

70

75

80

85

90

95

100

105

110

115

120

125

130

operating scales. Thus, the arrow on the lower movable member indicates the required reading on the Mean Corpuscular Hæmoglobin Concentration (M.C.H.C.) scale on the lower fixed member, one of the arrows on the upper movable member indicates the required reading on the Mean Corpuscular Volume (M.C.V.) scale on the lower movable member, whilst the other arrow indicates the readings for both the Mean Corpuscular Hæmoglobin (M.C.H.) scale and the Colour Index (C.I.) scale on the upper fixed member. It will, of course, be appreciated that the M.C.V. and M.C.H. values obtained must each be multiplied by 10⁷ and the M.C.H.C. value by 100. If desired, the scales may be such as automatically to allow for this.

Thus, all the required calculations have been effected by one initial setting of the calculating device in a simple and rapid manner.

The following example is illustrative of the manner in which the device is used in practice.

Initial determinations on a sample of blood gave the following figures:—

Red Cell Count	(R.B.C.) - - -	5.2 million/cu.mm.
Packed Cell Volume	(P.C.V.) - - -	45
Colorimeter reading	- - -	31

The cursor was first set in register with the given colorimeter reading and then the upper movable member was moved to bring the R.B.C. value under the cursor line. Similarly the lower movable member was adjusted to bring the P.C.V. value also under the cursor line. No other adjustments were made and the following results were read on the various scales:—

Hb %	- - -	91
Hb gm/100 ml.	- - -	13.5
M.C.V.	- - -	86.5 μ^3
M.C.H.	- - -	25.9 μ μ g.
M.C.H.C.	- - -	30%
C.I.	- - -	0.88

Whilst in the above, one specific embodi-

ment of the invention has been described by way of example, it is to be understood that modifications may be made therein without departing from the scope of the invention.

For example the detachable member carrying the colorimeter may be omitted, in which case the cursor will be set against the predetermined Hb value on the upper or the lower scale, as the case may be, which will also enable the other Hb value on the lower or the upper fixed scale to be directly read. If the colorimeter scale be provided, it will, of course, not be necessary to predetermine the hæmoglobin content as a percentage.

Moreover, if desired, either the % Hb scale or the Hb gm/100 ml. scale may be omitted. In the former case, the Colour Index (C.I.) scale would also not be provided and, in the latter case, no Mean Corpuscular Hæmoglobin (M.C.H.) scale will be included.

Although in the above the calculating device has been described as of flat slide-rule like construction, it is to be understood that it may be of any other suitable form, such as flat disc shape with concentric circular scales, tubular with the scales running circumferentially around the tube or any other suitable geometric shape.

The ranges of values covered by the various scales may differ to a greater or lesser extent from those cited above provided only that each covers, without it being necessary to reset the rule, the likely range of normal and pathological values for the quantity in question. It is further to be understood that the position of the index marks and scales may be varied from those given above; for example, if a reciprocal scale be used, the positions of the scale and its cooperating index mark will be interchanged on the fixed and movable members respectively.

CHARLES K. REDFERN,
Chartered Patent Agent,
78, Hatton Garden, London, E.C.1,
Agent for Applicant.

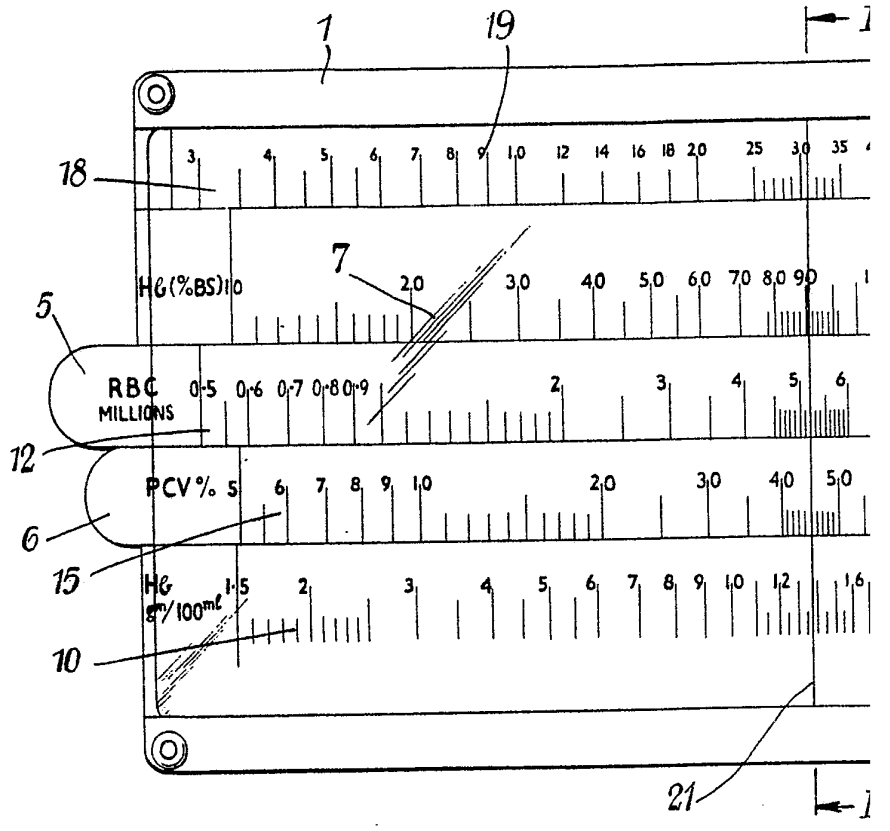


FIG. 1

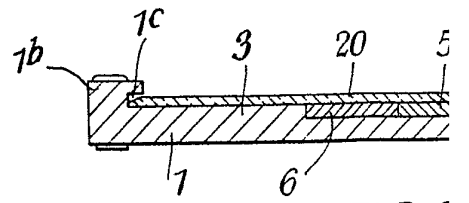


FIG. 2

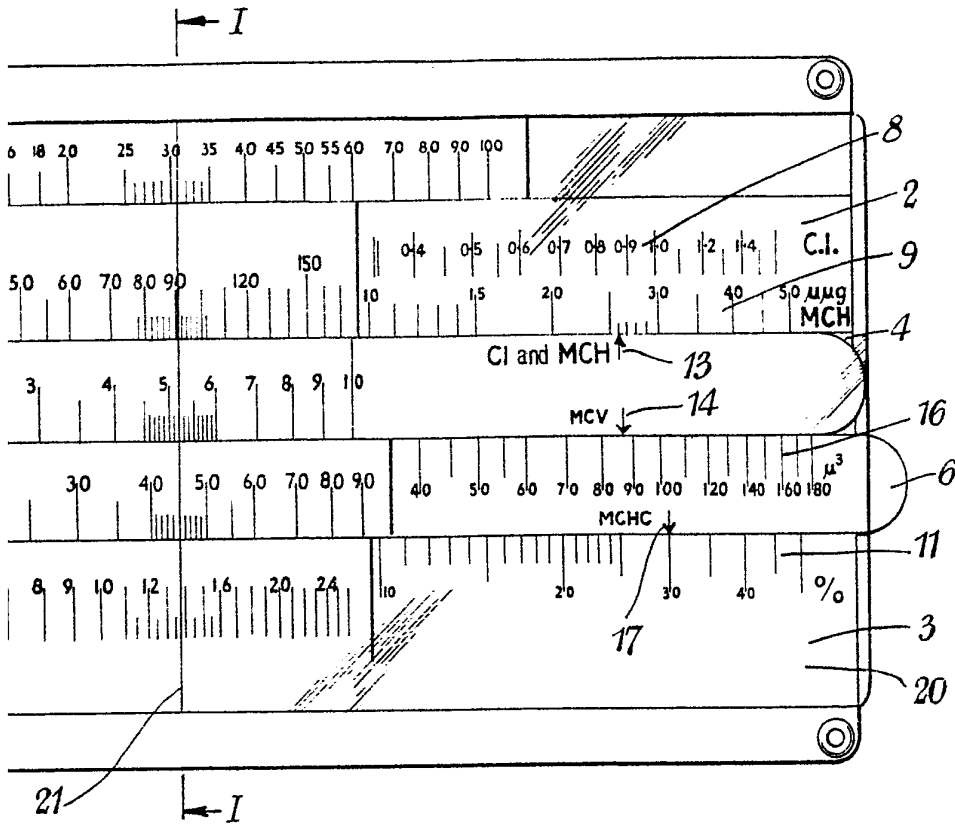


FIG. 1

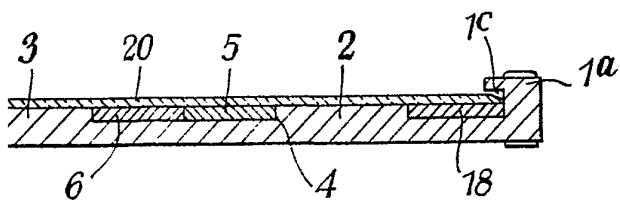


FIG. 2

816,443 COMPLETE SPECIFICATION
 1 SHEET
 This drawing is a reproduction of
 the Original on a reduced scale.

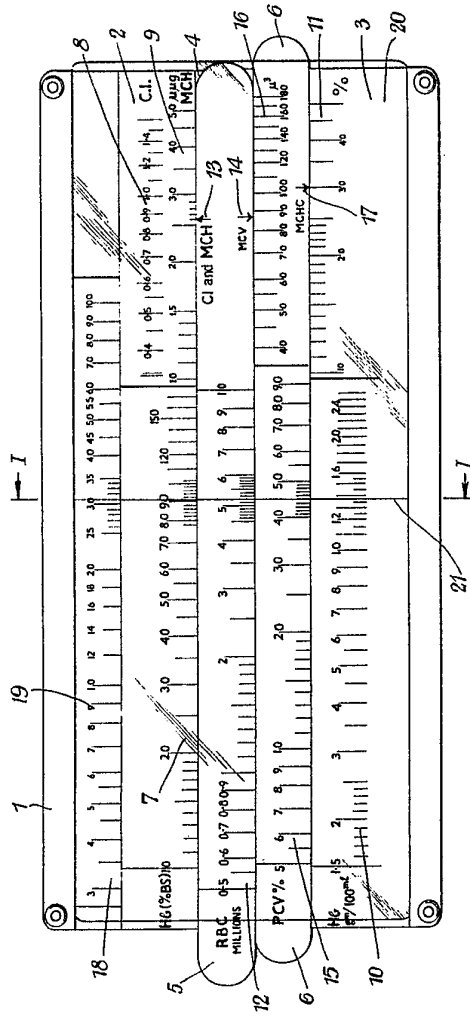


FIG. 1

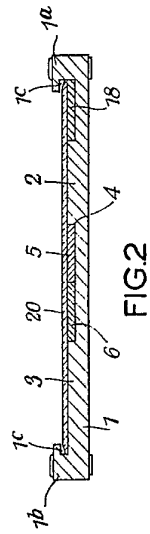


FIG. 2