PATENT SPECIFICATION

923,305

DRAWINGS ATTACHED.

Date of Application and filing Complete Specification :
Jan. 22, 1962. *No. 2248/62.*

Complete Specification Published : April 10, 1963.

Index at Acceptance :—Class 106(1), B5A, B5G(12:19).

International Classification :—G06g.

COMPLETE SPECIFICATION.

A Device to Measure Discounts and Profits and for Use in Sundry Other Computations and Determinations.

ERRATA

SPECIFICATION NO. 923,305

Page 1, line 13, *for* "300" *read* "900"

Page 1, line 21, *for* "indication" *read* "indicator"

Page 2, line 87, *for* "distil" *read* "distal"

Page 2, line 93, *for* "svale" *read* "scale"

Page 3, line 20, *for* "characteristics" *read* "characteristic"

Page 4, line 15, *for* "obverse" *read* "reverse"

Page 5, line 14, *for* "135" *read* "138"

Page 5, line 65, *for* "T.7310" *read* "T7310"

Page 6, line 3, *after* "Method" *insert* ":Part(1)"

Page 6, line 4, *delete* "Part (1)"

Page 6, line 89, *for* "β" *read* "B"

Page 6, line 91, *for* "(C -)" *read* "(C - A)"

Page 6, line 93, *for* " 39')" *read* "30')"

Page 6, line 100, *for* " $\infty \sin \beta$ " *read* "a sin B"

Page 8, line 110, *for* "un-" *read* "m-"

THE PATENT OFFICE,
19th July 1963

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COMPLETE SPECIFICATION.

A Device to Measure Discounts and Profits and for Use in Sundry Other Computations and Determinations.

I, THOMAS JOHN LE CHEMINANT, of 14 Cawston Road, Attadale, Western Australia, British Subject, Australian nationality, 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:—

The primary object of the device is to provide, automatically and quickly, a means of pricing goods after allowing for a given discount, up to 90 per cent, and providing for a given profit, up to 300 per cent. It may be used also in sundry other computations, in finding the trigonometrical ratios of any angle, and in the converse process, and it serves also as a circular protractor.

The device consists of three parts:—

(i) the base plate (see Fig. 1);

(ii) the rotor indication (see Fig. 2);

(iii) the rotary plate (see Figs. 3 and 4).

The rotary plate may have either the obverse face or the reverse face uppermost as desired.

The base plate is circular in plan and is made of transparent plastic material. A centrally-situated cylindrical boss, open at the top, serves as an axis about which the rotor indicator and the rotary plate rotate. The height of the boss is slightly in excess of the sum of the thicknesses of the rotor indicator and the rotary plate. About the periphery of the base plate is inscribed a logarithmic scale, called the base logarithmic scale. The method of graduating and calibrating this scale is described below. The graduations are marked on the circumference of the inner circle forming the ring, so that they will be in juxtaposition with the graduations of the scales on the rotary plate.

In the space lying between the base logarithmic scale and the central boss are inscribed three contiguous scales (hereinafter referred to, respectively, as the base sine scale, the base decimal equivalents scale, and the base shillings-pence scale) in the order named above, reading from the centre towards the periphery. The graduations and calibrations of these three scales will be described below.

Within the area bounded by the cylinder constituting the axial boss are drawn two diameters, mutually perpendicular, one of which, if produced, would pass through the zero graduation mark on the base logarithmic scale.

The rotor indicator is a thin circular sheet of transparent plastic material, slightly less in diameter than the base plate. It has a circular central aperture enabling it to fit snugly about the axial boss on the base plate. Protruding beyond the outer margin of the circular sheet is a narrow lug extending about half an inch beyond the base plate. A fine hair-line is inscribed diametrically upon the rotor indicator, symmetrically, to the outer extremity of the protruding lug. The lug serves as a hand-piece to facilitate rotary motion of the rotor indicator with respect to the base plate and to the rotary plate. The hair-line serves a three-fold purpose, in that it serves to define a functional relationship between readings on pairs of scales, to mark the point of departure on the base plate when the rotary plate is rotated with respect to the base plate, and to measure angles when the device is used as a circular protractor.

[*Price 4s. 6d.*]

The rotary plate consists of a circular sheet of light-coloured, opaque, plastic material, the diameter of which is slightly less than that of the base plate, to reveal the base logarithmic scale. At the centre of the plate is a circular opening which fits snugly about the axial boss on the base plate, to permit of free independent rotation.

Symmetrically disposed about a diameter on the reverse side of the rotary plate is a rectangular area with a surface prepared for the inscription and erasure of notes in pencil.

At the periphery of the obverse face of the rotary plate is inscribed a combined scale, consisting of a profit scale covering the range 0% to 150%, (hereinafter called the obverse rotary profit scale) inscribed in the same annulus as a discount scale covering the range 0% to 75%, hereinafter called the obverse rotary discount scale. The graduation and calibration of these scales will be described below.

On the reverse face of the rotary plate is inscribed, at the periphery, a set of graduation marks, on the outer circumference of the containing annulus. This set of graduations and its related three sets of calibrations will be described below.

The three scales so formed will be called hereinafter, respectively, the reverse rotary discount scale, the reverse rotary profit scale, and the reverse rotary combined scale, in the order named above, reading from the centre towards the periphery.

Symmetrically situated about that diamater of the rotary plate which passes through the zero mark of the reverse rotary combined scale are three apertures, in the form of part-annuli, excised at such distances from the centre of the plate as to reveal (through the transparent rotor indicator), on one side of the centre, parts of the base sine scale and of the base shillings-pence scale and, on the other side of the centre, the corresponding part of the base decimal equivalents scale.

The base logarithmic scale is determined by dividing the inner circumference of a peripheral annulus into 1,000 equal arcs, the position of the graduation marks being then fixed by the mantissae of the logarithms of the numbers 10 to 100. The calibration of the resulting scale is performed by inscribing, at the appropriate graduation marks, the antilogarithms corresponding to the respective mantissae covering the range 10 to 100. Spatial and mechanical considerations determine the density of inscription.

The distal circumference of the annulus bounding the shillings-pence scale is divided first into 20 equal arcs each representing one shilling; second, into 80 equal arcs, each representing threepence; and, third, into 240 equal arcs, each representing one penny. The graduation so obtained enables this scale to be used as an avoirdupois scale based on the following system of correspondences:—

1 shilling interval represents 1 hundredweight;
1 threepence interval represents 1 quarter;
1 penny interval represents $9\frac{1}{3}$ pounds.

The calibration of the base shillings-pence scale is performed by fixing the zero mark on that diameter which passes through the zero mark on the base logarithmic scale, and on the same side of the centre of rotation, and then inscribing the numbers 1 to 19 in a clockwise order at the successive graduation marks signifying shillings.

The proximal circumference of the annulus bounding the base shillings-pence scale serves as the distal circumference of the annulus bounding the base decimal equivalents scale. The base decimal equivalents scale is graduated by dividing the distil circumference of the annulus into 1,000 equal arcs by the inscription of 200 graduation marks at intervals of 5 units. The calibration is performed by fixing the zero calibration mark of the base decimal equivalents svale diametrically opposite to the zero calibration mark of the base logarithmic scale and then inscribing, clockwise, successive values at intervals of 50 covering the range 0 to 1,000. The inscribed digits are so orientated that the operator views the numbers in the same reading position as those of the base shillings-pence scale and of the base sine scale.

The proximal circumference of the annulus bounding the base decimal equivalents scale serves as the distal circumference of the annulus bounding the base sine scale.

The zero calibration mark of the base sine scale is that point on the distal circumference of the bounding annulus which lies on the diameter passing through the zero calibration mark on the base logarithmic scale. The zero calibration marks of the base sine scale and of the base logarithmic scale are on the same side of the centre of rotation. The graduation of the base sine scale is performed by marking, clockwise, on the distal circumference of the bounding annulus, points determined by the values of the sines of angles, at one-degree intervals, from 0° to 90°, as given in the column headed 0^1 in a table of natural sines, taking the circumference as covering the range of values 0 to 1. The calibration of the base sine scale consists in inscribing, clockwise, the values 5, 10, 15... and so on to 80, at five-degree intervals, at the appropriate graduation marks.

The graduation and calibration of the scales on the reverse face of the rotary plate

are determined by the following mathematical considerations:—

A discount of x% results in an actual cost price less than the marked, or quoted, price—

Cost Price $=(100-x)/100 \times$ Quoted Price.

It follows that, for any positive value of x less than 90 the decimal fraction equivalent to the vulgar fraction $(100-x)/100$ will have a logarithm the characteristic of which is -1.

Adding the positive fractional mantissa to the characteristic -1 results in a negative fraction. Again, a profit of y% results in a selling price greater than the actual cost price—

Selling Price $=(100+y)/100 \times$ Quoted Price.

It follows that, for any positive value of y less than 900, the decimal fraction equivalent to the vulgar fraction $(100+y)/100$ will have a logarithm the characteristics of which is 0, the mantissa being positive. These two considerations lead to the *ad hoc* convention:—

Profits are measured in the clockwise direction, which is taken to be the positive direction of rotation.

Discounts are measured in the counter-clockwise direction, which is taken to be the negative direction of rotation.

Since, by hypothesis, $90>x>0$, the fraction $(100-x)/100$ lies between 0.1 and 1.0.

Similarly, since, by hypothesis, $900>y>0$, the fraction $(100+y)/100$ lies between 1 and 10.

The decimal fractions equivalent to these vulgar fractions will have the same significant digits if—

$10 \times (100-x)/100=(100+y)/100$ that is, if—

$1{,}000-10x=100+y$ that is, if—

$y=900-10x$.

Hence, for every value of x satisfying the condition $90>x>0$, there is a corresponding value of y satisfying the condition $900>y>0$ and satisfying further, the condition that the significant digits of the decimal equivalents of the vulgar fractions $(100-x)/100$ and $(100+y)/100$ will be the same.

To illustrate: if in the equation

$$y=900-10x$$

there be given the value $x=5$ then $y=850$.

The numerator of the fraction $(100-x)/100$ is 95 and the numerator of the fraction $(100+y)/100$ is 950. The fractions thus have the same significant digits, and therefore the mantissae of their logarithms are the same.

If, then, the graduations of the scales are determined by the mantissae, it follows that the graduations on the discount scale and those on the profit scale will coincide throughout the range of each.

From these considerations a table may be drawn up, having five columns headed, respectively: (1) Random values of x; (2) Resultant values of y from the equation $y=900-10x$; (3) Significant digits in the value of $(100-x)/100$; (4) Significant digits in the value of $(100+y)/100$; and (5) Mantissae of logarithms of numbers in Columns (3) and (4). The following are some figures from such a table:—

(1)	(2)	(3)	(4)	(5)
5	850	95	95	9777
10	800	9	9	9542
15	750	85	85	9294
...	...	...	...	...
75	150	25	25	3979
89	10	11	11	0414

The table shows how a common set of graduations may be associated, in turn, (Column 5) with three sets of calibrations forming three scales, the reverse rotary discount scale (Column 1), the reverse rotary profit scale (Column 2), the reverse rotary combined scale (Columns 3 and 4), the reverse rotary combined scale being identical in graduation and calibration with the base logarithmic scale.

At the periphery of the reverse face of the rotary plate is inscribed an annulus the distal circumference of which is divided proportionately to the values adumbrated in Column 5 of the table above, the values increasing in a clockwise sense from a zero mark on the extremity of a diameter arbitrarily chosen. Parenthetically: the diameter fixes the position of the three part-annular apertures to which reference was made in an earlier section, and these apertures, in turn, fix the position of a diameter on the obverse face of the rotary plate which, for considerations of symmetry is medially situated with respect to the apertures. The extremity of this diameter fixes the zero calibration of the obverse rotary discount scale and the obverse rotary profit scale, the calibration of which scales is described below.

The calibration of the reverse rotary profit scale is performed by inscribing the value of y, as shown in Column 2 of the table above, at the graduation mark determined by the mantissa of the logarithm of the value $(100+y)/100$ as shown in Column 5 of the table. The scale covers the range 0 to 900.

The calibration of the reverse rotary discount scale is performed by inscribing the value of x in Column 1 of the table above at the graduation mark determined by the mantissa of the logarithm of the value $(100-x)/100$ as shown in Column 5 of the table. The scale covers the range 0 to 90.

The calibration of the reverse rotary combined scale is performed by inscribing opposite the graduations determined by the mantissae as shown in Column 5, the values

indicated by the significant digits, with ciphers inserted where applicable, as shown in Columns 3 and 4. The scale covers the range 10 to 100.

On the obverse face of the rotary plate is inscribed an annulus wherein is inscribed a set of graduations identical with that inscribed on the reverse face. The calibration of the obverse rotary discount scale is identical with that of the reverse rotary discount scale for the range 0% to 75%, at which point the calibration ceases.

The graduation of the obverse rotary profit scale is identical with that of the obverse rotary discount scale, the two scales sharing a common annulus and common graduations. The calibration of the obverse rotary profit scale is identical with that of the reverse rotary profit scale for the range 0% to 150%, at which latter point the calibration ceases.

The device is assembled by placing the rotor indicator upon the base plate so that the aperture on the rotor indicator fits about the axial boss on the base plate. The rotary plate is then placed upon the rotor indicator with the aperture of the rotary plate fitting about the axial boss on the base plate. The rotary plate may be lifted, inverted, and replaced so that the operator has at his disposal either the obverse face or the reverse face of the rotary plate. The inversion of the plate does not affect the use of the apertures on the rotary plate.

The device, for the purposes of calculation or for determining equivalences, is operated by treating the base plate as a plane of reference and rotating with respect to the fixed base plate, either or both of the superincumbent plates.

The hair-line on the rotor indicator serves as a rotatable diameter to define corresponding points on any one of the following scales inscribed upon the base plate:—

(i) the base logarithmic scale;

(ii) the base shillings-pence scale;

(iii) the base sine scale—considered in conjunction with the base decimal equivalents scale.

The value shown on the base decimal equivalents scale, by the rotor indicator, in any chance position of the rotor indicator, gives—

(i) the logarithm of the corresponding number shown by the rotor indicator on the base logarithmic scale, and conversely;

(ii) the decimal equivalent of £1 corresponding to the value shown, in shillings and pence, by the rotor indicator, on the base shillings-pence scale, and conversely;

(iii) the decimal equivalent of 1 ton corresponding to the value shown in hundredweights, quarters, and pounds, avoirdupois, by the rotor indicator, on the base shillings-pence scale, and conversely;

(iv) the sine of an angle shown on the base sine scale, and conversely;

(v) the cosine of the complement of the angle shown on the base sine scale, and conversely. Hence to read off any equivalence of the types cited above, the operator maintains the base plate in a fixed position and rotates appropriately the rotor indicator with respect to the base plate. This operation is most conveniently performed with the rotary plate removed. When the rotary plate is in the assembly position it may be necessary for the operator to rotate the rotary plate so that the desired values may be viewed through the apertures provided.

In performing the mathematical processes rendered possible by the device the operator rotates the rotary plate with respect to the fixed base plate with or without the ancillary use of the rotor indicator. Generally, the manipulation of the plates is in essence the practical application of one or other of the four principles of logarithms:—

$$\log (MN) = \log M + \log N$$
$$\log (M/N) = \log M - \log N$$
$$\log M^n = n \log M$$
$$\log \sqrt[n]{M} = \log M \div n$$

The method of finding the angle, given the value of the tangent of the angle is largely empirical.

To use the device as a circular protractor the operator causes one of the two mutually perpendicular diameters inscribed within the axial boss on the base plate to coincide with one arm of the angle, the point of intersection of the perpendicular diameters being made to coincide with the vertex of the angle. The hair-line on the rotor indicator is then applied to the other arm of the angle and the reading is taken either on the base shillings-pence scale or on the base decimal equivalents scale according to the system of measurement in use.

The practical manipulation of the device is shown in the following illustrative examples. For brevity, the symbols shown in the table below will be used throughout:—

Symbol	Signification
BL	Base logarithmic scale. [Numerals placed after the letters denoting scales refer to calibrations, e.g. BL 695 signifies the reading 695 (or 69.5, or the like) on the base logarithmic scale.]
BSP	Base shillings-pence scale.
BDE	Base decimal equivalents scale.
BS	Base sine scale.
ORP	Profit scale on the obverse face of the rotary plate cf. ORD.
ORD	Obverse rotary discount scale cf. ORP.

	RRD	Reverse rotary discount scale.
	RRP	Reverse rotary profit scale.
	RRC	Reverse rotary combined scale.
	R	Hair-line on rotor indicator.
5	Z	Zero [e.g. RRCZ signifies the zero calibration on the reverse rotary combined scale].

EXAMPLE 1.

The quoted price of an article is £3 13s. A discount of 35% is allowed. At what price must it be sold to yield a profit of 65%?

Method

Set R	At BSP135
Read BDE 65	At R
Set ORPZ	At BL365
Set R	At ORD35
Set ORPZ	At R
Set R	At ORP65
Read BL392	At R
Set R	At BDE920
Read BSP 18s. 4¾d.	At R

Answer £3 18s. 4¾d.

EXAMPLE 2.

Find the compound interest on £850 for 3 years at 5½%.

Method

Set RRCZ	At BL85
Set R	At RRC1055
Set RRCZ	At R
Set R	At RRC1055
Set RRCZ	At R
Set R	At RRC1055
Read BL998	At R

Amount = £998.

Answer £148.

EXAMPLE 3.

Find the value of $(3.67 \times .081 \times 11.3) \div (69.5 \times .007)$.

Set RRCZ	At BL367
Set R	At RRC81
Set RRCZ	At R
Set R	At RRC113
Set RRC695	At R
Set R	At RRCZ
Set RRC70	At R
Set R	At RRCZ
Read BL691	At R

The position of the decimal point is obtained by inspection.

Answer 6.91.

EXAMPLE 4.

Find the reciprocal of 137.

Method

Set RRC137	At BLZ
Read BL726	At RRCZ

Answer .00726.

EXAMPLE 5.

Find log log 3.456.

Method

Set R	At BL346
Read BDE538	At R
Set R	At BL538
Read BDE731	At R

Answer T.7310.

EXAMPLE 6.

Find the cost of 17 cwt. 3 qrs. 17lb. at £2 13s 7d. per ton.

Method

Set R	At BSP 17 cwt. 3 qrs. 17 lb.

that is, at a point corresponding to 17s. 10¾d.

Read BDE895	At R
Set R	At BSP 13s. 7d.
Read BDE680	At R
Set RRCZ	At BL895
Read BL24	At RRC268
Set R	At BDE400
Read BSP8s.	At R

Answer £2 8s.

EXAMPLE 7.

Given L tan A=9.4567, find A.

Method

Set R	At BDE457
Read BL286	At R

Hence tan A = .2860.

Now tan A = sin A ÷ cos A.
= sin A ÷ sin (90° − A).

Estimate value of A as 17°.

Set R	At BS17
Read BDE292	At R

Hence sin 17° = .2920.

Set R	At BS73 (=90° − 17°)
Read BDE956	At R

Hence sin (90° − 17°) = .9560.

Set RRCZ	At BL286

Note arc between BL292 and RRC956. This shows that the estimated value of A was too great. Try 16°.

As before, sin 16° = .276
and sin 74° = .961.

Set RRCZ	At BL286

Note arc between BL276 and RRC961. The arc is now small, indicating that the estimate of 16° is very slightly in excess of the required value. Try 15° 54′.

As before, sin 15° 54′ = .274
and sin 74° 6′ = .962.

Set RRCZ	At BL286

The arc between BL274 and RRC962 has virtually vanished. Hence A is very nearly 15° 54′.

Answer 15° 54′.

EXAMPLE 8.

Given that in the triangle ABC the side b=33.7 cm., the side c=19.8 cm., and the angle A=35° 24′, find (i) the angles B

and C, (ii) the side a, and (iii) the area of the triangle.

Method

Part (i) $\tan (B-C)/2 = (b-c)\cot A/2 \div (b+c)$
$= (13.9 \cos 17° 42')/(53.5 \sin 17° 42')$
$= (139 \sin 72° 18')/(535 \sin 17° 42')$.

Numerator:

Set R	At BS 72° 18′
Read BDE952	At R
Set RRCZ	At BL139
Read BL1315	At RRC952

Denominator:

Set R	At BS 17° 42′
Read BDE304	At R
Set RRCZ	At BL535
Read BL1635	At RRC304

Then— $\tan \frac{1}{2}(B-C) = 1315 \div 1635$.

Set RRC1635	At BL1315
Read BL815	At RRCZ

Whence— $\tan \frac{1}{2}(B-C) = .8150$.
Estimate— $\frac{1}{2}(B-C) = 40°$.
As in Example 7,
$\sin 40° = .6430$.
$\sin 50° = .7660$.

Set RRCZ	At BL815

Note arc between BL643 and RRC766. Decrease estimate to, say, 39° 15′. As before—
$\sin 39° 15' = .6330$.
$\sin 50° 45' = .7740$.

Set RRCZ	At BL815

Arc between BL633 and RRC774 is now small. Try 39° 9′. Then—
$\sin 39° 9' = .6320$.
$\sin 50° 51' = .7750$.

Set RRCZ	At BL815

Now BL632 and RRC775 coincide, nearly, hence—
$\frac{1}{2}(B-C) = 39° 9'$.
$\frac{1}{2}(B+C) = 90° - 17° 42' = 72° 18'$.
Whence $B = 111° 27'$ by addition and $C = 33° 9'$ by subtraction.

Part (ii)
Side $a = C \sin A/\sin C$
$= 19.8 \sin 35° 24' \div \sin 33° 9'$.

Set R	At BS 35° 24′
Read BDE579	At R
Set R	At BS 33° 9′
Read BDE547	At R

Hence— $a = 19.8 \times 579 \div 547$.

Set RRCZ	At BL579
Set R	At RRC198
Set RRC547	At R
Read BL209	At RRCZ

Therefore $a = 20.9$.

Part (iii)
Area $= \frac{1}{2} be \sin A$
$= 33.7 \times 19.8 \times .579 \div 2$.

Set RRCZ	At BL337
Set R	At RRC198
Set RRCZ	At R
Set R	At RRC579
Set RRC20	At R
Read BL193	At RRCZ

Whence, area = 193.
Answer (i) $B = 111° 27'$; $C = 33° 9'$.
(ii) $a = 20.9$ cm.
(iii) Area = 193 sq. cm.

EXAMPLE 9.

Find L sec 34° 56′.

Set R	At BS 55° 04′
Read BDE820	At R
Set RRCZ	At BL82
Read RRC122	At BLZ
Set R	At BL122
Read BDE086	At R

Answer 10.0860.

EXAMPLE 10.

Find the track and ground speed of an aircraft flying on course 47° True at air speed 570 knots, the wind direction being 330° True and wind speed 75 knots.

Method

The problem resolves itself into the solution of a triangle ABC where A is the point of departure and C is the point of arrival. The side $c = 570$, side $a = 75$, and angle $\beta = 77°$.

As in Example 8,
$\tan \frac{1}{2}(C-) = (c-a) \cot \frac{1}{2}B \div (c+a)$
$= (495 \cos 38° 30')$
$\div (645 \sin 38° 39')$
$= (495 \sin 51° 30')$
$\div (645 \sin 38° 30')$
$= .965$
Whence $\frac{1}{2}(C-A) = 43° 57'$ nearly
but $\frac{1}{2}(C+A) = 51° 30'$
therefore $A = 7° 33'$ by subtraction
Also $b = a \sin \beta \div \sin A$
$= 558$
Hence track $= 54° 33'$ True
And ground speed = 558 knots
Answer (i) 54° 33′ True.
(ii) 558 knots.

EXAMPLE 11.

At a point P in the straight line AB construct an angle BPC measuring 78° 9′.

Method

Set R at BSP 52.1d. (that is, $\frac{2}{3}$ of 78.15°).
Apply point of intersection of mutually perpendicular diameters on base plate to point P so that R falls along AB.
Set R at BSPZ, marking point C at R.
Join PC.
Then angle BPC is required angle.

The accompanying drawings, not to scale, illustrate in pictorial or schematic form the essential features of the device. The legends are as follows:—

Figure 1: Part of central strip showing features (reading upwards) of the base

plate—(a) axial boss with mutually perpendicular diameters; (b) base sine scale; (c) base decimal equivalents scale; (d) base shillings-pence scale; (e) base logarithmic scale.

Figure 2: Part of central strip showing features (reading upwards) of the rotor indicator—(a) axial aperture; (b) diametrical hair-line; (c) protruding lug.

Figure 3: Part of central strip showing features (reading upwards) of the obverse face of the rotary plate—(a) axial aperture; (b) part-annular aperture to reveal base sine scale; (c) part-annular aperture to reveal base shillings-pence scale; (d) part of obverse rotary discount scale (to left of common zero calibration); (e) part of obverse rotary profit scale (to right of common zero calibration. [The part-annular aperture to reveal the base decimal equivalents scale is not shown. It lies on that side of the centre of rotation remote from the other two apertures referred to in (b) and (c), all three apertures being symmetrically disposed about a common diameter.]

Figure 4: Part of central strip showing features (reading upwards) of the reverse face of the rotary plate—(a) axial aperture; (b) part-annular aperture to reveal base sine scale; (c) part-annular aperture to reveal base shillings-pence scale; (d) calibrations of reverse rotary discount scale; (e) calibrations of reverse rotary profit scale; (f) calibrations of reverse rotary combined scale; (g) single set of graduations serving all three scales on this face. [The part-annular aperture to reveal the base decimal equivalents scale is not shown. Confer legend, Figure 3.]

Figure 5: Part of central strip across a schema showing the relative positions of the three parts of the device, assembled in a pile, representing respectively (reading upwards)—(a) base plate; (b) rotor indicator; (c) rotary plate.

Figure 6: Part of central strip across a schema showing the relative distribution of the several scales inscribed upon the base plate and upon the obverse and reverse faces of the rotary plate, with respect to the axial boss on the base plate. For abbreviations vide supra. [The prepared area on the reverse face of the rotary plate for the inscription of notes is not shown.]

WHAT I CLAIM IS:—

1. A calculating device designed to give cost price after allowing for discount, to give selling price after allowing for profit, to express one quantity as the percentage of another, to decimalize an amount of money, to decimalize weights (avoirdupois), to give the common logarithm of any number, to give the trigonometrical ratios of any angle, for use in multiplication, division, involution and evolution, to serve as a circular protractor, and for use in sundry other mathematical processes; the said device being characterized by three parts consisting of thin circular plates of plastic or other material each bearing certain indicia, superposed with respect to each other without fastening and permitting independent relative rotation of the superincumbent plates upon the plate beneath about an axis common to all three plates so as to yield by manipulation certain desired values.

2. A device, as claimed in Claim Number 1, in which the fundamental part (hereinafter called the base plate) consists of a circular plate of clear plastic or other material having a central boss in the form of a hollow cylinder, open at the top, of a height approximately equal to the sum of the thicknesses of the two superincumbent plates; at the periphery of which base plate are inscribed certain indicia and upon which, in the space lying between the peripheral indicia and the central boss, certain other indicia are inscribed; and having inscribed upon the base plate, in the area enclosed by the central cylindrical boss, two mutually perpendicular diametrical lines intersecting at the centre of the base plate.

3. A device, as claimed in Claim Number 1, in which the middle member (hereinafter called the rotor indicator) of the series of three plates consists of a thin circular plate of transparent plastic or other material slightly less in diameter than the base plate, having excised from it a central circular aperture of such a diameter that the rotor indicator fits snugly about the central axial boss on the base plate, permitting independent rotation of the rotor indicator with respect to the base plate, the said rotor indicator having a short narrow lug protruding beyond its outer margin symmetrically upon which lug a hair-line is drawn diametrically through the centre of rotation of the plate.

4. A device, as claimed in Claim Number 1, in which the uppermost part (hereinafter called the rotary plate) of the three parts constituting the device has two faces, namely, the obverse face and the reverse face, and consists of a circular plate of opaque plastic or other material of substantially the same diameter as the rotor indicator, there being excised from the centre of the rotary plate a circular aperture of a diameter such that the rotary plate fits snugly about the central axial boss on the base plate; the said rotary plate having three further excisions each in the form of a part-annulus revealing, through the transparent rotor indicator, parts of certain indicia inscribed upon the base plate; and having certain peripheral indicia inscribed upon both the obverse face and the reverse face.

5. A device, as claimed in Claim Number 2, having inscribed upon the base plate four scales, the first being a peripheral logarithmic scale (hereinafter called the base logarithmic scale) having the graduation marks contiguous with the proximal circumference of the bounding annulus and the calibration marks contiguous with the distal circumference of that annulus, the calibrations increasing in a clockwise sense from a zero mark lying upon a prolongation of one of the two mutually perpendicular diameters inscribed upon the base plate; the second scale, next in order towards the centre, being a scale having 240 equal graduations (hereinafter called the base shillings-pence scale), having the graduations contiguous with the distal circumference of the bounding annulus and the calibrations contiguous with the proximal circumference of that annulus, the calibrations increasing in a clockwise sense from a zero mark lying on the same diameter and on the same side of the centre of the plate as that of the base logarithmic scale; the third scale (hereinafter called the base decimal equivalents scale) having 1,000 equal graduation intervals contiguous with the distal circumference of the bounding annulus and its calibrations increasing in a clockwise sense beginning with a zero mark on the same diameter as that of the base logarithmic scale but on the opposite side of the centre of rotation of the plate; and the fourth scale (hereinafter called the base sine scale) having its graduations determined by the angles forming the inverse sines of the values diametrically opposite upon the base decimal equivalents scale, that is to say, covering the range 0° to 90°, the graduation marks being contiguous with the distal circumference of the bounding annulus and the calibrations contiguous with the proximal circumference, the calibrations increasing in numerical order in a clockwise sense beginning with a zero mark on the same diameter as that of the base logarithmic scale and on the same side of the centre of rotation of the plate; the distal circumference of the base sine scale annulus being coincident with the proximal circumference of the base decimal equivalents scale annulus, and the distal circumference of the base decimal equivalents scale annulus being coincident with the proximal circumference of the base shillings-pence scale annulus.

6. A device, as claimed in Claim Number 4, in which on the obverse face of the rotary plate there is inscribed at the periphery a composite scale (hereinafter called, as to one part of the range of the scale, the obverse rotary profit scale, and, as to the other part of the range of the scale, the obverse rotary discount scale), the graduation intervals being identical with those of the base logarithmic scale, the two scales having a common zero mark and terminating at a common graduation mark, arbitrarily chosen, and representing, respectively, a profit of 150% and a discount of 75%, the calibrations representing profits increasing numerically in a clockwise sense and the calibrations representing discounts increasing numerically in a counter-clockwise sense, the calibrations being contiguous with the proximal circumference of the bounding annulus and the graduations being contiguous with the distal circumference of that annulus.

7. A device, as claimed in Claim Numbers 4 and 6, in which there is inscribed at the periphery of the reverse face of the rotary plate, contiguous with the distal circumference of the bounding annulus, a set of graduation marks identical in intervals with those of the base logarithmic scale, and having inscribed, also, in concomitance with the single set of graduations, three separate and distinct sets of calibration numbers, forming three scales (hereinafter called, respectively, the reverse rotary discount scale, the reverse rotary profit scale, and the reverse rotary combined scale) the zero calibration marks of all three scales being inscribed, from considerations of symmetry, on that diameter about which the three annular apertures are evenly disposed, and which throughout its length is vertically above the corresponding diameter on the obverse face which passes through the zero mark of the composite scale on the obverse face, the calibrations of the reverse rotary combined scale and of the reverse rotary profit scale increasing numerically in a clockwise sense, and those of the reverse rotary discount scale increasing in a counter-clockwise sense; the said rotary plate having an area on its reverse face prepared for the inscription, and the erasure, of unemonic notes.

8. A calculating device substantially as hereinbefore described with reference to the accompanying drawings.

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923305 COMPLETE SPECIFICATION
1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

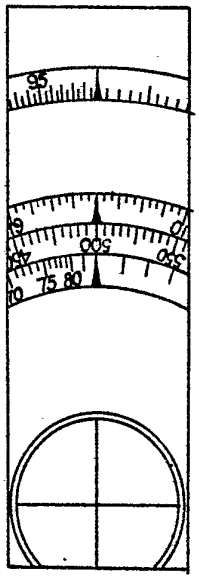

FIG 1

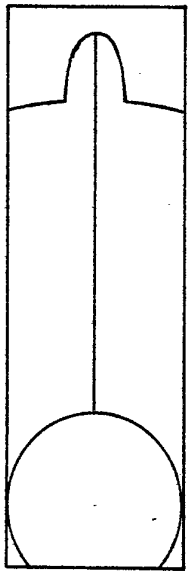

FIG 2

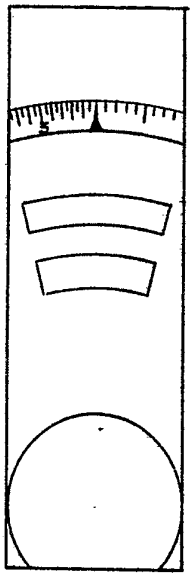

FIG 3

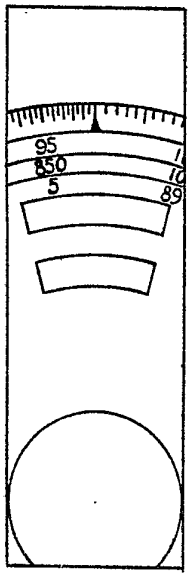

FIG 4

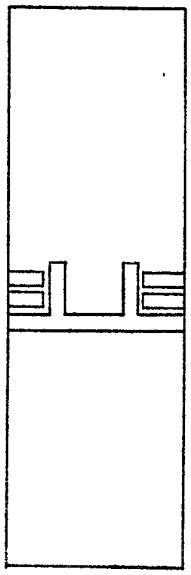

FIG 5

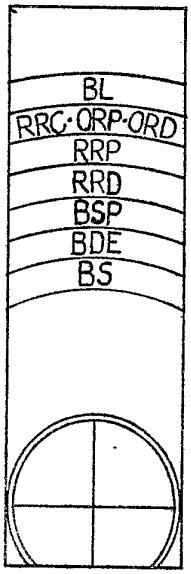

FIG 6