PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements in Calculating Devices

I, GLADYS MAUDE WORMAN, of 19, Church Road, Boldmere, Sutton Coldfield, Warwickshire, formerly of Alliance Buildings, 4, Moseley Street, Newcastle-upon-Tyne, 1, a British Subject, personal representative of the deceased William Montague Worman, of the aforesaid addresses, a British Subject, 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:—

This invention concerns improvements relating to calculating devices of the rotary slide-rule type, that is devices comprising relatively turnable discs, drums or the like, and has for its object to facilitate the solution of problems similar to the following,

$$n=\frac{k}{l\,c^2\,d}$$

where k is a constant and l, c and d are variable, firstly by eliminating the necessity for manually dividing the product $l\,c^2\,d$ into the constant k and secondly by eliminating the squaring of c as a separate operation. By manually is meant the physical operation of a slide rule or the like.

The calculating device according to the invention is particularly intended for computing the number (n) of articles, such as cigarettes, each of similar known size (length l and circumference c) and density (d) required to provide a given weight n, for example one ounce weight.

The calculating device in accordance with the invention comprises three coaxial parts which can be turned in relation to each other, namely a radial cursor arm furnished with a reading line and two superposed discs over which the said arm is mounted, an upper, smaller, disc being provided around its circumference with a logarithmic scale beginning and ending upon a radial unity line at which there is an indicator and with a second logarithmic scale, located radially inside the first-named scale, of limited range which is indexed in values which are the square roots of the values at the same angular positions in the first-named scale, while the other, lower and larger, disc is provided around its circumference with a logarithmic scale having an indicator at a constant point in the said scale. Thus, if the second scale is indexed numerically in terms of, say, c, it has its index lines radially aligned with the numerical values of c^2 in the first-named scale.

It will be evident that drums may be used in place of discs and the term discs used above and in the appended claims is to be understood to include rotary members of drum shape with the aforesaid scales on their cylindrical surfaces.

One embodiment of the invention by way of example will now be more fully described with reference to the accompanying drawing which is a plan view of the calculating device.

This example is particularly designed for computing the number n of cigarettes of known similar length l and circumference c (expressed in mm.) and density d required to provide one ounce weight of cigarettes according to the equation:—

$$n=\frac{356{,}256.3}{l\,c^2\,d}$$

The device comprises a transparent cursor arm 1 with a reading line 2 mounted above two superposed discs 3, 4 on a common pivot 5. The smaller upper disc 3 has, at its circumference 6, a logarithmic scale 7 graduated clockwise in terms of value $100\left(\frac{a}{b+1}\right)$, or

value $\frac{100a}{b}$ and beginning and ending at a radial unity line 8 at which an indicator 9 in the form of an arrow head is provided.

The formula $100\left(\frac{a}{b+1}\right)$ or $\frac{100a}{b}$ provides a means of obtaining the distance between graduations where a equals the logarithm of the numbers 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and b is the length of circumference available. By working out each separate value for the numbers 1 to 10 and expressing this as a percentage, it is possible to engrave the graduations at the correct distances around the circumference of the disc when the diameter of the disc is known.

The disc 3 also has, radially inside the scale 7, a second clockwise logarithmic scale 19 of limited range, its arc subtending an angle of about 136°. This scale is indexed, as shown, from 18 to 28 inclusive, with fractional subdivisions. The range 18—28 covers the normal range of cigarette circumferences in millimetres. However, the radial index lines of this scale 10 are in fact disposed in positions corresponding to the positions, on the scale 7, of the squares of the numerical values indicated. Thus, if the cursor line 2 is adjusted to the value 22 in scale 10, for example, it will also lie over the value 484 in the scale 7, as indicated at 2^1.

The lower, larger disc 4 is provided with a logarithmic scale 11 similarly graduated to the scale 7, but reading anticlockwise. Its unity line 12 has no indicator, but it is provided with an arrow-head indicator 13 at the value of the constant k, in this example as nearly as possible 356,256.3.

To avoid confusion of lines, the scales are not shown fully subdivided in the drawing. The legends "Density", "Circumference" and "Length" indicate the arcs within which the respective values will normally be found.

With the device described, the above-indicated problem can be solved to three significant figures at high speed. For instance, if the values of the cigarette length l, circumference c and density d are 70 and 22 mm. and 0.290 respectively, the procedure is as follows:—

The disc 3 is turned until its indicator 9 is aligned with the indicator 13 of the disc 4, as in the drawing. The arm 1 is then turned until its reading line 2 lies over the value 70 on the scale 7. It is held in this position, by pressing its end against the disc 4, while the disc 3 is turned until its indicator 9 lies under the line 2 of the arm 1. The arm is released from the disc 4 and turned so that its line 2 lies over the value 22 in the scale 10, whereupon its end is again held to the disc 4 while the disc 3 is turned to bring its indicator 9 once again under the line 2. Finally the arm 1 is turned to bring its line 2 over the value 29 in the scale 7, at which point the line 2 will be over the solution to the problem, namely 36.2, on the scale 11.

In the above instance, the known values l, c^2 and d are added logarithmically. However, if the value of n and any two of the values l, c, d are known, the third of the latter values can obviously also be rapidly ascertained by including a subtraction step in known manner. In fact, given any three of the four values n, l, c and d, the fourth can be found.

The above-described arrangement of scales greatly facilitates solutions of problems similar to the example given, for not only does the "pre-squared" scale 7 eliminate the necessity for separately ascertaining the value of c^2, but also the disposition of the disc 4 eliminates the necessity for a separate operation for dividing the product $l\ c^2\ d$ into the constant k.

The invention is not limited to the values stated for the scales or to the number of scales described in the example. The lower disc may, for example, be provided with a clockwise logarithmic scale similar to the scale 7 of the upper disc 3, but with a plain unity line, i.e. without the indicator 9. Provision may be made for varying the constant k by furnishing the indicator 13 in the form of an arrow head mounted for circumferential adjustment on the disc 4.

WHAT I CLAIM IS:—

1. A calculating device of the rotary slide-rule type, comprising three coaxial parts which can be turned in relation to each other, namely a radial cursor arm furnished with a reading line and two superposed discs over which the said arm is mounted, an upper, smaller, disc being provided around its circumference with a logarithmic scale beginning and ending upon a radial unity line at which there is an indicator and with a second logarithmic scale, located radially inside the first-named scale, of limited range which is indexed in values which are the square roots of the values at the same angular positions in the first-named scale, while the other, lower and larger, disc is provided around its circumference with a logarithmic scale having an indicator at a constant point in the said scale.

2. A device as claimed in Claim 1, wherein the third-named scale reads oppositely to the other scales, i.e. anticlockwise if the other scales read clockwise.

3. A modification of the device claimed in Claim 1 or 2, wherein the indicator provided on the third-named scale is adjustable so that it can be set to a required value in that scale.

4. A device as claimed in any one of Claims 1 to 3, graduated for solution of problems of the type

$$n=\frac{k}{l\ c^2\ d}$$

where k is a constant and l, c, d and n are, respectively, the length, circumference and density of cigarettes and n the number of cigarettes required to provide a given weight.

5. The calculating device substantially as hereinbefore described with reference to the accompanying drawing.

JENSEN & SON,
Agents for the Applicant,
77, Chancery Lane, London, W.C.2,
Chartered Patent Agents.

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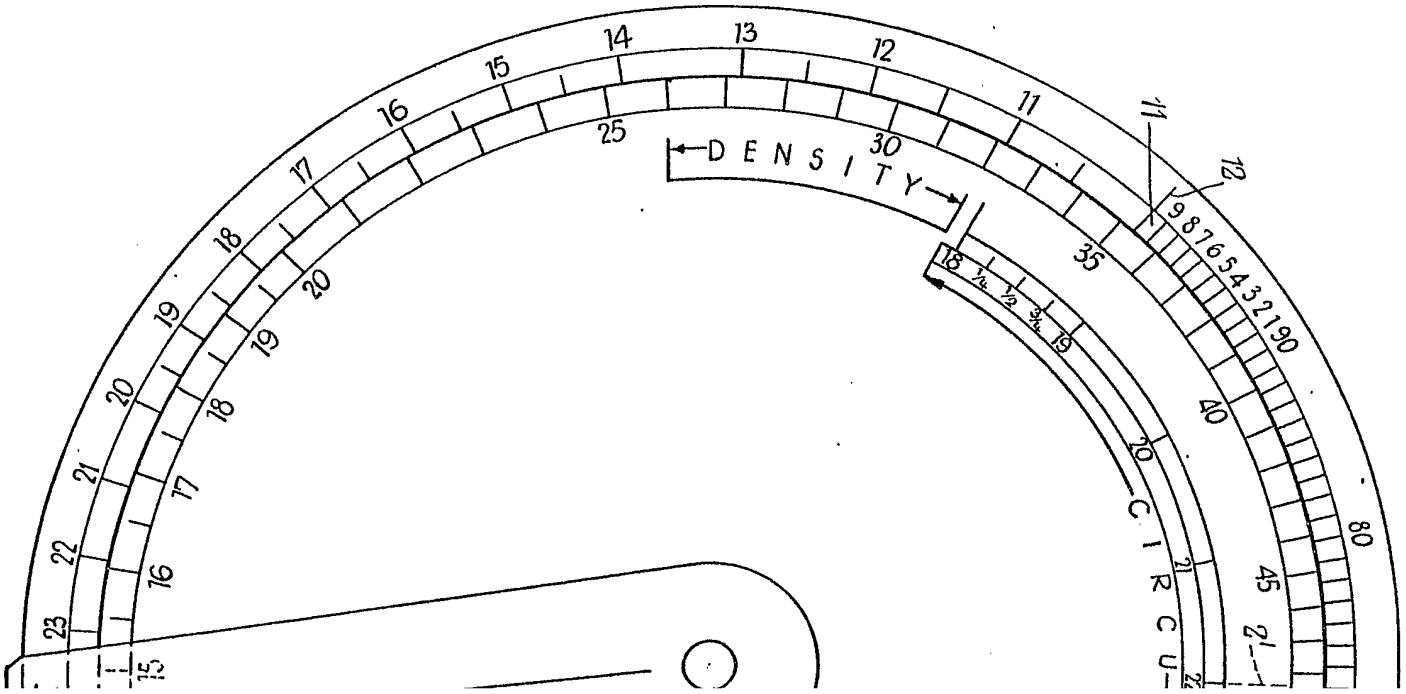
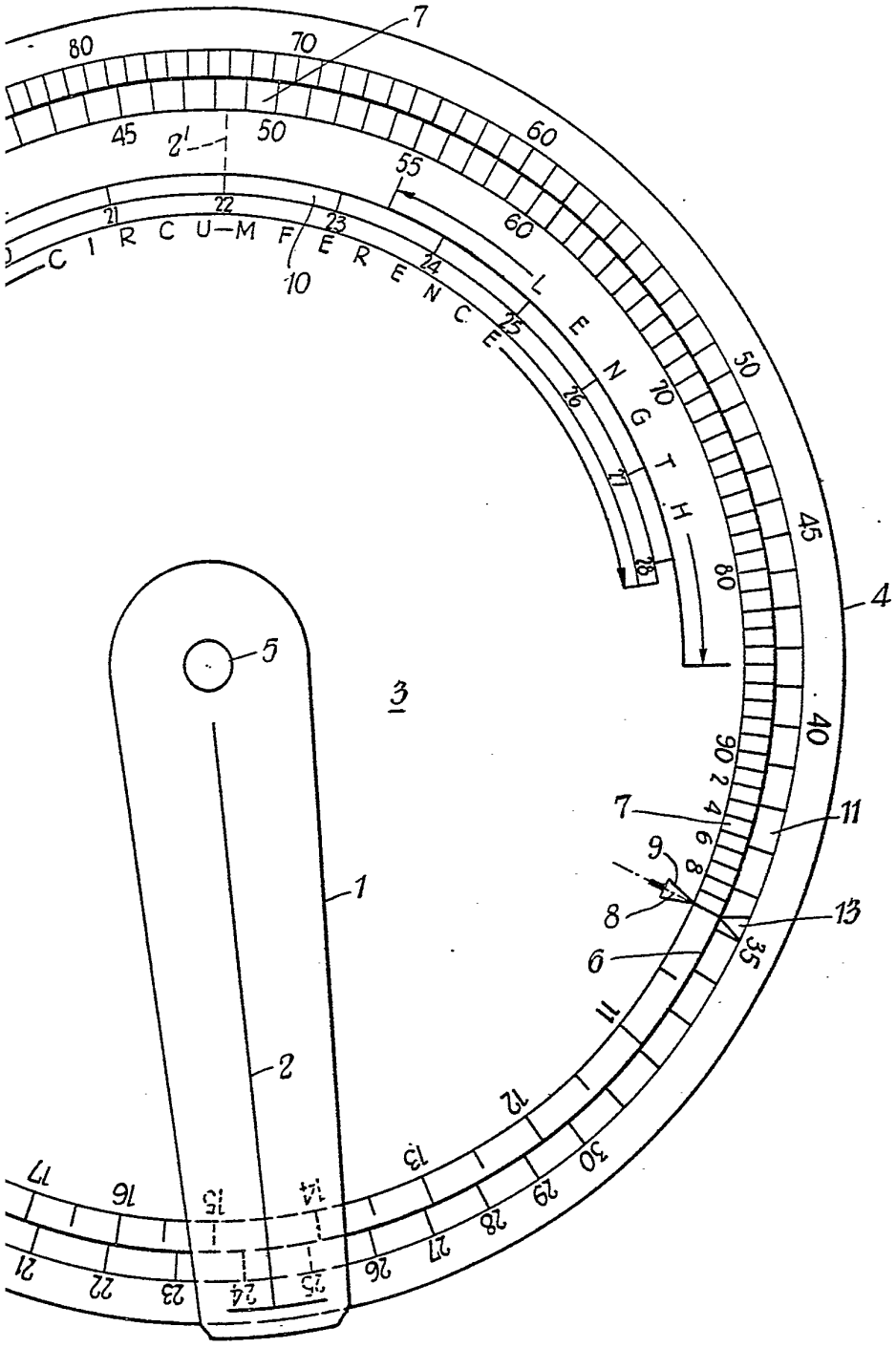

DENSITY
CIRCUM

917515 COMPLETE SPECIFICATION

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



917515 COMPLETE SPECIFICATION
1 SHEET

This drawing is a reproduction of the Original on a reduced scale