PATENT SPECIFICATION

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COMPLETE SPECIFICATION

Improvements in and relating to Combined Logarithmic Calculating and Linear Measurement Scales or Scales Having Equi-distant Graduations

I, WALTER HENRY EDRIDGE, British Subject of Adelaide House, King William Street, London, E.C.4, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates more especially to combined means for calculating and linear measurements and provides improved means for calculations such as multiplying and dividing and for the ascertainment of functions such as the logarithms of numbers by cross reference between a calculating scale having logarithmic graduations and a linear measurement scale or scale having equi-distant graduations.

For the purpose of rapid calculations such as of multiplication or division calculating instruments such as are known as slide rules are provided with two parallel scales mobile with respect to one another and each of which scales is usually graduated with numbers from 1 to 10 and intermediate sub-graduations; the distance of said scale graduation numbers from the beginning or origin of the scale being proportionate to the decimal part or mantissa of the common logarithm to the base 10 of said graduation numbers.

For the purpose of measurement of length or distance between two points rules or tapes for example are graduated with a linear measurement scale or scales such as feet and inches or millimetres or other equi-distant graduations.

Logarithmic scales are known on calculating slide rules and comprising a decimally divided linear measurement scale or scale having equi-distant graduations upon which may be read the decimal part of the common logarithmic of a number read on a logarithmically divided scale.

Further logarithmic calculating means exist on tape measures, comprising a logarithmic scale upon which may be read the decimal part of the common logarithmic corresponding to a measurement on a linear measurement scale; or comprising logarithmic scales on opposite sides of the tape, thus permitting of calculations as with a calculating slide rule by folding one end of the tape over on to the remainder.

An object of the present invention is to provide improved means for calculations such as of multiplication and division as with a table of common logarithms, by means of a tape measure, without the use of scales mobile with respect to one another and without the use of a table of common logarithms; means for such calculations consisting in a tape or strip comprising a logarithmic calculating scale having graduations of which the distance or measurement from the origin or beginning of said scale is proportionate to the decimal part or mantissa of the logarithm to the base 10 of the corresponding graduation number in combination with a linear measurement scale or scale having equi-distant graduations; said scales being so placed in relation to one another with their origin or zero graduations at the same extremity of the said tape or strip, that the decimal part of the common logarithm corresponding to a number read on said logarithmic calculating scale may be read on said linear measurement scale.

Further objects of the present invention are:—

Firstly to permit with facility of greater accuracy of calculations such as of multiplication and of ascertainment of logarithms and the like than is obtainable for example with a calculating slide rule of usual dimensions; means for such greater accuracy consisting in the provision of said scales of length substantially greater than that of 250 millimetres upon calculating slide rules of usual dimensions.

Secondly to permit of greater portability in comparison with a calculating slide rule; means for such greater portability consisting in for example a logarithmic calculating scale and a linear measurement scale or scale having equi-distant graduations juxtaposed on a

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tape which preferably by spring action is returned within a flat cylindrical container.

According to a preferred method of carrying out this invention by way of example and providing means for both calculating and linear measurement in an extremely portable form, a thin steel tape of for example 10 millimetres in width is graduated on one side with a linear measurement scale of 1000 millimetre divisions corresponding to 1 metre and also graduated on the same side with a logarithmic calculating scale as on a calculating slide rule; said tape being arranged for tangential withdrawal from and preferably by spring action return into a container of flat cylindrical shape of which the dimensions may be less than 35 millimetres diameter and axial length 13 millimetres.

Also according to said construction the zero millimetre graduation or origin of the said 1000 millimetre linear measurement scale is coincident with the numeral " 1 " or origin of the logarithm calculating scale and the 1000 millimetre or final graduation of the said linear measurement scale is coincident with the number " 10 " or final graduation of the said logarithmic calculating scale; the zero millimetre or origin graduation of the said linear measurement scale and the numeral " 1 " or origin of the said logarithmic calculating scale being preferably at the tape extremity which would first be withdrawn from the said tape container.

From the preceding description of a preferred method of carrying out this invention it will be understood that the total length of the said logarithmic calculating scale is preferably equal to the total length for example 1000 millimetres of a linear measurement scale or equal to the total length of a scale having 1000 equi-distant graduations; the two scales being coterminous with and parallel to one another along and on the same side of a tape or the equivalent.

The preferred embodiment of this invention is illustrated in the accompanying drawing: in the drawing:

(a) is the tape container of flat cylindrical shape;

(b) is the tape container outlet through which the tape is withdrawn from the container;

(c) is the tape container outlet edge under which the tape is withdrawn from the container;

(d) is the tape, which is preferably of curved section;

(e) is the linear measurement scale;

(f) is the logarithmic calculating scale;

(g) is a hook device provided for the purpose of preventing the tape from penetrating wholly within the container and for facilitating linear measurements.

Although according to the hereinbefore described method of carrying out this invention the linear measurement scale or scale having equi-distant graduations to be read in relation to a logarithmic calculating scale on a tape or strip for the purpose of for example multiplications or divisions as described hereafter, consists preferably in a 1000 millimetre scale, it should be understood that such linear measurement scale may be graduated according to the present invention with any number of convenient equally spaced divisions; a feature of the present invention being however the use of a linear measurement scale on a tape or strip for the dual purpose of linear measurements and of calculations such as multiplication and/or ascertainment of logarithms or the like; and a further feature being the use for said purposes on a tape or strip of a logarithmically divided calculating scale together with a decimally divided linear measurement scale thereby facilitating calculations as will be understood from the calculation examples hereinafter.

Also according to the present invention a cursor such as is employed with a calculating slide rule or other convenient indicator is provided for the purpose of facilitating and correlating readings from the hereinbefore described scales.

For example in said preferred construction according to the present invention and comprising a flexible tape and flat cylindrical tape container the edge C of said container under which said tape passes when withdrawn from said container and forming one side of an opening in the cylindrical side of said container, is disposed at right angles to the tape and parallel to lines engraved or otherwise marked on said tape and forming graduations thereon; said container opening hereinafter described as the container tape outlet edge being thus adapted to form a convenient indicator of the scale reading on one of said scales and which corresponds to a given scale reading on the other of said scales.

Also for example when said scales are not simultaneously visible and are placed for example upon opposite sides or faces for example of a tape of the type described hereinbefore, a slider or the like may be provided according to the present invention for example either free to move along the tape or attached to the tape container or the like and having

pointers or a lined glass or the equivalent on both sides or faces of said tape; said pointers or lined glass or the like being so placed with reference to one another and the graduations on both said scales that the scale reading on the one scale at the corresponding pointer line on glass or the like would correspond to the correct scale reading on the second scale at the corresponding pointer line on glass or the like. Said scales indicating lines or the equivalent may be provided on a magnifying glass or lens for example on said slider on said tape or at the tape outlet of said tape container for the purpose of facilitating and increasing the accuracy of said scale readings.

For the purpose of multiplying 2 by 4 for example the hereinbefore described scale bearing tape is employed according to the present invention as follows:—

Firstly the said tape is drawn out of said tape container until the number 2 and corresponding graduation on said logarithmic calculating scale appears at the hereinbefore described tape outlet edge C of said tape container and the reading of 0.30103 metres noted on said linear measurement scale at said container outlet edge.

Secondly said tape is drawn out of said container until the number 4 and corresponding graduation on said logarithmic calculating scale appears at said container tape outlet edge C and the reading of 0.60206 metres noted on said linear measurement scale at said container tape outlet edge.

Thirdly the readings of 0.30103 metres and 0.60206 metres corresponding respectively to the numbers 2 and 4 to be multiplied together are added together giving a total of 0.90309 metres.

Fourthly said tape is similarly drawn out from said container until the total graduation reading of 0.90309 metres appears at said container tape outlet edge C on said linear measurement scale and the number 8 or corresponding graduation noted on said logarithmic calculating scale at said tape container outlet edge C; said number 8 being the required product of the numbers 2 and 4.

Should the numbers of which the product is required be for example 2, 4 and 9 the total of the three corresponding readings on said linear measurement scale would exceed said total linear measurement scale length and the procedure would then be as follows:—

Having noted the linear measurement scale readings as in the preceding example and corresponding to the numbers 2 and 4 to be multiplied together and by 9 said tape is then similarly drawn out from said container until the graduation number 9 on said logarithmic calculating scale appears at said tape container outlet edge C and the reading of 0.95424 metres noted on said linear measurement scale at said container outlet edge. Said linear measurement scale reading is then added to the total of 0.90309 metres corresponding to the numbers 2 and 4 and the total found to be 1.85733 metres.

The tape is then drawn out from said container until the reading of 0.85733 metres appears at the outlet edge C of said tape container and the product number graduation 72 noted on said logarithmic calculating scale at said tape container outlet edge.

In the preceding multiplication example the integral part of the sum of linear measurement scale readings having been neglected in ascertaining the required product it will be understood that the decimal place in the required product number must then be determined by inspection as in the case of such calculation by means of a calculating slide rule.

The decimal place in a product or a division number for example may however also be determined according to the present invention precisely as if a table of decimal parts of common logarithms to the base 10 had been employed for the purpose of such calculations since as will be appreciated from the preceding multiplication examples the decimal part of the total 1 metre or other length of the said linear measurement scale and corresponding to a given number on the said logarithmic calculating scale is numerically equal to the decimal part or mantissa of the common logarithm to the base 10 of said number.

Since the decimal part of the total 1 metre or other length of the said linear measurement or decimally divided scale and corresponding to a given number on the said logarithmic calculating scale is according to a preferred construction numerically equal to the decimal part or mantissa of the common logarithm to the base 10 of said number it will be appreciated that according to the present invention the decimal part of the common logarithm to the base 10 or the equivalent of any given number may be ascertained by cross reference from the logarithmic calculating scale graduation corresponding to the given number to the corresponding graduation on said linear measurement or decimally divided scale.

As will be appreciated a logarithmic calculating scale and a linear measure-

ment scale or scale having equi-distant graduations may be employed according to the present invention in combination as and for the purpose hereinbefore described not only on the same side of a tape or strip of steel or other suitable material but also on opposite sides of such a tape or strip having either high or low coefficients of expansion and elasticity.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. Means for calculations or ascertainments such as may be made with a table of logarithms and means for linear measurements; said means consisting in a tape or strip comprising a logarithmic calculating scale having graduations of which the distance or measurement from the origin or beginning of said scale is proportionate to the decimal part or mantissa of the logarithm to the base 10 of the corresponding graduation number in combination with a linear measurement scale or scale having equi-distant graduations; said scales being so placed in relation to one another with their origin or zero graduations at the same extremity of the said tape or strip, that the decimal part of the common logarithm corresponding to a number read on said logarithmic calculating scale may be read on said linear measurement scale.

2. Means as claimed in claim 1 wherein said logarithmic calculating scale is of the same length as and coterminous with said linear measurement scale or scale having equi-distant graduations.

3. Means as claimed in claims 1 and 2 wherein said scales are engraved etched printed or otherwise marked on the same side or surface or different sides or surfaces of a tape or strip.

4. Means as claimed in claims 1, 2 and 3 wherein said scale bearing strip or tape is provided with a cursor slider or like known means for indicating and facilitating readings from said scales.

5. Means as claimed in claims 1, 2, 3 and 4 wherein said scale bearing tape or strip is arranged for withdrawal from and preferably by spring action return within a preferably cylindrical container through a tape outlet opening in said container one side or edge of said opening being disposed at right angles to the length of said scales and parallel to the graduations on said scales and thus adapted to form a scale reading indicator.

6. The improved means for calculations or ascertainments such as may be made with a table of logarithms and for linear measurements substantially as described and illustrated.

Dated this 27th day of May, 1937.

W. H. EDRIDGE.

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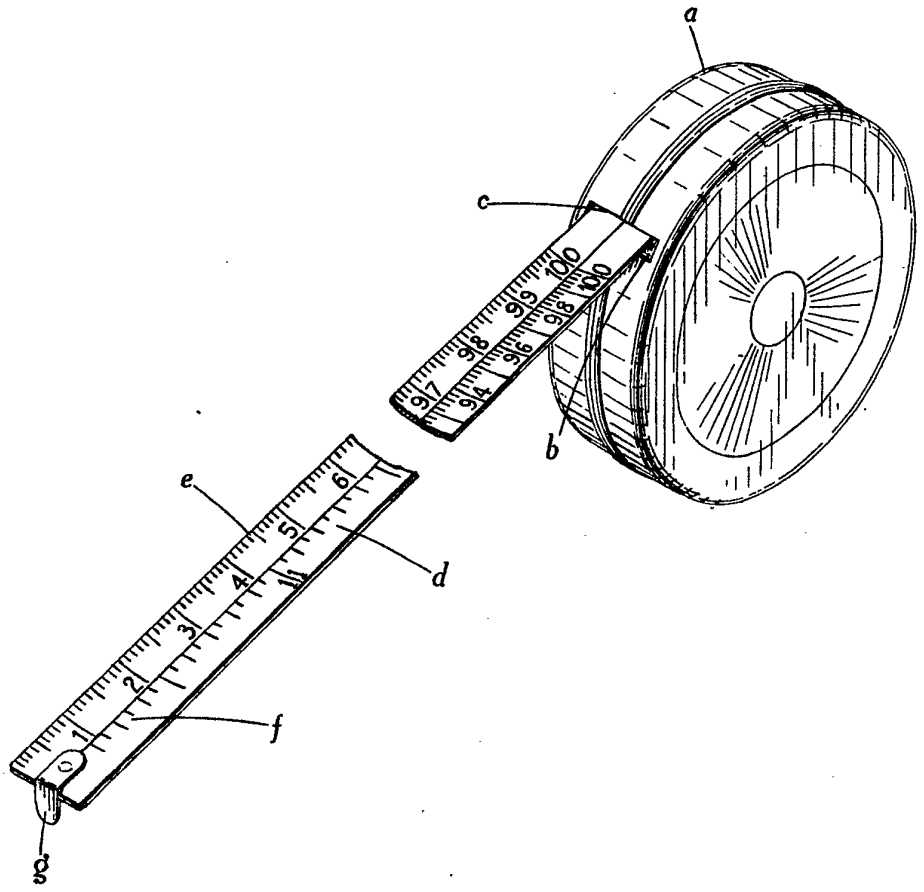

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