N° 3937 A.D. 1895

Date of Application, 23rd Feb., 1895

Complete Specification Left, 23rd Nov., 1895—Accepted, 4th Jan., 1896

PROVISIONAL SPECIFICATION.

An Improved Cylindrical Slide Rule.

I, JAMES EAGLES, of 55 Edith Grove, Chelsea, London in the County of Middlesex, National Scholar do hereby declare the nature of this invention to be as follows :—

This invention relates to slide rules in which the logarithmic scale is arranged on a cylinder of wood or other material, and consists essentially of the following :—

A cylinder of wood, or celluloid, or other suitable material on which is marked, or printed, a graduated logarithmic scale in the form of a continuous spiral or other convenient arrangement, which scale may also be marked or printed on paper or other suitable material and then fastened to the cylinder in any well-known manner.

Each complete turn of the scale is marked and at each end of it there is another scale of decimal parts, concentric with the cylinder, for reading off fractions of a turn of the logarithmic scale, and thus by the proper numbering of the complete turns and graduation of the concentric scales, the logarithm of any number on the logarithmic scale can, with the aid of the index tube to be hereafter described, be determined, within the limits of the instrument.

An index tube which is made of a transparent substance such as transparent celluloid, or glass, or other suitable material. It is made an accurate sliding fit over the cylinder before described and carries three indices or index points, one of which is moveable, and the other two fixed but one or both adjustable if found necessary. The moveable index may also be of transparent celluloid or any other suitable material and it is made an accurate sliding fit over the index tube.

Instead of, or in addition to the concentric scales on the cylinder before described, there may be a concentric scale on the moveable index and suitable markings on the index tube in order to read off fractions of a turn of the logarithmic scale.

By suitably arranging the parts of the instrument, and the markings on the cylinder, and on the index tube and moveable index, all the ordinary arithmetical operations which slide rules are used for may be performed.

The cylinder before described may be made hollow to contain other cylinders or tubes on which tables of constants and other *data* may be printed or marked.

Dated this Twenty-first day of February 1895.

JAMES EAGLES.

COMPLETE SPECIFICATION.

An Improved Cylindrical Slide Rule.

I, JAMES EAGLES, of 55 Edith Grove, Chelsea, in the County of Middlesex, National Scholar, 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 :—

My invention relates to an improved cylindrical slide rule, which consists of a

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logarithmic scale arranged on a cylinder of wood or other suitable material and enclosed in a movable transparent tube of celluloid or other suitable transparent material.

And in order that my invention may be thoroughly understood, I now proceed to describe the accompanying drawing thereof, reference being had to letters and figures marked thereon.

Fig. 1, is a plan of the end of the instrument.

Fig. 2, is an elevation of the movable tube and collar.

Fig. 3, is an elevation of the movable tube, collar and cylindrical graduated slide complete.

Fig. 4, is an elevation of the cylindrical graduated slide.

My invention is constructed with a logarithmic scale *a* printed or cut on a cylinder *b* made of wood or other suitable material. This said scale *a* is marked or printed preferably in the form of a continuous spiral, but any other convenient arrangement may be used, which said scale *a* may also be marked or printed on paper and then fastened to the cylinder *b* in any well-known manner.

Each complete turn of the scale *a* is marked by a straight line or scale *h h* which is marked on the cylinder *b* from end to end of the scale *a* as shewn in Fig. 4, the divisions of this scale *h h* being formed by the turns of the scale *a* and numbered from the beginning of said scale *a* as shewn.

The scale *a* makes a whole number of turns on the cylinder *b*.

At each end of the scale *a* there may be on the cylinder *b* and concentric with it, a scale *c* divided into 100 divisions, for the purpose of reading off fractions of a turn of the scale *a*. It is however preferable to have a concentric scale at one or both ends of the index tube *d* to be hereafter described as at *s t* in Fig. 2, the said concentric scales being then numbered the opposite way round to scale *a*.

An index tube *d* which is made of transparent material such as transparent celluloid, or glass or other suitable substance, transparent celluloid being preferable, the transparency of the substance used permitting the scale *a* to be visible through it.

This index tube *d* is made an accurate but easy sliding fit as in Fig. 3 over the cylinder *b* before described and carries three index points *e k* and *f*, the one marked *f* being on a movable collar *g* to be hereafter described, the other two *e* and *k* are fixed at a distance apart equal to the distance between the beginning and end of scale *a* so that when *e* is at the beginning, *k* is at the end of said scale *a*. The index *e k* though always fixed when the instrument is being used, may be made adjustable if necessary, by being made in the form of pointers on collars (not shewn) made a tight fit on the index tube *d*. It is in my opinion preferable to have them permanently fixed in the form of simple marks on the index tube *d*. The said index tube *d* is made rather shorter than the cylinder *b* for convenience in handling the instrument. At one or both ends of the said index tube *d* are the concentric scales *s t* as before described, and the said concentric scales are exactly alike and their zeros in a line with the index points *e k* as shewn in Fig. 2.

The collar *g* may be made of any suitable material such as metal, wood or glass, but preferably of transparent celluloid, the index point *f* being simply a mark on the said collar *g* as shewn in Figs. 2 and 3.

This collar *g* is made an accurate easy sliding fit over the index table *d* as before described.

The cylinder *b* before described may be made hollow to contain other cylinders or tubes on which tables of constants or other *data* may be fastened printed or marked.

The advantage of having a transparent index tube, is that the instrument is reduced in bulk for the same length of scale and hence rendered more portable.

By suitably arranging the parts of the instrument and the markings on the cylinder *b* and on the index tube *d* and movable index *f*, all the ordinary

arithmetical operations for which slide rules are used may be performed within the limits of the instrument.

To multiply, find the number on the logarithmic scale *a* which represents the multiplier and set either of the index points *e k* to it, then slide the index point *f* over the index tube *d* until it is at that end of scale *a* visible between *e* and *k*, next move the cylinder *b* until the index point *f* is over the number on the scale *a* that represents the multiplicand, and the product may then be read off at that index *e* or *k* which is now on the scale *a*. From the construction of the instrument it is obvious that the index points *e k* can never both point to a number on the scale *a*. The index point *f* must not in any operation be moved outside the space between *e* and *k*.

To perform division find the number on the scale *a* that represents the dividend and if it be less than the divisor set it to the index *e*, if it be greater than the divisor set it to the index *k*, then set the index *f* to that number on the scale *a* which represents the divisor, next move the cylinder *b* until the index *f* is at one end of the scale *a*, when the quotient will appear at that index *e* or *k* which is then over the scale *a*.

To find the logarithm of any number set the zero of scale *s* on index tube *d* to the number on scale *a* whose logarithm is required and read off on scale *h h* the number of whole turns and on scale *s* the decimal parts of a turn of scale *a*, between the beginning of scale *a* and the number whose logarithm is required, then multiply the number and parts of a turn thus obtained by a constant which depends on the length of scale *a* and which is marked on scale *a* or otherwise supplied with the instrument. The product is the mantissa of the required logarithms, and the characteristic is obtained by inspection in the usual well known manner.

Since logarithms of numbers can be found by the instrument the roots and powers of numbers can be found as if by means of a table of logarithms in the usual well known manner.

Another method of performing involution and evolution is as follows :—

Find on the scale *a* the number whose power or root is required, place it to the zero of the scale *s* on the index tube *d*, and read off the number of whole turns on scale *h h* and fraction of a turn on scale *s*, between the beginning of scale *a* and the number whose power or root is required and if the number whose power or root is required be in units, multiply the reading so obtained by the index of the power or root required to obtain a new reading and adjust the index tube *d* so that the zero of scale *s* will make this new reading on scales *h h* and *s*. The number on the scale *a* now appearing at the zero of scale *s* will be the required power or root. If the number whose power or root is required is in tens, the the whole number of turns made by scale *a* must be added to the reading obtained from scales *h h* and *s* before multiplying or dividing by the index of the required power or root. If the number is in hundreds twice the whole number of turns of scale *a* must be added and so on.

If after multiplying or dividing by the index of the required power or root, the product or quotient is greater than the whole number of turns of scale *a* the said product or quotient must be diminished by multiples of the whole number of turns of scale *a* until the remainder is less than the whole number of turns of said scale *a* and this remainder is the reading to which the index tube must then be adjusted as above explained.

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. In cylindrical slide rules, a transparent index tube *d* with index points *e k*, substantially as herein described.

2. In cylindrical slide rules, a transparent index tube *d* with suitable index points

and scales in combination with the movable collar *g*, substantially as herein described and according to the accompanying drawing.

3. In cylindrical slide rules, the combination of the various parts described in this Specification to form the instrument, substantially as described and for the purpose specified.

Dated this 23rd day of November 1895.

J. P. BAYLY,
18 Fulham Place, W., Agent for the Applicant.

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EAGLES' Complete Specification.

(1 SHEET)

Fig. 1.

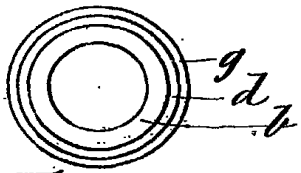


Fig. 2.

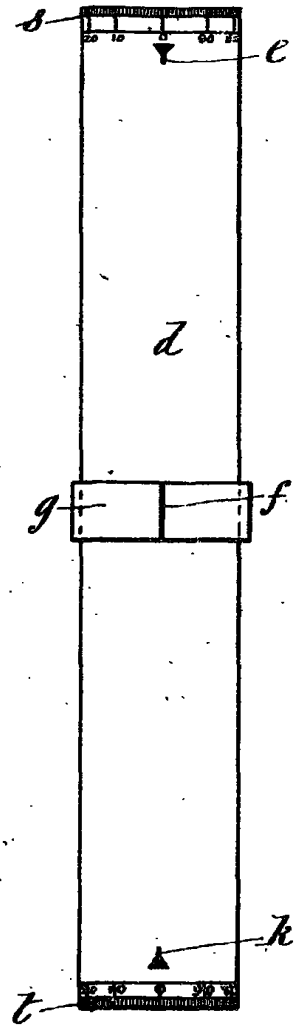


Fig. 3.

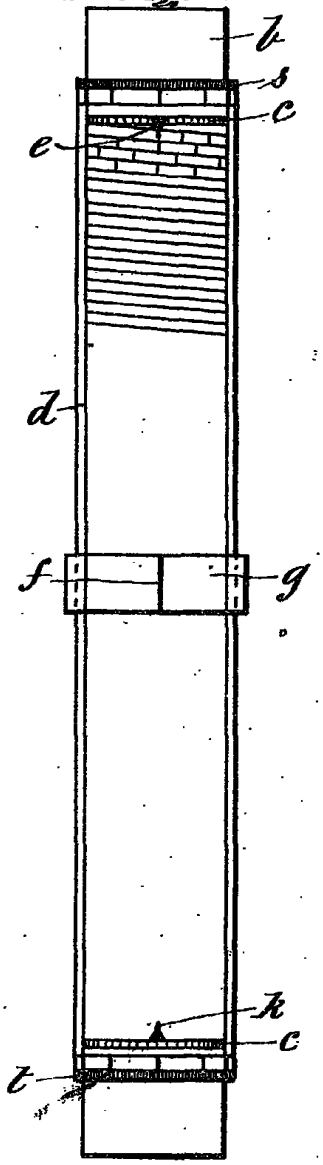
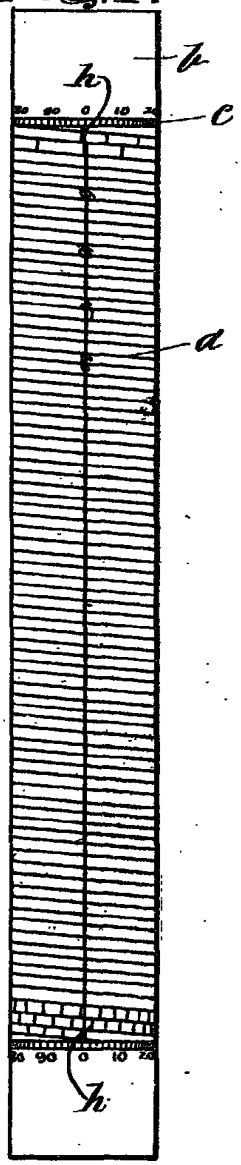


Fig. 4.



[This Drawing is a reproduction of the Original on a reduced scale.]

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