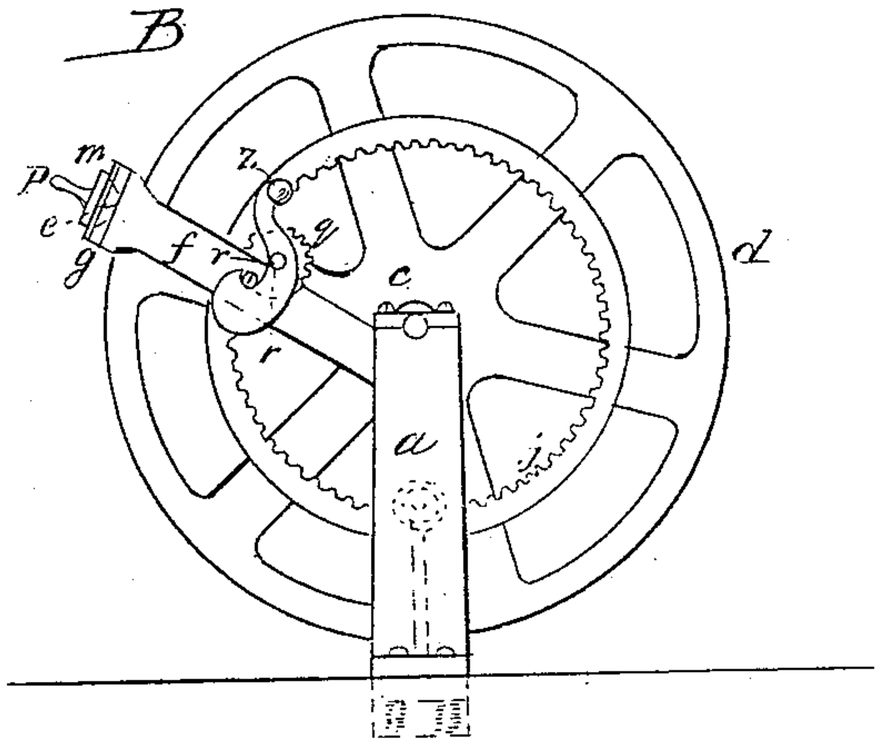
E. Wright,

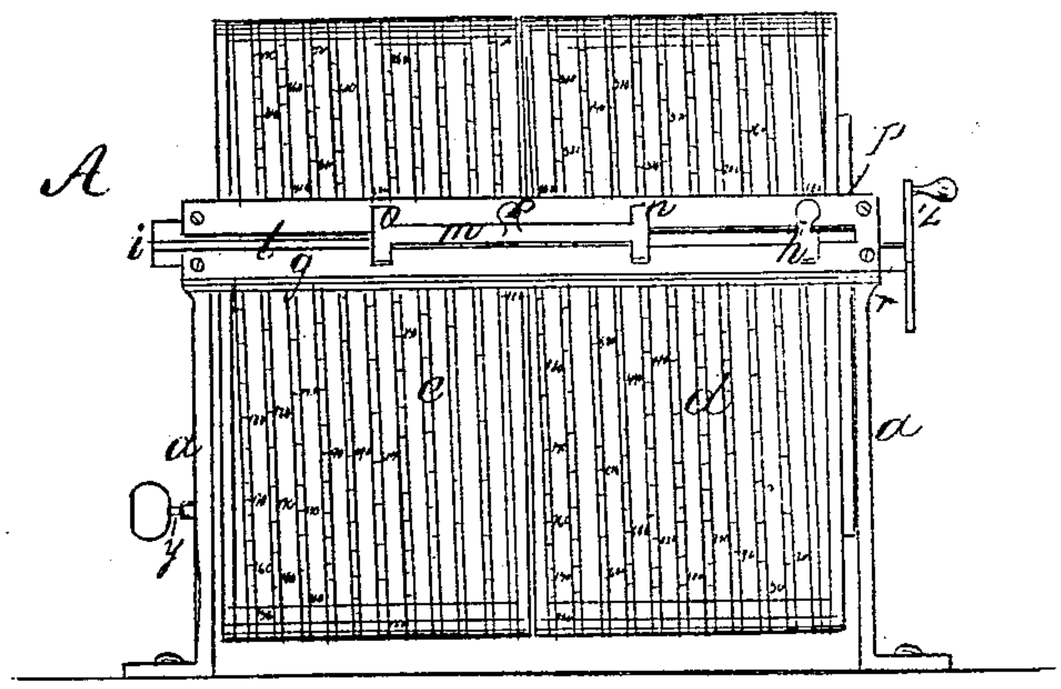
Calculator.

No. 93,849. Patented Aug. 17. 1869.

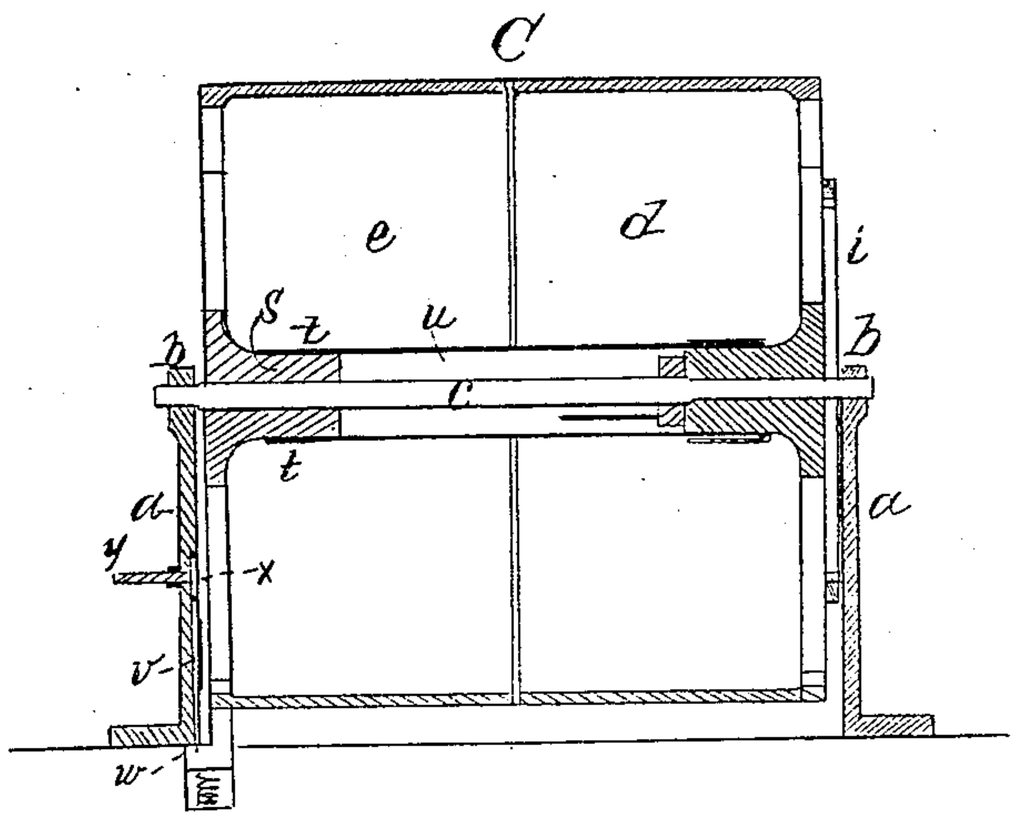
B



A



C



Witnesses
M. W. Frothingham
S. B. Kidder

E. Wright
by his Attys
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United States Patent Office.

ELIZUR WRIGHT, OF MEDFORD, MASSACHUSETTS.

Letters Patent No. 93,849, *dated August* 17, 1869.

IMPROVEMENT IN COMPUTING-APPARATUS.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, ELIZUR WRIGHT, of Medford, in the county of Middlesex, and State of Massachusetts, have invented an Arithmeter; and I do hereby declare that the following, taken in connection with the drawings which accompany and form part of this specification, is a description of my invention, sufficient to enable those skilled in the art to practise it.

This invention relates to the construction of a mechanism or apparatus for performing arithmetical operations without mental process.

The construction of slide-rules, and other scales for solving questions of multiplication and division of numbers by logarithmic proportions, is well known, such scales having division-lines and numbers engraved upon them, by means of which arithmetical results are obtained by inspection, and the use, in connection, of compasses or gauges stretching from division to division.

My improvement has particular reference to such an arrangement of the numbers and divisions of the respective scales as shall enable any factor of each scale to be brought into position, with relation to the sliding index or pointer, so that the result of the problem can be read by the position of an auxiliary pointer; and

The invention consists, primarily, in two rotary cylinders or disks, upon the surface of each of which the logarithmic scale is marked and numbered upon spiral or helical lines running many times around the cylindric surface of each cylinder, or the flat surface of each disk, these cylinders or disks having rotary movement, with respect to a stationary arm or bar, carrying sliding pointers for marking the factors and designating the result.

I term this instrument an "Arithmeter," and the drawings represent a machine embodying the invention.

A shows a front elevation of the arithmeter.

B, an end view of it.

C, a vertical central longitudinal section of it.

a a denote two standards, having, at top, bearings *b* for supporting a shaft, *c*.

On this shaft, between the standards, are mounted the two cylinders *d e*, one of which (*d*) is fast upon the shaft, while the other can slip or rotate upon the shaft.

The cylindrical surface of each cylinder is covered with a paper coating, connected thereto, and around this surface is drawn a spiral line, (or two adjacent parallel spiral lines,) running from one end of the cylinder to the other, starting at a point at one end of the cylinder, at the edge of the paper surface, and running spirally around, until the opposite end of the cylinder be reached, the distance between the adjacent lines of the spiral being uniform throughout, and the total length of the spiral being determined by the angle or pitch given to it.

The spiral lines of the two cylinders exactly correspond, and, after they are drawn, each is divided (preferably by means of a temporary peripheral scale, of equal parts, around the head of one of the cylinders) into logarithmic divisions, the two scales thus made corresponding in their divisions, and each being of a great and continuous length, equal to the circumference of the cylinder, multiplied by the number of times the spiral surrounds the cylinder.

From the top of the two standards *a*, two arms *f* extend out to the surface of the cylinder, and sustain, at their outer ends, a cross-bar, *g*, which extends across the surface of both cylinders, its upper edge serving as a straight-edge, down to or opposite which the respective divisions of the scale to be read, serving as factors, are brought, and over which the result is read.

This bar is made with guide-grooves, in which moves a slide, *i*, upon one end of which is a pointer, *k*, the outer edge of which, when the pointer is moved up to its normal position, comes opposite the first division of the scale.

In the face of the slide *i* is a guide-slot, *l*, in which runs a slide, *m*, bearing at its opposite ends two pointers *n o*.

Each slide may have a knob, *p*, by which to move it.

The slide *m* is provided with a suitable spring, fixed to or projecting from it, and bearing against the slide *i*, with stress sufficient to hold it stationary, with respect to the slide *i*, when the latter is moved.

The head of the cylinder *d* is provided with a gear-wheel, *j*, into which meshes a driving-pinion, *q*, on the end of a shaft, *r*, journalled in a bearing fixed upon the adjacent arm *f*, and having at its outer end a handle, *s*.

The head of the other cylinder *e*, has, projecting inwardly from it, a short hub, *s*, which is embraced by springs *t* projecting from a quill, *u*, on the shaft *c*, the pressure of these springs being sufficient to cause the two cylinders to rotate together, (or as one,) unless the cylinder *e* is held by some brake-mechanism.

The standard *a*, adjacent to the cylinder *e*, has in its inner side a vertical slot, in which is a rod, *v*, at the foot of which is a brake-shoe, *w*, which projects under the edge of the cylinder-head, and is pressed upward by a suitable spring or springs.

Over the top of the rod *v* is an eccentric, *x*, on the end of a thumb-shaft, *y*, passing through the standard.

By turning the thumb-shaft, and causing the eccentric to press down the rod, the brake-shoe is carried out of contact with the edge of the cylinder-head, when the cylinder *e* will turn with the cylinder *d*, while by turning the eccentric, so as to let the springs throw

the brake up against the edge of the cylinder-head, the cylinder *e* will be arrested, so that rotary motion of the cylinder *d* imparts no movement to the cylinder *e*.

To operate the instrument, either for multiplication or division, it is first to be observed, that of the three pointers, that at the right, which slides in the cross-bar *g*, belongs altogether to the right-hand cylinder, or *d*, and the other two, which slide in the slide *i*, belong altogether to the left-hand cylinder *e;* but only one of them indicates at the same time, because whenever one slides opposite the scale, the other slides off.

To multiply: Allow the cylinder *e* to revolve, find on it one of the factors, or as many as you can of the left-hand figures of it, bring it to the cross-bar, and fix that cylinder by a quarter of a turn of the thumb-shaft *y*. Then bring the unit, or beginning of the scale, on the other cylinder *d*, to the cross-bar, and set the pointer *k* to it, while you set the extreme left-hand pointer *n* to the factor already found on cylinder *e*. Then take off the brake, and turning the two cylinders as one till the other factor on cylinder *d* comes to the cross-bar, slide the pointer *k* to it, and whichever of the other pointers, *n* or *o*, is opposite the scale on cylinder *e*, will indicate the product, or the left-hand figures of it. If the factors contain more than the figures marked on the scale, they may be divided into convenient portions, and multiplied as polynomials.

To divide: Find the dividend on *e*, bring it to the cross-bar, and fix that cylinder. Then find the divisor on *d*, bring it to the cross-bar, and slide the pointers so that *k* will point to the divisor and *o* to the dividend, if the space is not too great, but *n* if it is. Then release cylinder *e* from the brake, turn the cylinders as one till the unit of *d* is at the cross-bar, and slide *k* to it. The quotient will be found on cylinder *e*, indicated by whichever of the pointers *n*, or *o*, is opposite the scale.

By this means, as will be obvious to persons acquainted with the use of logarithmic scales, operations of multiplication and division may be very speedily performed, without mental calculation or the use of "figuring," the instrument being of manifest utility in all offices where, in the preparation of statistical tables, such results have to be constantly obtained.

The specific description has had reference to a spiral scale, made around the surface of a cylinder; but it will be obvious that a similar result may be attained by employing two consecutive disks or rings, having the scale-lines running helically around the face of each, a radius-bar serving as a bed for the pointer-slides, and as a straight-edge, against which to bring and read the divisions; but I prefer the construction of the instrument as shown.

I claim, in combination with suitable pointing-mechanism, two cylinders or disks, on the same shaft, and operated by the same driver, one being driven by frictional contact with the other, and both having logarithmic divisions, marked upon coiled or helical lines drawn upon their surfaces, substantially as shown and described.

I also claim, in combination with cylinders, so arranged, lined, and divided, the stationary bar *g*, and the pointer-slides *n o*, substantially as shown and described.

I also claim, in combination with the cylinders, both operated from the same common driver, devices for effecting the rotation of both together, or of only one at option, substantially as shown and described.

ELIZUR WRIGHT.

Witnesses:
H. A. BROWN,
WALTER C. WRIGHT.