J. BILLETER.
LOGARITHMIC CALCULATOR.
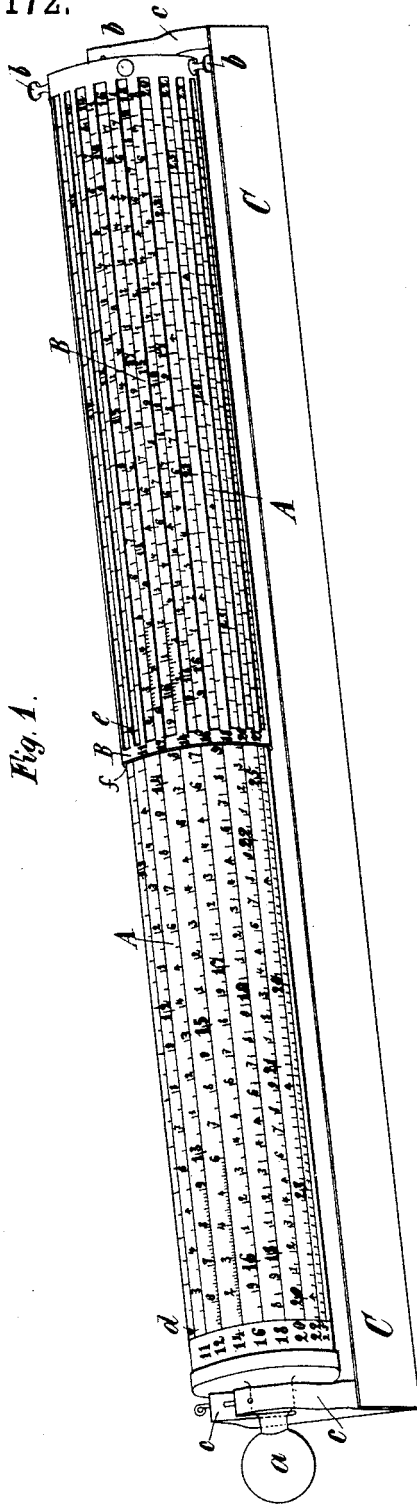
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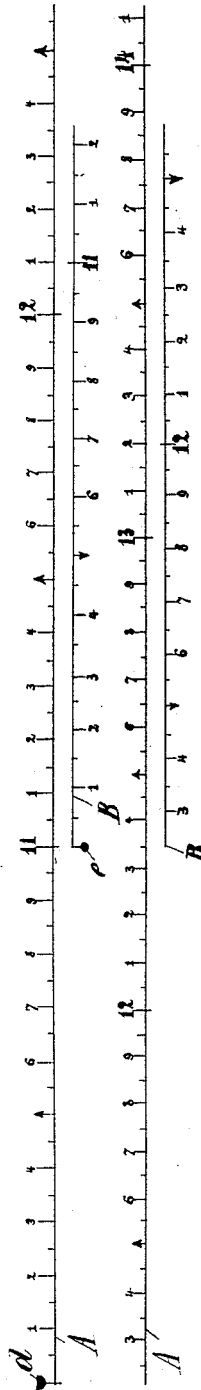Patented Jan. 23, 1894.

Fig. 1.

Fig. 2.

Witnesses:
W. Harry Muzzy
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Inventor.
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by
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UNITED STATES PATENT OFFICE.

JULIUS BILLETER, OF ZURICH, SWITZERLAND.

LOGARITHMIC CALCULATOR.

To all whom it may concern:

Be it known that I, JULIUS BILLETER, manufacturer, a citizen of Switzerland, residing at Zurich, in the canton of Zurich, Switzerland,
5 have invented certain new and useful Improvements in Calculating-Rollers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which
10 it appertains to make and use the same.

This invention has been patented in France, No. 217,367, dated November 10, 1891.

The calculating roller hereinafter described has for its object the execution of multiplica-
15 tions, divisions, proportions, and especially also repartition-calculations, which calculations are very much simplified and facilitated by the aid of the same.

In the annexed drawings, Figure 1 repre-
20 sents the calculating roller in perspective view, where the finer division lines of the scales are only marked in two places, and Fig. 2 is a diagram of the scales on the said cylinder and slide.

25 The calculating roller consists of the roller proper A, journaled in the bearings *c* of the frame C and turned by means of the knob *a* and of the slotted slide B which is movable and adjustable along the roller A, by means
30 of the knobs *b*. The slide B is made of a sheet of aluminium which is coated with celluloid, and strips are punched out of it in such a manner, that only the scale and a narrow margin are left on each side of the sheet. The
35 sheet thus cut out is bent into the shape of a hollow cylinder and the edges are fixed together. Its length is about half that of the roller or cylinder.

The calculating roller is based on the prin-
40 ciple of operations with logarithms, and for this reason all calculations, which can be executed by logarithms, may also be executed on this roller. The logarithms of the numbers are drawn up as linear values or lengths on
45 the scales of the calculating roller. The written figures however do not give the logarithm, but the number (*numerus*) corresponding to the logarithm in question. Multiplications, for instance, are logarithmically replaced by
50 the addition of the logarithms, with the calculating roller, that is, graphically, they are performed by simply adding together two lengths. If it is required, for instance, to multiply eleven by eleven on the calculating roller, then the zero point *e* of the slide is 55 placed against the figure 11 on the cylinder or roller (Fig. 2) and over the figure 11 of the slide is read the product 121 on the roller. The distance from the starting point *e* on the slide to the figure 11 is thus to be added to 60 the distance from the starting point *d* of the roller to the figure 11. The same position shows how to divide one hundred and twenty-

one by eleven $\left(\dfrac{121}{11}=11\right)$; in this case the dis- 65

tance on the slide from the starting point of the same to figure 11 must be subtracted from the distance between the starting point and figure 121 on the roller, and over the start- 70 ing point of the slide may be read the quotient 11 on the roller. The same position of the slide gives the example of proportion and repartition—

$$\frac{121}{11}=\frac{132}{12}=\frac{143}{13}=\frac{154}{14}=\frac{198}{18} \text{ \&c.} \qquad 75$$

In order that the slide may throughout cover figures and indicate the figures sought for, and in case of repeated multiplication by 80 the same number or multiplicator, to read off all the products and in case of repeated division by the same divisor to read off all the proportions or quotients and in case of repartition-calculations to show all figures of solu- 85 tion by one position of the slide on the calculating roller, the logarithmic division on the cylinder or roller A is repeated at intervals. The logarithmic division of the scale of the slide B, however, is continuous without 90 repetition, but otherwise corresponds to the division of the scale on the roller A.

The numbers with two places, 11 to 99, are distinguished by two bold figures. In seeking the numbers from 100 up to 1,000, 11 95 stands for 110, 12 for 120, &c., the naughts being added in the mind.

The manner of using the calculating roller is as follows:

In multiplication, the cylinder or roller is 100 turned with the left hand, so as to bring the starting point of the slide before the eye. The

slide is next grasped with the right hand on the knobs, and the starting point of the same is placed opposite the nearest factor, the roller being for this purpose turned toward or from the operator by the left hand. In line with the other factor, may be read the product on the roller. The bold figures arranged right and left on the cylinder and the slide facilitate the finding of any number. If the two highest places of any number are sought for among the numbers on the margin, then the next following places of this number are always to be found in the same line.

In division the divisor on the slide is brought before the eye, by turning the cylinder, and the said divisor is then placed under the end point f in the middle of the cylinder. In line with the dividend on the slide, may be read the quotient on the cylinder or roller.

In proportion and repartition calculations the known proportional numbers on the roller and on the slide are placed opposite each other, and similar proportions are read off on the cylinder and on the slide without the latter being moved.

In the following examples the numbers on the cylinder are placed above the line and those on the slide are below the line.

a) *Multiplication:*

Roller	11	22	121	165	1232	14938	53779
Slide	e	2(20)	11	15	112	1358	4889

b) *Division:*

Roller	end point	2(20)	11	15	112	1358
Slide	11	22	121	165	1232	14938
	4889					
	53779					

c) *Proportion:*

Roller	36	76	2(20)	
Slide	18	38	e	(starting or end mark).

d) *Repartition:*

Roller	240	45	126	1926	3075	19332
Slide	80	15	42	642	1025	6444

To more fully illustrate the operation of this calculating device the following logarithmic graphic solution of practical examples is appended:

a) Use of the calculating roller in banks, savings and money lending establishments:

Example: How much is the discount of $1,240 in 87 days at 5%?

Roller	Amount	Discount
Slide	Interest divisor	Days

Roller	Amount $1,240	$14.98 discount
Slide	5% interest divisor=72	Days 87

b) Use of the calculating roller in railway offices:

Example: For 320 kilometers the charge is $11.40; how much for 30, 80, 165, 45 (320 kilometers)?

Roller	$11.40	$1.06	$2.85	$5.88	$1.61
Slide	320 km.	30 km.	80 km.	165 km.	45 km.

c) Use of the calculating roller in insurance offices:

Example: Given the amount to be insured $13,570, the premium $37.50, the sum reinsured $7,580, what is the premium for reinsurance?

Roller	$37.50	x=$20.95
Slide	$1,357(o)	$758(o)

d) Use of the calculating roller by builders and other contractors:

Example: What are the wages for $8\frac{3}{4}$ days at $3.60?

Roller	8.75	x=$31.50 wages
Slide	e	$3.60

What is the cubature of a room 12.8 m. long, by 1.08 m. wide, by 0.65 m. deep?

Roller	12.8 m.	13.82 m².	13.82 m².	8.99 m³.
Slide	e	1.08 m.	e	65

e) Use of the calculating roller in statistical offices:

Example: Find out what percentage of the sum (11672) each of the following values represents:

710, 590, 612, 1240, 2180, 6340 (sum 11672).

Roller	end point=100	6.08%	5.06%	5.23%
Slide	11672	710	590	612
	10.62%	18.68%	54.33%	
	1240	2180	6340	

I claim—

In a logarithmic calculating device, a cylinder graduated and numbered in parallel longitudinal lines and capable of rotary motion only, in combination with an openwork slide fitting on the said cylinder and of half its length, the said slide being capable of both rotary and longitudinal motion and having longitudinal logarithmically graduated bars as well as notches and knobs on its margin to mark the beginning and end of the scale substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

JULIUS BILLETER.

Witnesses:
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T. BILLETER.