N° 12,935 A.D. 1910

Date of Application, 27th May, 1910—Accepted, 22nd Dec., 1910

COMPLETE SPECIFICATION.

Improvements in or relating to Logarithmic Calculating Apparatus.

I, HERMANN CARL CARSTEN VON HEMM, of 7², Rostgaardsvej, Elsinore, Denmark, 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 to calculating scales which permits of effecting technical and physical calculations by simple measurements and comparisons of distances.

The invention is based on a similar principle to the slide rule. The inventions which are made up to the present in this line consist merely in improved slide-rules, the improvement being generally of the kind that the scales of the slide rules are set out in a manner to facilitate a certain species of technical or commercial calculations, the slide rule being limited to this species. According to my invention however, I have on a sheet a number of scales presenting sides of equations with one or two different quantities. Either one quantity is known and by comparing its corresponding length, taken off of its own scale with the scale for two quantities which form the other part of the equation I can for instance calculate a series of values of these two quantities, which satisfy the equation. For comparing the lengths a beam compass is used.

In technical calculations formulas are generally used which are of the following general form or can be reduced to the same.

$$\frac{a}{b} = k.c \qquad \frac{a}{b} = k.c^n$$

$$a.b = k.c \qquad a.b = k.c^n.$$

Generally several of the quantities are given and the unknown quantity has to be determined by means of a formula. Let us, for example, suppose that a calculation has to be carried out with the formula $\frac{a}{b} = k.c$, in which a, b and k are the known quantities and c is the unknown quantity to be determined. Figure 1 shows a scale which is divided into two parts. On the left of the line E are inscribed the values of a and on the right of the line E the values for b. Now if both the points S^1 and S^2 of the measure L (Figure 4) are so placed in position that the point S^1 is situated on the scale to the left of E opposite the known value of a, and the point S^2 is situated on the scale to the right of E opposite the known value of b, then between the points S^1 and S^2 a distance is measured off by means of which the value of the unknown quantity can be determined on the scale shown in Figure 2 by simply placing the point S^1 at the commencement A of this scale and the value of the unknown quantity will be indicated by the point S^2. This c-scale is somewhat displaced with respect to the starting line A according to the value of the coefficient K.

If however, the formula is of the kind $\frac{a}{b} = k.c^n$, then the scale shown in Figure 2*a* must be used with the scale Figure 1 which scale Figure 2*a* is shown in the drawing for the special case $n = 3$ and $k = \frac{\pi}{32}$. This case corresponds

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to the known formula for calculating the diameter of a gudgeon in which the length and pressure are given. Now if instead of a we place the bending moment M and instead of b the strain coefficient K and for k the value indicated above, then is c = D = the diameter of the gudgeon.

Now a simple example may be calculated by means of the scales Figure 1 and Figure 2*a*. Let us suppose that the gudgeon is 15 centimetres long, that there is a uniform pressure of 2000 kilograms and K = 300. Now on the scale of Figure 1 the point S^1 is placed on the number 300 on the part of the scale indicated by K, and the point S^2 on the resulting amount 15,000 for the value of M on the part of the scale indicated by M. Now the distance between the two points is measured off on the scale D Figure 6, which in this case is identical with the scale Figure 2*a*, from the starting line A. We shall thus get the value 8 and consequently the diameter of the gudgeon is 8 centimetres. A whole series of other calculations will be similarly carried out by using correspondingly constructed scales, as for example the determination of section numbers, strengths of beams as well as also current velocities in turbines and electro-technical calculations.

In formulas of the kind $a.b = k.c$ or $= k.c^n$, the $a - b -$ scale will be made as shown in Figure 3 in which divisions pass from the middle line E increasing to the right and to the left so that according as one of the points of the beam compass device is adjusted to a value to the left and to the right of the middle line E so the distance contained between the points will correspond to the product a and b.

By means of this principle it is also possible to solve such equations in which occurs the ratio of two unknown quantities. Naturally also more than two scales may be required for carrying out the calculation, if for example several equations are employed to begin with. Generally speaking, however, almost all the important formulas in physics and technics may be solved in the manner indicated so that by means of the beam compass device by comparing the values embraced on separate scales, the unknown quantity can be determined.

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:—

Calculating scales for carrying out technical calculations, characterised in this that for carrying out a calculation according to a definite formula in which an unknown quantity is to be determined by means of known quantities, pairs of scales with logarithmic divisions are employed in which each scale corresponds to one equation side of the formula and by means of a ruler provided with movable pointers, by setting the points at definite divisions of the one scale corresponding to the known quantities, a distance will be embraced between the two points, which measured off on this second scale will give the unknown quantity.

Dated this 25th day of May, 1910.

A. BONING,
Agent for Applicant.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1911.

A.D. 1910. May 27. Nº 12,935.
VON HEMM'S Complete Specification. (1 SHEET)

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

Fig. 1.

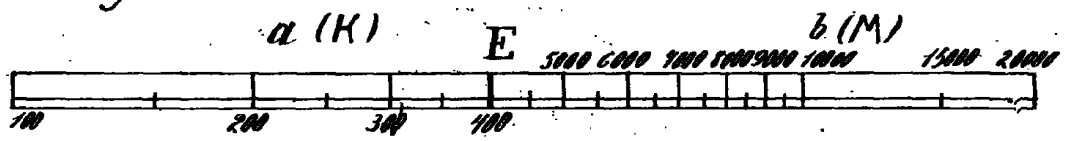


Fig. 2.

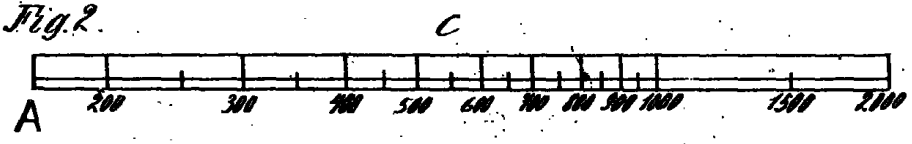


Fig. 2a.

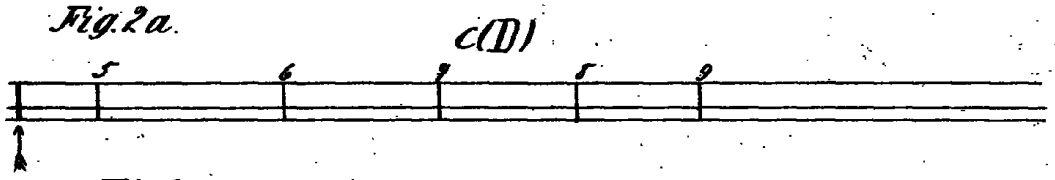


Fig. 3.

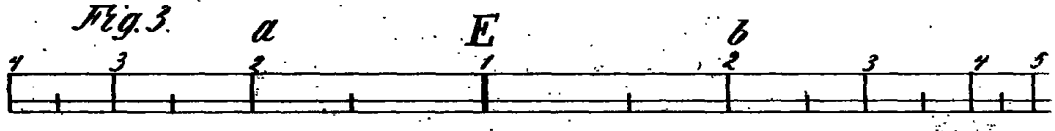


Fig. 4.

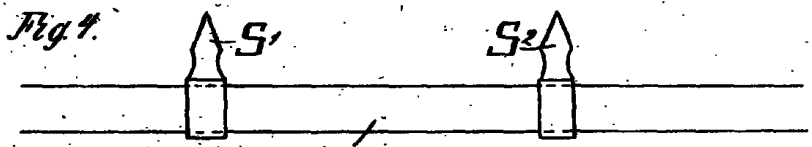


Fig. 5.

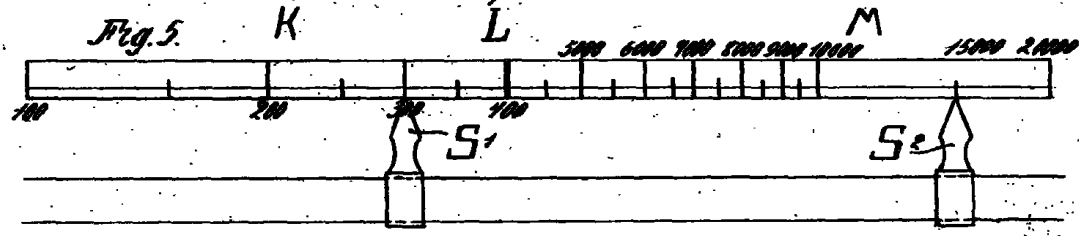
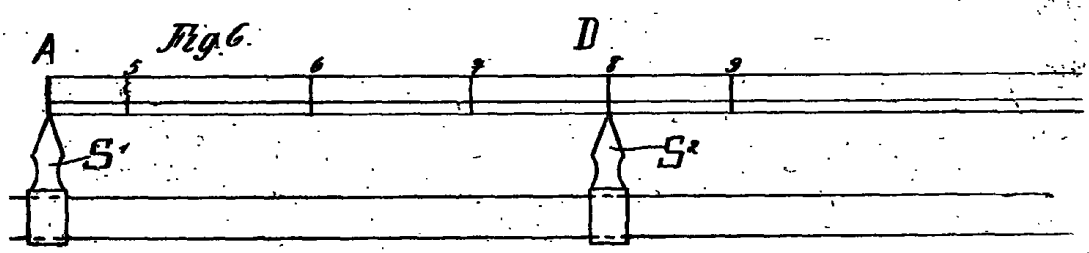


Fig. 6.



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