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COMPLETE SPECIFICATION

Improvements in Logarithmic Calculators

We, MARIO ABEILLE and VINCENZO AQUILECCHIA, both of Italian Nationality, and both of 12 Via Imperia, Rome, Italy, do hereby declare the invention,

for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a pocket logarithmic calculator having circular scales which, when used with an eyepiece, appear to be of exceptional length in relation to the dimensions of the instrument and therefore guarantee extremely close approximation in calculations, due to the fact that the apparent length of the scales is equal to the length of the original scales which were photographed for the purpose of producing the scales used in the calculator.

The purpose of the invention is to permit, with a pocket instrument which is simple to use, the calculation with a high degree of approximation of logarithmic, arithmetical, and tri-gonometrical expressions, as well as of exponential operations. Throughout this specification the term co-logarithm is intended to mean the logarithm of the value concerned subtracted from the logarithm of 10.

This purpose is achieved by providing a rotary logarithmic calculator with a rotatable ring, which for calculations by means of logarithms and exponential operators uses circular logarithmic and co-logarithmic scales and circular scales of uniform graduation, all marked on the cylindrical surface of the ring, or marked on paper or on celluloid or on sheet metal and wound around and affixed to the cylindrical surface of the ring, and a fixed reference pointer for said scales, and the present invention is characterised in that said calculator comprises a mobile pointer drivingly connected to the graduated ring by means of a friction system which permits the joint rotation of the mobile pointer and the graduated scales in relation to the fixed reference pointer, but, when desired, rotation of the graduated scales in relation to the mobile pointer, a second fixed reference pointer being provided to co-operate with the mobile pointer, and an optical magnifying system in front of the fixed reference pointer to assist in reading the scales.

The instrument is therefore essentially constituted of the members for obtaining the aforesaid movements with the precision indispensable for the purpose for which the micro-calculator has been conceived.

In the accompanying drawing, Figure 1 illustrates by way of example an instrument, according to the present invention, viewed from the front with the protecting cover half open;

Figure 2 illustrates the micro-calculator viewed in section, and

Figure 3 illustrates the instrument viewed from the back ready for use.

Referring to the drawing, the micro-calculator shown thereon essentially comprises a support in the form of a parallelepiped casing 1 having a hinged lid 2, on the two side faces of the support windows 3, 4 and 5, a glass 8 with zero line which acts as a fixed reference pointer, and over the glass an extremely powerful eyepiece 7 protected in the position of rest by the lid 2. A graduated ring 6 inside the casing 1 is adapted to turn in both directions around its own axis thus rendering visible in all of its positions a section of the graduated scales through the glass. This section is highly magnified by the eyepiece which is used for reading precisely the graduated scales. The rotation of the ring 6 is controlled by a pinion 9, a small arc of which projects from the casing and which is mounted on the latter by a resilient connection so that the rotation of the pinion is transmitted to the ring 6 by means of a slight pressure applied by the user. The ring,

as it rotates, renders visible through the windows 3 and 4 the figures from 1 to 9 of two subsidiary scales which indicate the distance of the origin of the main scales from the fixed reference pointer. A disc 10 coaxial with the graduated ring 6 is rotatably controlled by a pinion 11. On the disc 10 is marked a pointer which rotates therewith and is therefore called the "mobile pointer". The mobile pointer, which is visible through the window 5 encounters a co-acting pointer marked on the casing. The coincidence of the mobile pointer with the co-acting pointer indicates the "initial position" of the instrument and the position for reading results. Perfect coincidence of these pointers is ensured by an "elastic stop device" composed of an elastic support 17 and a small tooth 18 which during the rotation of the disc 10 engages a notch provided on the disc 10 in a predetermined position. The release which occurs when the tooth 18 enters the notch provides the required coincidence between the mobile pointer and the co-acting pointer. A friction system connects the disc 10 with the graduated ring 6 so that by acting on the pinion 9, which can only mesh with a toothed ring 12 on the ring under pressure, only the graduated ring 6 is rotated, while by acting on the pinion 11 there is obtained simultaneous rotation of the ring 6 and of the disc 10. The system comprises a fixed cone 16 which is surrounded by a hollow cone integral with the disc 10 and which in turn is surrounded by a second hollow cone integral with the graduated ring 6. In order therefore to prevent slipping between the disc 10 and the ring 6 when the pinion 11 is operated, the instrument is provided with a friction brake composed of a spring 13, a leather slide 14 and a regulating screw 15. On the cylindrical surface of the ring 6 are marked circular scales, graduated in accordance with logarithms of numbers, and others graduated in accordance with co-logarithms of numbers, and others again graduated in accordance with logarithms of the trigonometrical functions and finally a scale graduated in accordance with arcs of uniform amplitude, the graduations of which encounter the numerical values of a logarithmic scale and of a co-logarithmic scale, and which therefore permit the reading of the logarithms and of the co-logarithms of the numbers. The ring 6 also carries, marked on its plane surface, two subsidiary scales graduated respectively from 1 to 9, the graduations of which correspond respectively to the main graduations of a logarithmic scale and of a co-logarithmic scale, both in common use. These graduations appear successively, as the ring rotates, through the windows 3 and 4 and are indicative of the position of the corresponding scales in relation to the fixed pointer.

From the foregoing remarks it is obvious that by acting on the pinion 9 the origin of the graduated scales is caused to rotate and to be displaced in relation to the mobile pointer, and that by acting on the pinion 11 the mobile pointer and the origin of the graduations are displaced by equal arcs in relation to the fixed pointer. The chief scales of the calculator are a logarithmic scale and a co-logarithmic scale. Assuming that a multiplication, e.g., 3×5, is to be made, after bringing the mobile pointer marked on the disc 10 in register with the co-acting pointer marked on the casing, the pinion 9 is rotated until the scale-mark corresponding to the figure 3 on the logarithmic scale is brought in register with the fixed pointer on the glass 8.

Then the pinion 11 is rotated until the scale-mark corresponding to the Figure 5 appears in register with the fixed pointer on the co-logarithmic scale. At this stage the result is already contained in the apparatus i.e. the multiplication proper is already made. But once a multiplication of an even number of factors has been chosen by way of example in order to read this result on the logarithmic scale, a fictitious multiplication by 1 is required which is carried out by first rotating the pinion 9 until the origin of the logarithmic scales is brought in register with the fixed pointer, the disc 10 remaining stationary and then the pinion 11 must be again rotated until the mobile pointer has completed one revolution in respect to the starting position thereof. The product of 3×5 can now be read on the logarithmic scale, this product being the figure corresponding to the scale-mark appearing on this scale at the fixed pointer, in the present instance 15. If, on the contrary, the multiplication would include an odd number of factors, the multiplication by the last factor gives the result on the logarithmic scale, so that no fictitious multiplication by 1 is required in this case. Thus, it is possible to make use of the limited field of the eyepiece for the obtaining of the algebraic sum of arcs and hence for that of products and quotients between numbers and between numbers and trigonometrical functions, and between logarithms or cologarithms and numbers.

The present invention has been illustrated and described in one preferred embodiment, but it is understood that structural modifications could in practice

be made thereto without departing from the scope of the following claims.

What we claim is:—

1. A rotary logarithmic calculator provided with a rotatable ring, which for calculations by means of logarithms and exponential operators uses circular logarithmic and co-logarithmic scales and circular scales of uniform graduation, all marked on the cylindrical surface of the ring, or marked on paper or on celluloid or on sheet metal and wound around and affixed to the cylindrical surface of the ring, and a fixed reference pointer for said scales, characterised in that said calculator comprises a mobile pointer drivingly connected to the graduated ring by means of a friction system which permits the joint rotation of the mobile pointer and the graduated scales in relation to the fixed reference pointer, but when desired, rotation of the graduated scales in relation to the mobile pointer, a second fixed reference pointer being provided to co-operate with the mobile pointer, and an optical magnifying system in front of the fixed reference pointer to assist in reading the scales.

2. A rotary logarithmic calculator as claimed in claim 1, characterised in that it comprises two subsidiary scales, each being rotatable in front of a window in a support of the ring, and indicating at every moment the approximate position which the corresponding scales on the cylindrical surface have in relation to the fixed reference pointer.

3. A rotary logarithmic calculator as claimed in Claim 1, characterised in that it is provided with a resilient stop-device ensuring perfect coincidence of the mobile pointer and the respective co-acting fixed reference pointer.

4. A rotary logarithmic calculator constructed and arranged substantially as described herein with reference to and as illustrated in the accompanying drawing.

Dated this 11th day of April, 1950.

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688,639 COMPLETE SPECIFICATION
1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

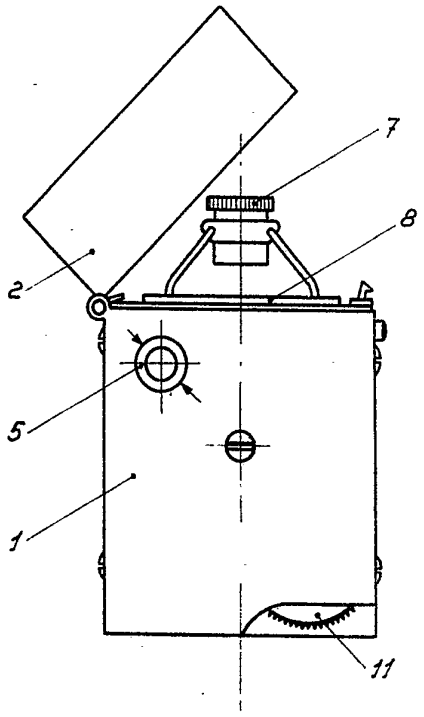

Fig. 1

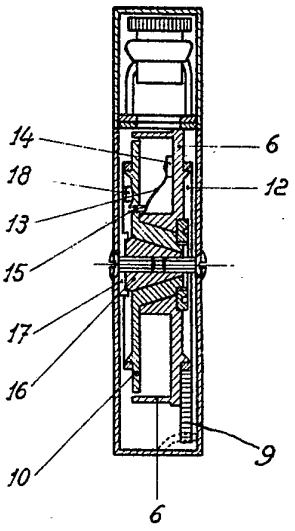

Fig. 2

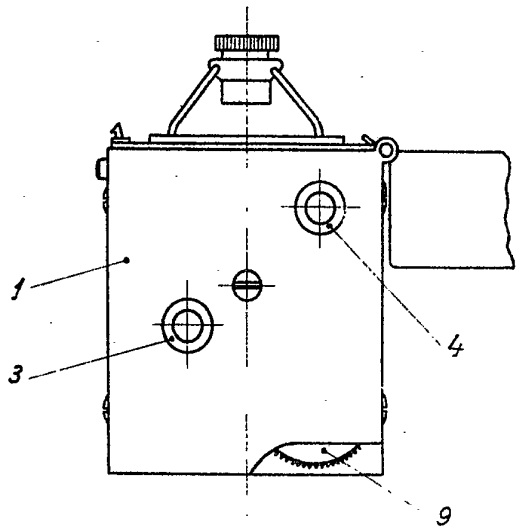

Fig. 3