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(54) **Logarithmic calculating appliance**

(57) A calculating appliance based on the same mathematical principle as is the common slide-rule, but in which the scales are inscribed in sections, suitably spaced, on sheets of material designed to be used in pairs, one sheet being placed over the other and manipulated by the operator; the upper sheet is either transparent, or the material between adjacent sections of scale is cut away, in such manner that the sections of scale on both sheets are in view to the operator.

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SPECIFICATION

Logarithmic calculating appliance

5 The technical field to which the invention relates is that of mathematics. The background art is that of the common slide-rule. The invention is that of an appliance for carrying out mathematical operations such as

10 are adapted to being carried out with the common slide-rule. It embodies the principle of the slide-rule, namely, that of manipulating suitably graduated scales placed side-by-side. Whereas, however, the scales of the slide-rule

15 are continuous, each scale of the appliance now being described is arranged in sections placed one following the other, suitably spaced, thus giving an appliance of far greater compactness than that of a slide-rule having

20 an equivalent degree of accuracy.

2. The appliance described in paras. 2 and 3 to illustrate the invention is for multiplication and division of numbers and for finding logarithms of numbers. It consists of two flat

25 sheets of material, on each of which a scale is inscribed, the material of one sheet being transparent; in use this is the upper sheet, and is set in appropriate position over the other, or lower, sheet by the operator. The

30 layout of the basic scale on each sheet is generally similar to that which is usual in the case of the common slide-rule apart from the separation of the scale into sections in the case of the appliance now being described.

35 Thus each scale, if continuous, would occupy an equal rectangular space of relatively short vertical dimension and longer horizontal dimension, the graduations being marked along

40 a horizontal edge. The manner of construction of the basic scale, as in the case of the slide-rule, is that the distance of any number along the scale, measured from the extreme left-hand point of the scale, and expressed as a

45 decimal of the length of the scale, is equal to the mantissa of the logarithm of that number; the graduations marked along the scale are numbered 100, 101, 102 and so on to 998, 999 and 100. Thus graduation 100 is the beginning, or extreme left-hand point, of the

50 scale, graduation 101 is placed along the scale at a distance of .0043 of the length of the scale (0043 being the mantissa of the logarithm of 101), and so on; the end, or extreme right-hand point, of the scale becomes graduation 100 again. This basic scale

55 is inscribed on each sheet in ten separate sections of equal length, hence the first section extends from graduation 100 to a point between graduations 125 and 126, the second section from this latter point to a point

60 between graduations 158 and 159, and so on to the tenth section which extends from a point between graduations 794 and 795 to graduation 100, the end point of the scale.

65 These ten sections of scale are inscribed in

order one below the other and in addition a 10th section is inscribed above the 1st section, and a 1st section is inscribed below the 10th section. (It is not necessary, for the

70 functioning of the appliance, to have the complete length of the two additional sections of scale, but it is necessary to have the right-hand end point of the upper (10th) section and the left-hand end point of the lower (1st)

75 section; these points are both positions of graduation 100, making four such positions in all, which are lettered A, B, C and D.) All these sections of scale have their horizontal edges parallel, their left-hand end points lying

80 in one vertical straight line, and their right-hand end points lying in another vertical straight line; the separation between adjacent sections is equal to the vertical dimension of the rectangular space occupied by a section.

85 Thus the arrangement is such that the upper sheet may be set in position over the lower sheet by the operator whereby sections of scale of the lower sheet, or parts thereof, are in view between sections of scale of the upper

90 sheet. Multiplication and division are carried out in the same manner, in principle, as in the case of the slide-rule, except that, in the case of multiplication, one only of the four positions of graduation 100 will in general be

95 appropriate for use in any specific calculations.

3. To enable the appliance to be used for finding the mantissa of the logarithm of any number, the numbers 0, 1, 2 and so on to 9

100 are inscribed in a column to the left in line with the 1st, 2nd, 3rd and so on 10th sections of scale respectively on one sheet, and a further scale equal in length to a section of scale and graduated in 10ths and 100ths of its length is inscribed along an edge of the

105 other sheet. To find the mantissa of the logarithm of a given number the scale graduated in tenths and hundredths is set against the section of scale of the other sheet on which

110 the given number lies; then the number to the left in line with this section of scale on which the given number lies is the first digit of the required mantissa, and the distance along this section of scale at which it lies, measured in

115 hundredths of the length of the section of scale, gives the second and third digits of that mantissa.

4. A variation of the arrangement of the scales of the appliance described in para. 2

120 will now be described. The lower sheet has inscribed on it continuous double-sections of the scale as described in para. 2, arranged as follows:—

1st + 2nd sections
 2nd + 3rd sections
 and so on to 9th + 10th sections
 5 10th + 1st sections
 1st + 2nd sections
 and so on to 10th and 1st sections;

the upper sheet has inscribed on it ten single
 10 sections of scale in order from the 1st to the
 10th.

5. A further variation of the appliance will
 be briefly described. The sheets of material
 are in the form of hollow cylinders fitting
 15 closely one around the other, the one being
 able to rotate around and slide along the
 other. The scales are inscribed along the cylin-
 ders parallel to the axis of rotation, there
 being on each cylinder ten sections of scale in
 20 order from the 1st to the 10th, the spacing
 between the 1st and the 10th sections being
 equal to that between the other pairs of
 adjacent sections. In this variation also, ten
 25 double-sections of scale from a 1st + 2nd
 double-section in order to a 10th + 1st dou-
 ble-section may replace the single sections.

6. In all appliances described above the
 upper sheet could be of opaque material, the
 material between adjacent sections of scale
 30 being cut away.

7. In the appliances as described in para.
 2 the number of sections into which the scale
 is divided need not necessarily have been ten.
 The arrangements described in para. 3, and
 35 which enable the appliance to be used for
 finding logarithms of numbers, are only appli-
 cable where the basic scale is separated into
 ten sections, although in certain other cases,
 as for instance when the basic scale is sepa-
 40 rated into five sections or into twenty sections,
 these arrangements are still applicable in prin-
 cipal, but would require some modification in
 their detailed application.

8. Further sheets of material, on which are
 45 inscribed scales suitable for calculations in-
 volving other mathematical functions, may be
 incorporated in the appliances described
 above. Any scales which, if inscribed in con-
 tinuous form on a slide-rule, would be suitable
 50 for use together, would be suitable for use in
 the appliances described above.

CLAIMS

1. A calculating appliance, based on the
 55 principle of the common slide-rule, in which
 scales, such as would be suitable for use one
 in conjunction with the other if inscribed on a
 slide-rule, are inscribed in sections on sheets
 of material. The sheets are designed to be
 60 placed one above the other and manipulated
 by the operator, the upper sheet being either
 of transparent material, or the material be-
 tween adjacent scales is cut away, in such
 manner that scales of the lower sheet are in
 65 view to the operator between scales of the

upper sheet.

2. The arrangement of the material of the
 appliance as claimed in Claim 1 in a cylindri-
 cal form, the outer cylinder being able to
 70 rotate around and slide along the inner one.

3. The provision of guides to facilitate the
 manipulation of the sheets of appliances as
 claimed in Claims 1 and 2.

4. In an appliance as claimed in Claims 1
 75 and 2, the separation of the complete scales
 into ten sections, the inscription of the digits
 0 to 9 against the sections of scale, and the
 provision of a further scale equal in length to
 the other sections of scale and graduated in
 80 tenths and hundredths, whereby the appliance
 may be used as a table of logarithms.

5. A calculating appliance substantially as
 described herein.

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