Nov. 19, 1940. J. W. PICKWORTH 2,221,924

DEVICE FOR INDICATING THE RESULTANT OF TWO SELECTIVELY COMBINED ITEMS

Filed June 28, 1938 2 Sheets-Sheet 1

Fig. 1

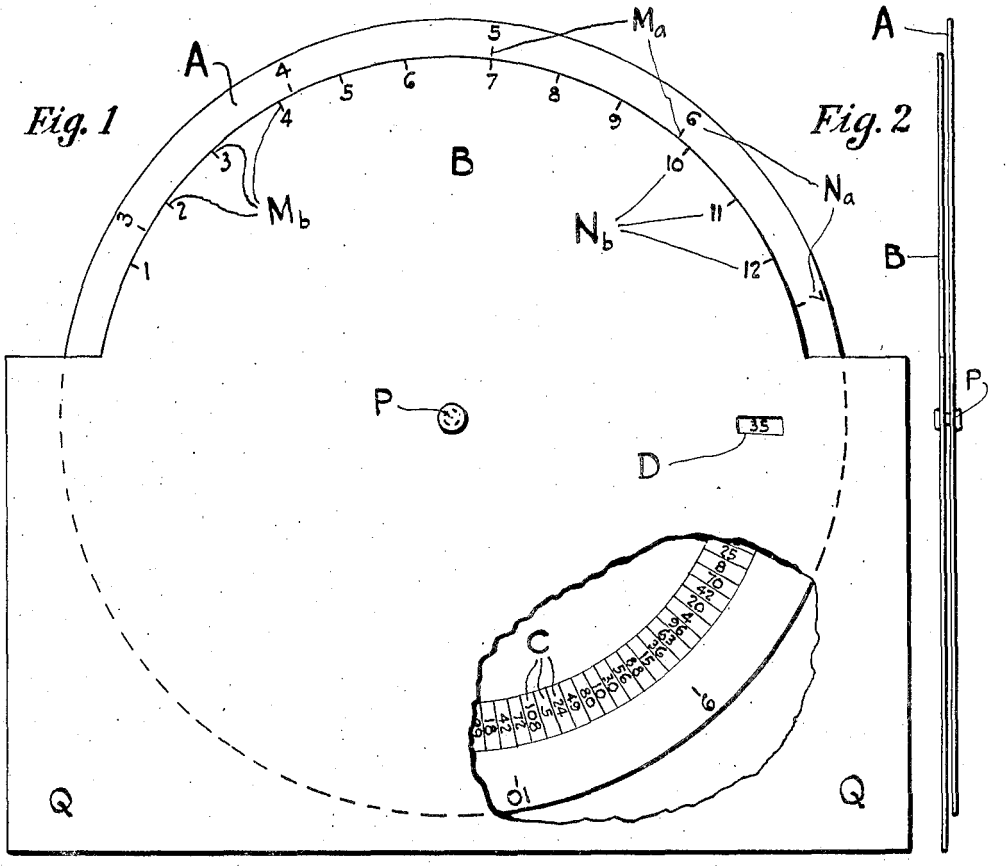

Fig. 2

SCALE A	SCALE B: ITEM 1 / 1	ITEM 2 / 2	ITEM 3 / 3	ITEM 4 / 4	ITEM 5 / 5	ITEM 6 / 6	ITEM 7 / 7	ITEM 8 / 8	ITEM 9 / 9	ITEM 10 / 10	ITEM 11 / 11	ITEM 12 / 12
ITEM 1 – 2	0	4	8	13	17	21	26	30	34	39	43	47
ITEM 2 – 3	120 -12	124 -8	128 -4	1	5	9	14	18	22	27	31	35
ITEM 3 – 4	108 -24	112 -20	116 -16	121 -11	125 -7	129 -3	2	6	10	15	19	23
ITEM 4 – 5	96 -36	100 -32	104 -28	109 -23	113 -19	117 -15	122 -10	126 -6	130 -2	3	7	11
ITEM 5 – 6	84 -48	88 -44	92 -40	97 -35	101 -31	105 -27	110 -22	114 -18	118 -14	123 -9	127 -5	131 -1
ITEM 6 – 7	72 -60	76 -56	80 -52	85 -47	89 -43	93 -39	98 -34	102 -30	106 -26	111 -21	115 -17	119 -13
ITEM 7 – 8	60 -72	64 -68	68 -64	73 -59	77 -55	81 -51	86 -46	90 -42	94 -38	99 -33	103 -29	107 -25
ITEM 8 – 9	48 -84	52 -80	56 -76	61 -71	65 -67	69 -63	74 -58	78 -54	82 -50	87 -45	91 -41	95 -37
ITEM 9 – 10	36 -96	40 -92	44 -88	49 -83	53 -79	57 -75	62 -70	66 -66	70 -62	75 -57	79 -53	83 -49
ITEM 10 – 11	24 -108	28 -104	32 -100	37 -95	41 -91	45 -87	50 -82	54 -78	58 -74	63 -69	67 -65	71 -61
ITEM 11 – 12	12 -120	16 -116	20 -112	25 -107	29 -103	33 -99	38 -94	42 -90	46 -86	51 -81	55 -77	59 -73

Fig. 3

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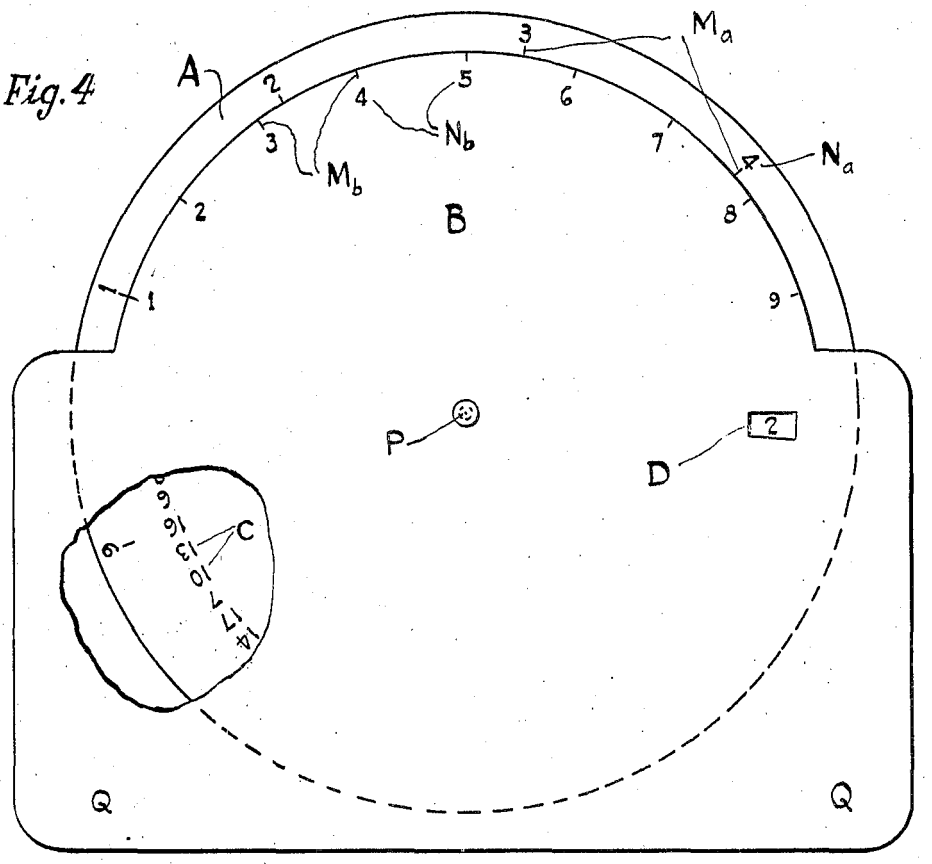
Fig. 4



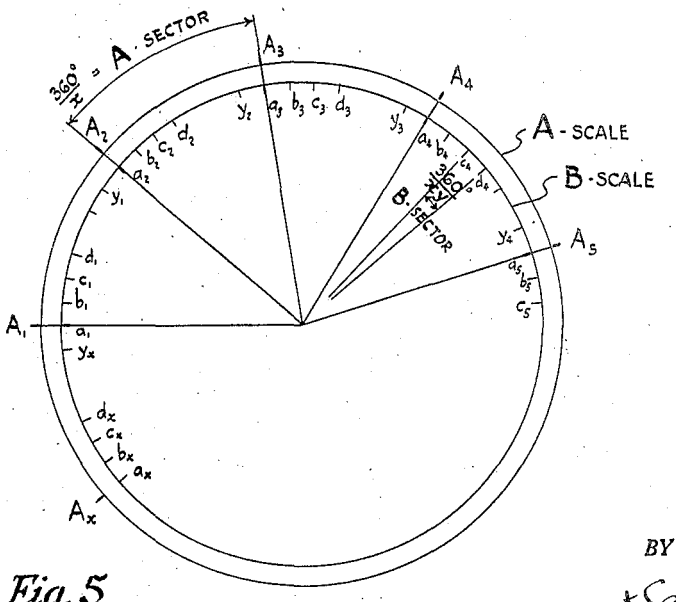


Fig. 5

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DEVICE FOR INDICATING THE RESULTANT OF TWO SELECTIVELY COMBINED ITEMS

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Application June 28, 1938, Serial No. 216,247

12 Claims. (Cl. 235—88)

This invention is a novel device for indicating the resultant of two selectively combined items; comprising two members mechanically connected and relatively movable, carrying combinable series of items which may be brought into proper relation, and providing also a series of resultants, the appropriate one of which is indicated for each possible combination of items. The invention is illustratively shown as applied to the selective combining of items which consists of numbers, the indicated resultant being a computed one, for example the product of the two numbers.

The invention is not in the class of exact or scientific instruments, such as the logarithmic sliderule, but is intended and adapted more particularly for certain popular or special uses, an instance of which is educational, for example, instruction of children to afford a familiarity with the multiplication table. The principles of the invention however are adapted to a wider field of utility. In respect to number items the resultant number may be the sum of each pair of item numbers, or it may be one of the item numbers raised to the power of the other. Instead of inscribed numbers the items may be other words or nouns, as the names of locations or cities, and the resultant may then be the distance between them or the rates of transportation or telephone charges from one to the other, or the like. The items might be chemical agents and the resultant the product of their reaction. The items need not be inscribed items, and might for example be colors, the resultant of each two being the color produced by mixing them. The term item therefore is intended to be considered broadly as a number, a condition, a cause or other factor, and the combining of two items may mean their association in various ways to afford appropriate resultants, as already indicated; the resultant being the product, or power, sum or other numerical result, or some other desired relation between the two items as already indicated; or for that matter it may be the proper answer to an inquiry propounded by the association of an item of one with an item of the other series.

The general object of the invention is to afford a simple and reliable device of the character referred to which will be of convenient availability and easy operation for such purposes as those enumerated, namely, the ascertaining or products or other resultants from the setting, preferably manual, of the two mechanical members of the device. Further objects and advantages of the invention will be explained in the hereinafter following description of an illustrative embodiment thereof or will be understood by those conversant with the subject.

In the accompanying drawings Fig. 1 is a face view of an indicating or computing device embodying the principles of the present invention, partly broken away to show interior features.

Fig. 2 is an edge view of the device of Fig. 1.

Fig. 3 is a chart showing one system for determining a proper mode of applying or inscribing the respective items and the resultants thereof in constructing the device.

Fig. 4 is a face view like Fig. 1, of a different embodiment of the invention.

Fig. 5 is a diagram for explaining graphically the principles of the invention and the mode of embodiment thereof in an actual device.

The device hereof may first be described in its general characteristics as follows. It comprises two adjacent scale members A and B having respectively a series of scale marks or graduations *Ma* and *Mb*, which members are mechanically connected for relative shifting of one over the other, thus to permit the selective registering of the scale marks of the first with the contiguous scale marks of the second member in various combinations and permutations. The first scale member A has its series of scale marks *Ma* graduated or disposed along its length or range, preferably in an even or uniform manner with equal spacings, and it carries also a first series of items *Na* applied along the successive scale marks on the first member. The second scale member B similarly carries, applied along its successive scale marks *Mb*, a second series of items *Nb*, these marks and items being applied or graduated in a methodical manner as will be further explained, in some cases preferably but not necessarily evenly, and in other cases necessarily unevenly or variably. The applying or spacing of the scale marks in any case is to be such that, in setting the two members to produce the various registerings desired, the same setting will not occur for more than one single registering of scale with scale; in other words, that any given relative setting of the two members or disks will bring about only one and not duplicate or plural conjunctions of mark on scale A with mark on scale B. One of the two scale members, in this case A, also carries a separate series of predetermined resultants C, while the other scale member carries a cooperating part or index D shown in the form of a narrow window; such resultant series and said index respectively being so related to the respective A and B item series

that when any two given marks or items are duly set into registration the index will then indicate the resultant of such two items.

Describing more completely the particular embodiment of Fig. 1, the two scale members A and B are in the nature of cards or slides appropriately shaped and methodically connected for their relative movements, being in fact shown as disks, at least one of which, the disk A, is preferably a complete circle, and relatively rotary, there being shown a pivot P connecting it to the other disk for their relative sliding or adjusting into selected positions.

The scale marks *Ma* on the first disk are simply edge graduation marks (of any sort, notches, points, etc.) spaced along the range of the scale, in this case spaced evenly and preferably around the entire circle of the disk. This may be considered the rotary scale member or disk, the second disk B being considered stationary, and having for example extensions or tabs Q for the convenient holding and handling of the device while the rotary disk is circularly adjusted. The scale marks *Mb* on the second disk will sometimes be unevenly spaced, and are so shown in Fig. 1, for reasons and in a manner which will be further explained, and they preferably extend only around part of a circumference, for example something under a half circumference of the non-rotary scale, as shown, conducing to convenience of reading and handling the device.

The items *Na* inscribed on the first disk are shown as consisting of a series of numbers, for example the numbers 2 to 12, a total of eleven items. The items *Nb* on the second disk are shown as consisting of the numbers 1 to 12, a total of twelve items, confined to a partial circumference. This is a convenient choice of items for teaching arithmetic; and the arrangement shown, by the relative rotation and settings of the disks, affords permutations of the respective item series to the number of 11 times 12 or a total of 132 different registerings or conjunctions of mark to mark, providing for the same number of resultants C. Since the first series of items *Na* and the resultant series C, both on the disk A, preferably occupy complete circumferences it follows that the 132 resultants will subtend each a unit space or angle of 360°/132 or slightly under 3°, which will be referred to as a unit in describing the constructional laying out of the several series of scale marks and items of this embodiment.

The resultant series C is preferably applied or inscribed at the inner face of the first disk A, while the second disk B carries the cooperating index or window D by which is revealed or indicated the resultant of any two items which have been juxtaposed or combined in register as already described. The window being narrow discloses but a single resultant and so is equivalent to an arrow or other form of index. The index or window may be located on disk B in any convenient position, for example as shown, easily viewable, and is in fixed relation to the item series of the second disk, while the series of resulants on disk A will similarly be in fixed relation to the items of the first disk, and arranged in proper order, and in such position on the disk that the correct resultant will appear at the index for each setting of the graduated disks. In some cases the resultants may be represented by contacts or other means connected and operating to display the actual resultant at a remote point.

It has been pointed out that one of the disks, the first scale member A, has its scale marks shown evenly graduated, and that the scale marks of the other disk B have to be graduated methodically in a manner to avoid duplications when setting the disks. In the Fig. 1 embodiment an uneven graduation of marks *Mb* affords this result, insuring only a single conjunction of two marks at any one setting. Thus when the mark for item **5** on disk A and that for item **7** on disk B are registered, giving resultant **35**, as on Fig. 1, no other two marks are in register.

In explaining this subject it is convenient to make use of the small space or angle unit which, in this embodiment, is $\frac{1}{132}$ of the circumference. Each scale division of the first disk A is therefore 12 units long, there being 11 such divisions. It being decided that the short-length scale B should be about, or under, a half circumference, its twelve divisions may average 6 units or less in length. These divisions are illustratively shown respectively of lengths, measured in such space units, of 4, 4, 5, 4, 4, 5, 4, 4, 5, 4, 4 units. By this arrangement any three consecutive scale spaces on disk B totals 13 units, as compared with 12 units for each scale space on disk A; and this arrangement affords one way of securing the desired protection against duplication. If the scale B divisions were uniformly of 4 units then obviously each setting would register several pairs of items, and since these could not all result in the same product the device would be inoperative. Spacings of 6, 7, 6, 7, 6, 7, etc., would operate, but not all varying or uneven spacings will serve, since for example divisions of 5, 5, 4, 5, 5, 4, 5, 5, 4, 5, 5 units, with each three adding to 14, would give duplications. The instance illustrated is typical in the case of 12 scale marks subtending on disk B somewhat less than half of the complete circle subtended by the 11 marks on scale A.

The study chart of Fig. 3 contains entries by which an operative order of registrations is indicated and it therefore shows the order in which the numbers in the resultant series are to be inscribed, in this case, as partly shown in the lower part of Fig. 1. On the chart the vertical left scale A comprises 11 items, numbered 1 to 11 but in this instance named or designated 2 to 12 inclusive, while the horizontal scale B at the top comprises 12 items, numbered 1 to 12, and also named 1 to 12 inclusive. To the right of and below these item entries are therefore 132 chart spaces or squares and on these are inscribed, not the resultants or products, but the orders or places in the resultant series that the several resultants must assume.

As a datum or zero we may take the first item **2** on disk A and the first item **1** on disk B, their products being 2, but their order being zero, which is so entered in the chart. When the disks are placed to perform this multiplying operation it will readily be found that turning the disk A the small distance of one constructional unit clockwise or in a plus direction will bring the second item **3** on disk A into registry with item **4** on disk B; or for brevity items **A3** and **B4** register, using for convenience the actual item rather than its number. This will be the first progressive step, and the order number **1** is therefore found on the chart opposite to items **A3** and **B4**, the product being 12. Similarly the next unit advance of disk A brings item **A4** in conjunction with **B7** and the order number **2** will be found correspondingly on the chart; and so on with order numbers 3, 4, etc. In some case the chart entries are seen to carry also a supplemental

minus number which is intended to show the order of entry of resultants in the case that disk A is turned from zero in a minus or counterclockwise direction; the two numbers in any square being seen to add to 132.

Without going though this process in detail of text the following incomplete table is presented showing the respective items of the first and second series, and the resultant or product thereof, and the order of entry of such product in the resultant series, rearranged so that the orders are consecutive, and with parts of the entries skipped in the middle of the table, the omitted entries being readily supplied by reference to the chart Fig. 3.

A items 1st series	B items 2d series	C resultant series	Order
2	1	2	0
3	4	12	1
4	7	28	2
5	10	50	3
2	2	4	4
3	5	15	5
4	8	32	6
5	11	55	7
2	3	6	8
3	6	18	9
4	9	36	10
5	12	60	11
12	1	12	12
2	4	6	13
3	7	21	14
4	10	40	15
12	2	24	16
2	5	10	17

Then, skipping 76 entries, continue as follows, this group shown in Fig. 1:

A items 1st series	B items 2d series	C resultant series	Order
8	9	72	94
9	12	108	95
5	1	5	96
6	4	24	97
7	7	49	98
8	10	80	99
5	2	10	100
6	5	30	101
7	8	56	102
8	11	88	103
5	3	15	104

Then skipping 13 entries, continue as follows:

A items 1st series	B items 2d series	C resultant series	Order
6	9	54	118 or −14
7	12	84	119 −13
3	1	3	120 or −12
4	4	16	121 −11
*5	*7	*35	122 −10
6	10	60	123 − 9
3	2	6	124 − 8
4	5	20	125 − 7
5	8	40	126 − 6
6	11	66	127 − 5
3	3	9	128 − 4
4	6	24	129 − 3
5	9	45	130 − 2
6	12	72	131 − 1

This completes the entire cycle of 132 operations, disk A having turned 360°, and the next entries would duplicate the initial ones of the above table. It will be noted that the A items and B items of the table go through methodical or progressive cyclical changes, covering every possible combination of items, and that this object is accomplished without any duplications, wherefore each product, such as 35, of the resultant series C, is the resultant only of a particular pair of items, such as A5 and B7, as marked with star (*) in the above table, this setting actually illustrated on Fig. 1.

The chart Fig. 3 also indicates the methodical plotting of the items and resultants. In the first column, under item B1, opposite to the first item of scale A is the datum number zero (or 132). This is the datum place of scale C occupied by the resultant of $2\times1=2$. The next chart entry beneath zero is 120 or −12, since the second item of scale A is 12 constructional units removed from the first, wherefore the product $3\times1=3$ will be in 120th place in series C, or the 12th place counterclockwise. The above table agress. The next entry below 120 is 108 so the product 4 will be in the 108th place, and so on to the bottom, in arithmetical progression. So with the second column, the entries 4, 124, 112, 100, etc., show in progression the resultant positions of products 4, 6, 8, 10, etc., and similarly with the other columns.

For convenience a short range for the second scale has been taken, confining it to the upper portion of disk B. From item B1 to B2 being 4 units and B2 to B3 being the same, the next space must differ and is shown as 5 units, these 3 therefore subtending 13 units, and so on. The entries in line 1 of the chart therefore are not 4, 8, 12, 16, etc., but are 4, 8, 13, 17, 21, 26, 30, 34, 39, 43 and 47 due to the 1 unit increment at each third space. The total range or length of scale B therefore in this instance is 47 units, which however is not essential, as the principles explained can be variously applied. The principle being established, the marks on the two scales or disks can now be inscribed with their proper items or numbers and the answers or resultants can be entered in their proper order along the series C, either by computation, or by manual setting for the making of each entry. To use the described device for purposes of addition, the only changes need be the substitutions of the sums of the item numbers for the resultant products, in the proper order; and the same with powers; and various other kinds of items and resultants can be analogously entered.

Whereas a particular embodiment and its mode of construction have now been described in full, yet the abstract principles have not been indicated for laying out the scales, items and resultants; the principles being available within a wide range of desired use and to allow much scope in choice and taste; an underlying requirement being to avoid duplication of conjunctions of scale marks so that each resultant may apply to but a single pair of registered items. The principles may therefore now be examined graphically by the Fig. 5 diagram, the parenthetical insertions referring to the instance of Fig. 1.

Let it be required to plot the permutations of what may be called an A-series of items of a certain number which will be called x, with a B-series of items, y in number (e. g. 11 and 12 respectively).

As on the diagram Fig. 5, lay off upon or outside of scale A a number of sectors, marked A-sectors, these being assumed equal for explanatory purposes, of such size or subtended angle that x of them will fill the desired range, preferably the complete circumference. Each sector will subtend $360°/x$. The scale marks Ma of Fig. 1 are the dividing marks between the A-sectors,

and each of such marks can represent an item of the A-series as shown in the diagram, namely the marks A_1, A_2, A_3, A_4, etc., around to an indefinite extent to the last or final scale marked A_x (e. g. A_1 to A_{11}). We then have A-sectors, x in number, contained between the long radial lines of the diagram, these extending from the center across the B-scale or disk and across the peripheral part of the A-scale to the outside.

Now adjacently upon the B-scale member or disk of the diagram we may subdivide each of the A-sectors into y parts or theoretical subsectors (e. g. 12), so that each of these B-subsectors on the B-scale has a magnitude of $360°/xy$, as also marked on the diagram (e. g. 360°/132.) Each of these subsectors corresponds with what has been heretofore termed the constructional unit used in laying out the apparatus.

On the diagram then, working in the abstract, the A-sectors are each subdivided, not into a definite extent of subsectors or units, but an abstract number, indicated by the subdivision marks a, b, c, d, etc., to y, with subnumbers corresponding to the subnumbers of the A-sectors. Thus in the first A-sector, between A_1 and A_2 the subdivision marks for the subsectors are a_1, b_1, c_1, . . . y_1. Similarly in the second A-sector, the subdivision marks are designated a_2, b_2, c_2, . . . y_2. In the third A-sector the designations are a_3, b_3, c_3 etc.; and so on throughcut the extent of the scale, to the last A-sector, between A_x and A_1.

Now, in any setting of the scale A to scale B all of the scale marks of scale A will register with certain of the theoretical division marks of scale B, representing units or subsectors, and in this sense there will be conjunctions of x in number; for example A_1 is shown on the diagram registered with a_1, and around the two scales A_2 will register with a_2 and so on until A_x registers with a_x. So also, if scale A be rotated one unit clockwise then A_1 and b_1 will register, and at the same time b_2 will register with A_2, b_3 with A_3, and so on to the same extent of x registrations or conjunctions. With one further unit rotation on scale A, c_1 will register with A_1, and so on. This condition follows to any desired extent. For example if scale A is rotated further until A_1 comes around to b_2 then b_3 will be opposite to A_2, etc.

Thus for one setting a_1, a_2, a_3, etc., x in number, on the B-scale will all be in register with marks on the A-scale, whereas for a different setting b_1, b_2, b_3 etc. will all be in register, and so on until y_1, y_2 etc. are all in register, for one setting. Under no setting however will any of the a-series of theoretical marks be in conjunction with an A-scale mark at the same time with the registry of any b or c or d mark or any other. There has thus been presented a condition or basis wherein selections may readily be made for the B-scale of item marks which can be so located that there will be no conflicts or duplications of registration, namely, by avoiding the choice of more than one of the theoretical a-series, or more than one of the b-series, and so forth.

Proceeding upon this principle we may now select for scale B any one of the a-series, and apply the scale mark at this point, removing or cancelling all of the other a entires of the diagram; so that when this is done the selected a mark may be registered with any one of the A marks of scale A, whereupon their will be no other conjunctions at any point, for that setting. The a which is selected and retained may be in any one of the A-sectors, as may be selected.

We may similarly treat the theoretical b-series of scale B subsectors, by eliminating all but a selected one thereof, which may be in any A-sector; whereupon when the so-selected mark on scale B is registered with any A-mark, there will be no other conjunctions at any point. The selected b entry may be in the same or in a different sector from the selected a entry. This process of selection and designation of the marks on scale B may be continued throughout the series of entries, the c entries, the d entries, to and including the y entries, until, by elimination, there is only one entry and mark left of each of the series a, b, c, etc. to y. When this is accomplished then the setting of any one of the selected positions or marks on the B-scale, with any mark on the A-scale may be effected without causing any other conjunctions of any selected B-scale marks with any of the A-scale marks.

Within these principles various kinds of selections and plans can be adopted, so as to produce any desired one of many possible patterns. Thus a simple selection may be to employ, for the B-scale marks, the points a_1, b_2, c_3, etc., to y_x; this affording a uniform spacing extending entirely around the B-disk. Another selection may be a_1, b_3, c_2, d_4, e_5, or any other of the possible arrangements within the described principle of avoiding duplications. When complete selections are thus made throughout the desired range of scale B, whatever its length, there will be items or scale marks y in number on scale B, each registrable with each of the scale marks x in number on scale A, so that the total number of possible settings will be xy, the product of these two numbers agreeing with the number of permutations of the several items of the two series representing the number of resultants on scale C. Thus in the Fig. 1 embodiment with disk A having 11 sectors and marks A_1 to A_{11} and each sector subdivided into 12 units a to l there have been chosen for the B-scale marks the 12 positions a^1, e^1, i^1, b^2, f^2, j^2, c^3, g^3, k^3, d^4, h^4, l^4, as can be checked up by setting item 2 of scale A to item 1 of scale B, the items 1 to 12 being applied to the marks in their natural order. Since the selected B marks extend into only 4 of the A-sectors, the B-scale will be conveniently short, approximately $\frac{4}{11}$ or less than half of a complete circumference. Extreme cases would be when the B-scale covers the entire circumference, introducing inconveniences; or when the entire B-scale is concentrated within a single space of the A-scale, which shortens each space of the B-scale to the length of the constructional unit, producing congestion and difficulty in applying legible items thereto. Therefore it is preferred to have the B-scale extended over two or more or several A spaces less than all thereof, for example, as shown.

The resultant or C-scale is readily arranged and constructed for any selected arrangement of the A-scale and B-scale. It is only necessary to divide the C-scale into a number of small factors or units, xy (e. g. 132) in number; whereupon each small unit or space of the C-scale will correspond to some one single setting by which an A-scale mark is registered with a B-scale mark, permitting the proper resultant or value to be inscribed in the C-scale space in register with the index point or window cooperating therewith, with assurance against duplications. Since the C-spaces are all equal they will follow, from any starting point, in arithmetical progressions, the difference being some multiple of the B-subsector, (e. g. 12 units, according to Figs. 1 and 3).

The principle of plotting the marks of the second or B disk may be restated as follows. For each of the sectors or spaces between scale marks of the first disk A, first lay out on the second disk a series of theoretical division lines *a*, *b*, *c* etc. subdividing each A-sector or its angle into constructional units or subsectors equal in number to the total number of scale marks desired to be used upon the second scale, and then locate the several second disk scale marks at or upon selected division lines distributed preferably over two or more but not all of the sectors of the first disk and in such manner that no two (or more) such scale marks are located at any two (or more) corresponding division lines, that is, at two division lines (as a_1, a_2) occupying corresponding places in any two of such sectors; the number of A-sectors subtended by scale B determining its length.

As suggested above the spacings may be uniform on both scales in some cases, and Fig. 4 shows such a case, disk A having 9 marks and spaces and the short scale B having also 9 marks, separated by 8 spaces. The constructional unit or subsector is 360°/81. Each A-sector or space subtends 9 units, and in this case each B space may subtend 4 units uniformly, the selections for B-scale marks according to the diagram being a_1, e_1, i_1, d_2, h_2, c_3, g_3, b_4 *and* f_4, incurring no duplications, although if a tenth mark were then sought to be added to scale B it would be a_5 and so duplicate a_1.

Fig. 4 shows the devise just described used for addition, with 9 marks M*a* or M*b* on each scale and 9 items N*a* or N*b*; the items A1 and B1 being shown registered, the sum being 2 and showing at the window D. There will be 81 resultants C, between 1 and 18, with of course many duplicate sums, all arranged in successive series with a difference of 3 in each series.

In game scoring, as at contract bridge, this invention may be used by registering the tricks bid with tricks made, in the various permutations possible, the window or windows displaying the score below and above the line for various conditions of suit, vulnerability, etc.

What is claimed is:

1. A device for indicating the resultant of two selectively combined items, as the product of two selected numbers, comprising two adjacent scale members connected for relative shifting or sliding one over the other, as a pair of pivoted disk members, to permit the selective registering of the scale marks on the first with the adjacent scale marks on the second member, the first scale member carrying a first series of items along its successive scale marks evenly graduated, the second scale member carrying a second series of items along its successive scale marks these being unevenly graduated methodically in such manner as to avoid duplication of setting positions for the various registerings of mark to mark, whereby for each setting of the members there is only a single registering of mark to mark, one of the scale members carrying a separate extended series of predetermined resultants, one for each setting and registering of the members and marks, and the other member carrying a cooperating index therefor, said resultant series and said index respectively being so related to the respective series of items that when any two given items are set in individual register the index indicates the individual resultant thereof.

2. A device for indicating the resultant of two selectively combined items, comprising two adjacent scale memgers mechanically connected for relative shifting one over the other in a number of individual settings, to permit the selective registering of the scale marks of the first with the adjacent scale marks of the second member in various settings of the members, the first scale member carrying a first series of factors applied along its successive scale marks and the second scale member carrying a second series of factors applied along its successive scale marks; the scale marks of the two members being applied methodically in such manner as to avoid duplications of relative setting positions of the two members for the various registerings of scale mark with mark, whereby for each setting of the two members there is only a single registering of mark to mark; one of the two scale members carrying an extended separate series of predetermined resultants, one for each setting and registering of the members and marks, and the other member carrying a cooperating index, and said resultant series and said index respectively being so related to the respective series of factors that when any two given factors of the respective members are set into individual register with each other the index indicates only a single resultant, namely the individual resultant of such two factors.

3. A device for indicating the resultant of two selectively combined items, as the sum or product of two selected numbers, comprising two scale disks pivotally connected for relative shifting one over the other, in a large number of settings, to permit the selective registering of the scale marks on the first with the adjacent marks on the second disk, the first disk having its scale marks evenly graduated and carrying a first series of items applied along its successive scale marks, the second disk carrying a second series of items applied along its successive scale marks these being graduated methodically in such manner as to avoid duplication of disk setting positions for the various registerings of mark to mark, whereby for each setting of the disks there is only one registering of marks, one of the disks carrying a separate extended series of predetermined resultants, one for each and every registering of mark to mark, and the other disk carrying a cooperating index therefor, and said resultant series and said index respectively being so related to the respective series of items that when two selected items are set into mutual register the index indicates the individual resultant thereof.

4. A device as in claim 3 and wherein the first disk scale and item series extend around its entire circumference, and the second disk scale and item series extend around only a portion of the circumference greater than the extent between two marks of the first disk, and the resultant series being on the first disk and evenly spaced around its entire circumference.

5. A device as in claim 3 and wherein the marks and items on the second disk are unevenly and unequally spaced in a manner to avoid duplication of settings.

6. A device as in claim 1 and wherein the first member has 11 scale marks over its entire range and the second member has 12 scale marks over a shorter range, with 132 resultants and space units, each space on the first member subtending 12 units and the successive spaces on the second member subtending uneven distances, as 4, 4, 5, 4, 4, 5, 4, 4, 5, 4 and 4 units respectively.

7. A device for indicating the resultant of two selectively combined numbers, as their sum or product or power, comprising two adjacent scale

members connected for relative shifting one over the other, in a large number of settings, as a pair of pivoted disk members, to permit the selective registering of the scale marks on the first with the adjacent marks on the second member, the first scale member carrying a first series of numbers, as 2 to 12, along its successive scale marks evenly graduated, the second scale member carrying a second series of numbers, as 1 to 12, along its successive scale marks these being unevenly graduated methodically in such manner as to avoid duplication of setting positions for the various registerings of mark to mark, whereby for each setting of the members there is only a single registering of mark to mark, one of the scale members carrying a separate extended series of predetermined resultants, one for each setting and registering of the members and marks, and the other member carrying a cooperating index therefor, said resultant series and index being so related to the respective series of numbers that when two given numbers are set in individual register the index indicates the individual resultant thereof.

8. A device as in claim 7 and wherein the second scale subtends a shorter range than the first scale, but longer than the space or sector between each two marks of the first scale, and the spaces of the second scale are unequal and so laid out that each plural group thereof subtends a distance differing by a small fraction from the first scale spacing.

9. A device for indicating the resultant of two selectively combined numbers or other items, comprising two scale disks rotatively connected for relative shifting of one over the other, in a large number of settings, to permit the selective registering of the scale marks on the first with the adjacent marks on the second disk, the first disk having its scale marks evenly graduated and carrying a first series of items applied along its successive scale marks, the second disk carrying along its successive marks a second series of items graduated methodically in such manner that any given setting of the two disks will produce only one registration or conjunction of scale mark with mark, one of the disks carrying a separate extended, series of predetermined resultants, one for each and every registering of mark to mark, and the other disk carrying a cooperating index therefor, and said resultant series and said index being in such fixed relation to the series of items respectively that when two given items are set into mutual register the index indicates the individual resultant of them.

10. A device for indicating the resultant of two selectively combined numbers or other items, comprising two scale disks rotatively connected for relative shifting of one over the other, in a large number of settings, to permit the selective registering of the scale marks on the first with the adjacent marks on the second disk, the first disk having its scale marks evenly graduated around its entire periphery and carrying a first series of items applied along its successive scale marks, the second disk having its scale applied only to a part of the circumference and carrying along its successive scale marks a second series of items graduated methodically in such manner that any given setting of the two disks will produce only one registration or conjunction of scale mark with mark, whereby for each setting of the disks there is only one registering of marks, the first disk carrying a separate extended series of predetermined resultants evenly spaced around the entire circumference, one for each and every registering of mark to mark, and the second disk carrying a cooperating index therefor, and said resultant series and said index being in such fixed relation to the series of items respectively that when two given items are set into mutual register the index indicates the individual resultant of them.

11. A device for indicating the resultant of two selectively combined numbers or other items, comprising two scale disks rotatively connected for relative shifting of one over the other, to permit the selective registering of the scale marks on the first with the adjacent marks on the second disk, the first disk having its scale marks evenly graduated and carrying a first series of items applied along its successive scale marks, the second disk carrying along its successive scale marks a second series of items graduated methodically in such manner that any given setting of the two disks will produce only one registration or conjunction of scale mark with mark, one of the disks carrying a separate series of evenly spaced predetermined resultants and the other carrying a cooperating index therefor, and said resultant series and said index being in such fixed relation to the series of items respectively that when two given items are set into mutual register the index indicates the resultant of them; the second disk scale having its marks located in individual locations determined through division lines laid out on the second disk equally to subdivide each first-disk space-sector into units equal in number to the number of scale marks of the second disk, with the second disk scale marks so located at certain of such division lines that no two such scale marks are located at any two corresponding division lines.

12. A device as in claim 11 and wherein the constructional division lines are so determined that the second scale marks will be distributed over more than one but less than all of the first-scale sectors.

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