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GRAPHIC CALCULATOR

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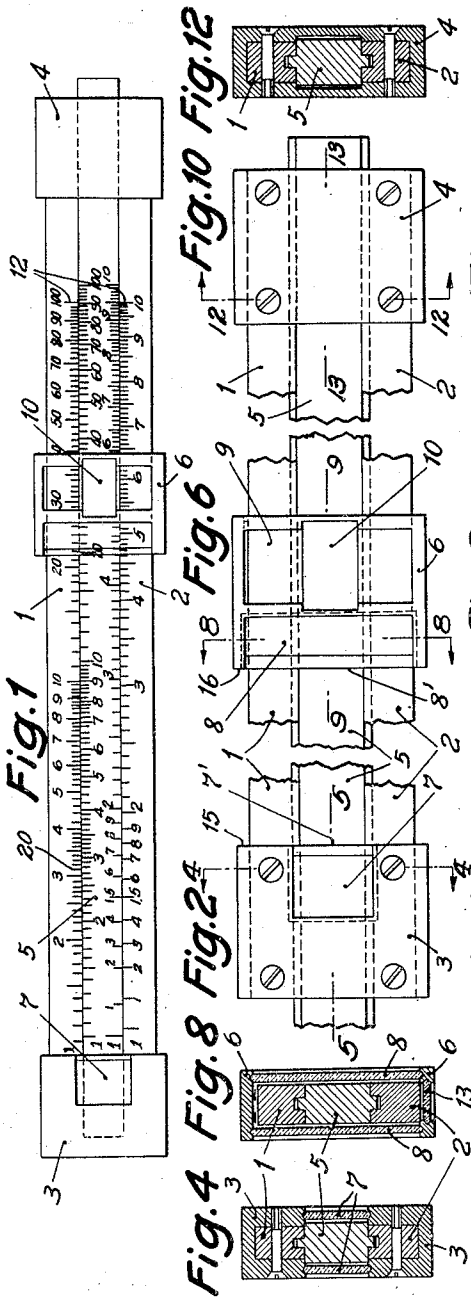


Fig. 1

Fig. 12 Fig. 10 Fig. 6 Fig. 24 Fig. 8 Fig. 4

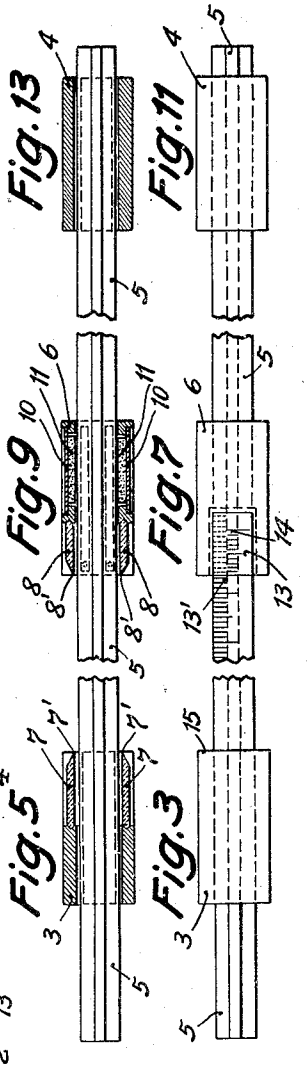


Fig. 13 Fig. 9 Fig. 5

Fig. 11 Fig. 7 Fig. 3

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GRAPHIC CALCULATOR

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The present invention relates to a graphic calculator composed of two scale-carrying elements capable of relatively moving towards each other in such a manner that the scales always remain parallel, and of a sliding frame, its index always covering all scales of the two-scale carrying elements at the same angle, the sliding frame being provided with a coupling device, by means of which it can be coupled with the element carrying the multiplicand and dividend scales in each of its positions, whereby the element carrying the multiplier- and the divisor-scales is provided with two detentions for the sliding frame, arranged in such a manner that the index of the sliding frame covers one of the terminal scale-strokes of the multiplier and divisor-scales, when the sliding frame is brought to one of these detentions.

The sketch illustrates an embodiment of the graphic calculator, by way of example.

Fig. 1 represents a front view of a slide-rule;

Fig. 2 shows a front-view of the left hand end of the body of the slide-rule, on a larger scale;

Fig. 3 is a top plan view thereof;

Fig. 4 is a section on the line 4—4 of Fig. 2;

Fig. 5 is a horizontal section on the line 5—5 of Fig. 2;

Fig. 6 is a front view of the sliding frame or runner on an enlarged scale;

Fig. 7 is a top plan view thereof;

Fig. 8 is a section on the line 8—8 of Fig. 6;

Fig. 9 is a section on the line 9—9, Fig. 6.

Fig. 10 is a front elevation of the other right hand end portion of the body of the slide-rule on an enlarged scale;

Fig. 11 is a top plan view thereof;

Fig. 12 is a section on the line 12—12 of Fig. 10;

Fig. 13 is a section on the line 13—13 of Fig. 10.

The element carrying the multiplier- and the divisor-scales, subsequently designated as the body of the slide-rule, is composed of two bars 1 and 2, attached to the terminal parts 3 and 4 by screws, and kept at a certain distance from each other by means of these terminal parts. These bars 1 and 2 are provided, on their surfaces facing each other with guides for a slider 5, movably arranged between these surfaces, and which forms the element carrying the multiplicand- and dividend-scales. The terminal parts 3 and 4 form the stops for a movable, box-like sliding frame 6, also called cursor or runner, and shiftable between them on the body of the slide-rule. The multiplier- and divisor-scales are applied to the

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bars 1 and 2 in such a manner that their zero lines are located on the right hand edge of the stop 3. The stop 3 is provided on its front and back with a cut-out extending over the entire width of the slider 5, and opening in that edge of stop 3 which is directed towards the sliding frame 6. A transparent plate 7 is set into this cut-out, its bevelled edge 7' serving as an index and being in exact alinement with the zero lines of all scales applied to the bars 1 and 2. The sliding frame 6 is provided, on its front and back, with cut-outs, each extending over the entire height of the scales of both the bars 1 and 2, and of the slider 5, there being an opening in that edge of the runner which is directed towards the stop 3, a transparent plate 8 being set into this cut-out with its bevelled edge 8' forming an index. If the sliding frame 6 is pushed on to the limit of its travel formed by the terminal part 3, this edge 8' registers with the initial division lines of the scales applied to the bars 1 and 2. The sliding frame 6 is, furthermore, provided on its front and back with additional cut-outs 9 each of which is bridged by a spring-steel-plate 10 attached to the sliding frame 6, and having a width slightly less than that of the slider 5. A pad 11 made of rubber, leather, etc., is attached to the inner face of each steel-plate 10. If these steel-plates 10 are flexed toward each other, the pads 11 are pressed against the slider 5, whereby this slider 5 is coupled with the sliding frame 6 and, in this manner, the slider 5 is shiftable, together with the sliding frame 6. If the steel-plates are released, the pads 11 are lifted off the slider 5, due to the resiliency of the plates, whereby this slider is freed from the sliding frame 6, and remains stationary in case of a shifting movement of the sliding frame. The end division lines of the multiplier- and divisor-scales arranged on the bars 1 and 2 are positioned in such a manner that, when the sliding frame 6 is brought to the limit of its travel formed by the stop 4, they are in register with the edge 8' serving as an index.

On the upwardly directed face of the bar 1 a scale 20 is provided, its zero-point being located in the same plane as the zero lines of the scales fixed up on the front faces of bars 1 and 2. In order to be able to read this scale 20, a cut-out is provided on the sliding frame 6 opening in the direction of the terminal part 3, and a transparent plate 13 is set into this cut-out, whose bevelled edge 13' serves as an index for the scale. Adjoining the bevelled edge 13' serving as an index, a vernier-division 14 is provided on the

plate 13, enabling a more precise reading of the scale. A metrical scale and an inch-divisioned scale may be provided side by side on the top face of bar 1, or a metrical scale alone may be arranged on the top surface of the bar 1, and an inch-divisioned scale on the bottom surface of the bar 2. The edge 15 of the terminal part 3 corresponding to the zero-point of the scale, and the edge 16 of the sliding frame 6 corresponding to the bevel edge index 13' permit the use of the slide rule in a similar manner to that of the slide-gauge. Inasmuch as, for measuring a length the edges 15 and 16 of the terminal part 3 and of the sliding frame 6 are used, the length scale or scales might also be arranged on the front or back of the body of the slide-rule and be read by means of the edges 7' and 8' of the stop 3 and the sliding frame, so that a separate window on the outer side of the sliding frame 6 would not be required.

If a multiplication, $a \times b$, is to be carried out by means of the slide-rule, the sliding frame 6 is adjusted in such a manner that the index edge 8' on the multiplicand-scale of the slider 5 lies above the value "a". Subsequently, the sliding frame 6 and the slider 5 are coupled with each other by pressing the steel-plates 10 together with the pads 11 gripping the slider 5, and in this coupled condition the slider 5 and runner 6 are shifted together until the runner strikes the stop 3, corresponding to the zero line of the multiplier-scale of the body. Then the coupling of the sliding frame 6 and of the slider 5 is released, and the sliding frame 6 alone is dislodged, until the edge 8' lies above "b" on the multiplier-scale of the body, and by means of the edge 8' the value on the multiplicand-scale of the slider 5 is read as the product of the operation. In order to carry out a division, "a" divided by "b," the edge 8' of the sliding frame 6 is positioned above "a" on the dividend-scale of the slider, the sliding frame and the slider are coupled and moved in this coupled condition, in such a manner that the edge 8' lies above "b" on the divisor-scale of the body, and the result or quotient is read off on the dividend-scale of the slider, by means of the edge 7' of the transparent plate 7 in the window of the terminal part 3.

The graphic calculator, according to the present invention offers considerable advantages as compared with the slide-rules and slide-disks, so far known, i. e. (1) The body offers more space for application of the multiplier- and divisor-scales than the slides on which these scales were applied heretofore.

(2) If the result of a multiplication is to be used as a multiplicand for the next calculation, primarily the zero divisions of the multiplier-scales must be positioned in register with this multiplicand. When using this slide-rule, this is done by pushing the sliding frame, while coupled with the slider, to the stop at the respective end of the multiplier- and divisor-scales, without any attention whatever being paid to the scales. If the result of a division is to be used as a dividend for the next calculation, the index 8' of the sliding frame 6 must first be positioned in register with this dividend on the slider 5. This is done by pushing the sliding frame, while uncoupled, from the slider to the detention located at the respective end of the multiplier- and divisor-scales. Also in this case, no attention must be paid to the scales.

These preliminary regulations of the slide-rule are effected in a most simple, rapid, and precise manner, whereby the correct adjustment is

achieved automatically, whereas, in the case of slide-rules so far known, this preliminary regulation requires the same skill and attention as the final or intermediate adjustment itself.

(3) If, in the course of a calculation, an intermediate result, or a result is obtained outside the range of the multiplicand- and dividend-scales of the slider, it is possible to extend the range by first pushing the sliding frame while coupled with the slider, to the stop located at the terminal part of the multiplicator- and divisor-scales of the body. To divide a result by 10, or to multiply a result with 10 the sliding frame, while uncoupled from the slider, is pushed then to the respective stop. This movement against the stop automatically effects a precise adjustment, and this adjustment can be carried out, without paying any attention to the scales. The result can be brought within to the range of the scales in a most simple, rapid and precise manner.

(4) Inasmuch as the logarithmic scales of x^2, x^3, $\sin x$, $\cos x$, $\tan x$, $\cot x$, $\log \log x$, and of other functions are indicated in the usual manner on the body, the values of the root of x, the cube-root of x, $\sin x$, $\cos x$, $\tan x$, $\cot x$, $\log \log x$, and of other functions can be read off on the logarithmic scale x of the body. Inasmuch as multiplications and divisions are calculated by means of this logarithmic scale x of the body, it is possible, in the course of a continuous calculation, to directly multiply with and divide by root of x, cube-root of x, $\sin x$, $\cos x$, $\tan x$, $\cot x$, $\log \log x$, and other functions, i. e. all logarithmic scales of the body can be employed directly as a multiplier, or as a divisor. The working possibilities are thereby considerably simplified.

I claim:

1. A slide rule, comprising a body, a slide movably supported relatively to the body and accessible from opposite sides of the body over its entire length presented between the ends of the body, a sliding frame on the body, and means on the frame for frictionally connecting said frame to said slide at any selectively determined point of said slide located between the ends of the body.

2. A slide rule, as set forth in claim 1, including a body assembled of parallel bars and metal stop elements fixed to said bars in such manner as to maintain them in parallel relation over their entire length, a slide movable between said bars beyond the stop elements, a frame movable on said bars and on said slide between the stop elements, and means carried by said frame adapted for engaging opposite sides of said slide for coupling said frame with said slide at any selectively determined point of said slide between said stop elements.

3. A slide rule, comprising a body formed of parallel bars, stop elements fixed to the ends of the bars and adapted to hold the bars in spaced parallel relation, the inner edge of one of said elements being disposed in registration with zero lines of gradations applied to said bars, one of said stop elements having a cut-out portion, a glass plate provided with a beveled edge inserted in said cut-out portion in such manner that the beveled edge of said glass plate is in alinement with those edge portions of the stop element which coincide with zero gradations on the bars, a slide between said bars and readable over its entire length on opposite sides, a frame slidable relatively to said bars and slide, and means on said frame for frictionally coupling said frame with said slide by engagement with opposite sides of said slide, said coupling means for the frame

being operable on said slide on any selectively determined point of said slide presented between the stop elements of said body.

4. A slide rule, comprising a body consisting of parallel bars, stop elements fixed to the ends of said bars and adapted to maintain said bars in spaced parallel relation immovable relatively to each other, a slide movably supported in the space between and by said bars, a frame slidable on said bars between said stop elements and relatively to the slide, said frame having face portions on opposite sides of said bars and slide, and pressure plates normally spaced from said slide carried by each of the face portions of the frame and depressible into engagement with said slide on opposite faces thereof for coupling said frame with said slide at any selectively determined point of said slide presented between the stop elements of said bars.

5. In a slide rule, the combination of a pair of bars, stop elements secured to the end of the bars and adapted to maintain them in fixed spaced parallel relation, a slide movably supported between and by said bars, a frame slidably supported relatively to said bars and said slide and having face portions on opposite sides of said bars and slide, said face portions being provided with cut-outs, plates on both sides of the frame bridging said cut-outs, said plates being normally spaced from the opposite faces of said slide and being in registry with said slide, said plates being depressible into engagement with opposite faces of the slide for coupling said frame to said slide for conjoint movement of said slide and frame relatively to the bars.

6. A slide rule, as set forth in claim 5, including pads on the plates and facing opposite sides of the slide for engagement with said opposite faces of the slide upon manual depression of the plates in direction towards said opposite faces.

7. In a slide rule, the combination of a pair of bars, stop elements on said bars adapted to hold them in fixed spaced parallel relation, a slide movably supported between and by said bars and movable beyond each of said stop elements, a frame slidable relatively to said bars and slide, means for frictionally coupling said frame to said slide at any selectively determined point of said slide between said stop elements, one of said stop elements having an index line in alinement with an edge of said stop element, an index line carrier on said frame adapted for abutment with said stop element in a position in which the index line on the carrier of the frame abuts the index line of the carrier on the stop element.

8. A slide rule, comprising in combination,

a pair of bars, stop elements secured to the ends of said bars for maintaining them in fixed parallel relation, said bars being provided with gradations terminating at one end at a distance from the said stop elements, a slide movably support by and between said bars, a frame movable on said bars and on said slide, means for frictionally coupling said frame with said slide at any selectively determined point of said slide presented between said stop elements, an index carrier supported by said frame and having an index line, the index line of said frame being in registry with the end line of the gradations on said bars when said frame is in engagement with the respective stop element on the bars.

9. A slide rule, comprising in combination, a pair of bars, stop elements secured to said bars and adapted to maintain them in fixed parallel relation, a slide movably supported by and between said bars and movable beyond said stop elements, one of said stop elements being provided with a cut-out, a glass plate inserted in said cut-out in position over the space between said bars through which the slide is movable, the bars having gradation lines, the edge of said stop element coinciding with the zero division of said gradation lines, the glass plate in the stop element having a bevel edge in alinement with the edge portions of said stop element, a frame slidable relatively to said bars and slide and supported thereby, means for frictionally coupling said frame to said slide at any selectively determined point of said slide presented between the stop elements of the body, said frame having face portions on opposite sides of said bars and slide, cut-out portions in the opposite sides of said frame and extending over the width of the combined bars and slide, a glass plate inserted in each of said cut-outs, said plate having a bevel edge adapted to serve as an index for the position of the frame relatively to said bars and slide, and adapted when the frame is in engagement with one stop element of the body to overlie the zero line of gradations on the bars, and adapted when in engagement with the opposite stop element to overlie the opposite end division lines of the series of gradations on the bars.

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