

June 25, 1963

P. O. MIMS
MANUAL CALCULATOR

3,095,144

Filed May 29, 1961

2 Sheets-Sheet 1

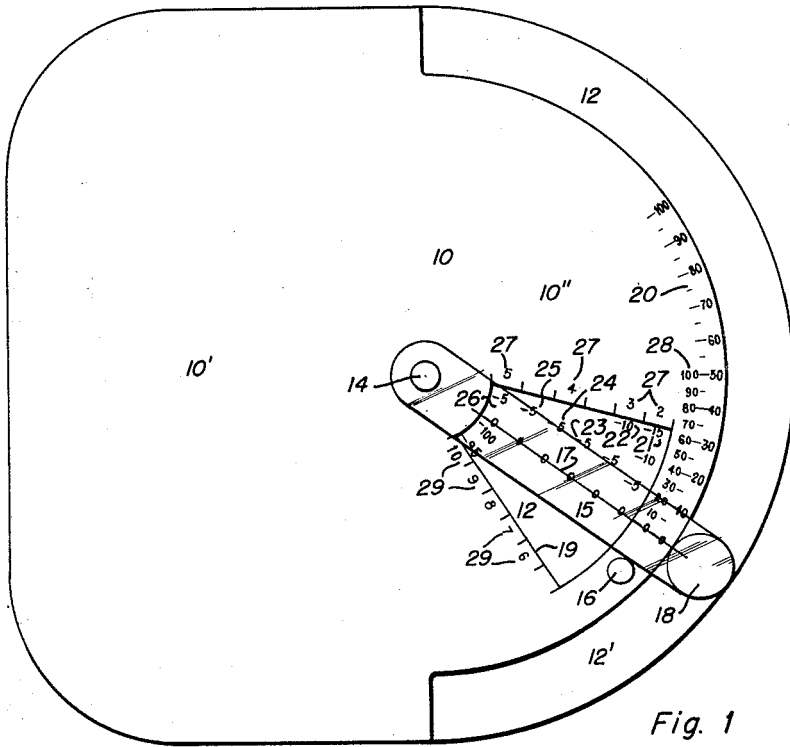


Fig. 1

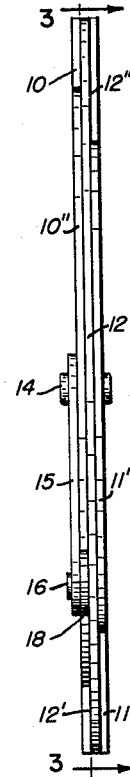


Fig. 2

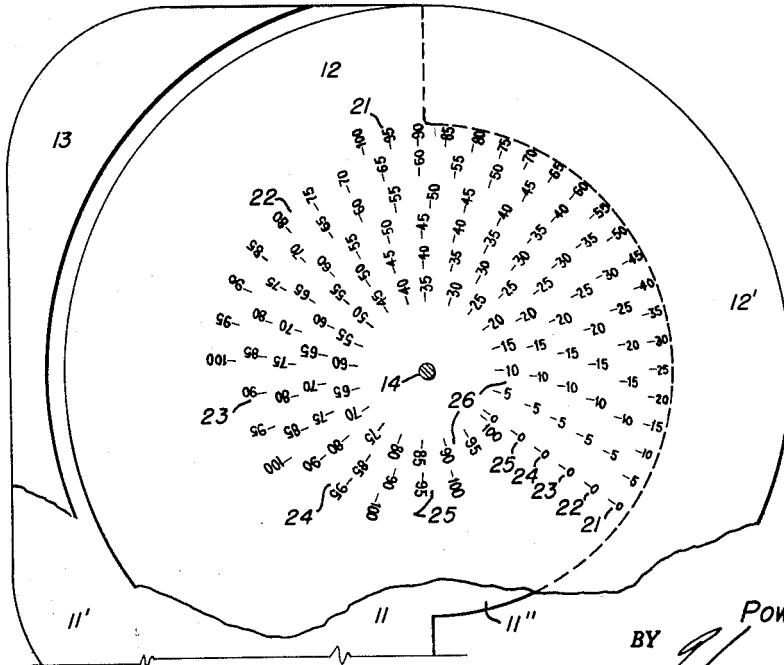


Fig. 3

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2 Sheets-Sheet 2

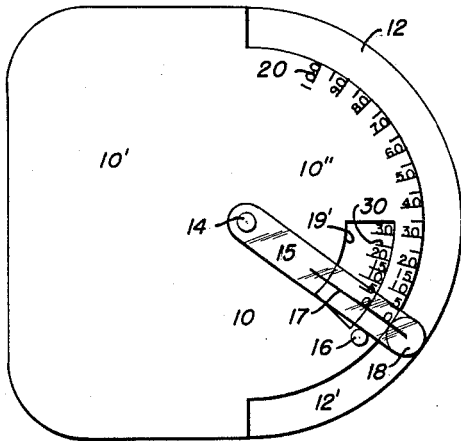


Fig. 4

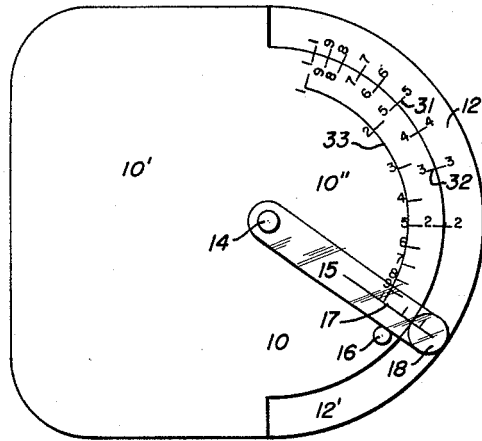


Fig. 5

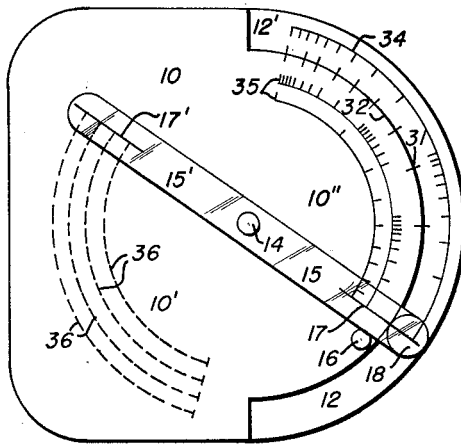


Fig. 6

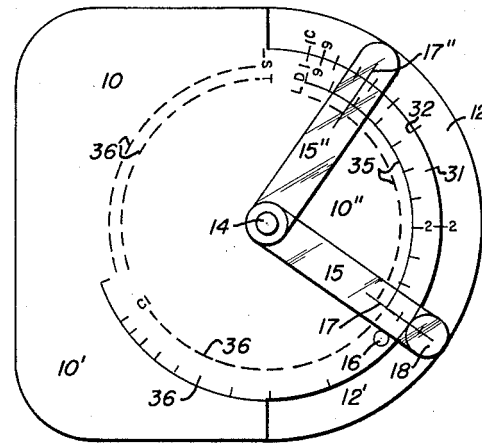


Fig. 7

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3,095,144

MANUAL CALCULATOR

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9 Claims. (Cl. 235-77)

This invention relates to calculating instruments applicable to the solution of mathematical problems, and more particularly to such instruments organized for manual actuation and adjustment in general analogy with circular slide rules, and has as an object to provide a novel and improved manual calculator that is feasible and convenient of use for the prompt solution of problems resolvable thereby.

A further object of the invention is to provide a novel and improved manual calculator that is susceptible of production in diverse specific adaptations appropriate for the solution of various mathematical problems.

A further object of the invention is to provide a novel and improved construction and unitary correlation of elements constituting a manual calculator.

A further object of the invention is to provide a novel and improved organization of elements amenable to selective calibration therein manipulable for the facile calculation of values derivable therefrom.

A further object of the invention is to provide a novel and improved organization of elements that is susceptible of selective calibration and manually operable to derive from pertinent such calibrations solutions to problems of addition, subtraction, determination of averages, multiplication, division, powers and roots of numbers, trigonometric relationships, and the like.

A further object of the invention is to provide a novel and improved manual calculator of expedient specific adaptability that is economical of production from readily-available materials in a wide range of feasible sizes and functional particularity, that is simple, convenient, and rapid of application to intended use, that is compact in a sturdy and practical unitary arrangement, and that is positive and efficient in attainment of the ends for which designed.

With the foregoing and other objects in view, my invention consists in the construction, arrangement, and operative combination of elements as hereinafter set forth, pointed out in the appended claims, and illustrated by the accompanying drawings, in which—

FIGURE 1 is a front face view of a typical embodiment of the invention as organized for the calculation of averages.

FIGURE 2 is an edge elevational view of the organization according to FIGURE 1.

FIGURE 3 is a sectional view of the arrangement according to the preceding views taken substantially on the indicated line 3—3 of FIGURE 2, portions of the view not essential to understanding of the disclosure being broken away to conserve space.

FIGURE 4 is a view similar to FIGURE 1 representing adaptation of the invention to use for purposes of addition and subtraction.

FIGURE 5 is a view similar to FIGURE 1 showing adaptation of the invention to use for purposes of multiplication, division, and analogous logarithmic calculations.

FIGURE 6 is a view similar to FIGURE 5 exemplifying a modification within the contemplation of the invention applicable to extend the utility of the arrangement according to the preceding view.

FIGURE 7 is a view similar to FIGURE 5 showing a further practical modification within the contemplation of the invention.

In a distinctive structural combination common to all

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operative adaptations thereof, the elements and features of the invention are correlated as a unitary assembly on, in, and with a substantially-rigid, flat case comprised from a thin, flat, face member 10 and a complementary thin, flat, back member 11 fixedly conjoined to receive and rotatably accommodate therebetween a thin, flat, circular paten 12. Formed from any suitable, preferably opaque, sheet material, the members 10 and 11 are similarly characterized by corresponding, generally-rectangular, marginally-registrable, major area portions 10' and 11', respectively, approximating in length, or greater dimension, the diameter of the paten 12 and exceeding in width, or lesser dimension, the radius of the latter, and semi-circular area portions 10'' and 11'', respectively, of unlike radii less than that of said paten coplanar with the associated member in projection from symmetrical relation with one long side of the contiguous rectangular area portion thereof. In the arrangement of the members 10 and 11 illustrated and just described, the centers for the bounding arcs of the semi-circular areas 10'' and 11'' bisect the lines respectively marking conjunction thereof with the adjacent rectangular member areas and hence are susceptible of registration as a common pivotal axis concentric with the arcs struck therefrom when the members 10 and 11 are superposed in registration of the three free margins of the areas 10' and 11' with consequent registration of the lines of conjunction bisected by the centers. Applicable to intended use in the registration of the free margins of their major rectangular areas above specified, the members 10 and 11 are fixed in parallel with a separation adequate to shiftably accommodate the thickness of the paten 12 by means of a spacer insert 13 secured to close in a uniform thickness therebetween and conformably along the registered free margins of the areas 10' and 11' at the side of the resulting assembly remote from the semi-circular areas 10'' and 11'', and the inwardly-directed margin of said insert 13 is concaved to an arc concentric with the registered centers of said semi-circular areas having a radius greater than that of the paten 12, whereby to complete the case comprised from the members 10, 11, and insert 13 for reception of the paten 12 in a manner to accommodate rotation of the latter within the case about the axis common to the centers of the arcs bounding the areas 10'' and 11''.

Centrally apertured for revoluble coaction with a pivot and received between the members 10 and 11 in concentric relation with the semi-circular areas 10'' and 11'' thereof, the paten 12 is positioned and rotatably retained within the case by a hub pin 14 fixed perpendicularly through said members and revolubly traversing the central aperture of the paten in axial registration with the centers from which the bounding arcs of the said areas 10'' and 11'' are derived. Proportioned and assembled as shown and described in an arrangement characterized by a radial dimension for the area 10'' less than that of the paten 12 and a radial dimension for the area 11'' less than that of the area 10'', the said paten is largely housed within and mounted for rotation relative to the case peripherally tangent to the sides of the latter in a manner to expose a semi-circular, marginal band area 12' of the paten exteriorly adjacent the bounding arc of the area 10'' and a relatively-wider, semi-circular, marginal band area 12'' of the paten exteriorly adjacent the bounding arc of the area 11''. Pivotaly retained on the appropriate end of the pin 14, a straight, stiff arm 15 of transparent material is mounted to radially overlie the semi-circular area 10' for angular adjustment relative thereto toward and away from a stop 16 fixedly outstanding from and inwardly adjacent the arcuate edge of said area in a moderate angular spacing from one end termination of the edge, said arm 15 being of a length to overlap the exposed area 12' of the paten 12, being

scribed with a reference line 17 radial of the pin 14, and being expanded in thickness at its free end in opposition to the paten area 12', as by means of an attached supplemental disk 18, or otherwise, in a manner to accommodate unimpeded swing of the arm relative to the area 10'' when the outward end of the arm is pressed to engagement against the paten area 12'. As thus contrived, the unitary assembly of case, paten, and radial arm may be held by grasp of one hand of an operator applied to the closed, rectangular-area portion of the case for selective adjustment of the paten and arm, either independently or conjointly, angularly about the axis of the pin 14 and relative to the case in reaction to manipulations applied by the other hand of the operator; the opposed marginal band areas 12' and 12'' of the paten exterior to the case providing a convenient grip area available for desired angular adjustment of the paten, the overlay and free end extension of the radial arm relative to the case feasibly conditioning the arm for independent grip and manipulation toward and away from the stop 16, and the thickened free end overlap of said arm with respect to the paten area 12' functioning, when desired, to reflect compressive grip applied to the free end of the arm and the area of the paten covered thereby as a temporary clamping effect therebetween available to transiently couple the arm and paten for simultaneous angular adjustment in a relatively-fixed, angular correlation.

Diversely susceptible of adaptation to expedite and facilitate various mathematical calculations, the unitary assembly structurally comprised as hereinabove set forth has important practical merit when arranged for determination of the average of a succession of values in accord with the representations of FIGURES 1 and 3. As shown, the unitary assembly of case, paten, and radial arm is very simply conditioned for use as an average finder through the provision of a sight aperture 19 opening through a portion of the semi-circular case area 10'' inwardly adjacent the stop 16 to expose an underlying area of the paten 12 and the indication of appropriate scales on said paten and along the convex margin of the area 10'' arcuately and concentrically correlated to effectuate the desired purpose. Expediently defined between side margins outwardly divergent from and radially of the pin 14 and spaced end margins closing between said side margins in concentric relation with the pin, the sight aperture 19 desirably is located to open through the area 10'' beneath and for bisection by the reference line 17 of the arm 15 when the latter is engaged against the stop 16 at the corresponding limit of its adjustable range, as in FIGURE 1, and a scale 20 reading in uniform graduations radial of the pin 14 from zero to one hundred is applied in wardly adjacent and arcuately along the convex edge of the area 10'' in an order of values ascending away from the stop 16 and from registration of the initial, or zero, point of the scale with the reference line 17 of the arm 15 when said arm abuts said stop. Concentric in spaced juxtaposition radially of the area of the paten 12 amenable to exposure through the sight aperture 19 in consequence of paten rotation about its pivotal axis, a plurality of separate scales 21, 22, 23, 24, 25 and 26, similarly reading in graduations radial of the pin 14 which are uniform in the individual scale and unlike in adjacent scales from zero to one hundred in an order of values ascending in correspondence with the scale 20 from alignment of their initial, or zero, points radially of the paten, is established on the surface of the latter opposed to the case areas 10' and 10'' in a manner to qualify the zero points of all of said scales for alignment radially of the pin 14 with the zero point of the scale 20 and consequent registration with the reference line 17 of the arm 15 as limited by the stop 16 in one adjusted position of the paten. While alike divided into a number of uniform intervals the same as indicated by the scale 20, the scales 21, 22, 23, 24, 25 and 26 are, to realize the purposes of the specific adaptation, 75

progressively greater in angular extent relative to the scale 20, and to each other, as they are progressively remote from the fixed scale 20, the arrangement being such as to qualify each of the inwardly-successive scales movable with the paten as a correspondingly-higher multiple of the arcuate length of the fixed scale. Thus, the scale 21 first inwardly from the fixed scale 20 has an arcuate extent of one hundred uniform divisions twice the arcuate extent of the equivalently-divided scale 20; the next-inward movable scale 22 is of an arcuate length three times that of the scale 20 divided into one hundred like intervals; the third-inward scale 23 has one hundred uniform divisions of an arcuate length three and one-half times that of the scale 20; the next-inward scale 24 represents one hundred uniform divisions of an arcuate length four times that of the scale 20; the inwardly-adjacent scale 25 is of an arcuate length four and one-half times that of the scale 20 characterized by one hundred uniform intervals; and the innermost scale 26 utilizes an arcuate length five times that of the fixed scale 20 to established a count of one hundred uniform divisions. Indicative of the multiple relation obtaining between the individual movable scales and the fixed scale 20, and to facilitate intended use of the described adaptation of the calculator, the radial margin of the sight aperture 19 remote from the stop 16 is scribed in defining registration with the orbital paths of the several movable scales and supplied with numerical identification, as at 27, of the arcuate length relation each so-located movable scale bears to the fixed scale 20.

Conditioned as a facility for the determination of the average of a succession of values in the arrangement exemplified by FIGURES 1 and 3 as above described, manipulation and use of the calculator for realization of the intended purpose should be reasonably obvious. It being desired to calculate the average of a series of values, the arm 15 is shifted to its limiting position against the stop 16 and the paten 12 is adjusted about its pivot to register the aligned initial points of the scales 21, 22, 23, 24, 25 and 26 with the reference line 17 of the so-positioned arm, whereafter said arm is moved independently of the paten and away from the stop to intercept on the fixed scale 20 read against the reference line 17 a first value of the series to be averaged, the free end of the so-adjusted arm is grip-clamped to the exposed marginal band 12' of the paten and returned to its limiting position against the stop 16 with simultaneous and corresponding angular displacement of the paten effective to manifest at the interval of the scale 21 then readable against the reference line 17 the half measure of the value intercepted on the scale 20, and the cycle of manipulations is repeated with successive interception from the scale 20 of the other values of the series to be averaged and consequent proportional, angular advance of the paten accompanied by progressive exposure of the movable scales at the sight aperture 19 in the ascending order of their numerical indications. Thus operated, progressive advance of the paten 12 reflecting the successive values intercepted on the scale 20 acts to register the indications of the movable scales with the reference line 17 of the arm 15 in its limiting position against the stop 16 where they are readable with reference to the appropriate movable scale as the numerical average of a corresponding number of values comprised in the series subject to calculation. Organized as shown and described, intended manipulation of the calculator represented by FIGURES 1 and 3 automatically develops in registration with the reference line 17 of the arm 15 positioned against the stop 16 the average of a two-number series readable from scale 21, the average of a three-number series readable from scale 22, the average of a four-number series readable from scale 24, and the average of a five-number series readable from scale 26, as to which the identifications 27 coordinated with the movable scales are visually informative.

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Arranged as disclosed for calculation of the average of those series of values not exceeding five separate quantities susceptible of reflection on the fixed scale 20, the capacity and utility of the device expediently may be extended without alteration of its structural organization or change in the plan of the movable scales through the provision of a second fixed scale 28 half the length of and complementarily adjacent the scale 20 graduated to read in terms of one hundred uniform intervals from an initial, or zero, point aligned radially of the pin 14 with the corresponding point of said scale 20, scribing of the radial margin of the sight aperture 19 adjacent the stop 16 to mark the orbital paths of the several movable scales in opposition to the similar designations applied to the other radial margin of the aperture, and numerical identification, as at 29, in the so-scribed zones of the multiple arcuate length relation obtaining between each of the movable scales 21, 22, 23, 24, 25 and 26 and the fixed scale 28, which relation, obviously, is exactly twice that identified by the indicia 27. Manifest beyond occasion for detailed recapitulation, the average of any series of values exceeding five and not exceeding ten separate quantities is obtained exactly as above set forth through reflection of the values of each higher-number series on and by means of the fixed scale 28 in substitution for the scale 20.

Elimination of the scales 21, 22, 23, 24, 25 and 26 on and movable with the paten 12 in favor of but a single, substitute scale 30 identical with the scale 20 applied to the paten and therewith movable concentrically adjacent and into and away from radial registration with said fixed scale conditions the structural organization of the calculator as hereinabove described for operations of addition and subtraction, as typified by FIGURE 4. With but a single, largely-concealed scale carried by the paten for partial exposure adjacent the stop-limited position of the arm 15, the sight aperture of the adaptation conditioned to effect additions and subtractions feasibly may be narrowed radially and extended circumferentially with respect to the aperture 19 of the preceding disclosure as exemplified at 19' of FIGURE 4, but in all other respects the organization according to said latter view is the structural counterpart of that represented by FIGURES 1, 2 and 3. Furnished with the single movable scale 30 as above described, application of the arrangement according to FIGURE 4 to effect the operations of addition and subtraction should be readily apparent, since it is evident that from the initial correlations shown the arm 15 may be manipulated to accumulate successive increments measured on the scale 20 with corresponding displacement of the paten and consequently totaled on the scale 30, through practice of the same techniques earlier set forth. Reversal of the manipulations operates, very naturally, to reduce a sum by the amount of successive decrements applied thereto in consequence of relative adjustment of the scales 20 and 30 had in the manner described.

With omission of the sight aperture, 19 or 19', and substitution of an alternative arrangement of specific scales, the calculator unit structure primary to the foregoing adaptations may be conditioned as represented by FIGURE 5 for the resolution of problems in multiplication and division. In a customary application of known logarithmic principles, the arrangement according to FIGURE 5 is distinguished by a conventional logarithmic scale 31 of the type and form commonly employed in slide rules which is applied to the annular band 12' of the paten 12 in arcuate conformity with the edge of the semi-circular case area 10'' to read in terms of ascending values away from the stop 16 adjacent and for adjustment relative to a like, complementary scale 32 applied to and along the arcuate margin of the case area 10'' with its initial point disposed to register with the reference line 17 of the arm 15 when the latter is engaged with the stop 16 and its graduations adapted, at times, to register

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radially of the pin 14 with the like calibrations of the scale 31. Obviously manipulable in simulation of a conventional slide rule, the structural components furnished with the scales 31 and 32 may be selectively and relatively adjusted to establish relationships determinative of solutions readable against the reference line 17 of the adjustable arm 15, the capacity and utility of the adaptation according to FIGURE 5 being susceptible of extension, when and as desired, by the provision of additional scales carried by the area 10'' in appropriate correlation with the scales 31 and 32, such as, for example, a reversed logarithmic scale 33 inwardly and concentrically adjacent the scale 32 in radial coalignment of terminals.

As exemplified by FIGURE 6, the capacity and utility of the calculator unit typified by FIGURE 5 may be further extended by the addition of an appropriate supplementary logarithmic scale 34 outwardly adjacent and functionally correlated on the annular band 12' of the paten with the scale 31, the application of desired supplementary logarithmic scales 35 having trigonometric, or other, significance to the case area 10'' in functional correlation with other scale indications of the unit, the elongation of the arm 15 beyond the pin 14 to span diametrically of the paten 12 by virtue of an aligned terminal component 15' scribed with a reference line 17' radial of said pin, and the representation on the case area portion 10' of arcuate scales 36 concentrically and functionally correlated in any appropriate particularity with the other scales of the unit to read against the reference line 17' throughout the significant adjustable range of the elongated arm 15. Manipulable as previously explained in simulation of conventional circular slide rules, operation of the adaptation represented by FIGURE 6 for the resolution of diverse problems and the determination of calculations amenable of reference to the scale data provided should be apparent beyond occasion for elaboration.

The primary structural organization of the improved calculator unit accommodates yet further modification facilitating and extending its practicality and specific utility by the means and in the manner distinguishing the showing of FIGURE 7, wherein features of the adaptation according to FIGURE 6 are combined with the arrangement of FIGURE 5 and ingeniously augmented with consequent functional advantage. Structurally identical with the arrangement of FIGURE 5 save for an addition hereinafter discussed, and furnished with the scales 31 and 32 supplemented by scales 35 and 36, or their analogues, correlated substantially as hereinabove discussed in connection with FIGURES 5 and 6, the feature distinguishing the modification represented by FIGURE 7 is an auxiliary arm 15'', similar to or identical with the arm 15, pivotally retained at one end on the pin 14 to swing with some frictional resistance independently of the arm 15 and in adjustable angular relation therewith radially of and about said pin for traversing registration, as by means of a reference line 17'' scribed thereon radially of the pin, with the various scales carried by the unit, whereby, as is manifest, selected angular relationships may be established between the reference lines 17 and 17'' of the associated arms and variously utilized in association with the available scales for expeditious correlation of values not otherwise facile of determination.

Since changes, variations, and modifications in the form, construction, and arrangement of the elements shown and described may be had without departing from the spirit of my invention, I wish to be understood as being limited solely by the scope of the appended claims, rather than by any details of the illustrative showing and foregoing description.

I claim as my invention:

1. In a manual calculator having a case and a circular paten revolvably housed within said case in partial peripheral exposure at one side thereof, a transparent arm radial of said paten pivoted to and exteriorly of said case in spacedly-overlying extension across the exposed area of

the paten for independent angular adjustment concentrically thereof, a stop fixedly outstanding from said case adjacent the exposed area of the paten effective to limit angular adjustment of said arm relative to the case in one direction, visible complementary scales on said case and paten shiftable correlatable for the solution of mathematical problems, a reference line on said arm radially of the paten for visually relating adjustments of said arm to said scales, and an offset stepped from said arm in opposition to the subjacent exposed area of the paten optionally grip-engageable against said area to accommodate simultaneous shift of said arm and paten in and with maintenance of a selected condition of relative angular adjustment.

2. The organization according to claim 1, wherein said case is a thin, flat unit having complementary members marginally united in closely-spaced relation to define a side-open pocket adapted to rotatably enclose substantially one-half of the associated paten, a hub pin fixed through said members at the midlength of the open side of said pocket, and semi-circular areas of different radii less than the radius of the paten extending said members beyond and in concentric relation with said pin to overlie corresponding areas of the paten with consequent exposure of paten peripheral bands of unequal radial extent suited for manual grip applied to engage the arm through its offset with the paten.

3. The organization according to claim 1, wherein said case is a thin, flat unit having complementary members marginally united in closely-spaced relation to define a side-open pocket adapted to rotatably enclose substantially one-half of the associated paten, a hub pin fixed through said members at the midlength of the open side of said pocket, and semi-circular areas of different radii less than the radius of the paten extending said members beyond and in concentric relation with said pin to overlie corresponding areas of the paten with consequent exposure of paten peripheral bands of unequal radial extent, said stop is carried by and adjacent the arcuate margin of the semi-circular case member area of greater radius, and said arm pivotally engages said hub pin at the same side of the case as said stop to radially traverse the narrower peripheral band exposure of the paten, whereby the wider of said peripheral band exposures is adapted for grip by the fingers of an operator applied to interengage the arm and paten for simultaneous shift.

4. The organization according to claim 1, wherein said arm is extended to diametric relation with the paten, supplementary scales functionally correlated with said first scales are applied to the case area traversable by the arm portion remote from the exposed area of the paten, and a reference line is provided radially of said latter arm portion to read against said supplementary scales.

5. The organization according to claim 1, wherein a second transparent arm furnished with a reference line radial of the paten is concentrically and frictionally associated with said first arm for independent angular adjustment relative thereto and for optional shift in adjusted relation therewith.

6. The organization according to claim 1, wherein scale calibrations carried by the case read in an order of values ascending in the direction of arm adjustment away from said stop with respect to an initial minimum scale value disposed to register with the radial reference line of the arm in the stop-limited position of the latter, and the scale calibrations carried by the paten read in a corresponding order of values with respect to initial scale points aligned

radially of the paten and susceptible of adjustment therewith into registration with the reference line of the arm when the latter is against the stop.

7. The organization according to claim 1, wherein scale calibrations carried by the case read in appropriate functional order of values from initial scale values disposed to register with the radial reference line of the arm in the stop-limited position of the latter, and the scale calibrations carried by the paten read in appropriate functional order of values from initial scale points aligned radially of the paten and susceptible of adjustment therewith into registration with the reference line of the arm when the latter is against the stop.

8. The organization according to claim 1, wherein a semi-circular area of the case concentrically covers a corresponding area of the paten to expose for traverse by said arm but a narrow band peripherally of the paten, said stop is carried by and adjacent the arcuate margin of said semi-circular case area, said semi-circular case area is formed with a sight aperture opening to the paten in symmetrical correlation with the stop-limited position of the arm, scale calibrations carried by the case read along the arcuate margin of said semi-circular case area in appropriate functional order of values from initial scale values disposed to register with the radial reference line of said arm in the stop-limited position thereof, and scale calibrations carried by the paten read arcuately of the paten area exposable through said sight aperture in appropriate functional order of values from initial scale points aligned radially of the paten and susceptible of adjustment therewith into registration with the reference line of the arm when the latter is against the stop.

9. The organization according to claim 1, wherein said case covers the surface of the paten subjacent said arm save for a semi-circular, narrow band peripherally of the paten and is formed with a sight aperture opening to an area of the underlying paten surface inwardly adjacent said band, said stop is correlated with said sight aperture to position the arm when engaged with the stop for traverse across said sight aperture, the scale carried by the case is calibrated to read between said sight aperture and the exposed peripheral band of the paten in an order of uniform graduations ascending in the direction of arm adjustment away from said stop with respect to an initial point disposed to register with the radial reference line of the arm in the stop-limited position of the latter, and the scales carried by the paten are arcuately and concentrically arranged on the paten area exposable through the sight aperture to read from initial points aligned radially of the paten and susceptible of adjustment therewith into registration with the reference line of the arm when the latter is against the stop in uniform graduations corresponding in number and ascending order with the representations of the scale carried by the case as angular-span multiples of the arcuate length of the scale carried by the case progressively and numerically increasing inwardly of the paten, whereby to qualify the calculator for use in determining the average of a series of values.

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