April 7, 1964 A. E. GOLDFARB 3,127,686

CALCULATOR

Filed March 3, 1961 3 Sheets-Sheet 1

Fig. 1

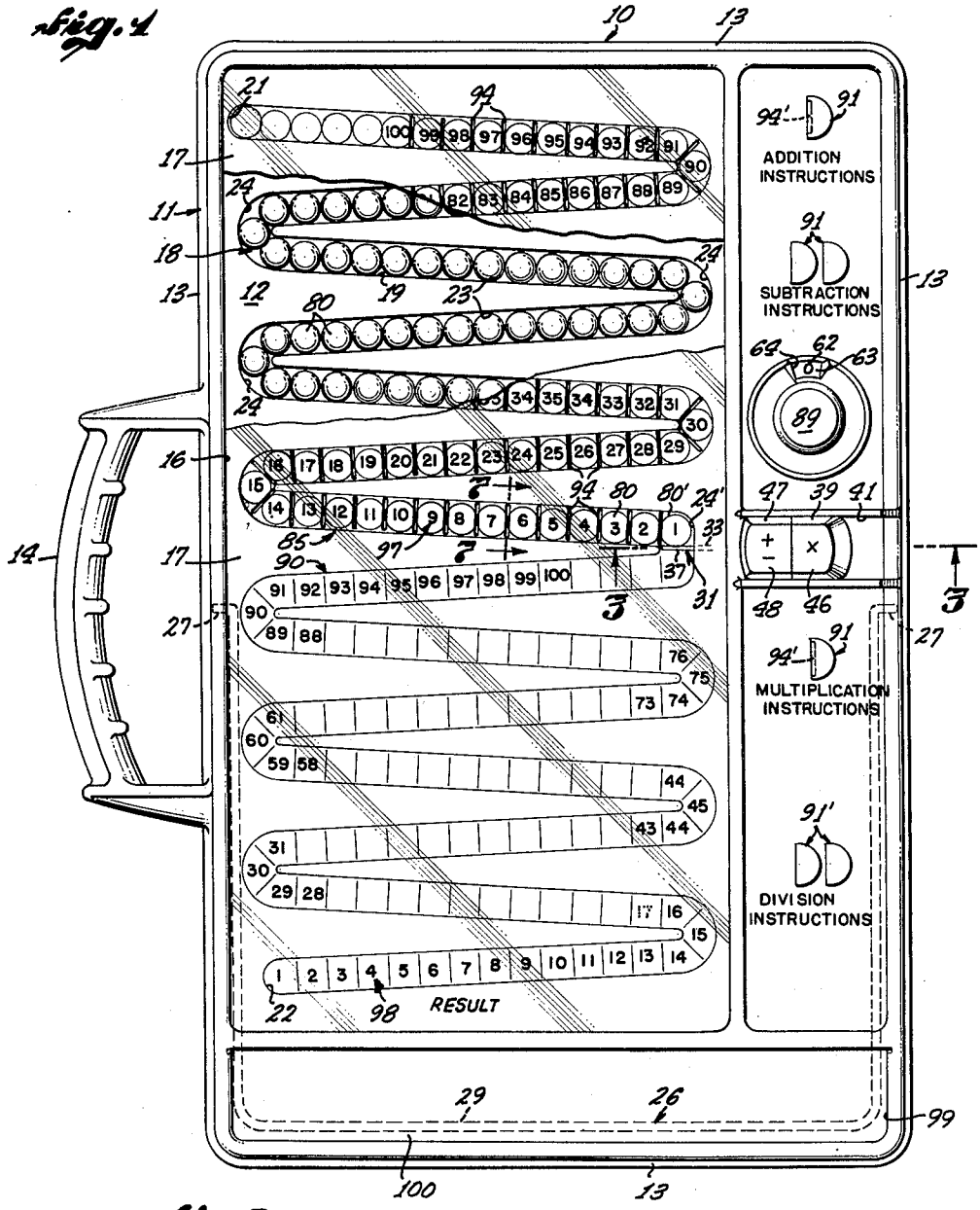
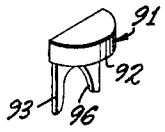


Fig. 2



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CALCULATOR

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Fig. 3

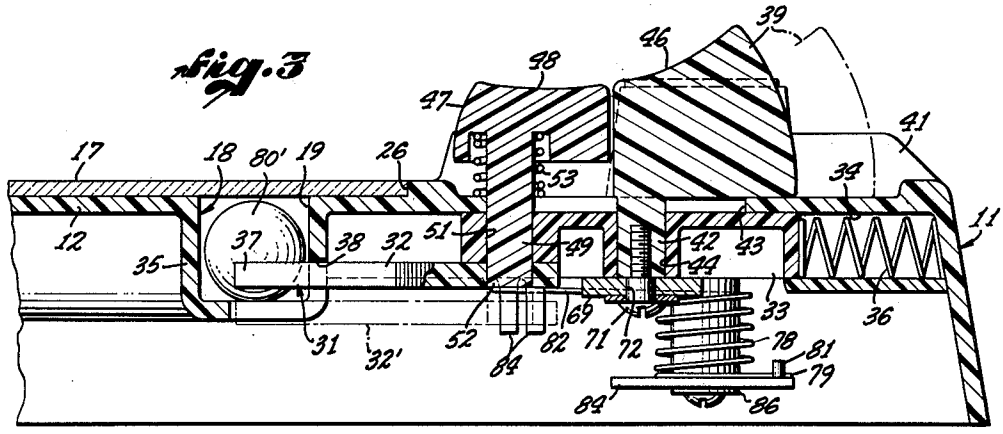
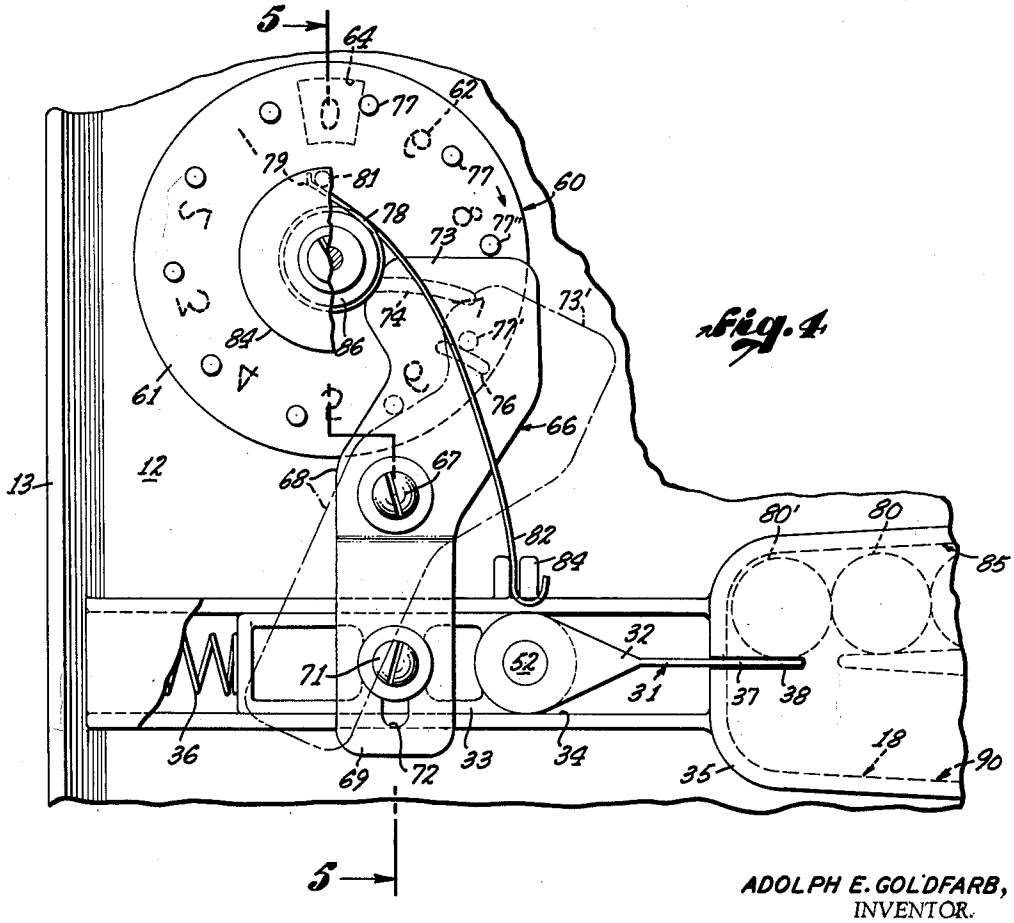


Fig. 4



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CALCULATOR

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Fig. 5

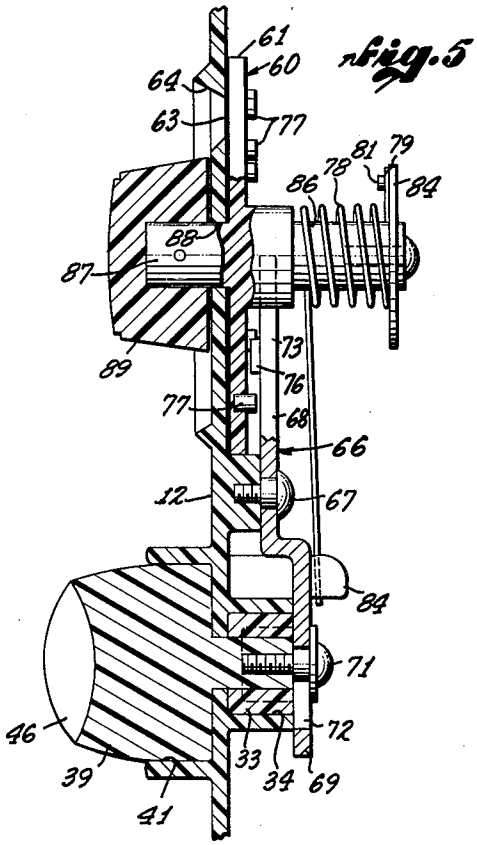


Fig. 11

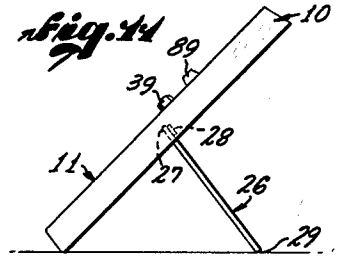


Fig. 6

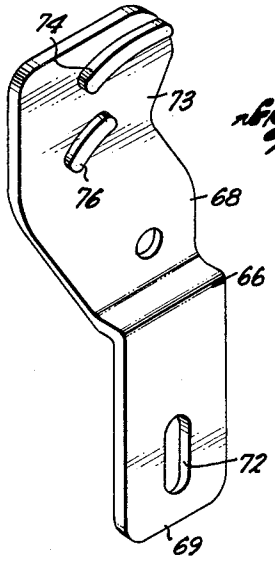


Fig. 7

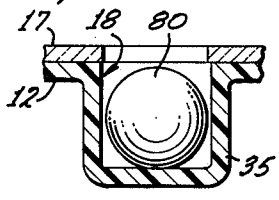


Fig. 8

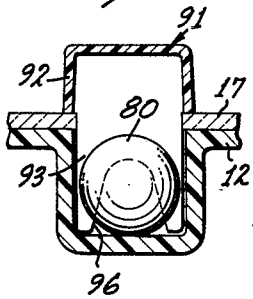


Fig. 10

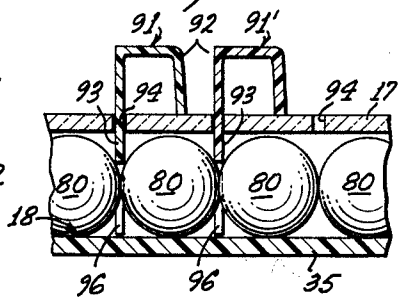
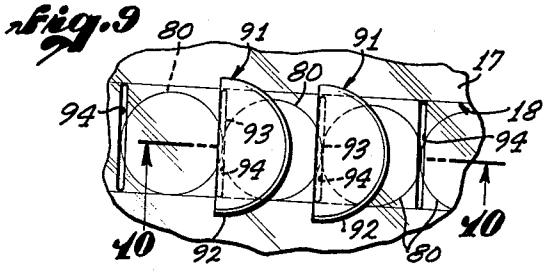


Fig. 9



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United States Patent Office 3,127,686 Patented Apr. 7, 1964

3,127,686

CALCULATOR

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Filed Mar. 3, 1961, Ser. No. 93,079
5 Claims. (Cl. 35—31)

This invention relates to a calculator and more particularly to a simplified or instruction type of calculator useful for teaching children the fundamentals of arithmetic including the operation of addition, subtraction, multiplication, and division.

This invention provides a new and improved calculator having a relatively flat base in which a sinuous passageway is defined, the passageway extending back and forth across the face of the base from one blind end to another and the base being tiltable and supportable either by manual means or by a foldable support therefor in an inclined or vertical position wherein all portions of the passageway are sloped downwardly. A manually operable gate is mounted on the base and is spring-biased into a position intersecting a midway portion of the passageway so as to block the passageway and is manually operable to selectively remove the gate from the passageway so as to allow a predetermined quantity of rolling members, such as balls, or the like, to be gravitationally biased from an upper portion of the passageway to a lower portion thereof.

The balls normally reside in the upper portion of the passageway and are arranged in single file in the passageway so that the lowermost of the balls rests against the gate when it is blocking the passageway. When the gate is removed from the passageway, the balls are gravitationally biased to enter the lower portion of the passageway, towards the lowermost blind end thereof.

Stop means are provided and insertable through slits formed in a transparent cover enclosing the passageway, the stop means being selectively positionable relative to a given problem to be solved to arrest a given amount of balls in the upper portion of the passageway while releasing a given number of balls to roll downwardly towards the blind end in response to removal of the gate from its blocking position. In this manner, simple problems of arithmetic may be vividly illustrated and quickly understood and performed by a young child.

For example, in solving an addition problem, a given number of balls are released through the gate means to be deposited in the lowermost portion of the passageway in addition to a given number of balls previously released thereto, the total being visibly indicated by indicia printed or otherwise applied on the transparent cover. The indicia are unique by being increasingly visible when balls underlie them and substantially invisible when the space in the passageway beneath the indicia is unoccupied.

Subtraction is similarly performed whereby a given number of balls of a given total are released to roll into the lowermost portion of the passageway to obtain the result; multiplication is performed by releasing a given amount of balls a given number of times into the result portion of the passageway; and division is performed by releasing an equal amount of balls from a given total of balls into the lowermost portion of the passageway and recording the number of times the given amount of balls were released to obtain the result.

After obtaining the results, the balls in the lowermost portion of the passageway may be returned to the uppermost portion by reversing the tilt of the calculator base and opening the gate to allow gravitational rolling of the balls to their original position, after which the gate is released for closing the passageway and, when again tilted into its original position, is ready for operation.

It is among the objects of this invention to provide a new and improved calculator which is simplified in its construction and operation so as to clearly and simply illustrate various functions of arithmetical operations.

An object of this invention is to provide a new and improved calculator which quickly and visibly indicates the results of the various mathematical operations.

Another object of this invention is to provide a new and improved calculator in which the problems are easily and readily fed into the apparatus and the results are progressively and accumulatively illustrated.

A further object of this invention is to provide a new and improved calculator which is easily and practically supported manually in its operational position or is optionally supported permanently or non-permanently on a table or desk or the like by support means compactly foldable within the body thereof.

A still further object of this invention is to provide a new and improved calculator of the character described which is economical to manufacture and capable of mass production.

A general object of this invention is to provide a new and improved calculator of the character described which overcomes disadvantages of prior means and methods heretofore intended to accomplish generally similar purposes.

These and other objects of this invention will be more apparent from the following drawings, detailed description and appended claims.

In the drawings:

FIG. 1 is a top plan view of the calculator of this invention, with parts broken away for great clarity;

FIG. 2 is a perspective view, in elevation, of a removable stop means embodied in this invention;

FIG. 3 is an enlarged, fragmentary, cross-sectional view as taken substantially along the line 3—3 of FIG. 1;

FIG. 4 is a fragmentary bottom plan view illustrating the underside of FIG. 3;

FIG. 5 is a cross-sectional view as viewed substantially along the line 5—5 of FIG. 4;

FIG. 6 is a perspective view illustrating a portion of the indicating means embodied in this invention in greater detail;

FIG. 7 is an enlarged, fragmentary cross-sectional view as taken substantially along the line 7—7 of FIG. 1;

FIG. 8 is a cross-sectional view, similar to FIG. 7, illustrating the relationship of the stop means of FIG. 2 to the passageway during use thereof;

FIG. 9 is an enlarged, fragmentary plan view illustrating a portion of the passageway of FIG. 1, and the relationship of a pair of stop means thereto;

FIG. 10 is a cross-sectional view, as taken substantially along the line 10—10 of FIG. 9; and

FIG. 11 is a side view of the calculator supported in an angular position.

Referring in detail to the drawings, there is shown by way of illustration, but not of limitation, a calculator designed and constructed in accordance with this invention and generally referred to by the numeral **10**. The calculator **10** comprises a base **11** having a relatively flat top wall **12** and side walls **13** and a handle **14** extending laterally from one of the side walls **13**. The walls **12** and **13** and the handle **14** are preferably formed integrally by casting, molding, or the like, of a relatively light and rigid material such as plastics or the like. The top wall **12** is preferably indented as at **16** for accommodating a panel **17** of transparent material such as plastics, glass, or the like. The panel **17** preferably comprises an unbreakable material such as plastics and is cemented or otherwise secured to the outer face of the wall **12** de-

fined by the indentation 16 for a purpose to be hereinafter described.

A sinuous passageway, generally indicated by the numeral 18, is formed in the wall 12. The passageway 18 includes a groove 19, preferably integrally formed in the face of a top wall 12 and having a pair of blind ends 21 and 22. The groove 19 is uniform in width and comprises a plurality of rectilinear portions 23 in convergent and divergent angular relationship to each other, as best illustrated in FIG. 1, and curved portions 24 connecting the rectilinear portions. The transparent panel 17 overlies the groove 19 to enclose the passageway 18 providing a continuous passageway extending from the blind end 21 and extending back and forth to the blind end 22, yet being visible through the panel.

The calculator 10 is easily and readily carried by the use of the handle 14. The handle 14 may also be used to manually tilt the base 11 into an angular position illustrated in FIG. 11 or to a vertical position, wherein all rectilinear and curved portions of the passageway 18 are sloped downwardly from horizontal for a purpose to be hereinafter described.

Separate means are provided for optionally permanently or non-permanently supporting the base 11 in the tilted position. A supporting means, best illustrated in FIGS. 1 and 11, is preferably of the easel type in which a U-shaped bracket 26 is hingedly secured as at its free ends 27 to the side walls 13. The bracket 26 is swingable into an angular position relative to the base 11 into a predetermined practicable position determined as by a stop 28. By this means the calculator 10 may be supported as on one edge of an end wall 13 and the bight portion 29 of the bracket 26 during the various operations to be hereinafter described.

A gate means, generally referred to by the numeral 31, is mounted in the base 11 for reciprocal movement of a gate member 32 thereof into a position, illustrated in FIGS. 1, 3 and 4, intercepting the passageway 18 for blocking the passageway. The gate member 32 is selectively positionable by manually operable means to be hereinafter described into open positions, one of which is indicated by the broken lines 32' in FIG. 3, wherein the gate member 32 is clear of the passageway for opening the passageway.

The gate means 31 includes a slide member 33 movably secured to the underside of the wall 12 for linear movement in a slideway 34 transverse to an adjacent curved portion 24' midway of the passageway 18. The gate member 32 is secured to the slide member 33 for linear movement therewith so that a spring 36 biasing the slide means 33 in a direction towards the passageway 18 normally biases the gate member 32 into a position blocking the passageway 18. The gate member 32 includes a relatively thin portion 37 extensible through a slot 38 formed in the wall portion 35 defining the groove 19.

A manually operable actuating member 39 is slidably disposed on the outer surface of the wall 12 as in a slideway 41 and has a reduced shank 42 extending through a slot 43 of the wall 12 and into an aperture 44 of the slide means 33 for securement thereto as by a fastener. The member 39 preferably includes a finger-engaging concave surface 46 to facilitate engagement as by a finger of the operator to slide the member 39 in a direction to compress the spring 36, thereby sliding the slide means 33 and the gate member 32 in a direction to retract the gate member 32 from the passageway 18 to open the passageway. Upon release of the member 39, the slide 33 is biased by the spring 36 to extend the reduced portion 37 of the gate member 32 through the slot 38 to block the passageway 18.

The gate member 32 is movable relative to the slide member 33 for opening movement independent of the slide means 33. For this purpose, a second manually

operable actuating member 47, having a concave finger-engaging surface 48, includes a reduced shank portion 49 slidable in a second transverse bore 51 of the slide member 33, the gate member 32 being secured to an outer end 52 of the shank for movement therewith. A spring means 53 is interposed between the wall 12 and the underside of the finger-engaging portion 47 to normally bias the gate member 32 into abutment with the slide means 33. In this position, the reduced portion 37 of the gate member is biased into the blocking relationship relative to the passageway 18. The member 47 may be depressed or pushed inwardly against the bias of the spring 53 to extend the gate member 32 to the position indicated at 32' of FIG. 3 to clear the passageway for opening thereof.

It will now be more clearly understood from the foregoing description that the gate member 32 is reciprocal in a slot 38 communicating with the passageway 18 by lateral movement of the slide means 33 to compress the spring 36 and retract the reduced portion 37 of the gate member 32 from the passageway 18 or by a downward or inward movement of the actuating member 47, independently of the slide means 33, to accomplish the same purpose.

An indicator means is provided to visibly tabulate the number of actuations of the actuator member 39. The indicating means, generally referred to by the numeral 60, includes a disc 61 underlying the wall 12 and having a predetermined number of equally and circumferentially spaced indicia 62 imprinted on a face 63 adjacent to the underside of the wall 12 and visible as through a window 64 formed in the wall. The indicia 62, herein illustrated, indicate numerals consecutively from one to nine and a zero indicating a zero or a 10. An escapement means 66 is pivotally secured as at 67 to the underside of the wall 12 and is operatively associated with the disc 61 and the slide means 33 to translate the linear movement of the slide 33 into an intermittent rotation of the disc 61 so as to progressively rotate the disc 61 and the numerals thereon in response to each actuation of the slide means 33 by the actuating member 39.

The escapement mechanism 66 includes a bell crank 68 pivotably mounted on the underside of the wall 12 as at 67 and having one end 69 secured to the slide means 33 as by a screw 71 extending through a slot 72 provided in the end 69 and an offset end 73 underlying the disc 61. A pair of lugs 74 and 76 are alternately engageable with equally spaced pins 77 depending from the disc 61. The lugs are radially spaced from the pivot 67 of the bell crank 68 so that when the slide means 33 is biased into the position to block the passageway 18 with the gate member 32, the lug 76 is positioned to intercept the path of movement of the pins like 77 so that the pin 77 most adjacent thereto abuts the lug 76. The disc 61 is rotatable by the force of a torque spring 78 having one end 79 abutting a pin 81 movable with the disc 61 and another end 82 anchored as at lugs 84 secured to the wall 12. The pin 81 is located on a plate 84 secured to a post 86 integral with or secured to the disc 61. An extension 87 of the post 86 extends through a hole 88 of the wall 12 for pivotally mounting the disc 61. A manually operable knob 89 is secured to the extension 87 for manual rotation of the post 86 to wind the spring 78.

With the spring 78 wound, the disc 61 is biased to rotate and thereby biases a pin 77' to abut against the lug 76 when the slide 33 is in the passageway-closing position. In this position, the lug 74 is clear of the path of the pin 77. When the slide means 33 is actuated to withdraw the gate member 32 to open the passageway 18, the bell crank 66 is pivoted at 67 to pivot the end 73 into the broken line position 73' of FIG. 4 to position the lug 74 into the path of the pins 77 and remove the lug 76 from its abutting pin 77'. The disc 61 thereby rotates in response to the torque of the spring 78 to position the next adjacent pin 77'' into abutment with the lug 74 while the pin 77' passes

the lug 76. Thereupon, in response to release of the actuator member 46 for bias of the spring 36 to return the slide member 33 to the solid line position of FIG. 4, the bell crank 66 is pivoted to its solid line position of the same figure to remove the lug 74 from the pin 77'' and swing the lug 76 into the path of the oncoming pin 77''. The disc 61 may now again rotate under the force of the spring 78 to abut the pin 77'' against the lug 76 and position the ensuing numeral (like 1) to underlie the window 64 to indicate one actuation of the actuating member 39. Subsequent actuation of the actuator 39 again actuates the bell crank 66 to allow progressive rotation of the disc 61 to reveal the ensuing numeral (numeral 2) signifying the completion of the second actuation of the member 39.

A plurality of equally sized rollable members are disposed in single file in an upper portion 85 (above the midway curved portion 24') of the passageway 18. The rollable members 80 are preferably relatively heavy and spherical in configuration to minimize friction within the passageway 18 and are gravitationally biased when the base 11 is tilted upwardly, as previously described, to roll downwardly in the passageway 18 for abutment of the lowermost ball indicated by the numeral 80' with the reduced portion 37 of the gate member 32 when the gate means is in its closed position. When the gate member is positioned to open the passageway, the balls 80 and 80' are free to enter a lower portion 90 of the passageway 18 and towards the lower blind end 22 of the passageway.

Stop members like the stop member 91, as best illustrated in FIG. 2, are selectively positionable relative to the passageway 18 so as to intercept a selective ball 80 to prevent rolling movement thereof and of balls 80 which are backed up above the ball. By this means, the balls 80 and 80' which are now positioned between a stop means 91 and the gate means 31 are released to enter the lower portion 90 of the passageway in response to actuation of the gate means 31 to open the passageway. In this manner, various problems may be applied to the calculator 10 to obtain results, as will be hereinafter described.

The stop means 91 includes an enlarged head 92 having a generally D configuration and a depending relatively thin forked portion 93. The forked portion 93 is extensible through any of a plurality of slots 94 extending through the transparent plate 17. The slots 94 are spaced, relative to the passageway 18, in increments equalling the diameter of the rollable members 80 whereby the stop means 91 may be positioned to intercept and block any selected ball 80 for a purpose to be hereinafter described. The forked ends 93 provide cut-outs 96 which clear the balls 80, as best seen in FIGS. 8 and 10, so as not to separate the balls when the forked ends 93 are inserted through the slots 94.

Indicia 97 are provided by printing, engraving, or the like, on the outer surface of the transparent plate 17 and coinciding with the spaces between slots 94 for numerically indicating the number of balls stored in the upper portion 85 of the passageway 18. As best seen in FIG. 1, the indicia 97 includes consecutive numbers from 1 to 100 for visibly indicating the balls occupying the groove portion 85.

The lower portion 90 of the passageway 18 is similarly identified by numerical indicia 98 progressing from the blind end 22 and upwardly to overlie the groove 18, similarly indicating numerals consecutively from 1 to 100.

Means are preferably provided for making the numerals of the indicia 97 and 98 more prominently visible when a ball like 80 occupies the space thereunder. For this purpose, the interior of the passageway 18 is preferably coated with a color, like black, identical to the color used for applying the numerals to the exterior of the plate 17, whereas the balls 80 are preferably uncolored and having their metallic finish. By this means, when a space under a numeral is unoccupied by a ball 80, the numeral is substantially indistinguishable against the background of the passageway then visible through the transparent plate 17. However, when a ball 80 occupies a space underlying a numeral, the numeral is perceptibly more prominent.

In the application of the calculator 10 to resolve various arithmetical problems, including the operation of addition, subtraction, multiplication and division, the base 11 is tilted and the gate means 31 positioned to open the passageway so as to cause all of the balls like 80 to roll into the upper portion 85 of the passageway 18. The gate means 31 is then released to close the passageway 18 and the base 11 is tilted into an angular position approximating that of FIG. 11 or into a vertical position by either manually manipulating the handle 14 or supporting the base on the means 26. The balls 80 residing in the upper portion 85 are now biased to roll downwardly and are blocked by the gate means 31.

Assume that the number 3 is to be added to the number 2 in an addition problem. The forked end 93 of the stop member 91 is inserted into the slot 94 between the spaces marked 3 and 4 so as to captivate the first three balls adjacent to the gate means 32. The actuator 47 is then pressed downwardly to position the stop member 32 into the position 32' of FIG. 3 so as to open the passageway 18. The balls 80 positioned under the spaces marked 1, 2 and 3 are now free to roll downwardly in the passageway to the blind end 22 where the three balls then underlie the numerals 1, 2 and 3 of the indicia 98. The actuator member 47 is then released for closure of the passageway 18 by the gate member 32 and the stop member 91 is removed so as to allow the remaining balls to roll downwardly until the ball that had been positioned under the space marked 4 is positioned under the space marked 1 and abutting the gate member 32. The stop member 91 is then inserted into the slot between the spaces marked by the numerals 2 and 3 whereby the balls occupying the spaces marked 1 and 2 are captivated between the forked member 93 and the gate member 32 and the ball occupying the space marked 3 is blocked. The actuating member 47 is again actuated to retract the gate member 32 and the balls occupying the spaces 1 and 2 are freed to roll downwardly in the passageway 18 and fill the spaces 4 and 5 adjacent to the first three balls previously released. In this manner, the last ball to be released occupies the space marked 5 and by color contrast makes the numeral 5 more prominently visible, indicating the result. The highest number to be made prominently visible indicates the result. Additional numbers may be added by releasing an additional predetermined amount of balls in like manner and the result indicated by the last released ball occupying the lower portion 90 of the passageway 18.

As an example of the operation of subtraction, assume that three (3) is to be subtracted from ten (10). Two methods may be employed to achieve the result. In the first method, the passageway 18 is blocked by a stop member 91, by insertion of its forked end 93 in the slot 94 between the spaces marked by the numerals ten (10) and eleven (11). This blocks the ball 80 occupying the space indicated by eleven (11) from rolling downwardly. Next, another stop member like 91 is positioned in the slot between the spaces marked three (3) and four (4) to indicate the number to be subtracted. The gate member 32 is then retracted from the passageway 18 by the actuator 47 to release the balls occupying the spaces one (1), two (2) and three (3) to roll downwardly into the lower portion 90 of the passageway 18. The actuator 47 is then released to return the gate member 32 to its blocking position and the second stop member like 91, the one position between the spaces three (3) and four (4) is removed to allow the balls remaining between the two stop means to roll downwardly into abutment with the gate member 32 indicating the result to be seven (7).

In the second of the subtraction methods, a stop member 91 is positioned to block the balls above the tenth ball and a second stop member 91 is positioned by count-

ing three spaces downwardly, relative to the slope of the passageway 18, and away from the stop member blocking the eleventh ball, whereby, upon retraction of the gate member 32, the seven balls residing in the spaces between the second stop member and the gate member 32 are free to roll downwardly in the lower portion 90 to reside in the first seven spaces adjacent to the end 22 and indicate a result of seven (7).

For multiplication, as for example, three (3) times nine (9), one of the stop members 91 is inserted into the slot above the ninth space in the upper portion of the passageway and the gate means 32 is retracted by actuation of the actuator member 39 in a lateral direction as previously described. The nine balls are then released to roll downwardly into the lower portion 90 of the passageway 18 to occupy the first nine spaces adjacent to the blind end 22. The actuator 39 is then released to block the passageway 18 and the stop member 91 withdrawn for a time interval sufficient to allow the remaining balls in the upper portion 90 to roll downwardly to abut a ball against the gate member 32 and refill the first nine spaces. The stop member 91 is then reinserted in the same slot and the gate member retracted again by actuating the actuator member 39 to again release another nine balls to back up the first nine balls adjacent to the end 22 and thereby indicate the numeralf eighteen (18) as the total. A third repetition of this operation to release nine more balls finally positions the last released ball under the numeral in the space marked 27 to indicate a total twenty-seven (27). Each actuation of the actuator 37 has meanwhile rotated the disc 61 and the numeral three (3) appears in the window 64 to indicate the multiplier.

In the operation of division, assume the example as nine (9) divided by three (3). This is accomplished by placing a stop member 91 in the slot above the space numbered nine (9) in the upper half 85 of the passageway 18, thereby captivating nine balls in the accumulated space above the gate means 32. Another stop member like 91 is then inserted in the slot above the space three (3) and the gate means is retracted by actuation of the actuator 39 to release the balls into the lower portion 90 of the passageway 18. When the actuator 39 is released, the number one (1) on the disc 61 is registered with the opening 64. The gate member 91 indicating the divisor of three (3) is then removed to allow the remaining balls below the stop member blocking above the space nine (9) to roll downwardly into abutment with the gate member 32. The second stop member 91 is reinserted above the space three (3) and the three balls captivated between the second stop member and the gate member 32 are released upon subsequent actuation of the actuator 39 to roll downwardly into the lower portion 90. Actuation of the actuator member 39 is repeated as long as there are balls remaining in quantity equal to or greater than the divisor of three (3) for dividing, the result being registered by numerals registrable with the window 64. In the event that a number which is unequally divisable is used, the remainder is indicated in the number of balls remaining above the gate member 32, whereas the result is shown by the window 64.

For convenience, stop members like 91 are preferably stored in slots 94', extending through the wall 12 adjacent to the area occupied by the passageway 18. To indicate the number of stop members like 91 to be used in each operation, discrete stop members are provided for each operation such as one for the operation of addition, two for the operation of subtraction, one for the operation of multiplication and two for division. Instructions are also preferably printed or otherwise inscribed adjacent to the stop member provided therefor.

Additional space of the wall 12 may be utilized for the provision of a compartment indicated by the numeral 99 having a hinged cover indicated by the numeral 100 for storage of pencils, pens, or the like.

While the instant invention has been shown and described herein in what is conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom in the scope of the invention, which is therefore not to be limited to the details disclosed herein, but is to be afforded the full scope of the claims.

What is claimed as new and desired to secure by Letters Patent is:

1. A calculator comprising: a base; means defining a sinuous passageway in said base and having blind ends, said base being tiltable into a plane wherein all portions of said passageway are downwardly sloped; manually operable gate means movably mounted in said base for selectively intersecting said passageway so as to selectively open and close said passageway; a plurality of equally dimensioned rollable members residing in an upper portion of said passageway and arranged in single file therein, said rollable members being gravitationally biased towards said gate means in response to tilting of said base into said plane; and removable stop means selectively positionable in said passageway in upwardly spaced relationship to said gate means and spaceable in increments of said dimension of said rollable members for arresting movement of a selective rollable member residing in said upper portion of said passageway, whereby rollable members positioned between said gate means and said stop means are gravitationally biased to roll downwardly in said passage and toward the lowermost of said blind ends in response to actuation of said gate means to open said passageway, said calculator also including indicator means in said base and selectively operable in response to actuation of said gate means for indicating the number of actuations of said gate means.

2. A calculator comprising: a base; means defining a sinuous passageway in said base and having blind ends, said passageway being comprised of a groove in said base and a transparent panel overlying said groove so as to enclose said groove, said base being tiltable into a plane wherein all portions of said passageway are downwardly sloped; manually operable gate means movably mounted in said base for selectively intersecting said passageway so as to selectively open and close said passageway; a plurality of equally dimensioned rollable members residing in an upper portion of said passageway and arranged in single file therein, said rollable members being gravitationally biased towards said gate means in response to tilting of said base into said plane; and removable stop means selectively positionable in said passageway in upwardly spaced relationship to said gate means and spaceable in increments of said dimension of said rollable members for arresting movement of a selective rollable member residing in said upper portion of said passageway, whereby rollable members positioned between said gate means and said stop means are gravitationally biased to roll downwardly in said passage and toward the lowermost of said blind ends in response to actuation of said gate means to open said passageway, said calculator including indicia means fixed on said transparent panel and overlying the upper portion of said passageway above said gate means, said indicia means being spaced in increments of said dimension of said rollable members and prominently visible in response to occupation of rollable members thereunder for numerically indicating the number of roller members backed up above said gate means, said passageway in said indicia means being indistinguishable in color so as to make said indicia means substantially invisible in the absence of a rollable member thereunder.

3. A calculator as defined in claim 2, including a second indicia means fixed on said transparent panel and overlying the lower portion of said passageway, below said gate means, said second indicia means being spaced in increments of said dimension of said roller members, progressively from said lowermost of said blind ends of said passageway and prominently visible in response to occupation of roller members thereunder and released by

said gate means for indicating the number of roller members released by said gate means, said passageway and said second indicia means being indistinguishable in color so as to make said second indicia means substantially invisible in the absence of a rollable member thereunder.

4. A calculator comprising: a base having a relatively flat face; means defining a sinuous passageway in said face, said passageway having a pair of closed ends and a plurality of rectilinear portions in angular relationship to each other and curved portions connecting said rectilinear portions; means for supporting said base in a plane whereby all portions of said passageway are sloped downwardly from a horizontal plane; manually operable gate means movably mounted on said base for selectively intersecting said passageway midway of its length so as to selectively open and close said passageway; a plurality of spherical members of equal size residing in an upper portion of said passageway above said gate means and arranged in single file in said passageway, said spherical members being gravitationally biased towards said gate means in response to tilting of said base into said plane; and removable stop means selectively positionable in said upper portion of said passageway and in spaced relationship to said gate means, said stop means being spaceable in increments of said spherical members for arresting movement of selective spherical members residing in said upper portion of said passageway; spherical members positioned between said gate means in its closed position and said stop member being gravitationally biased to roll downwardly in said passageway and towards the lowermost of said blind ends in response to actuation of said gate means to open said passageway, said gate means including: slide means juxtaposed to said passageway for lateral movement relative to said passageway; a gate member movably mounted on said slide means and positionable for closing and opening said passageway; first spring means biasing said slide means in a direction to bias said gate member into a position closing said passageway; a first manually operable means for actuating said slide means so as to position said gate means to open said passageway; second spring means biasing said gate member independently of said first spring means and into said position for closing said passageway; and second manually operable means for selectively independently actuating said gate member so as to position said gate member to open said passageway.

5. A calculator as defined in claim 4, including indicating means operable in response to actuation of said first manually operable means for indicating the number of actuations of said gate means.

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