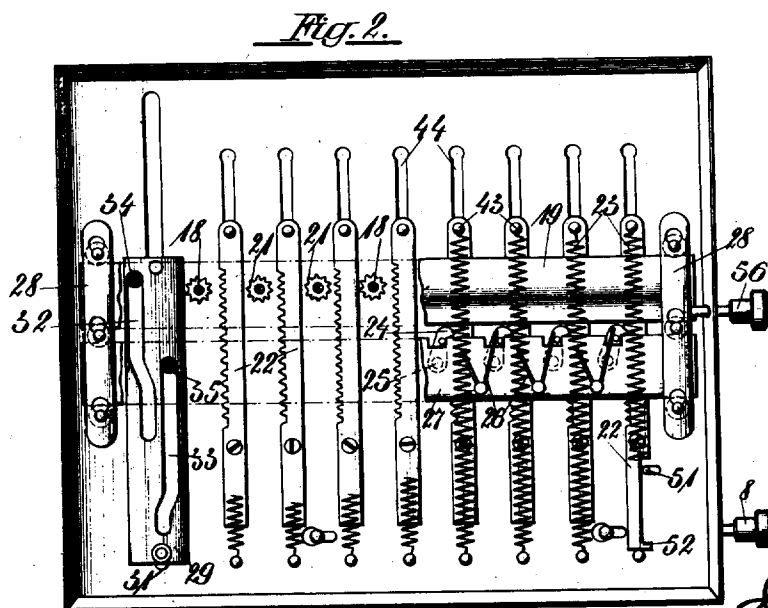
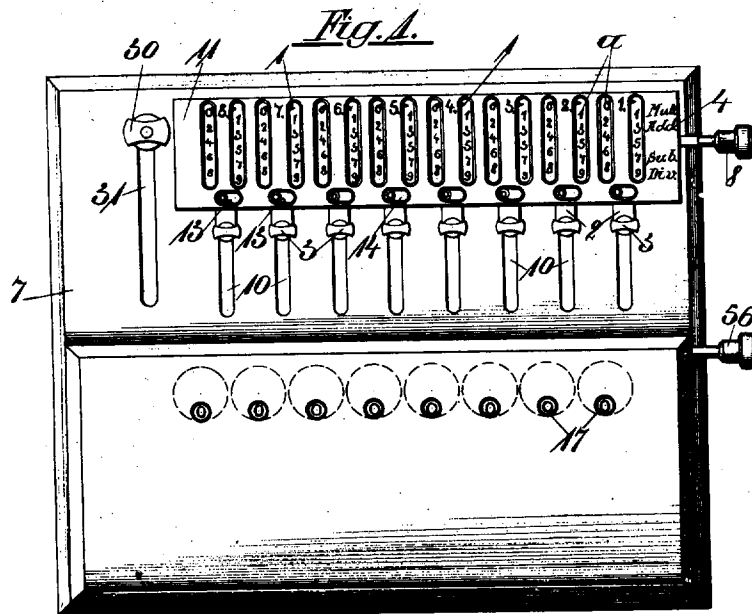


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APPLICATION FILED APR. 1, 1909.

974,006.

Patented Oct. 25, 1910.

4 SHEETS—SHEET 1.



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4 SHEETS—SHEET 2.

Fig. 3.

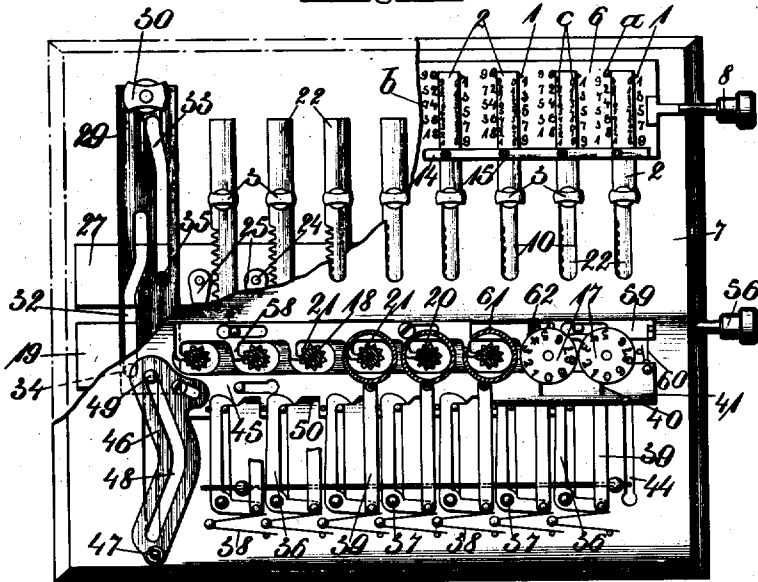


Fig. 4.

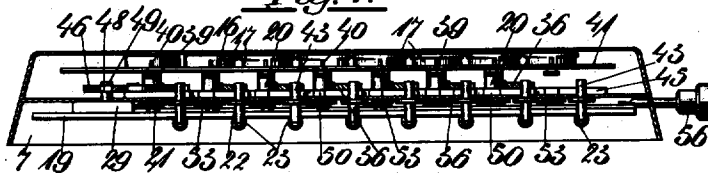
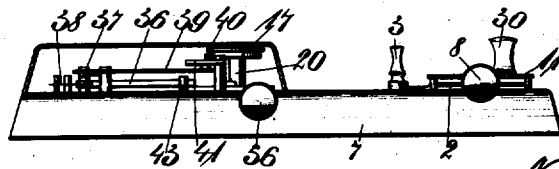


Fig. 5.



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4 SHEETS—SHEET 3.

Fig. 6.

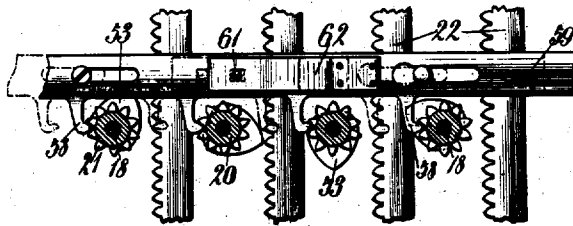


Fig. 7.

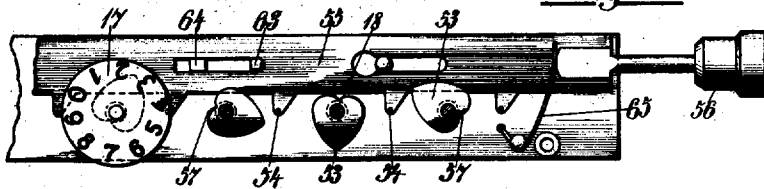


Fig. 8.

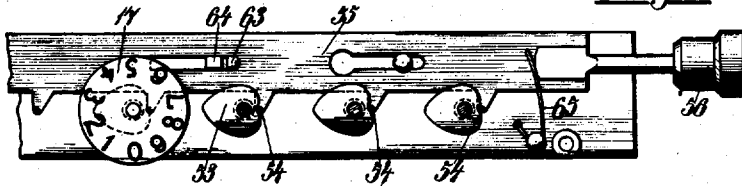
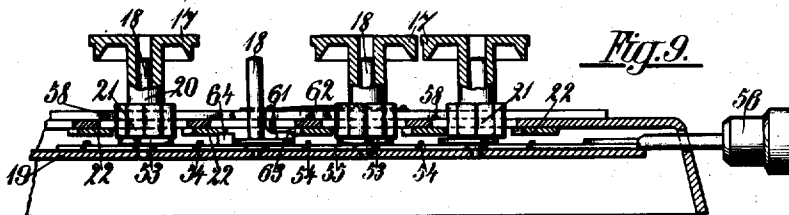


Fig. 9.



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4 SHEETS—SHEET 4.

Fig. 10.

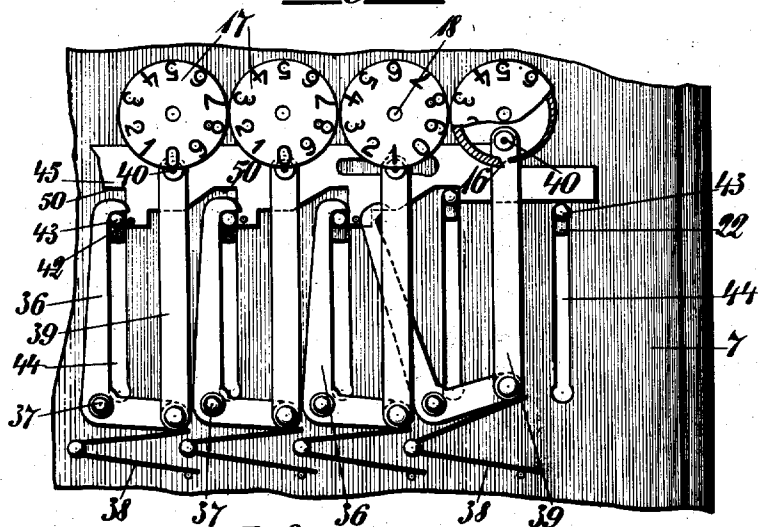


Fig. 11.

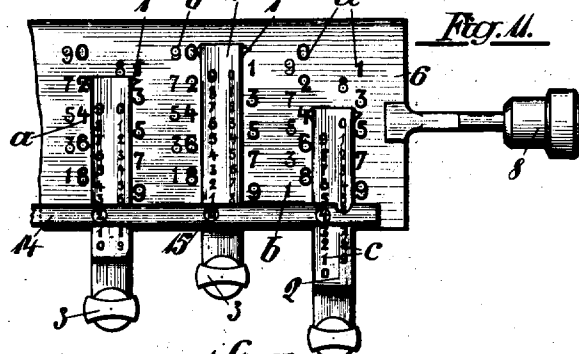
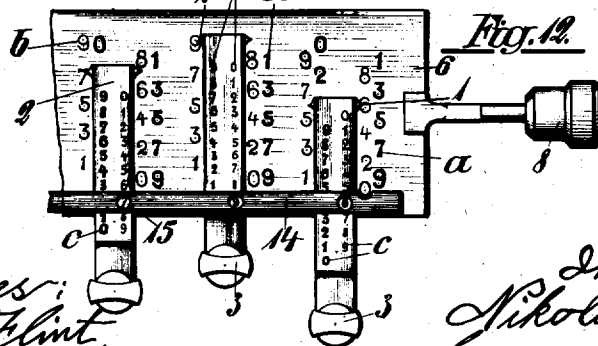


Fig. 12.



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UNITED STATES PATENT OFFICE.

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CONTROLLING APPARATUS.

974,006.

Specification of Letters Patent.

Patented Oct. 25, 1910.

Application filed April 1, 1909. Serial No. 487,323.

To all whom it may concern:

Be it known that I, NIKOLAUS WERLÉ, a citizen of the German Empire, residing at Stuttgart, in the Kingdom of Württemberg, Empire of Germany, have invented certain new and useful Improvements in Controlling Apparatus; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to calculating machines designed to perform examples of addition or subtraction, and in which the subtraction is accomplished as an addition operation so far as the mechanical processes are concerned, but in which machine certain supplemental columns of figures are provided for use when subtraction processes are to be performed.

My invention includes general structure of machines of the type above specified, and also certain minor or auxiliary features applicable to machines of the type specified and contributing to the operation of the machine as a whole.

In the drawings: Figure 1 is a view showing the machine in plan; Fig. 2 is a view of the machine as seen from a point beneath it looking up; Fig. 3 is a view showing the machine in plan, the cover for the transfer mechanism, and a part of the frame or casing being broken away, in order to better show various parts of the machine; Fig. 4 is a view showing a section upon a vertical transverse plane; Fig. 5 is a side view with the cover for the transfer mechanism in section to better show the transfer mechanism; Fig. 6 is a view showing details of certain locking mechanism upon a larger scale; Figs. 7 and 8 are views showing details of certain zero-setting mechanism upon an enlarged scale; Fig. 9 is a view showing details, upon a larger scale, of certain indicating mechanism and the operating means therefor; Fig. 10 is a view showing details of certain transfer mechanism and also portions of recording or indicating mechanism; Fig. 11 is a view, upon a large scale, showing the number plate arranged for performing addition operations, and; Fig. 12 is a similar view, the number plate being arranged for subtraction.

In the drawings, the reference numerals 2 designate a series of slides extending longitudinally of the machine, eight such slides being employed in the machine illustrated, although a greater or lesser number may be employed. These slides are movable longitudinally for the purpose of setting them to correspond with a number to be added to or subtracted from an amount indicated by certain recording or indicating mechanism forming a part of the machine, to which end they are provided each with an operating knob 3.

7 is the casing or frame of the machine within which the greater part of the elements of the machine are inclosed and by means of which all are supported, which casing is provided with slots 10 through which a prolongation of the knobs 3 extends and which slots therefore form guides for the said knobs and for one end of the slides 2. The ends of the slides remote from the knobs are provided with pointers 1, each slide having two pointers arranged one upon either side as shown particularly in Figs. 11 and 12.

The reference characters 22 designate racks, one for each slide 2, arranged within the casing 7 and connected at one end with the slides 2 by means of a downwardly projecting portion of the knobs 3, and having at their other ends pins 43 which project upward through slots 44 formed in the casing 7 and cooperate with transfer mechanism to be hereinafter described. The knob 3 and the pin 43 of each slide therefore serve as guides for each end of the slides 2 as said knob and pin move in the slots 10 and 44 formed in the casing 7, and said racks are adapted to engage and operate a series of number wheels or disks 17 which form part of the indicating mechanism for showing at all times the total or net result of a series of additions or subtractions.

The pointers of the slides 2 move over a number plate 6 upon which are placed various columns of figures used in setting the slides 2 preliminarily to adding or subtracting a preconceived number. The plate 6 is movable transverse to the machine by means of a handle 8 to bring the proper columns of figures beneath the pointers 1 according as the machine is to be used for addition or sub-

traction, and this number plate is covered by a second or cover plate 11 arranged over the slides 2 and having a plurality of slots, two for each slide, as shown in Fig. 1, through which the pointers 1 and columns of figures upon the plate 6 may be seen, but which plate conceals the columns of figures not for the present to be used.

The plate 6 has upon it, see Figs. 11 and 12, two columns of figures *a* used in addition for each slide 2, the figures being arranged alternately upon either side of the slide 2 so that the even numbers are all in one column and the odd in the other and by means of which arrangement the figures are more easily read; and two other similarly arranged columns of supplementary figures for each slide used in subtraction; the cover plate 11, however, concealing the columns not to be used so that the columns visible through the slots thereof will be either all addition or all subtraction columns as will be understood from Fig. 1 wherein the columns visible are for use in addition.

Referring further to Figs. 11 and 12, one addition column *a* contains the even numbers 0—2—4—6 and 8 while the other contains the odd numbers 1—3—5—7 and 9, these two columns being so spaced that they will be upon opposite sides of the slide 2, so that one of the pointers 1 of a slide will move over even numbers while the other moves over odd numbers, it being understood that the arrangement above specified is repeated for each slide. Fig. 7 shows the number plate 6 set for addition, while Fig. 12 shows the plate set for subtraction in which process columns *b* of supplemental figures are utilized, these having odd numbers arranged upon one side of the slide and even numbers upon the other, the same as in the case of the addition columns.

Referring to the above figures it will be seen that the slides 2 occupy the same position in both and that the pointers in Fig. 11 indicate the number 204 while in Fig. 12 they indicate 796 the sum of which is 1,000, a 1 followed by naughts or ciphers. This arrangement is followed throughout all the columns upon the plate 6, and the sum of the addition and subtraction readings with a given position of slides will always be all naughts except the left hand figure which will be 1. This requirement will be seen to result in that the sum of an addition and a subtraction number which the pointer on the right hand or units slide 2 may point to, for example 4 and 6, will always be 10; while for all the other slides the sum of an addition and a subtraction number which a pointer may point to, for example 7 and 2 or 9 and 0, will always be 9. Like numbers in the additions columns, that is all naughts, all 1's etc., are arranged in the same line longitudinally of the plate 6, or across the

machine, and the same is true of like numbers in all the subtraction columns except those for the right hand or units slide, the subtraction numbers of which are depressed one space. This follows from the consideration that while in all columns except the units columns the sum of the numbers which a pointer may indicate is 9, in the units columns it is 10; so that one of the columns must be shifted one space to secure an arrangement of figures the sum of which will be 10, and the subtraction columns are displaced as being of the least inconvenience to the user. This brings the naught of the subtraction columns one space below the lowest transverse line of addition figures and below the bottoms of all the other columns as shown.

The slides 2 have columns of figures *c* as shown in Figs. 11 and 12, the column upon the left being an addition and that on the right a subtraction column, and 14 is a bar carried by the plate 6 and having a hole 15 for each slide 2 which hole comes over an addition or a subtraction column *c* according to the position of the slide 6, so that a figure of one or another of the columns may be seen through it; and the cover plate 11 has slots 13 long enough to permit the holes 15 to be seen when over either an addition or a subtraction column *c*.

Referring now to Fig. 11 the slides 2 are set to indicate the number 204 which is to be added to whatever amount may have been previously accumulated in the total indicating mechanism as hereinafter explained, and this same number may be read through the slots 13 and holes 15 which elements are provided for the purpose of checking the setting operation performed upon the slides 2.

Fig. 12 shows the slides 2 set to indicate the number 796 both in the columns *b* and holes 15, which number is to be taken from whatever may be indicated by the indicating mechanism, it being understood that in the complete machine all figures upon the plate 6 except the columns *a* or *b* and the columns upon the slides except the figures in line with the holes 15, will be concealed by the cover plate 11.

27 is a bar beneath the horizontal portion of the casing 7 and best shown in Fig. 2, which extends transverse to the machine and is movable across the machine, and to which spring-pressed pawls 24 corresponding in number with the slides 2 and racks 22 are pivoted as at 25, which pawls permit the racks to move freely in setting the slides but engage and prevent a return movement thereof, thereby temporarily holding the racks in whatever position they may be moved into by the knobs 3 in setting the slides.

26 are springs carried by the bar 27 and

serving to press the pawls toward the racks, and 23 are springs, one for each slide 2, located beneath the racks and the purpose of which is to return the racks and slides to their original position when the pawls 24 are moved so as to disengage and release the racks as will hereinafter appear. One end of each of these springs is connected with the pin 43 above referred to, and the other end is connected to the frame or casing of the machine as shown.

The total indicating mechanism includes a bar 19 within the casing 7 and movable across the machine, and carrying a series of upright pins 18 corresponding in number with the slides 2 and upon each of which pins a number wheel 17 is supported, which wheels are provided with hubs 20, and with pinions 21 at their lower ends, see Fig. 9, which pinions when the bar 19 is moved to the right will be brought into engagement with the racks 22, and when said bar is moved to the left will be disengaged from the racks. The number wheels 17 have figures 0 to 9 and the pinions 21 have each ten teeth, the same in number as the number of figures upon the number wheels. These number wheels are rotated in a counter clockwise direction by means of the racks 22 as they move forward or away from the operator, the pinions 21 having been brought into engagement with the racks as aforesaid. One figure only of each number wheel is visible through a series of holes formed in the casing 7 as shown in Fig. 1, and the figures thus appearing represent the total net result of the preceding operations of the machine.

28 are guides for the bars 19 and 27, a guide being placed upon either side of the machine so that each end of the bars referred to is supported.

The bars 19 and 27 are operated to move the pinions 21 into engagement with the racks 22 and to disengage the pawls 24 from the racks, for which purpose each pawl has a pin projecting into a recess formed in the bar 27 as shown in Fig. 2 and within which recesses the pins have a limited movement, by means of an operating member in the form of a reciprocating slide 29 located beneath the horizontal portion of the casing 7 and movable longitudinally of the machine, which operating member is provided with a cam slot 32 with which a pin 34 carried by the bar 19 engages, and with a second cam slot 33 with which a pin 35 carried by the bar 27 engages, the said cam slots having offset portions as shown in Fig. 3, by means of which construction and arrangement transverse movements will be communicated to the bars 19 and 27 as the operating slide is reciprocated, as will be understood. The slide 29 is operated by a knob or handle 30 movable in a slot 31

formed in the casing 7 as shown in Fig. 1 and which slot forms a guide for one end of the slide 29, the other end thereof being guided by a pin 49 movable in a second slot formed also in the casing 7.

The relative arrangement of the parts above referred to is such that as the operating slide 29 is moved downward from the position shown in Figs. 1 and 3, which will commonly be toward the operator, the bar 19 is first moved to the right as the offset portion of the cam slot 32 engages the pin 34 to thereby move the pinions 21 into engagement with the racks 22, after which the bar 27 is moved to the left as the offset portion of the cam slot 33 engages the pin 35 to thereby move the pawls 24 out of engagement with the racks 22. The racks are now in engagement with the pinions 21 and, the pawls 24 having been disengaged from them, the racks are free to return to their original positions under the influence of the springs 23, during which movement rotary motion will be communicated to the several number wheels 17 and they will, at the end of such return movement, register or indicate a number corresponding with the number for which the slides were set, assuming the wheels to have been in their initial or zero positions. The operating slide 29 is then moved upward or away from the operator, the effect of which will obviously be the reverse of the operations upon the bars above explained, that is the bar 27 will be first moved so as to bring the pawls 24 into engagement with the racks 22, after which the pinions 21 will be moved away from and out of engagement with the racks 22 so that the slides 2 and racks may be set to correspond with a number to be next added to or subtracted from the amount or remainder indicated by the several number wheels as seen through the holes in the casing.

The operation thus far explained does not contemplate transfer mechanism for advancing any given number wheel 17 one place as the number wheel next to the right of it completes a rotation.

The construction and operation of the transfer mechanism forming a part of the machine is as follows: The pins 43 whereby the slides 2 and the racks 22 are connected together extend upward through the slots 44 as aforesaid which slots form guides for the pins. The reference characters 36 indicate a series of right-angled or elbow levers, one for each slide 2 and rack 22, pivoted at 37 to the casing 7 and the longer arm of which is provided with a hook lying normally in the path of movement of the pins 43 and which hooks form a stop for the pins, and consequently for the racks 22 and slides 2, when the slides have returned to their original positions and the pointers which they carry again indicate naught (0).

When a transfer is to be effected from any number wheel to the wheel of the next higher order, being the wheel next toward the left, the slide and rack which operate the number wheel of the next higher order referred to go back or return one space beyond their original position in which the pointer indicates (0), or one space beyond the position in which they will normally be arrested by the hooked end of the lever 36, thereby turning the number wheel of the rack and slide in question one space or number farther than it would be turned by its rack were not such further movement permitted, whereby the number wheel in question is caused to indicate a number greater by one (1) than the number it would indicate because of the position into which its slide was adjusted or set. The shorter arms of the levers 36 are pivotally connected each with a rod 39, and the upper ends of the said rods are provided with pins 40 which bear against the periphery of the number wheels 17. 41 is a guide plate having slots wherein the pins 40 are guided, and 38 are springs, one for each lever, in engagement with the short arms of the levers and which press the pins 40 against the peripheries of the number wheels as shown in Fig. 10. The periphery of each number wheel has a slot 16 at the portion thereof occupied by the figure naught (0) through which the pins 40 will pass when the slot is opposite the pin, and the wheels 17 are beveled interiorly as shown in Fig. 9 so that the pins may slide over the edge of the wheels when such pins as have passed through slots 16 are withdrawn from the interior of the wheels as will appear hereinafter. From the above it will be seen that when any pin 40 passes through a slot 16 the hook at the end of the long arm of the lever 36 will be swung to the left, thereby releasing the pin 43 and rack and slide 2 which operate the number wheel which is next to the left and consequently of the next higher order, thus permitting the rack and slide to move back one space beyond their initial position as above explained.

The transfer mechanism above disclosed is controlled by the operating slide 29 as follows: 45 is a reciprocating bar extending across the machine as shown in Figs. 3 and 10 and provided with suitable guides, and 46 is a link pivoted to the casing 7 at 47 and the free end of which is connected with the hand end of the bar 45 and which link is provided with a curved cam slot 48 in which a pin 49 carried by the operating slide 29 travels as the slide is operated. The arrangement of the parts, as shown in Fig. 3, is such that during the first part of the movement of the slide toward the operator the bar 45 will be moved to the left by the action of the pin 49 in the slot 48 while during the latter part

of the movement of said operating slide the bar will remain at rest or will have very little movement. The bar 45 has a plurality of pins 42, one for each lever 36, which pins, when the bar is in its right hand position as shown in Fig. 3, engage the ends of the longer arms of the levers 36 as shown. As the bar 45 is moved to the left as aforesaid the pins 42 are moved away from the levers 36, thereby permitting the springs 38 to force the pins 40 toward the peripheries of the several number wheels 17, whereupon the pins 40 will enter the interiors of such of the number wheels as may be in position such that the slot 16 thereof is in line with the pins 40, while the pins 40 will rest against the peripheries of the other number wheels. This will place the transfer mechanism in condition such that the required tens transfers will be effected as above explained when the several racks and slides are released as explained at the end of the movement of the operating slide 29, it being remembered that the bar 45 is operated to set the transfer mechanism during the first part of the movement of the slide 29 and before the racks and slides are released. As the slide 29 is moved away from the operator and during the last part of its movement the bar 45 will be moved to the right, the effect of which is to swing such of the levers 36 as may have been operated because of their pins 40 passing through the slots 16, back into their original positions thereby withdrawing the pins 40 from the interior of the number wheels 17. The bar 45 also forms a stop for limiting the excess backward or return movement of the several racks and slides above referred to and for returning the slides to a zero position, to which end the bar is provided with recesses 50 corresponding in number with the slides, which recesses have inclined walls. As the slides return beyond their naught or zero position the bottoms of the recesses 50 are engaged by the pins 43 to limit the return movement to one space beyond the naught or zero positions, and, as the bar moves to the right the inclined walls of the recesses engage the pins 43 and move the racks and slides one space, so that the pointers will all point to naught (0) thus placing them in condition such that they may be adjusted or set to correspond with a new number to be added or subtracted.

As explained above, the right hand or units slide and rack must be capable of movement one space below the lower ends of the several columns of figures upon the number plate 6 when the machine is used for subtraction, but not when used for addition, to which end a pin 51, Fig. 2, is provided upon the under side of the plate 6 which depends through a slot in the casing 7 and comes adjacent the rack 22 of the

units slide. The units slide has a stop 52 at its end which stop contacts with the pin 51, when the machine is set for addition and the units slide is drawn downward or toward the operator, when the pointer 1 reaches the bottom of a column upon the number plate and points to the addition number 9. When, however, the machine is to be used for subtraction the movement of the number plate 6 will carry the pin 51 out of line with the stop 52, and the slide may then be moved farther to bring the pointer 1 one space below the lower ends of the columns of addition figures.

Means are provided for preventing rotary movement of the several number wheels 17 when they are not in engagement with the racks 22 as follows: 59 is a bar extending transverse to the machine and located adjacent the pinions 21 and having lock hooks 58 adapted to engage the pinions as shown in Figs. 3 and 6. The bar 59 is prevented from moving to the right farther than the position in which it is shown in these figures; from which it is obvious that the pinions and number wheels are locked and prevented from rotating when the parts are in the positions shown, but that the pinions, upon being moved to the right as aforesaid, will be moved away from the lock hooks and brought into contact with the racks 21. After having been turned by the racks the pinions are returned to the left and brought into engagement with the lock hooks as will be understood. The bar, 59, is, however, capable of movement to the left, a spring 60 being provided for opposing such movement. This movement of the bar 59 to the left from the position shown in Figs. 3 and 6 is for the purpose of releasing the pinions 21 to allow them to be returned to their zero positions by means of zero-setting mechanism as follows: Secured to the lower ends of the several pinions 21, see Figs. 7 to 9, are heart-shaped cams 53, and 54 are a series of pins adapted to engage the cams and which pins are carried by a bar 55 movable transverse to the machine and operable by a handle or knob 56, a spring 65 being provided for returning the bar to its right hand position and keeping it there when not pressed to the left by the operator. The bar 55 is provided with a lug 63 which is adapted to engage lug 61 attached to the locking bar 59. This lug 61 is carried at the free end of a flat spring 62 secured to the bar 59, and said lug is beveled and adapted to engage a stationary lug 64, whereby the lug 61 will be lifted, as will be understood from Fig. 9.

Such being the construction of the zero-setting mechanism, it will be understood that as the bar 55 is moved to the left the bar 59 and lock hooks 58 will also be moved because of the engagement of the lugs 63

and 61 thus moving the lock hooks 58 out of engagement with the pinions 21. The pins 54 will presently engage the heart-shaped cams 53 and will rotate them until the cams assume the positions shown in Fig. 8 at which time the number wheels will have been all returned to their zero-positions. At this time the lug 61 comes into engagement with the fixed lug 64, whereupon the lug 61 is lifted and the locking bar 59 freed from the bar 55, and moved to the right by the spring 60 and the lock hooks 58 again brought into engagement with the pinions 21 to lock the number wheels in their zero positions.

The operations of the various separate mechanisms of my device have been hereinbefore explained. The operation of the machine as a whole in performing operations of addition or subtraction will be understood from the following: Assume that 734 and 648 are to be added. The slides 2 and racks 22 are moved toward the operator or downward, the pointer 1 on the units slide being moved to 4, that of the tens slide to 3 and of the hundreds slide to 7, the pointers of all the other slides pointing to 0. The number 734 is thus set. The operating slide 29 is now moved downward or toward the operator whereupon the pinions 21 are moved into contact with the racks 22 and the racks released so that they may rotate the number wheels 17. The slide is then returned to its original position, whereupon the number wheels will indicate the number 00000734 and the several wheels will be locked in position by the lock hooks 58. The several slides are next set to indicate the number 648, and the operating slide 29 again operated, whereupon the number 648 will be added to the number already indicated by the number wheels, the total result being 00001382. The mechanical operations are precisely the same if subtraction is to be performed. Assuming the registering wheels to indicate 00001382 and it is required to subtract 648 therefrom. The number plate 6 is moved to the right so as to bring the subtraction or supplementary columns *b* into sight, and the pointers set to 648 upon the subtraction scale, attention being called to the fact that all the pointers not in use must be set to indicate naught (0) upon the subtraction scale. The pointers when set to indicate 648 upon the subtraction columns will, if for experiment and in order to better understand the operation of the machine the number plate is moved into its addition position, indicate 99999352, the pointers and racks not having been moved. When, therefore, the slides set to subtract the number 648 as explained, are released and permitted to return to their initial position, an addition process will in reality be performed by the mechanical elements of

the machine, which process may be expressed

$$00001382 + 99999352 = 100000734.$$

The left hand 1 will, however, not appear
5 as it is in the ninth place, and the number
wheels will record as the result of the operation,
00000734, which is the result of the subtraction
to be performed, for,

$$1382 - 648 = 734.$$

10 Multiplication may obviously be accomplished as a series of addition operations,
and division as a series of subtractions, although
my machine is more especially designed for addition
and subtraction operations.

Having thus described my invention and explained the operation thereof, I claim and desire to secure by Letters Patent:

- 20 1. In a calculating machine, a series of reciprocating racks arranged parallel with one another; means for temporarily retaining said racks in the positions into which they may be moved; means for automatically
25 returning said racks to their initial positions; a graduated scale; a pointer connected with each of said racks and movable adjacent said scale; a reciprocating bar arranged transverse to said racks; a series of
30 number wheels, one for each rack, carried by said bar and each of which has a pinion, said pinions being normally out of engagement with said racks but adapted to be brought into engagement therewith by a
35 movement of said bar; means for moving said bar to move said pinions into engagement with said racks; and means acting upon the temporary retaining means aforesaid for releasing said racks.
- 40 2. In a calculating machine, a series of reciprocating racks arranged parallel with one another; a spring for each of said racks, the tendency of which is to return the rack to its initial position after it has been
45 moved therefrom; a graduated scale; a pointer connected with each of said racks and movable adjacent said scale; a reciprocating bar arranged transverse to said racks; a series of number wheels, one for
50 each rack, carried by said bar and each of which has a pinion, said pinions being normally out of engagement with said racks but adapted to be brought into engagement therewith by a movement of said bar; a
55 second reciprocating bar arranged transverse to said racks; a series of pawls, one for each rack, carried by said second bar and said pawls being normally in engagement with said racks but adapted to be disengaged therefrom by a movement of said second bar; means for moving said first mentioned bar to move said pinions into engagement with said racks; and means for
60 moving said second bar to move said pawls out of engagement with said racks.

3. In a calculating machine, a series of reciprocating racks arranged parallel with one another; a spring for each of said racks, the tendency of which is to return the rack to its initial position after it has been moved
70 therefrom; a graduated scale; a pointer connected with each of said racks and movable adjacent said scale; a reciprocating bar arranged transverse to said racks; a series of number wheels, one for each rack, carried
75 by said bar and each of which has a pinion, said pinions being normally out of engagement with said racks but adapted to be brought into engagement therewith by a movement of said bar; a second reciprocating
80 bar arranged transverse to said racks; a series of pawls, one for each rack, carried by said second bar and said pawls being normally in engagement with said racks but adapted to be disengaged therefrom by a
85 movement of said second bar; a reciprocating operating slide having two cam slots; a pin carried by said first mentioned bar and adapted to engage one of the cam slots of said operating slide; and a pin carried by
90 said second bar and adapted to engage the other cam slot of said operating slide.

4. In a calculating machine, a plurality of adjustable slides, each of which is provided
95 with two pointers arranged one upon either side thereof; and a number plate having two columns of figures for each of said slides the same being arranged one upon either side of each slide and over which the pointers of
100 said slide move, one of said columns being made up of even and the other of odd numbers.

5. In a calculating machine, a plurality of adjustable slides, each of which is provided
105 with two pointers arranged one upon either side thereof; a movable number plate having four columns of figures for each of said slides, two being for use in addition and two in subtraction operations, the columns being
110 so arranged that the addition or the subtraction columns will be one upon either side of each slide and over which two columns the pointers of said slide move, and each individual column being made up of even or
115 of odd numbers; and means for moving said number plate so as to bring all the addition or all the subtraction columns beneath said pointers.

6. In a calculating machine, a plurality of adjustable slides, each of which is provided
120 with two pointers arranged one upon either side thereof; a number plate movable transverse to said pointers and having four columns of figures for each of said slides, two
125 being for use in addition and two in subtraction operations, the columns being so arranged that the addition or the subtraction columns will be one upon either side of each slide and over which two columns the pointers of said slide move, and each individual
130

column being made up of even or of odd numbers; means for moving said number plate so as to bring all the addition or all the subtraction columns beneath said pointers; and a stationary cover plate having slots through which the pointers and the columns of figures beneath them are visible, but which conceals the columns not in use.

7. In a calculating machine, a series of racks arranged parallel with one another and movable from a given initial position in one direction into various positions to indicate a number to be added, and movable in a reverse direction into positions beyond their initial positions, each of said racks having a stop; a series of number wheels, one for each rack, each of which has a pinion engaged by one of said racks and through which said number wheels are rotated, and each number wheel having a slot formed in its periphery; a series of oscillating levers, one for each rack, one arm of each of which levers has a hook adapted to engage the stop aforesaid of a rack to arrest the reverse movement thereof, and the other arm of which is connected with a rod, the free end of which rod has a pin adapted to bear against the periphery of the number wheel of the next lower order than the number wheel operated by the rack the movement of which a particular lever arrests, or to enter the slot of said number wheel; a spring acting upon each lever to swing the hooked end of such levers as are released by their rod entering the slot of a number wheel as aforesaid away from the stop which it normally engages to thereby release its rack; and means for returning such racks as may have moved beyond their initial positions as aforesaid, and such levers as may have been swung as aforesaid, back to their initial positions.

8. In a calculating machine, a series of racks arranged parallel with one another and movable from a given initial position in one direction into various positions to indicate a number to be added, and movable in a reverse direction into positions beyond their initial positions, each of said racks having a stop; a spring for each rack, the tendency of which is to move the rack in a reverse direction as aforesaid; a reciprocating bar arranged transverse to said racks; a series of number wheels, one for each rack, carried by said bar and each of which has a pinion, said pinions being normally out of engagement with said racks but adapted to be brought into engagement therewith by a movement of said bar, and each of which number wheels has a slot formed in its periphery; a second reciprocating bar arranged transverse to said racks; a series of pawls, one for each rack, carried by said second bar and said pawls being normally in engagement with said racks but adapted

to be disengaged therefrom by a movement of said second bar; a series of oscillating levers, one for each rack, one arm of each of which levers has a hook adapted to engage the stop aforesaid of a rack to arrest the reverse movement thereof, and the other arm of which is connected with a rod, the free end of which rod has a pin adapted to bear against the periphery of the number wheel of the next lower order than the number wheel operated by the rack the movement of which a particular lever arrests, or to enter the slot of said number wheel; a spring acting upon each lever to swing the hooked end of such levers as are released by the pin of their rod entering the slot of a number wheel as aforesaid away from the stop which it normally engages to thereby release its rack; means for moving said first mentioned bar to move said pinions into engagement with said racks; means for moving said second bar to move said pawls out of engagement with said racks; and means for returning such racks as may have been moved beyond their initial positions as aforesaid, and such levers as may have been swung as aforesaid, back to their initial positions.

9. In a calculating machine, a series of racks arranged parallel with one another and movable from a given initial position in one direction into various positions to indicate a number to be added, and movable in a reverse direction into positions beyond their initial positions, each of said racks having a stop; a spring for each rack; the tendency of which is to move the rack in a reverse direction as aforesaid; a reciprocating bar arranged transverse to said racks; a series of number wheels, one for each rack, carried by said bar and each of which has a pinion, said pinions being normally out of engagement with said racks but adapted to be brought into engagement therewith by a movement of said bar, and each of which number wheels has a slot formed in its periphery; a second reciprocating bar arranged transverse to said racks; a series of pawls, one for each rack, carried by said second bar and said pawls being normally in engagement with said racks but adapted to be disengaged therefrom by a movement of said second bar; a series of oscillating levers, one for each rack, one arm of each of which levers has a hook adapted to engage the stop aforesaid of a rack to arrest the reverse movement thereof, and the other arm of which is connected with a rod, the free end of which rod has a pin adapted to bear against the periphery of the number wheel of the next lower order than the number wheel operated by the rack the movement of which a particular lever arrests, or to enter the slot of said number wheel; a spring acting upon each lever to swing the

hooked end of such levers as are released by the pin of their rod entering the slot of a number wheel as aforesaid away from the stop which it normally engages to thereby release its rack; a reciprocating operating slide having a projecting pin and having also two cam slots; a pin carried by said first mentioned bar and adapted to engage one of the cam slots of said operating slide; a pin carried by said second bar and adapted to engage the other cam slot of said operating slide; a reciprocating bar having a series of inclined portions adapted to engage the stops of such racks as may have moved beyond their initial positions as aforesaid to thereby move them back to their initial positions, and having also a series of pins adapted to engage by the hooked ends of such levers as may have been swung as aforesaid to thereby move them back to their initial positions; and a pivoted link connected with said last mentioned bar and having a cam slot in which the pin of said operating slide moves.

10. In a calculating machine, a series of reciprocating racks; a reciprocating bar arranged transverse to said racks; a series of number wheels, one for each rack, carried by said bar and each of which has a pinion, said pinions being normally out of engagement with said racks but adapted to be brought into engagement therewith by a movement of said bar; and a lock bar arranged transverse to said racks and having

a series of lock hooks, one for each pinion, into engagement with which lock hooks said pinions are brought as said pinions are moved away from said racks.

11. In a calculating machine, a series of reciprocating racks; a reciprocating bar arranged transverse to said racks; a series of number wheels, one for each rack, carried by said bar and each of which has a pinion, said pinions being normally out of engagement with said racks but adapted to be brought into engagement therewith by a movement of said bar; a lock bar arranged transverse to said racks and having a series of lock hooks, one for each pinion, into engagement with which lock hooks said pinions are brought as said pinions are moved away from said racks; a heart-shaped cam connected with each of said number wheels; a reciprocating setting bar arranged transverse to said racks and having a pin adapted to engage each cam; a lug carried by said setting bar and adapted to engage a second lug upon the free end of a spring carried by said lock bar; and a lug with which the lug upon said spring contacts at the end of movement of said setting bar.

In testimony whereof I affix my signature, in presence of two witnesses.

NIKOLAUS WERLE.

Witnesses:

JEAN GULDEN,
HERMANN HUPPE.