W. P. QUENTELL.

CALCULATING MACHINE.

APPLICATION FILED NOV. 26, 1918.

1,293,544.

Patented Feb. 4, 1919.

2 SHEETS—SHEET 1.

Fig. 1.

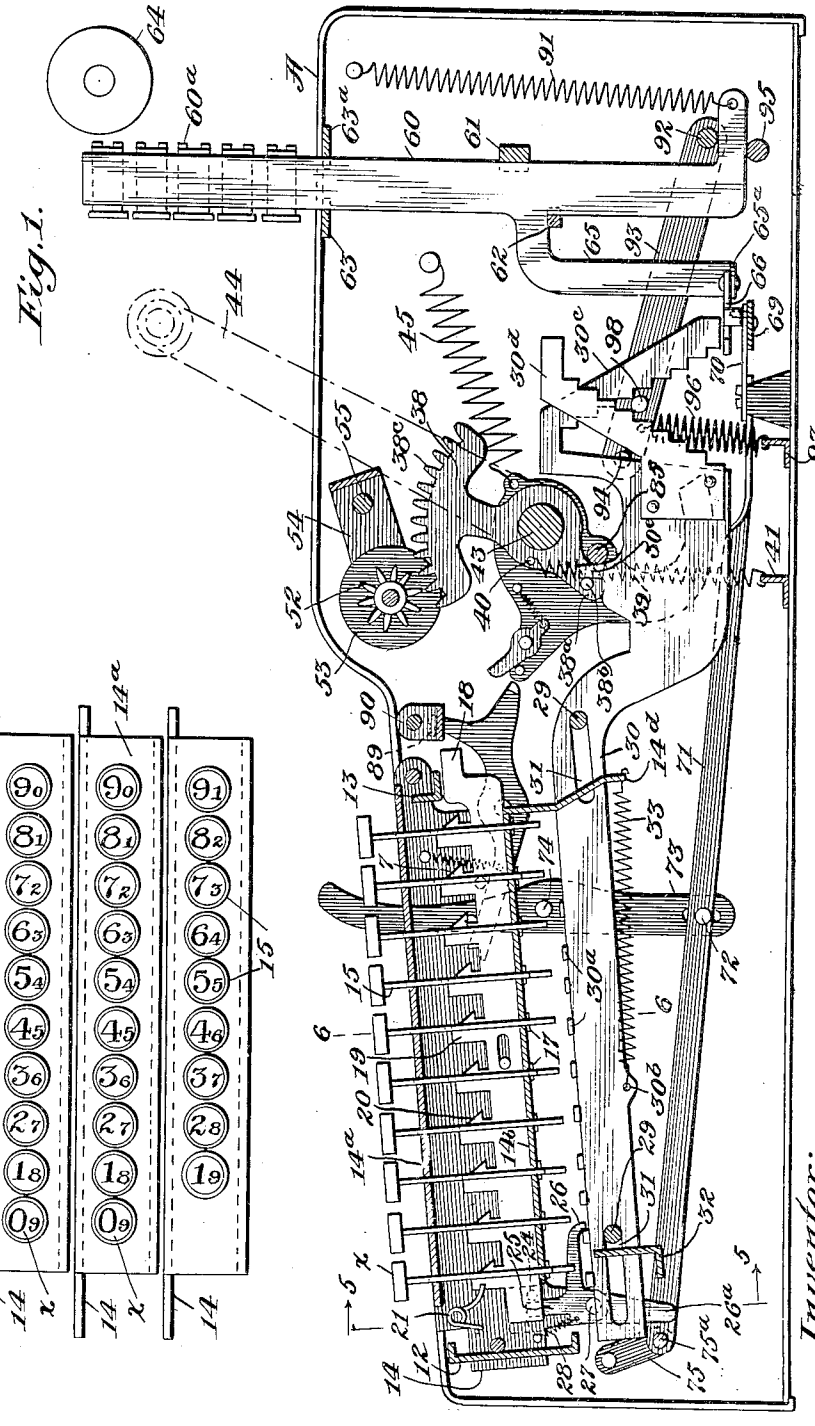


Fig. 4.

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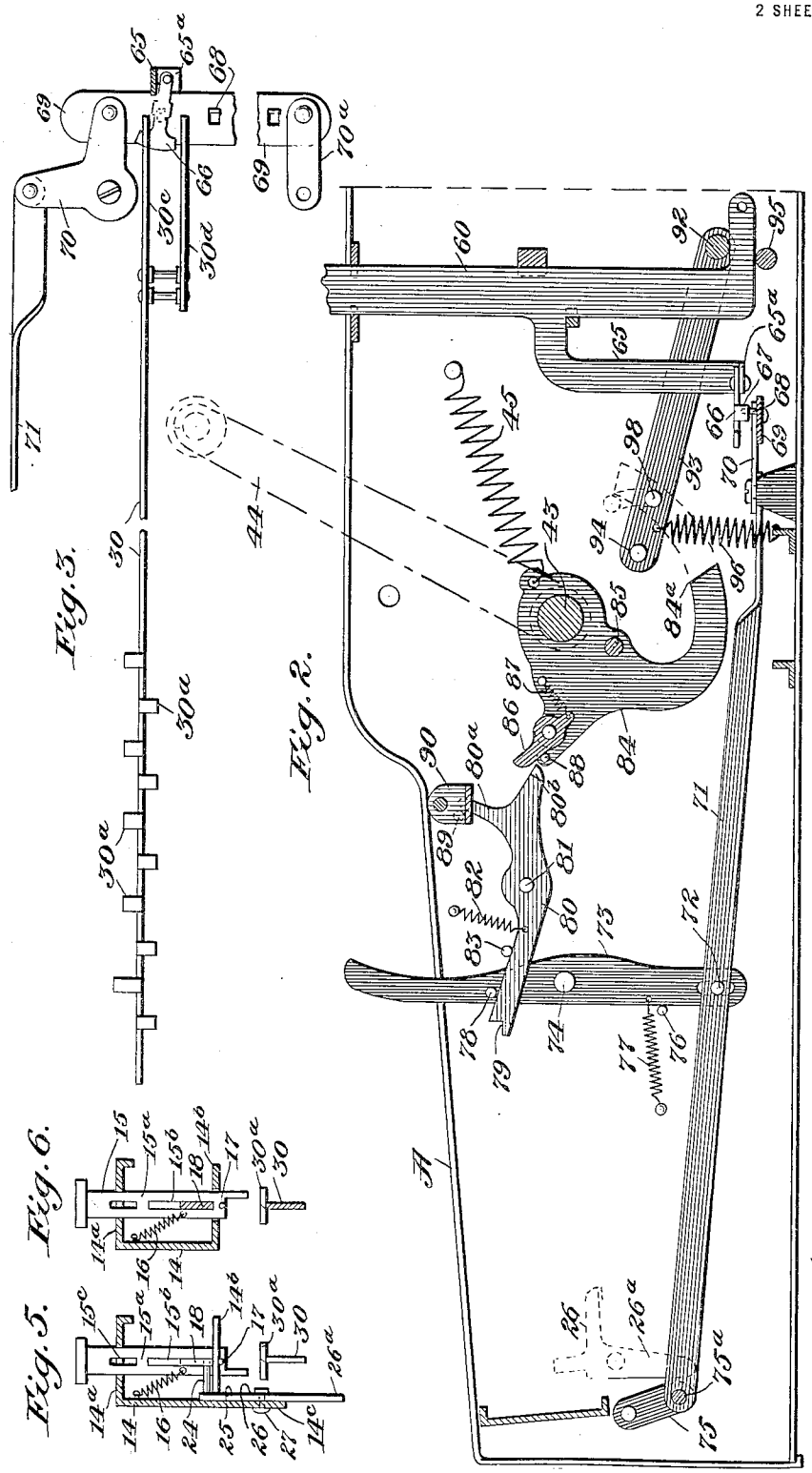


Fig. 2.

Fig. 3.

Fig. 5.

Fig. 6.

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CALCULATING-MACHINE.

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To all whom it may concern:

Be it known that I, WILLIAM P. QUENTELL, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented or discovered certain new and useful Improvements in Calculating-Machines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to calculating machines and more particularly to that class of such machines in which either adding or subtracting may be done, and in which the subtracting is effected by complemental adding. In the present machine the value indicated by an operated key may be added and printed, or the value indicated by an operated key may be added and the complemental figure on the key printed. The invention has for its object to provide a simple mechanism whereby the results just stated may be effected.

In subtracting by complemental adding it is necessary to use the complements of 10 in the unit column and the complements of 9 in all the higher columns and to carry the decimal out to the left of the subtrahend by adding 9 in every column to the left of the subtrahend item. When the numeral 9 is part of the subtrahend item, as, for instance, in 798, it is not added, because the complements of 9 are used in the columns higher than the unit column; but if the numeral 9 should be in the unit column of the subtrahend as in 789, for instance, 1 is added to the unit column. Example: Let 88888 on the total wheels of a five column capacity adding machine be the minuend and 899 be the subtrahend, the figures 101 and a 9 in each column to the left, *i. e.* 99,101, would be added; the total wheels would then read 87989 which is the correct answer. The operation above described refers only to the accumulating mechanism, and I will now describe my method of positioning the type to print the figures of the subtrahend. Two sets of stops are employed for controlling the positions of the type carrier; one being for positioning the type carrier to print the value of the key operated and the other to position the type carrier to print the complemental value of the key operated. In each case the actual value of the operated key is added. A shift lever is used to set the parts that effect the complemental printing. The same shift lever also sets the mechanism necessary for adding the 9's in those columns where no key is depressed and 10 in the unit column when no key is depressed in that column. For the sake of convenience I employ keys having two figures, one representing the adding value of the key and which is preferably of large size, and the other the complement of that figure and preferably small in size. In the units column the figures are arranged with the complements of 10, and in the other columns with the complements of 9. In the latter columns 10 keys are used, the 10th key being for controlling the type carrier to position 9 when 9 appears in the subtrahend, as in 798, for instance. This key bears a large 0 and small 9 and when it is operated it prevents adding, but the corresponding type carrier is permitted to rise its full travel when the shift lever is in operative position and the machine is operated and thus position the 9 type to print.

In the accompanying drawings Figures 1 and 2 are vertical sections showing certain parts of an adding machine embodying the present invention, a portion of the mechanism shown in Fig. 1 being omitted from Fig. 2 for clearness of illustration. Fig. 3 is a detail plan view of the control bar and certain coöperating parts. Fig. 4 is a plan view of the unit series of keys and two of the higher sets of keys. Fig. 5 is a detail sectional view on line 5—5, Fig. 1, and Fig. 6 is a sectional view on line 6—6, Fig. 1.

Referring to the drawings, A denotes the left side frame part of the machine, it being understood that all the mechanism of the machine is within the two side frames, and that the machine will include at its right hand side a frame part corresponding to that denoted by A.

Extending transversely of the machine, near the front end of the side frame parts thereof, is a slotted bar 12 and further to the rear is a second transverse bar 13 pref-

erably L-shaped in cross-section, and the upper flange of which is slotted, these bars, in connection with other suitable parts, connecting the two side frame parts of the machine.

Mounted in the tranverse bars 12 and 13 is a key supporting bar 14 formed in cross section as shown in Figs. 5 and 6, and having upper and lower slotted horizontal members 14^a and 14^b in which the slotted keys 15 are adapted to slide vertically, each key being retained in raised position by a spring 16 attached to the bar 14 and to the body of the key. The upward movements of the keys 15 under the influence of the springs 16 are arrested by stop pins 17 on said keys.

Resting on the horizontal part 14^b of the bar 14 is a sliding latch bar 18 provided with a series of latches 19 having inclined faces 20 against which impinge cross parts 15^a of the keys 15, so that when one of said keys is depressed said latch bar will be forced forward against the stress of a spring 21, until said cross part 15^a has passed by the incline 20 on a latch 19, the said latch bar 18 will be urged rearward by said spring 21, so that the hooked portion of said latch 19, normally extending through the slot 15^b in the body 15 of the key, will enter a slot 15^c in the body of the said key and, by engaging the lower wall of said slot 15^c will retain said key in its depressed position until released. The latch bar 18 carries a pin 24 which is in contact with the tail 25 of a retaining pawl 26 pivoted on a rivet 27 mounted in the hanger 14^c which is preferably formed as part of the bar 14. The pawl 26 is retained in its operative position by a spring 28 connecting said pawl 26 with the said bar 14.

Mounted on rods 29 extending transversely of the machine is a sliding control bar 30 provided with slots 31 which permit endwise movements of said bar 30 and which bar is steadied and guided laterally by a slotted L-shaped bar 32 near the front of the machine and which bar extends transversely of the machine, said bar 30 being also steadied and guided by a bifurcated downturned extension 14^d of the bar 14. The sliding control bar 30 is provided with a series of stops 30^a preferably integral with said bar and staggered on opposite sides thereof, as clearly shown in Fig. 3. Said bar is also provided with a lug 30^b connected by a coil spring 33 with an extension 14^d of the bar 14, said spring tending to move the said control bar rearward when released. The sliding control bar 30 is normally held in the position shown in Fig. 1 by the pawl 26 which engages one of the stops 30^a on said bar. Said sliding control bar 30 is also provided at its rear end with an inclined and preferably stepped extension 30^c. Said control bar also carries an auxiliary inclined and preferably stepped part 30^d which is complemental or reversely inclined relative to the part 30^c.

Coöperating with the control bar 30 is an adding wheel actuator 38 having a tail portion 38^a carrying a pin 38^b which engages a lug 30^e in an upwardly projecting portion of the said control bar, so that as the latter is moved rearwardly the said actuator, which is loosely mounted on the power shaft 43, will be permitted to swing on said shaft as a center under the influence of the spring 39 by which a pin 40 on said actuator is connected to a cross bar 41 mounted on the frame of the machine. The adding wheel actuator 38 carries a sector gear 38^c which coöperates with a gear wheel 52 on a numeral wheel 53 and which gear wheel is mounted in a swinging frame 54 which is pivoted on a cross rod 55, and which swinging frame, at proper times, may be moved to throw the said gear wheel into and out of mesh with the said sector gear by means well known to those skilled in the art.

Coöperating with the stepped parts 30^c and 30^d carried by the control bar is a type carrier 60 which is guided vertically by slotted cross bars 61 and 62 and by slotted cross bars 63 and 63^a mounted on the frame of the machine, said type carrier having a series of types 60^a coöperating in a well-known manner with the impression cylinder or platen 64.

The type carrier 60 is provided with an arm 65 on a bent portion 65^a of which is pivoted a switch lever 66 which may be moved into position to coöperate with either of the stepped stop parts 30^c or 30^d carried by the control bar 30. The switch lever 66 is provided with downturned ears 67 adapted to embrace a turned up lug 68 on a shifting bar 69 which is jointed to one arm of a bell crank lever 70, the other arm of which is jointed to a link 71 having a slot and pin connection at 72 with a shift lever 73 pivoted on a stud 74, said link 71 being connected at its forward end to a swinging bail 75. The other end of the shifting bar 69 is supported by a link 70^a on the other side of the base of the machine so as to permit a proper movement of said bar. The cross rod 75^a of the bail 75 is in a position to engage the depending tail portion 26^a of the retaining pawl or detent 26, so that when the shifting lever is operated it not only moves the shifting bar 69 but through a lug 68 on said bar will cause the switch lever 66 to be moved from its normally operative relation to the stepped extension 30^c into operative relation to the stepped extension 30^d, and will also cause the cross rod 75^a to engage the tail 26^a of the retaining pawl or detent 26 and thus release the said pawl or detent from engagement with its lug on the control bar 30, so that when the power shaft is operated the

complemental nines (or ten for the unit column) in those columns in which no keys are depressed, will be automatically added for a substraction operation.

The shift lever 73 is held in its normal position against the stop pin 76 by a spring 77, said lever being provided with a pin 78 adapted, when said shift lever is moved forward, to engage a notch 79 in a latch 80 pivoted on the pin 81 and normally held by a spring 82 against a stop pin 83 on the machine frame.

Fixed to the power shaft 43 within the frame portion of the machine, and near the opposite ends of said shaft, are arms 84 which carry a cross rod 85. Pivotally mounted on one of the arms 84 is a pawl 86 held by a spring 87 against a stop pin 88 carried by said arm 84, said pawl coöperating with the latch 80 on a return movement of the power shaft to release said latch from the pin 78 on the switch lever 73. The latch 80 carries a finger 80^a coöperating with a pin 89 on a bail 90 which is pivotally mounted between the side frame parts of the machine and which, when the said bail is swung forward by said finger, will engage the rear ends of the latch bars 18 so as to move said latch bars and thus release the latches carried thereby from the depressed keys which under the action of their lifting springs 16 will be restored to their normal positions.

When the operating handle 44 which is connected to shaft 43 is moved forward by the operator the pawl 86 carried by one of the arms 84 will move past a lug 80^b on the latch 80, the spring 87 yielding to permit this movement; but when the operating handle 44 is restored to its normal position the said pawl 86 will engage the said lug 80^b and will thus actuate the latch 80 as above described so as to operate the bail 90 and also release the said latch from the pin 78 on the shift lever 73 so that said lever will be returned to its normal position by the stress of its cooperating spring 77.

The type carrier 60 is connected with a spring 91 which tends to lift said type carrier, but the latter is held down against the action of said spring by a cross rod 92 forming part of a bail comprising side portions 93 pivoted on studs 94 on the side frame parts of the machine, said type carrier being held downward against a stop cross rod 95 by springs 96 sufficiently strong to overcome the stress of the lifting springs 91; said springs being connected with said side portions 93 of said bail and with a cross bar 97 on the base of the machine. The side parts 93 of the bail are provided with studs 98 which are arranged to be engaged by the ends 84^a of the arms 84 fixed to the power shaft 43 so that when the said power shaft is operated by the handle 44 the said arms will engage said studs and lift the bail so as to permit the type carriers to be raised by their springs 91 to positions governed by the stop shoulders or portions of the stepped parts 30^c or 30^d movable with the control bar 30. As the arms 84 swing upward to the position indicated by dotted lines in Fig. 2 the studs 98 will ride inward over the ends of said arms which swing in a circle of a much larger radius than the radius of the circle on which the said studs move, so that the said arms 84 may continue to be moved past the said studs to allow proper time for effecting the printing operation, and the bail will still be held in its upward position.

For simplicity of illustration only three columns or series of keys are herein shown, and only a single set of elements coöperating with each type carrier, but it will be understood that the machine will contain as many columns or series of keys as may be desired and that the coöperating parts, including the control bars, adding wheel actuators, adding wheels and type carriers, will correspond to the number of columns or series of keys which the machine may contain.

All of the columns or series of keys, excepting the unit column or series will contain a tenth key x preferably bearing a large 0 and small 9 for the purpose of positioning a 9 to print when 9 is part of the subtrahend and occurs in a column, other than the unit column, as, for example, in 798, as hereinafter described.

The power shaft 43 is returned to its normal position, after the handle 44 has been operated, by a retracting spring 45 connected to the machine frame and an arm 84.

The operation of the machine is as follows:

For adding the keys are selected by the large numerals they bear. The depressing of a key moves a latch bar 18 forward until it latches the depressed key. At the same time the latch bar lifts the detent 26 and holds it in lifted position as long as the latch bar is in latched position. On operation of the power shaft 43 forward, by means of the handle 44, the cross rod 85, carried by the arms 84, moves away from the control bar lug 30^e and the actuator tail 38^a and allows them to respond to their springs 33 and 39 and follow the cross rod 85 until the control bar 30 is stopped by the depressed key; or, when no key is depressed, by the end of slot 31 and rod 29. When the control bar is stopped the actuator 38 is also stopped through its pin 38^b being in contact with lug 30^e of the control bar. After the power shaft has moved sufficiently to permit the control bar to perform its extreme travel the arms 84 pick up the pins 98 on the bail sides 93 and so lift the bail cross rod 92 its full distance of travel, and as it rises the type carrier 60 follows it until the switch lever 66 of the type carrier is

stopped against the step of stop 30^c which corresponds with the key which has been depressed. On still further movement of the power shaft the printing is effected in any well-known manner. During the forward movement of the power shaft the adding wheels 52 have been out of mesh with the gears 38^c, but on the return movement of the power shaft they are brought into mesh and held there by any well-known means, so that the adding of the item may be effected during the return movement of the power shaft as it returns the actuator 38 to normal through the cross rod 85 engaging the tail part 38^a of the actuator. Simultaneously with the returning of the actuator 38 the cross rod restores the control bar 30 by engaging the lug 30^e. During the return movement of the power shaft 43 the bail cross rod 92, under the influence of its springs 96, returns the type carrier 60 to normal and near the finish of the power shaft's return movement the pawl 86, carried by one of the arms 84, rocks the bail 90 forward and so releases the depressed key which returns to normal under influence of its spring 16.

For subtracting the keys are selected by the small numerals they bear and the shift lever 73 is drawn forward until it latches with latch 80. When it is in this position it has moved and holds the shifting bar 69 so that, through a lug 68 on the bar 69, the switch lever 66 is held in operative location relative to the stepped part 30^d of the control bar and all the detents 26 are held in released position so that on operation of the machine, that is the power shaft, the control bars of those columns in which there is no key depressed will move their full distance and permit of adding the capacity of their columns. In other words, 10 would be added to the unit column and nine in each of the other columns in which no key was depressed. This movement of the control bars where no key is depressed is limited by the slots 31 in those bars. The operation of the machine is then as for adding, and as the power shaft nears the end of its return movement the shift lever 73 is released as the pawl 86 actuates the latch 80 and all parts are restored to normal and the machine is in condition for adding again.

When the numeral 9 appears in the subtrahend and is in a column higher than the unit column, the special or tenth key, x, which is non-adding and which bears the figures 09, is used, and when it is depressed its shank engages the first or forward stop 30^a of the control bar 30, this stop being so located as to permit of no movement of the control bar, so that when the said tenth key is operated no adding can take place when the machine is operated. If the shift lever 73 is in latched position the type carrier 60 will rise as the cross rod 92 rises and will position the 9 to print.

It will be seen by the above that the actual value of the operated key is always added, and that when subtracting is being done the actual value of the key is added and the complement of that key is printed.

The above description of the operation of the keys of a single column or series and of the control bar and other coöperating parts will be understood as referring to the operation of any or all of the columns or series of keys and their coöperating parts.

Having thus described my invention I claim and desire to secure by Letters Patent:

1. In a calculating machine, the combination of a series of keys, an adding wheel, an actuator for said adding wheel, a type carrier, and a control bar movable independently of said actuator and said type carrier and provided with means for limiting the movement of said actuator and said type carrier independently of each other, so that the movements of said actuator and type carrier may occur at differing periods.

2. In a calculating machine, the combination of a series of keys, an adding wheel, an actuator for said adding wheel, a type carrier, a control bar provided with means for limiting the movement of said actuator and said type carrier separately, so that the movements of said actuator and type carrier will be independent, and differential stop means comprising two coöperating parts, one of which is carried by said control bar and the other of which is carried by said type carrier.

3. In a calculating machine, the combination of a series of keys, an adding wheel, an actuator for said adding wheel, a type carrier, a control bar provided with means for limiting the movement of said actuator and said type carrier separately, so that the movements of said actuator and type carrier will be independent, differential stop means comprising coöperating parts carried by said control bar and by said type carrier, respectively, said coöperating parts including two sets of stops, complemental to each other, and shifting means for causing either set of stops to coöperate with the other of said coöperating parts when the machine is actuated.

4. In a calculating machine, the combination of a series of keys, an adding wheel, an actuator for said adding wheel, a type carrier, a control bar provided with means for limiting the movement of said actuator and said type carrier separately, so that the movements of said actuator and type carrier will be independent, said control bar having, movable therewith, two sets of stops, one of which is complemental to the other, for limiting the movement of said type carrier, and manually operable shifting means

for causing either set of said stops to cooperate with said type carrier when the machine is operated.

5. In a calculating machine, the combination with adding mechanism and printing mechanism, comprising a type carrier, of a series of keys comprising a special key which, when operated, prevents adding, and shifting means for causing the type carrier to be positioned to bring a 9 into printing position when said special key is operated.

6. In a calculating machine, the combination with a plurality of columns or series of keys, all of which columns, representing values higher than units, contain a tenth key which, when operated, will prevent adding, of type carriers, adding mechanism, intermediate mechanism between said keys and said adding mechanism and said type carriers, for controlling said adding mechanism and said type carriers, and shifting means for controlling the controlling mechanism for said type carrier, any one of said tenth keys, when operated in connection with said shifting means, causing its corresponding type carrier to position a 9 to print.

7. In a calculating machine, the combination of a series of keys, an adding wheel, an actuator for said adding wheel, a type carrier, and a control bar movable independently of said actuator and said type carrier and having stop means to be engaged by said keys for limiting its movements, said control bar being provided with means for limiting the movement of said actuator and said type carrier independently of each other, so that the movements of said actuator and type carrier may occur at differing periods.

8. In a calculating machine, the combination of a series of keys, an adding wheel, an actuator for said adding wheel, a type carrier, a control bar movable independently of said actuator and said type carrier and having stop means to be engaged by said keys for limiting its movements, said control bar being provided with means for limiting the movement of said actuator and said type carrier independently of each other, so that the movements of said actuator and type carrier may occur at differing periods, a spring for moving said control bar in one direction, a detent for holding said control bar in non-operative position against the action of said spring, and means for disengaging said detent from said control bar when a key is operated.

9. In a calculating machine, the combination of a series of keys, an adding wheel, an actuator for said adding wheel, a type carrier, a control bar movable independently of said actuator and said type carrier and having stop means to be engaged by said keys for limiting its movements, said control bar being provided with means for limiting the movement of said actuator and said type carrier independently of each other, so that the movements of said actuator and type carrier may occur at differing periods, a spring for moving said control bar in one direction, a detent for holding said control bar in non-operative position against the action of said spring, means for disengaging said detent from said control bar when a key is operated, and springs for imparting movements in one direction to said actuator and said type carrier.

10. In a calculating machine, the combination of a series of keys, an adding wheel, an actuator for said adding wheel, a type carrier, a control bar movable independently of said actuator and said type carrier and having stop means to be engaged by said keys for limiting its movements, said control bar being provided with means for limiting the movements of said actuator and said type carrier independently of each other, so that the movements of said actuator and type carrier may occur at different periods, a spring for moving said control bar in one direction, a detent for holding said control bar in non-operative position against the action of said spring, means for disengaging said detent from said control bar when a key is operated, springs for imparting movements in one direction to said actuator and said type-carrier, and a power shaft and connections for governing the movements of said control bar, actuator, and type-carrier under the influence of said springs.

11. In a calculating machine, the combination of a series of keys, an adding wheel, an actuator for said adding wheel, a type carrier, a control bar having stop means to be engaged by said keys for limiting its movements, said control bar being provided with means for limiting the movement of said actuator and said type carrier separately, so that the movements of said actuator and type carrier will be independent and may therefore occur at different periods, a spring for moving said control bar in one direction, a detent for holding said control bar in non-operative position against the action of said spring, means for disengaging said detent from said control bar when a key is operated, and means, operable independently of said keys, for disengaging said detent from said control bar.

12. In a calculating machine, the combination of a series of keys, an adding wheel, an actuator for said adding wheel, a type carrier, a control bar having stop means to be engaged by said keys to limit its movements, said control bar being provided with means for limiting the movements of said actuator and said type-carrier separately, so that the movements of said actuator and type carrier will be independent, a spring

for moving said control bar in one direction, a detent for holding said control bar in non-operative position against the action of said spring, means operable by said keys, for disengaging said detent from said control bar, differential stop means comprising coöperating parts carried by said control bar and by said type carrier, respectively, said coöperating parts including two sets of stops, complemental to each other, and shifting means serving to release said detent from said control bar and for causing either set of stops to coöperate with the other of said coöperating parts when the machine is actuated.

In testimony whereof I affix my signature.

WILLIAM P. QUENTELL.