

July 11, 1933.

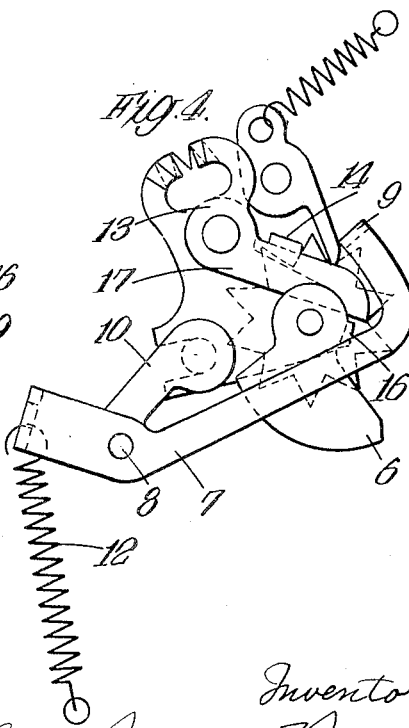
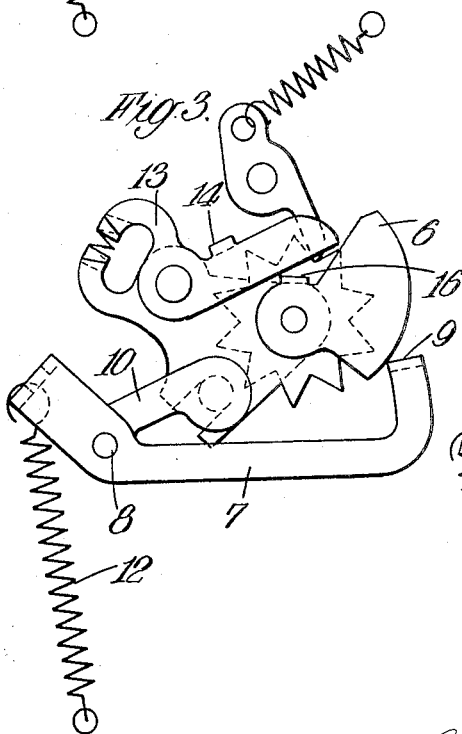
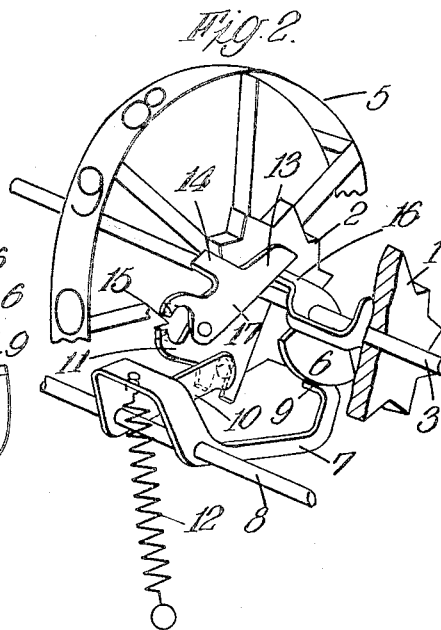
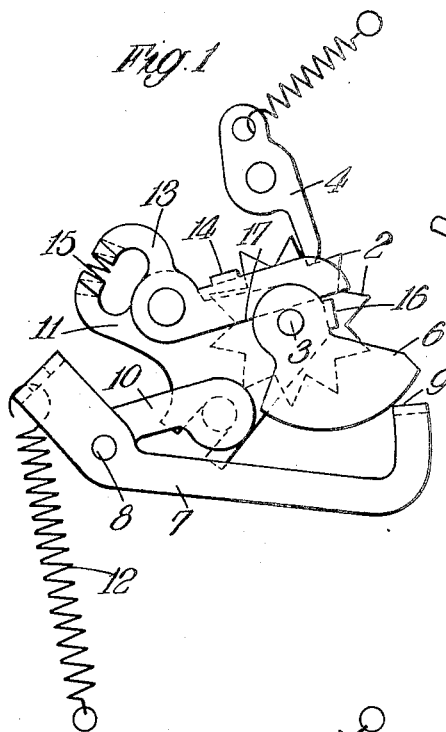
G. B. PETTER

1,917,732

CALCULATING OR ADDING MACHINE

Filed July 6, 1931

2 Sheets-Sheet 1



Inventor
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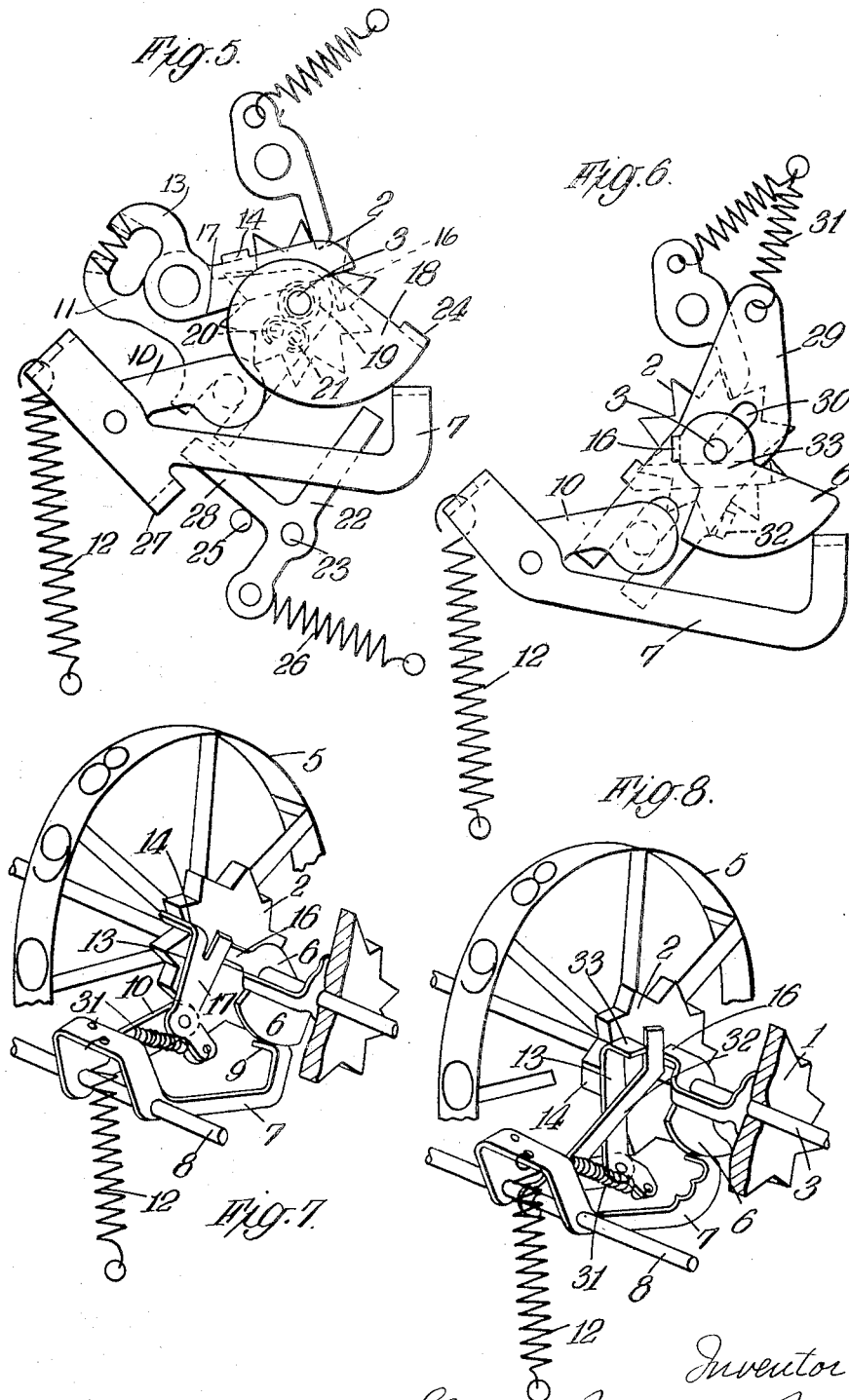
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2 Sheets-Sheet 2



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CALCULATING OR ADDING MACHINE

Application filed July 6, 1931, Serial No. 549,026, and in Great Britain August 1, 1930.

This invention relates to calculating or adding machines of the multiple bank type having a series of ordinal keys in each bank in which depression of one of the keys is adapted to rotate a pinion which rotates with a numeral wheel having upon its periphery a series of ordinal numbers. The invention relates more particularly to transfer mechanism for use in connection with such machines.

Transfer mechanism heretofore constructed has sometimes comprised a cam rotated from a column of one order which cam co-operates with a transfer lever which in turn actuates a pawl having a transfer element which engages a tooth of a pinion associated with a column of higher order to move it forward one tooth to effect a transfer. The cam moves the transfer lever in one direction and permits the lever to move in the reverse direction during the transfer operation. The transfer lever during its movement under the action of the cam carries the pawl from one position to another position and upon reverse movement of the transfer lever the pawl moves the pinion forward one tooth.

The chief object of the present invention is to provide an improved form of transfer mechanism in which over-travel of the parts due to high speed of operation or to small inaccuracies or tolerances in the working fits of the parts or to both such causes may not promote a partial or complete transfer operation at an inappropriate time thereby giving rise to inaccuracies in the result of the additions or calculations.

According to the invention the transfer mechanism comprises a cam rotated from one column, a transfer element actuated by said cam and associated with a pinion in an adjacent column of higher order and normally lying in the path of the pinion teeth and means for moving said transfer element out of the path of the teeth of its associated pinion for a predetermined period until the moment at which transfer is due to take place.

Thus a premature engagement of the transfer element with a tooth of the pinion due to over-travel of the parts is avoided. The transfer element may comprise a trans-

fer finger forming part of a spring controlled pawl. The pawl may be mounted upon a bell crank lever which may be pivoted on the same axis as the pinion one arm of the bell crank lever carrying the pawl while the other arm of the bell crank lever may be connected to a transfer lever by means of a pin and slot connection. The pawl may be normally urged in one direction by means of a spring and may have a lug or finger constituting the transfer finger which engages with the teeth of the pinion to effect the transfer operation. The aforesaid means for moving the transfer finger out of the path of the pinion teeth may comprise a lug or a finger provided on the aforesaid cam which engages the pawl during a predetermined part of the rotation of the cam so as to lift the transfer finger on the pawl outside the path of the pinion teeth, the lug or finger on the cam permitting the transfer finger to move into operative position at the moment when transfer is due to take place. If desired the pawl and bell crank lever may be replaced by a single lever in which case the lever may be formed integral with a transfer finger which engages with the teeth of the pinion to effect the transfer operation and may be provided with a ledge or projecting part with which engages a lug or finger on the cam, to move the transfer finger outside the path of the pinion teeth. According to a further form the pawl may be directly pivoted on one arm of the transfer lever and is provided with the aforesaid transfer finger which engages with the teeth of the pinion the aforesaid lug or finger on the cam co-operating with a part of said pawl to move the transfer finger out of the path of the pinion teeth. Alternatively, instead of the lug or finger on the cam directly co-operating with the aforesaid pawl a lever may be provided interposed between the lug or finger on said cam and a projection on the aforesaid pawl.

The invention may be employed in connection with a partial keyboard machine, that is to say, a machine in which for example only five keys in each bank are employed or in connection with a full keyboard machine in which for example nine keys are employed in

each bank. In the former case the aforesaid cam is constructed and arranged so as not to commence actuating the transfer lever until after a predetermined period. In full keyboard machines the cam is arranged so as to actuate the transfer lever immediately after the 0 reading has been registered and the cam follows the movement of the pinion which rotates the cam through the medium of a spring drive for the purpose hereinafter stated. The invention may be employed in connection with the actuating mechanism described in the specification of our co-pending application Serial No. 547,101 and with the zeroizing or cancelling mechanism described in the specification of our co-pending application Serial No. 548,673.

In order that the said invention may be clearly understood and readily carried into effect, the same will now be more fully described with reference to the accompanying drawings in which like reference numerals indicate similar parts and which illustrate several forms of mechanism according to the invention and in which:—

Figure 1 is a side elevation of one form of transfer mechanism applicable to a partial keyboard machine;

Figure 2 is a perspective view of the transfer mechanism shown in Figure 1;

Figures 3 and 4 are views similar to Figure 1 but showing the parts in different positions;

Figure 5 is a view similar to Figure 1 but showing mechanism applicable to a full keyboard machine;

Figure 6 illustrates a modified form of transfer mechanism, and Figures 7 and 8 illustrate still further modified forms.

Referring now more particularly to Figures 1 to 4 of the accompanying drawings which illustrate the invention as applied to a partial keyboard machine having for example five keys numbered 1 to 5, and in which in order for example to add the numeral 9 the 5 and 4 keys are successively depressed and in order to add the numeral 8 and 4 key is depressed twice and so on, reference numeral 1 (Figure 2) indicates a pinion and reference numeral 2 indicates another pinion associated with a column of higher order adjacent the column with which the pinion 1 is associated. The pinions 1 and 2 are freely mounted on a transverse spindle 3. The pinions have ten teeth and are maintained in their correct positions by means of spring pressed ratchet pawls 4 (Figure 1) which permit rotation in a clockwise direction but prevent rotation in the reverse direction. A numeral wheel 5 (Figure 2) rotates with each pinion and carries on its periphery figures 0 to 9 one of which is at any time visible through a window in a casing enclosing the mechanism. The pinions may be rotated by means of the actuating mechanism

referred to in the specification of our co-pending application Serial No. 547,101. A snail cam 6 is mounted on the spindle 3 and is attached to and rotated by the pinion 1 in the column of lower order. Coacting with the cam 6 is a transfer lever 7 pivoted on a transverse spindle 8. The transfer lever has two arms, one of which is provided with a bent portion 9 which makes contact with the acting surface of the cam 6 while the other arm 10 projects into the column of higher order and has a pin and slot connection with a bell crank lever 11 mounted on the spindle 3. The transfer lever 7 is normally urged in an anticlockwise direction by means of a spring 12. Pivotaly mounted upon the bell crank lever 11 is a pawl 13 which has a transfer element or finger 14 which engages the teeth of the pinion 2.

The transfer finger 14 is normally urged in a clockwise direction into contact with the teeth of the pinion by means of a compression spring 15. The cam 6 is foreshortened so that it does not commence actuating the transfer lever 7 until after the interval between the readings 0 and 4 has been passed. For example, if the reading in one column stands at 9 and the key 5 in that column is depressed so as to give the maximum single key stroke addition of the machine the reading will pass to 4 and the transfer will pass to the next higher column without the interference which might be caused by the cam commencing to actuate the transfer lever again before the transfer is completed.

There is a possibility due to the action of the cam at high speeds of operation that an overthrow of the transfer lever 7 might cause the transfer finger 14 to move into engagement with the following tooth of the pinion 2 before the pinion 1 has reached the 9 position with the result that the movement of the transfer lever 7 in moving back into contact with the cam 6 would move the pinion 2 forward and hold it displaced thus effecting a partial or even a complete transfer at the inappropriate time. The present invention overcomes this disadvantage by the provision of means for moving the transfer finger outside the path of the teeth of the pinion 2 until the moment at which transfer is due to take place. As shown in Figures 1 to 4 these means comprise a lug or finger 16 on the cam 6 which makes contact with the pawl 13 and serves to lift the transfer finger 14 outside the path of the pinion teeth until the parts in the column associated with the pinion 1 have reached the position between 9 and 0. The finger or lug 16 is preferably arranged so that it makes contact with the surface 17 of the pawl 13 at the readings 6, 7 and 8 so that the transfer finger 14 is moved outside the path of the teeth of the pinion 2 during these readings, the finger 14 moving into engagement with the appropriate pinion

tooth at or about the 9 reading after the lug 16 has moved out of contact with the surface 17.

In operation, the pinion 1 is rotated by means of suitable actuating mechanism and the cam 6 rotates with the pinion and after the 4 reading moves the transfer lever 7 in a clockwise direction. At the same time the transfer lever causes through the medium of its arm 10 the bell crank lever 11 to be moved in an anti-clockwise direction about the spindle 3 moving the transfer finger 14 from the position shown in Figure 4 to a position as shown in Figure 1 in which the transfer finger 14 may engage the following tooth of the pinion 2. At about the reading 6 the lug 16 makes contact with the pawl 13 and moves the transfer finger 14 outside the path of the pinion teeth as shown in Figure 3 and at or about the 9 reading, the lug 16 moves out of contact with the pawl 13 and allows the transfer finger 14 to move into a position in which it may engage the following tooth of the pinion as shown in Figure 1. Thus when the peak of the cam 6 moves out of engagement with the bent portion 9 of the transfer lever 7 the latter is moved in an anti-clockwise direction under the action of the spring 12 and moves the bell crank lever 11 in a clockwise direction about the spindle 3. During this movement the transfer finger 14 moves the pinion 2 forward one tooth to effect the transfer. In the final position of the parts as shown in Figure 4 key actuation of the pinion 2 may nevertheless occur without detrimental disturbance of the pawl 13 which yields and allows the teeth to pass under it. Due to the provision of the means for moving the transfer finger 14 outside the path of the pinion teeth during for example the 6, 7 and 8 readings a premature engagement of the pawl with the following pinion tooth is avoided.

Where the invention is employed in connection with machines having a full range of keys, for example, nine keys ranging from 1 to 9 the aforesaid cam is arranged so as to actuate the transfer lever immediately after the 0 reading has been registered but instead of the cam being rigidly attached to the pinion it is arranged to follow the movement of the pinion through the medium of a spring drive. Figure 5 of the accompanying drawings illustrates such an arrangement. In this figure the reference numeral 18 indicates a cam which is so arranged as to commence actuating the transfer lever 7 as soon as the 0 reading has been registered. The cam 18 follows the movement of the pinion which rotates it for example the pinion 1 shown in Figure 2 through the medium of a spring drive. In Figure 5 the spring drive is shown in dotted lines and associated with pinion 2 and the cam rotated thereby. As shown a coil spring 19 is located around the

spindle 3 carrying the pinions. One end of the coil spring is attached to a stud 20 on the pinion 2 while the other end of the spring is attached to a stud 21 on the cam associated with the pinion 2. Normally the two studs are maintained in contact but if the cam is held back, the pinion may still be moved forward for nearly one revolution. A spring catch 22 pivoted at 23 is adapted to lie in the path of a lug 24 provided on the cam 18 at its peak. The spring catch 22 is held in the path of the lug 24 by means of a spring 26 which normally maintains the catch 22 against a stop 25. When the cam 18 reaches the 0 position it has moved out of contact with the transfer lever 7 which moves back under the action of the spring 12 into its initial position to effect a transfer as described in connection with Figures 1 to 4. The cam however is held back by the engagement of the spring catch 22 with the lug 24 so that the transfer may be effective irrespective of the fact that the pinion itself may move forward to the 8 reading this occurring should for example, the numeral wheel be in the 9 position and the transfer be effected by depressing the 9 key. At the moment however when the transfer is reaching completion a lug 27 on the transfer lever 7 strikes an arm 28 on the catch 22 thereby moving the catch 22 out of the path of the lug 24 and releasing the latter which immediately moves about the spindle 3 to its normal position with the studs 20 and 21 in contact.

Figure 6 illustrates a modified form of the invention in which the bell crank lever 11 and the pawl 13 (Figures 1 to 5) are replaced by a single member in the form of a lever 29, hereinafter referred to as the "pinion lever" mounted upon the spindle carrying the cams and pinions. The pinion lever 29 is mounted upon the pinion spindle 3 by means of a slot 30 which permits the pinion lever 29 to reciprocate along a path transverse to the axis of the spindle 3. A spring 31 is attached at one end to the pinion lever or an extension thereof and at the other end to a fixed point which spring 31 acts substantially in the direction of the slot 30. The pinion lever has a transfer finger 32 fixed thereon or formed integral therewith, the finger being the equivalent of the transfer finger 14 described in connection with Figures 1 to 5, and at the appropriate time engages the pinion 2 to move it forward one tooth. The transfer lever 7 is connected to the pinion lever 29 by means of a pin and slot connection for the purpose of enabling the transfer lever 7 to actuate it. The transfer lever 7 when rotated by the cam 6 rotates in a clockwise direction and causes the pinion lever 29 to move in an anti-clockwise direction by virtue of the pin and slot connection. Upon rotation of the pinion 2 due to key actuation the transfer finger 32 on the pinion lever 29

yields due to the slot connection 30. Attached to the pinion lever is an inclined straight ledge or projection 33 with which a finger or lug 16 on the cam 6 engages during for example the period when the pinion associated with the cam 6 passes through the 6, 7 and 8 readings for the purpose hereinbefore stated. During the anti-clockwise rotation of the pinion lever the finger 32 contacts with the edge of the teeth of the pinion 2 and slips over into engagement with the following tooth this action being permitted by means of the slot 30, the spring 31 causing the finger to pass into the tooth except of course at the readings 6, 7 and 8 when the finger 32 is out of the path of the pinion teeth. When the peak of the cam 6 passes out of engagement with the transfer lever 7 the latter moves back in an anti-clockwise direction under the action of its spring 12 and causes the pinion lever 29 to rotate and carry the pinion forward one tooth. The finger 32 upon the pinion lever is arranged to engage with that pinion tooth the driving face of which lies substantially at right angles to the direction of the slot 30 at the beginning or end of its movement so as to enable the pinion lever and the finger to yield when the pinion lever is stationary and the pinion is rotated clockwise or when the pinion is stationary and the pinion lever is rotated anti-clockwise.

Figure 7 illustrates a further form of the invention in which the transfer pawl 13 is pivotally attached to the arm 10 of the transfer lever 7. The pawl 13 is normally urged towards the pinion 2 by a spring 31 connected to the pawl 13 and to the transfer lever 7. The pawl 13 has a bent portion 14 constituting the transfer finger which co-operates with the teeth of the pinion 2. The pawl 13 also has a straight portion 17 with which a lug or finger 16 on the cam 6 engages to move the transfer finger 14 outside the path of the pinion teeth at for example the readings 6, 7 and 8 for the purpose above mentioned.

Figure 8 illustrates a further modification in which a lever 32 is interposed between the pawl 13 and the lug or finger 16 on the cam 6. The lever 32 is pivoted on the transverse spindle 8 and projects between a bent part 33 of the pawl 13 and the lug 16 on the cam 6. The pawl 13 has a transfer finger 14 and is normally urged into contact with the lever 32 by means of spring 31.

It will be appreciated that the mechanisms above described are associated with each bank of keys for the purpose of carrying forward or transferring a unit digit to the tens digit and so on. Various changes may be made in the form and arrangement of the parts without departing from the working principles described. For example, the pin and slot are interchangeable between the transfer lever and pinion lever or bell crank lever or the slot of the pinion lever or bell

crank lever may be replaced by a surface making contact with the pin on the transfer lever on one side only and the two parts may be held in contact by a spring or by suitably arranging for example the spring 31 (Figure 6) so that it exerts its force in the appropriate direction.

The invention has been described above as applied to calculating machines operating on the decimal system of notation but it must be understood that the invention is not to be limited thereto as other systems of notation may be employed for example the English monetary system.

What I claim and desire to secure by Letters Patent of the United States is:—

1. A calculating or adding machine of the type referred to having transfer mechanism comprising a cam rotated from one bank or column, a transfer element actuated by said cam and associated with a pinion in an adjacent column of higher order and normally lying in the path of the pinion teeth and means for moving said transfer element out of the path of the teeth of its associated pinion for a predetermined period until the moment at which transfer is due to take place.

2. In a calculating or adding machine of the type referred to, transfer mechanism comprising a cam rotated from one bank or column, a transfer element comprising a spring controlled pawl and a transfer finger thereon, said transfer element being actuated by said cam and associated with a pinion in an adjacent column of higher order and normally lying in the path of the pinion teeth and means for moving said transfer element out of the path of the teeth on its associated pinion for a predetermined period until the moment at which transfer is due to take place.

3. In a calculating or adding machine of the type referred to, transfer mechanism comprising a cam rotated from one bank or column, a transfer element comprising a spring controlled pawl having a transfer finger thereon, said transfer element being actuated by said cam and associated with a pinion in an adjacent column of higher order and normally lying in the path of the pinion teeth said cam having a member which co-operates with the said pawl to move the transfer finger out of the path of the teeth on its associated pinion for a predetermined period until the moment at which transfer is due to take place.

4. In a calculating or adding machine of the type referred to, transfer mechanism comprising a cam rotated from one bank or column, a transfer element comprising a spring controlled member having a transfer finger thereon, said transfer element being actuated by said cam and associated with a pinion in an adjacent column of higher order and normally lying in the path of the pinion teeth,

said cam having a member thereon which co-operates with said spring controlled member to move the transfer finger out of the path of the teeth of its associated pinion for a predetermined period until the moment at which transfer is due to take place.

5. In a calculating or adding machine of the type referred to, transfer mechanism comprising a cam rotated from one bank or column, a transfer element comprising a spring controlled pawl having a transfer finger thereon said transfer element being actuated by said cam and associated with a pinion in an adjacent column of higher order and normally lying in the path of the pinion teeth, a lever to which said pawl is pivoted, a transfer lever actuated by said cam, a connection between the aforesaid lever and said transfer lever, said cam having a part which co-operates with the said pawl to move the said transfer finger out of the path of the teeth on its associated pinion for a predetermined period until the moment at which transfer is due to take place.

6. In a calculating or adding machine of the type referred to, transfer mechanism comprising a cam rotated from one bank or column, a transfer element comprising a spring controlled pawl having a transfer finger thereon said transfer element being actuated by said cam which latter is so shaped that it does not commence to actuate the said transfer lever until after a predetermined period, said cam having a part which co-operates with the said pawl to move the transfer finger thereon out of the path of the teeth of its associated pinion for a predetermined period until the moment at which transfer is due to take place.

7. In a calculating or adding machine of the type referred to, transfer mechanism comprising a cam rotated from one bank or column, a transfer element comprising a spring controlled pawl having a transfer finger thereon, said transfer element being

actuated by said cam which latter is so shaped as to actuate the transfer lever immediately after the 0 reading has been registered, said cam having a part which co-operates with the said pawl to move the transfer finger thereon out of the path of the teeth of its associated pinion for a predetermined period until the moment at which transfer is due to take place.

8. In a calculating or adding machine as in claim 7, wherein the cam is driven by its associated pinion through the medium of the spring drive and means are provided for arresting the movement of a cam during the transfer operation for a predetermined period.

9. In a calculating or adding machine as in claim 7, wherein the cam is driven by its associated pinion through the medium of a spring drive, and a spring controlled catch is provided having a part projecting into the path of a projection on said cam for arresting the movement of the cam during the transfer operation for a predetermined period, means being also provided for moving the catch out of the path of the said projection at the appropriate time.

10. In a calculating or adding machine of the type referred to, transfer mechanism comprising a cam rotated from one bank or column, a transfer element comprising a spring controlled pawl having a transfer finger thereon said transfer element being actuated by said cam and associated with a pinion in an adjacent column of higher order and normally lying in the path of the pinion teeth, a transfer lever upon which said pawl is mounted, a lever interposed between said pawl and a projection on said cam for moving the transfer finger on the said pawl out of the path of the teeth of its associated pinion for a predetermined period until the moment at which transfer is due to take place.

GUY BAZELEY PETTER.

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CERTIFICATE OF CORRECTION.

Patent No. 1,917,732.

July 11, 1933.

GUY BAZELEY PETTER.

It is hereby certified that the above numbered patent was erroneously issued to "Petters Limited," as assignee of the entire interest in said invention, whereas said patent should have been issued to the inventor said "Petter" and "Petters Limited," as assignee of one-half interest only, as shown by the records of assignments in this office; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 14th day of November, A. D. 1933.

(Seal)

F. M. Hopkins
Acting Commissioner of Patents.