

May 8, 1934.

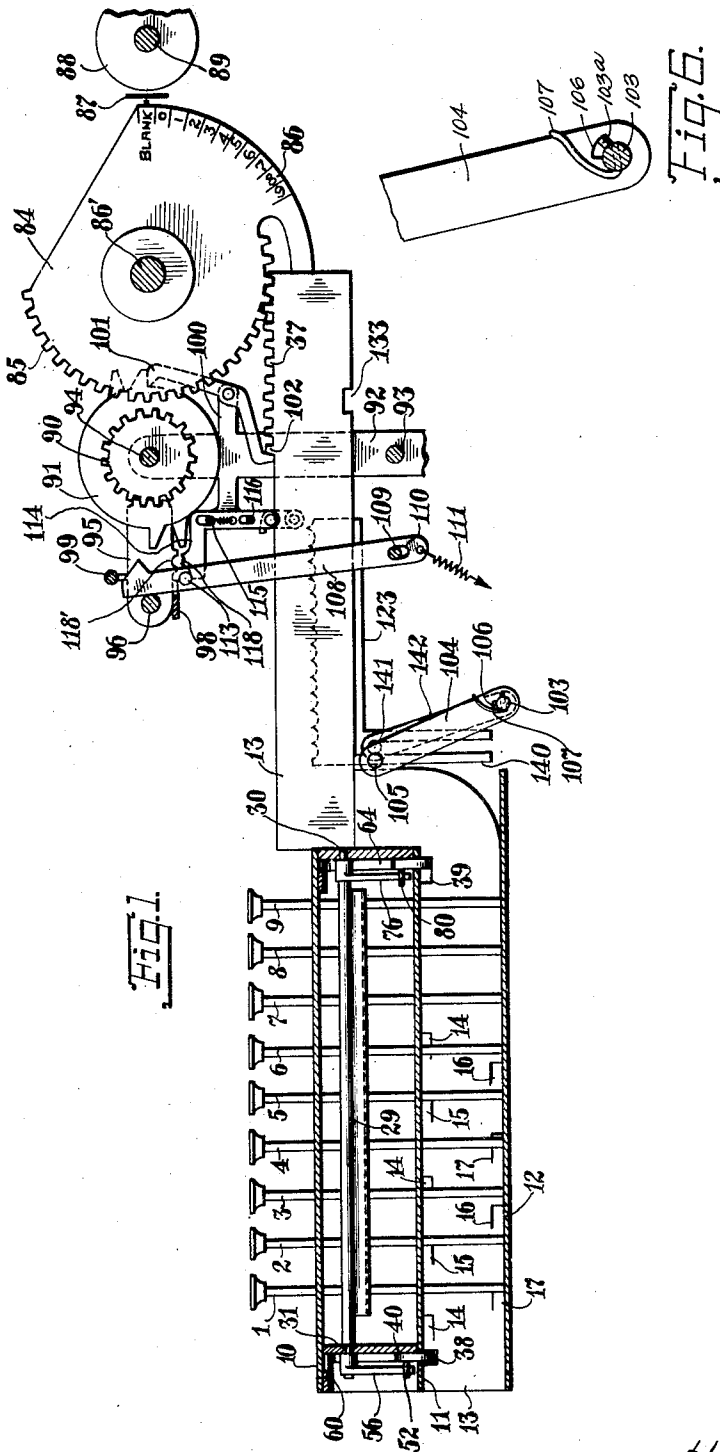
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1,957,960

TRANSFER MECHANISM

Original Filed Aug. 11, 1925

2 Sheets-Sheet 1



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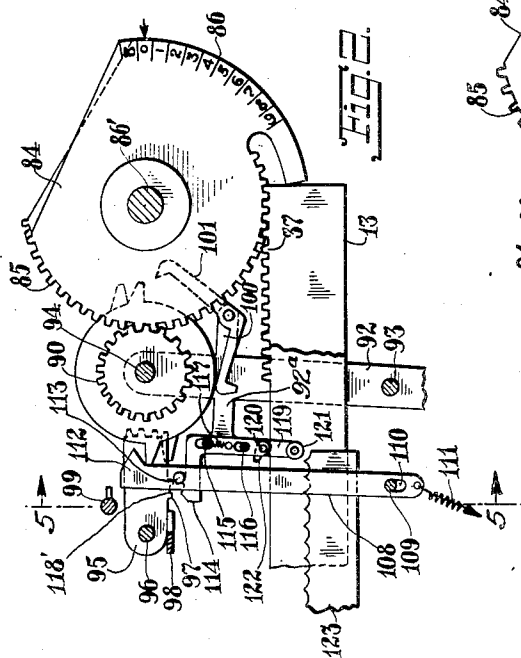
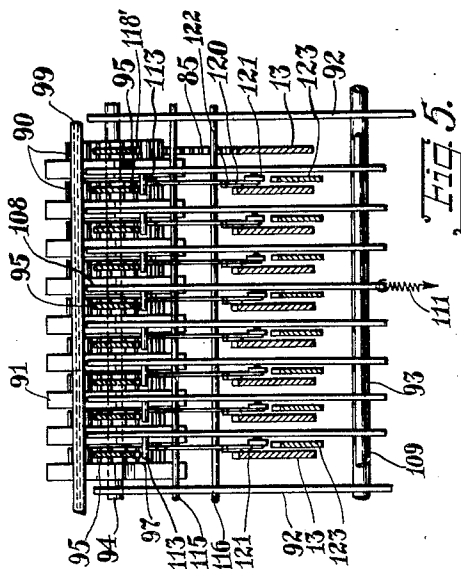
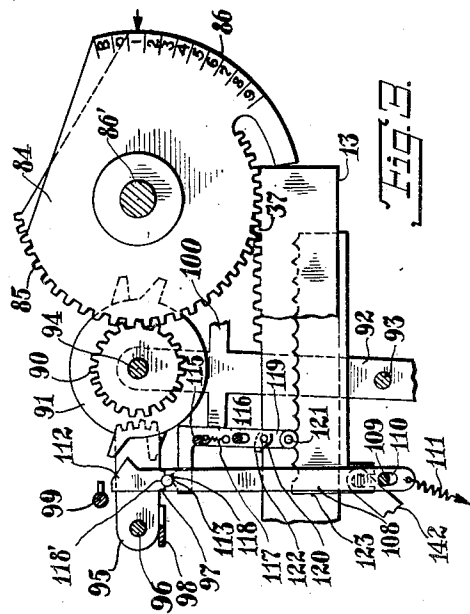
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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

1,957,960

TRANSFER MECHANISM

Francis A. Hosack, New York, N. Y.

Original application August 11, 1925, Serial No. 49,565. Divided and this application November 25, 1929, Serial No. 409,473

14 Claims. (Cl. 235-133)

This invention relates to transfer mechanisms and particularly to transfer mechanisms for calculating machines of that class in which subtracting and adding operations are carried out in conjunction with totaling and listing operations.

An object of my invention is to carry out the transfer operation directly, and to provide a step motion for such operation, operating positively and functioning throughout the whole width of the machine when such functioning is necessary with simplification of the construction as compared with other means now employed for this purpose.

In carrying out my invention I provide reciprocating bars each having a plurality of cam surfaces, which are located between the actuating bars of each order. The accumulating pinion of each order is provided with a cam which actuates a pivoted member when the pinion associated therewith is rotated through its zero position. The pivoted member is moved to a position in which a sliding member in contact with the cam surfaces operates the adding pinion lock of the next higher order to move its accumulating pinion through one number to effect the undercarry or carry-over as the case may be, depending on whether the transfer mechanism is being used to effect subtracting or adding operations. For convenience, I am illustrating the invention as being used in effecting subtracting operations.

A better understanding of the invention may be had by reading the following description together with the accompanying drawings, of which

Fig. 1 is a fragmentary, vertical, longitudinal, sectional view through the machine showing the relation of the keyboard actuator bars and subtracting mechanism in normal position;

Fig. 2 is a partial fragmentary, vertical, longitudinal, sectional view showing the subtracting mechanism after the subtracting lever (not shown) has prepared the mechanism for the subtracting operation;

Fig. 3 is a partial fragmentary, vertical, longitudinal, sectional view showing the subtracting mechanism prepared for the undercarry;

Fig. 4 is a partial fragmentary, vertical, longitudinal, sectional view showing the subtracting mechanism, after the undercarry has been effected;

Fig. 5 is a fragmentary vertical transverse section on the line 5-5 of Fig. 2 showing the undercarry mechanism; and

Figure 6 is a fragmentary side elevation on an enlarged scale of one of the restoring frames.

It will be understood that wherever I speak of "front" or "forward" it will mean in relation to the person facing the keyboard and "rear" or "rearward" will be away from such person. In other words, the left hand end of Figure 1 represents the front of the machine. Also, when I speak of "right" or "left" it means to the corresponding direction of the person who faces the machine.

This is a division of my co-pending application Serial No. 49,565, filed August 11, 1925, now Patent No. 1,823,859, and in designating the various features in the drawings of the present application I have used reference numerals similar to those used in the earlier application in designating like parts.

In Fig. 1, I have shown, as described more in detail in the prior application, a longitudinal section of a keyboard in which the respective keys 1 to 9, inclusive, of the columns making up the keyboard, are supported and guided in suitable horizontally spaced plates 10, 11 and 12. Actuator bars 13, of which there is one for each column of keys, pass through and are guided in slots or cut-out portions formed in and adjacent the lower ends of the stems of the respective keys of each column, as shown more particularly in Patent No. 1,823,859. The portions of the actuator bars which pass through the aligned slots in the keystems are provided at points adjacent their top and bottom edges with laterally projecting stops as indicated at 14, 15, 16 and 17. These stops are adapted to engage certain of the keystems of the keys in their respective columns and thereby limit the longitudinal movement of the actuator bars 13, all as described more fully in Patent No. 1,823,859.

On the rearward ends of the actuator bars 13 are toothed racks 37 (Figs. 1, 2, 3, and 4) and near the forward end of each is a cut or slot 38 for the actuator bar locks. Further rearwardly there is another cut or slot 39 for zero locks to be presently described. The actuator bar locks consist of a series of pivoted members 40, etc., one for each actuator bar. Pins 52, etc. or similar laterally-projecting members are carried by the actuator bar locks to engage with the arms 56, etc., which are carried by and move with the keystem locks 29. The upper edge portions of the actuator bar locks are formed of two plane surfaces meeting at an angle to each other so that flat springs 60, etc. may press against one or the other of these surfaces, as desired, and thus

serve to retain the actuator bar locks in their locked or unlocked positions.

The zero locks, one of which is indicated in Fig. 1 at 64, are pivotally mounted on and secured to the keyboard frame. Fixed to the rear end of each keystem lock is an arm 76, etc. which is adapted to contact with the pin 80, etc. on one side of the adjacent zero lock. The operation of the actuator bar locks and of the zero locks on depression of keys either in their respective columns or in adjacent columns is described in greater detail in Patent No. 1,823,859, and for a fuller understanding of such operation attention is directed to that patent. As is brought out more fully in Patent No. 1,823,859, the actuator bar locks and the zero locks co-act to insure the printing of zeros for those columns in which no key has been depressed that are located to the right of the column of highest order in which a key has been depressed, and to inhibit the movement of any actuator bars to the left of such column of highest order in which a key has been depressed.

As before mentioned, each actuator bar 13 has a rack, such as at 37, on its rearward end which engages with a printing segment 84 by means of the toothed portion 85. These segments are preferably mounted on a common shaft 86' with proper provision for retaining them in alignment with the actuator bars. In one side of each of the printing segments 84 is the printing portion 86 which I illustrate as having type on the edge to act in conjunction with the ribbon 87 and the movable platen 88; this platen having a shaft 89 and being shiftable through the medium of any suitable mechanism known to those skilled in the art. The printing portion 86 of the printing segment 84 would ordinarily have eleven divisions; one blank and the others composing type from 0 to 9 consecutively.

It will be noted that the printing portion 86 is at a greater distance from the shaft 86' than is the toothed portion 85. This is done in order to provide a greater degree of movement for the printing portion 86 for a given movement of the toothed portion 85 and I can vary this proportional movement for any given conditions to be met. The ribbon 87 may be one applied and actuated by any of the means and methods well known in the art while equally common means may be used to force the platen 88 against the type faces in the printing operation. The accumulating pinions 90 and the accumulating pinion cams 91 move together and are mounted in a pivoted frame 92, the pivot being indicated at 93 and the shaft for the cams and pinions at 94. Forward of the accumulating pinions are the pinion locks 95, mounted on the shaft 96 and having teeth into which the teeth of the accumulating pinions fit. Also, beneath each pinion lock is a stop 98 which acts in conjunction with a cam lock or other suitable means 99 by which this pinion lock may be held against movement in the adding operations and released in order to swing about the shaft 96 in the subtracting operations; it being understood that the cam lock means 99 is operated by the same means that is used to change from adding or subtracting operations. Pivoted on the extensions, such as 100, of the frame 92 are the adding step levers 101, the upper ends of which are adapted to seat upon the straight faces of the corresponding accumulating pinion cams 91 and the lower ends of which are adapted to engage with stops 102 on the actuator bars 13 adjacent to the racks 37; it

being understood that each step lever operates between its cam and the actuator bar of next higher order.

Below the actuator bars and operated by a main shaft (not shown) is the restoring frame shaft 103 upon which are the restoring frames 104. There is one of these frames for each actuator bar of the general shape shown in Fig. 1 and having on their upper ends studs or bearings such as 105 which contact with the actuator bars 13. These restoring frames are keyed to the shaft 103 by means of the spline or key 103a, but the keyways 106, are enlarged so that the restoring frames 104 have a certain extent of movement independent of the shaft 103 for a purpose to appear hereafter. Passing around each of the restoring frames is a spring 107, the ends of which are held in holes through the shaft 103 so that this spring acts as a resilient coupling between the shaft 103 and the restoring frame 104 within the limits of the keyway 106.

In an adding operation, the actuation of the main shaft causes frames 104 to move rearward releasing the actuator bars 13 whereby they move rearward moving the printing segments 84 to the positions to print the amount registered on the keyboard of the machine. During the rearward movement of bars 13 the pinions 90 are out of engagement with the toothed portion 85 and in engagement with the locks 95. At the end of the rearward movement of bars 13, frames 92 are rocked to bring the pinions 90 into engagement with the toothed portions 85 and out of engagement with the locks 95. On the restoring movement of the machine, the bars 13 move forwardly and accumulate the total on the accumulating pinions all as more particularly described in my prior Patent No. 1,823,859.

In Figs. 1 to 4 the subtracting mechanism is shown which operates as a direct undercarry throughout the machine. For each accumulating pinion cam 91, there is a subtracting step lever 108 which is pivoted at 109, the slot 110 in which the pivot acts being large enough to permit of some vertical movement of lever 108 against the tension of the spring 111. The upper end of this lever 108 has a cam surface 112, while slightly below this portion of the lever is a pin or stud 113 extending under the pinion lock 95 of the next higher order (Fig. 5). Extending from the lower edge of pinion lock 95 is a projection 97 (Fig. 2) having a seat 118' adapted to engage the stud 113 under circumstances which will appear hereafter. Adjacent to each of the subtraction step levers 108 is a lever 114 arranged to move vertically on the pins 115 and 116 and normally held upward by the tension of spring 117. The pins 115 and 116 are carried by the extension 92a of the frame 92. On the upper end of the undercarry lever 114 is a seat 118 while pivoted on the lower end thereof is an extension arm 119 pivoted at 120. The extension arm 119 can swing freely in the direction toward the rear of the machine but not in the opposite direction on account of the stop 122 at the top of the extension arm 119 which engages the front edge of the lever 114. At the lower extremity of extension arm 119 is the cam roller 121. Between the actuator bars 13 at the rear portions thereof are the subtracting bars 123 each having a series of cam contours on its upper edge which in this instance are shown as being approximately portions of circles adapted to conform to the cam roller 121. At the forward ends of the subtracting bars are forked portions 140 in which rides the ball 141 carried by arms 142, it

which in turn are keyed to the actuating shaft 103. These subtracting bars have a reciprocating motion each time that the actuating shaft 103 is operated, but neither the rate nor extent of their movement need be the same as that of the actuator bars 13 as obviously they may move to any extent in any time relation within the range of movement of the restoring frame, or separate actuating means may be provided therefor or the extent of the movement thereof may be varied by varying the length of the arms 142. Also it should be understood that the lever 114 operates between the subtracting bars 123 of one order to the pinion lock 95 of the accumulating pinion of the next higher order.

The subtracting operation is illustrated in Figs. 1 to 4 and at the outset it will be understood that here the times of engagement and disengagement of the accumulating pinions are opposite to that in the adding operations. That is, the actuator bars which have been released by their actuator bar locks move rearward to their zero position at which point their corresponding pinions engage with their printing segments and disengage from those printing segments before the actuator bars start to move to the front. The normal position of the subtracting mechanism is as shown in Fig. 1. When the subtracting lever (not shown) is thrown in, the various parts of the machine assume the relative positions in Fig. 2 where the accumulating pinions have gone into engagement with their printing segments, the subtracting step levers 108 have been carried rearwardly, the cam locks 99 have moved to free the pinion locks 95 and the adding step levers 101 have been thrown up to their inoperative position by suitable means not shown. When the operating handle is brought forward, the actuator bars move rearward, the accumulating pinions are rotated in a clockwise direction and the proper numerals are brought to the printing line and the number to be subtracted is printed. As heretofore described, the subtracting bars 123 have a movement to correspond in time with the actuator bars 13 although this movement may be of greater or less extent. So that, in the movement just described, these subtracting bars will move rearward with the actuator bars. Also in the clockwise rotation of the accumulating pinions and their cams, some of the subtracting step levers 108 will remain as in Fig. 2 while those subtracting step levers whose cams have rotated through the zero position will be thrown back as in Fig. 3 so as to bring the studs 113 of the subtracting step levers 108 into registry with the seats 118' of the projections 97 of the locks 95. As shown in Fig. 3, the studs 113 will at this stage have moved slightly past a full seating position with respect to the complementary seats 118 of the levers 114. At the same time the levers 114 will have been forced downward in the path of the subtracting bars 123. As the subtracting bars move rearwardly no further effect is produced on the levers 114 because the pivoted knuckles or extensions 119 on these levers allow the rollers 121 to swing freely rearwardly whenever struck by the cam surfaces of the subtracting bars. Of course, those levers 114 which have not been depressed, as in Fig. 2, will not contact with the subtracting bars in any way and no undercarry will be effected. When the rearward motion of the actuator and subtracting bars is complete and the undercarry to be made, the accumulating pinions first leave their printing segments and enter the locks and the actuator and subtracting bars start to move to the front. As the

accumulating pinions enter their locks and the levers 114 associated therewith are carried forwardly the seats 118 of those levers 114 that have been depressed are moved into full seating position beneath the studs 113 as shown in Fig. 4. In the first part of the forward movement of the adding and subtracting bars, the accumulating pinions being in their locks and the printing segments free, the cam surfaces of the subtracting bars associated with depressed levers 114 will contact with the rollers 121 of the levers 114 and as these rollers cannot move forward because of the stop 122 on the pivoted extension 119, the lever 114 will be forced upward to carry with it the subtracting step lever 108 and the lock 95. This movement of the lock 95 rotates the accumulating pinion one step (Fig. 4) to effect the undercarry. It will be understood that this acts from one subtracting bar to the pinion of next higher order for the reason that the stud 113 on the subtracting lever 108 of one order co-operates with the extension 97 on the pinion lock 95 of the next higher order.

Furthermore, where the number to be subtracted requires that several of the adding pinions be rotated through their zero positions, but does not require an undercarry in any case through more than the next higher order, the undercarry in the case of all the pinions occurs substantially simultaneously throughout the machine because each subtracting bar being operable by the bail 141 moves at the same time and affects its corresponding lever 114 which in turn operates its associated lever 108, so that all columns of the machine may be affected without having to regard the factor of time in which the operation takes place.

However, there are some instances where the accumulation in the machine is such that the number subtracted therefrom will require an undercarry to more than the next higher order. Suppose, for example the number in the machine is 1004 and it is desired to subtract from this, the number, 76. As previously described the accumulating pinion in the unit column will rotate in a clockwise direction, through the zero position to the position 8. At the same time the accumulating pinion in the 10's column will likewise rotate through the zero position to the position 3. As these pinions pass through the zero positions the respective step levers 108 and levers 114 associated therewith are stepped to the positions shown in Fig. 3 preparatory to the undercarry when the subtracting bars 123 return to their normal positions. The returning subtracting bars 123 effect the undercarry in the manner heretofore described bringing the pinion in the tens column to 2 and that in the hundreds column to 9. But in the undercarry to the hundreds column the accumulating pinion for this column has itself passed through the zero position and has prepared the lever 108 associated with it for an undercarry into the thousand's column which is effected by its associated subtracting bar 123 on its return stroke although slightly subsequent in time to the undercarry of the preceding columns. The number now set up on the accumulating pinions in these four columns is 0928 which is the correct result, and as the zero is to the left of the number, its printing is prevented in the totaling operation by means of my novel cipher lock which is the subject of my copending application, Serial No. 701,283, filed December 7, 1933.

After the lock 95 has been pivoted upwardly in effecting the undercarry, the roller 121 of the

lever 114 associated therewith will continue to ride up and down each successive cam on the subtracting bar disposed in its path until the return movement of the subtracting bars is completed. However, this has no effect on the under-
 5 carry as the lock 95 remains in its raised position in locking engagement with its associated accumulating pinion until the pinion frames are again swung to carry the several accumulating pinions
 10 out of engagement with their associated pinion locks in the next succeeding adding or subtracting operation as the case may be.

It will be noted that the subtracting mechanism just described could equally well be used for
 15 adding operations by substituting it for the adding mechanism described in my Patent No. 1,823,859 hereinbefore mentioned. My invention is to be limited therefore only by the prior art and the scope of the appended claims.

20 I claim:

1. Transfer mechanism comprising an accumulating pinion; a pinion lock for normally holding said pinion against rotation, said lock also being
 25 operable to rotate said pinion; means for operating said pinion lock, comprising a movable member associated with said pinion lock but normally disconnected therefrom; means for operatively connecting said movable member to said pinion lock; and means for operating said movable member
 30 to move said pinion lock and rotate said pinion.

2. In a calculating machine having a pair of accumulating pinions of successive denominational orders; a pinion lock for normally holding
 35 one of said pinions against rotation, said lock also being operable to rotate said pinion; means for operating said pinion lock, comprising a movable member associated with said pinion lock but normally disconnected therefrom; means for operatively
 40 connecting said movable member to said pinion lock; and reciprocating means adapted, when said movable member and said pinion lock have been operatively connected, to move said movable member to effect operation of said pinion
 45 lock and rotation of the pinion associated therewith.

3. In a calculating machine, the combination with an accumulating pinion of means for causing the rotation thereof comprising a reciprocating member having cam surfaces, a holding member
 50 associated with said accumulating pinion for selectively holding said pinion against movement or for rotating said pinion, a movable member associated with said holding member but normally
 55 disconnected therefrom and adapted to be brought into co-acting relationship with said cam surfaces, and means for operatively connecting said movable member with said holding member, whereby on movement of said reciprocating member
 60 motion is imparted through said movable member to said holding member to rotate said pinion.

4. In a calculating machine, the combination with an accumulating pinion of means for causing the rotation thereof comprising a reciprocating member having cam surfaces, a slidable member
 65 coacting with said cam surfaces, a pivoted holding member coacting with said accumulating pinion, and a pivoted member acting between said slidable member and said pivoted holding member.

5. In a calculating machine, the combination with an accumulating pinion having cam means associated therewith of means for rotating said
 75 pinion comprising a reciprocating member, slid-

able means coacting therewith, a pivoted holding member adapted to engage said accumulating pinion, and another pivoted member actuated by said cam means to an operative position between
 80 said holding means and said slidable member.

6. In a calculating machine, the combination with an accumulating pinion having cam means associated therewith of means for rotating said pinion comprising a reciprocating member having
 85 cam surfaces, a slidable member coacting with said cam surfaces, pivoted holding means for said pinion, and another pivoted element having means thereon adapted to coact with said cam means to interpose said pivoted element between
 90 said slidable member and said holding member whereby the motion of said slidable member is caused to rotate said pinion.

7. In a calculating machine having a pair of accumulating pinions of successive denominational orders and cams associated with said pinions, the combination therewith of a reciprocating element having cam surfaces, a slidable member
 95 actuated by said reciprocating element, pivoted holding means for one of said pinions, and another pivoted element adapted to be actuated by the cam associated with the second of said pinions to a position intermediate said slidable member and said holding member, thereby establishing operative connection between said slidable member and said holding member to permit
 100 motion to be imparted from said slidable member to said holding member to rotate said first pinion a predetermined degree with respect to said second pinion.

8. Transfer mechanism comprising an accumulating pinion; a pinion lock for normally holding
 110 said pinion against rotation, said lock also being operable to rotate said pinion; a slidable member normally disconnected from said pinion lock; means for connecting said slidable member to said pinion lock; and means for moving said slidable member to cause the latter to act through
 115 said connecting means to operate said pinion lock for rotating said pinion.

9. In a calculating machine having a pair of accumulating pinions of successive denominational orders, a cam movable with the pinion of lower denomination and a pinion lock associated with the pinion of higher denomination; a slidable member associated with said pinion lock;
 120 means for operatively connecting said slidable member to said pinion lock; means controlled by said cam for causing said connecting means to operatively connect said slidable member and said pinion lock, to operate said pinion lock to rotate
 125 the pinion of higher denomination; and a reciprocating member for actuating said slidable member.

10. In a calculating machine having a pair of accumulating pinions of successive denominational orders, a cam movable with the pinion of lower denomination and a pinion lock associated with the pinion of higher denomination; a reciprocating member; a slidable member associated with said pinion lock and adapted to be
 135 actuated by said reciprocating member for moving said pinion lock to rotate the pinion of higher denomination; means for operatively connecting said member to said pinion lock; and a lever operable by said cam for moving said slidable member
 140 into position to be actuated by said reciprocating member.

11. Transfer mechanism comprising a pair of accumulating pinions of successive denominational orders; a movable pinion lock for normally
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holding the pinion of higher denomination against rotation; a slidable member associated with said pinion lock and normally disconnected therefrom; a lever; a cam associated with the
 5 pinion of lower denomination for moving said lever to cause the latter to operatively connect said slidable member and pinion lock; and means for operating said slidable member to move said pinion lock and rotate said pinion of higher den-
 10 mination.

12. In a calculating machine having a pair of accumulating pinions corresponding to successive denominational orders; a pinion lock for nor-
 15 mally holding the pinion of higher denomination against rotation, said lock also being operable to rotate said pinion; means for operating said pinion lock, comprising a movable member associated with said pinion lock but normally disconnected
 20 therefrom; a pivoted lever; a cam associated with the pinion of lower denomination for moving said lever to connect said movable member to said pinion lock; and reciprocating means having cam surfaces for moving said movable member to effect operation of said pinion lock and rota-
 25 tion of said pinion of higher denomination.

13. In a calculating machine having a pair of accumulating pinions of successive denomina-
 30 tional orders and a pinion lock normally holding the pinion of higher denomination against rotation, said lock also being operable to rotate said pinion; a slidable member for operating said lock,

said member being normally disconnected from said lock; a pivoted lever; a stud on said lever; a cam associated with the pinion of lower denomi-
 nation for pivotally moving said lever to inter-
 80 pose said stud between said slidable member and said pinion lock for providing an operating connection therebetween; and means for moving said slidable member and acting through said stud to move said pinion lock for rotating the pinion
 85 of higher denomination.

14. In a calculating machine; a pair of accum-
 ulating pinions of successive denominational orders; a movable pinion lock associated with the pinion of higher denomination for normally hold-
 90 ing the latter against rotation; a reciprocating member having cam surfaces; a slidable member adapted to coact with said cam surfaces and to be moved thereby on reciprocation of said member; a pivoted lever; a stud on said lever; a cam asso-
 95 ciated with the pinion of lower denomination for operating said lever to interpose said stud between said slidable member and said pinion lock to connect the said member and lock and to move said member into coacting relation with the cam
 100 surfaces of said reciprocating member, whereby said reciprocating member effects movement of said slidable member and acts through the said connection between said slidable member and said pinion lock to move the latter for rotating said
 105 pinion of higher denomination.

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