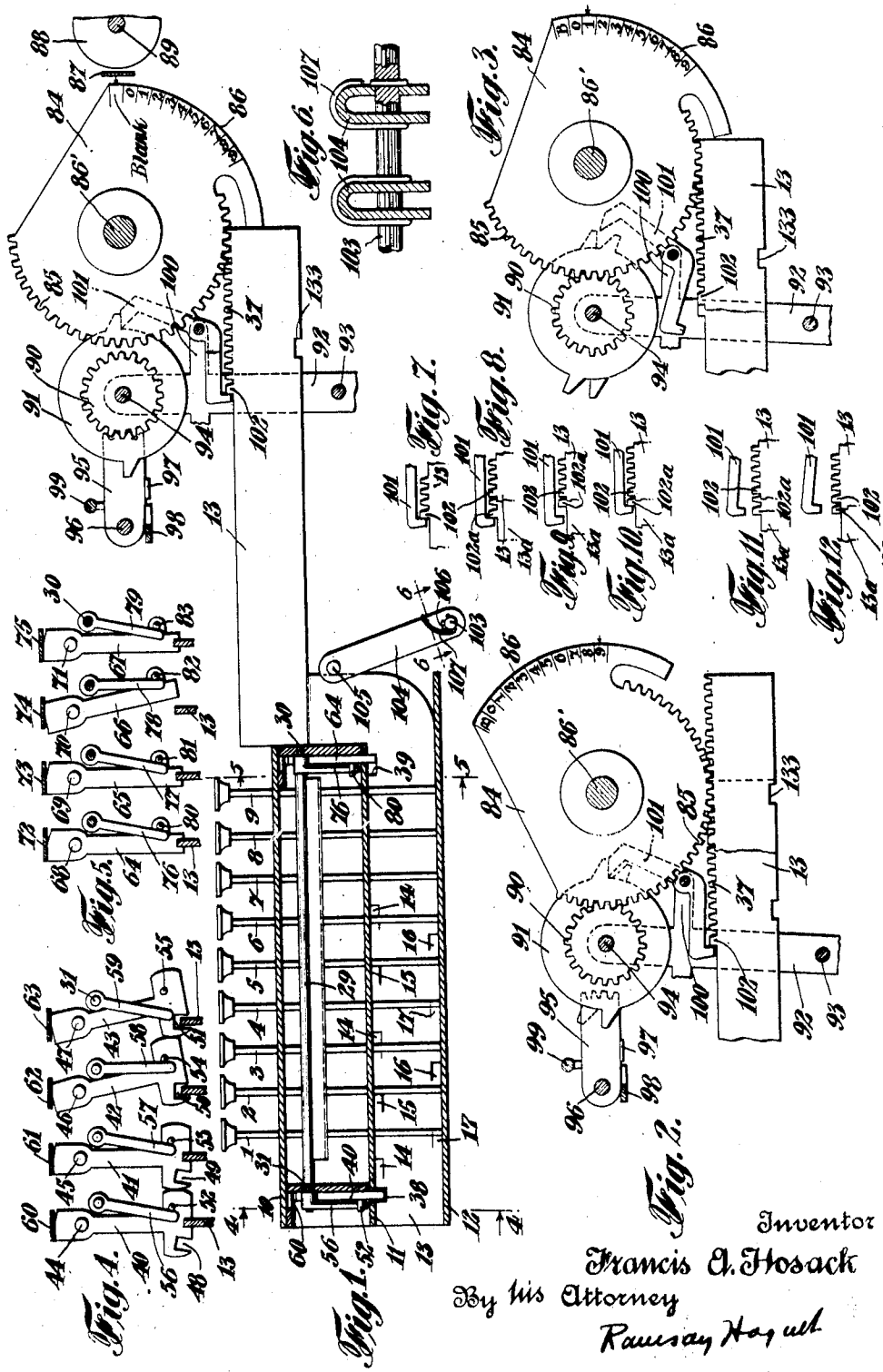
Sept. 15, 1931. F. A. HOSACK 1,823,859

CALCULATING MACHINE

Filed Aug. 11, 1925 5 Sheets-Sheet 1



Inventor
Francis A. Hosack
By his Attorney
Ramsay Haguth

Sept. 15, 1931. F. A. HOSACK 1,823,859

CALCULATING MACHINE

Filed Aug. 11, 1925 5 Sheets-Sheet 2

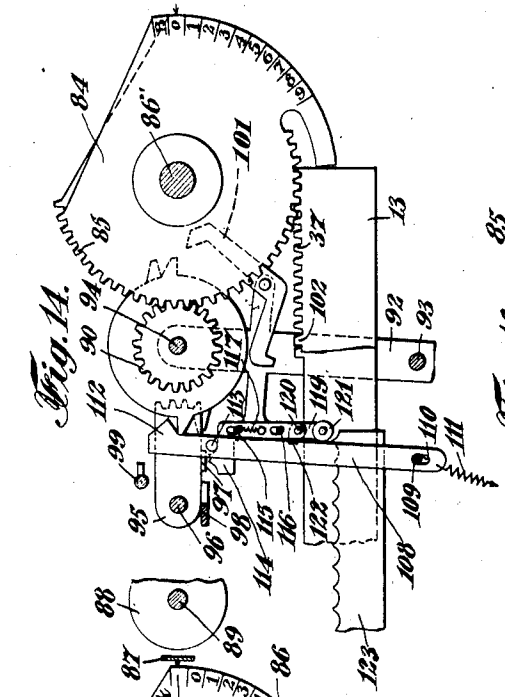


Fig. 14.

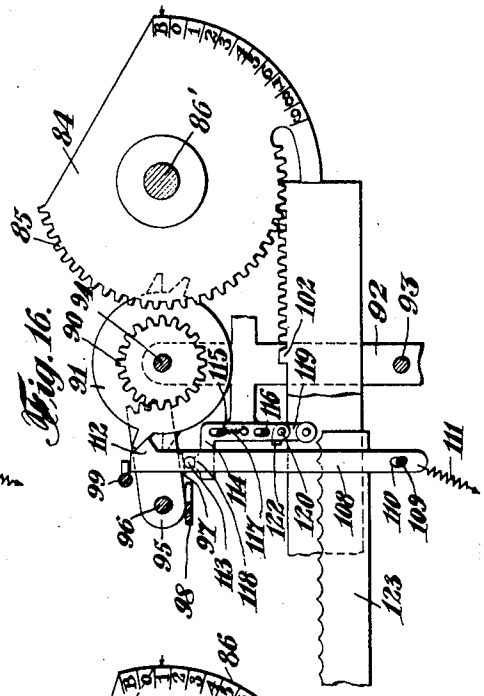


Fig. 16.

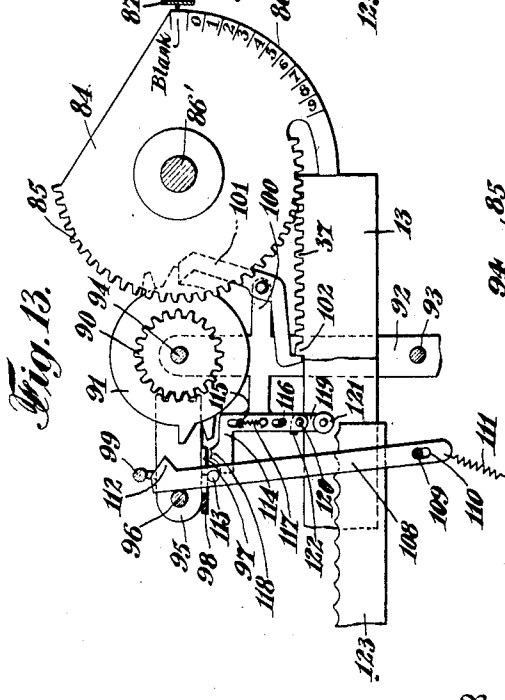


Fig. 13.

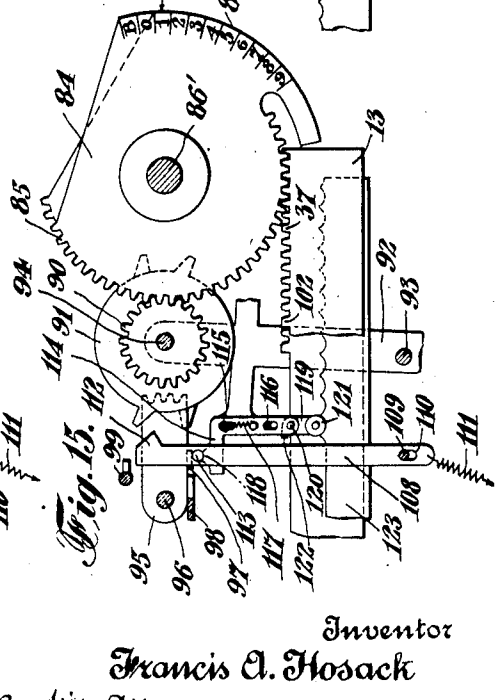


Fig. 15.

Inventor
Francis A. Hosack
By his Attorney
Ramsay Hoguet

Sept. 15, 1931. F. A. HOSACK 1,823,859

CALCULATING MACHINE

Filed Aug. 11, 1925 5 Sheets-Sheet 3

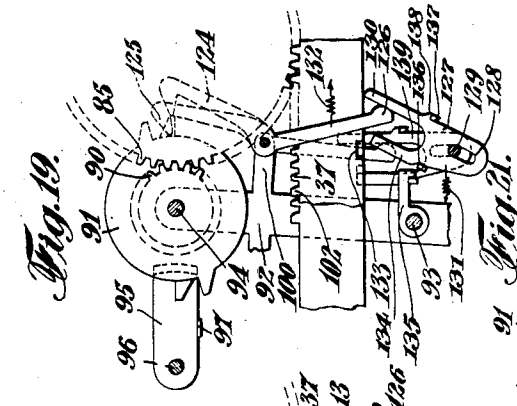


Fig. 19.

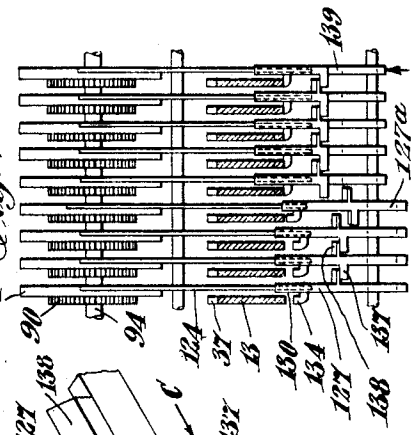


Fig. 21.

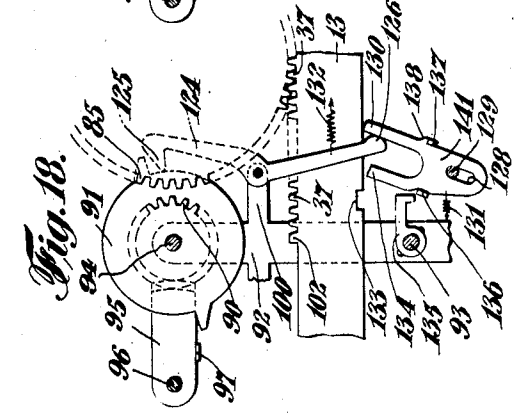


Fig. 18.

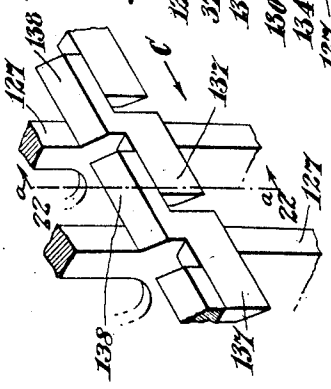


Fig. 22.

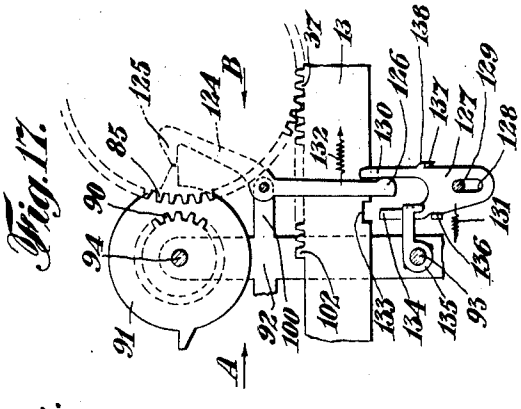


Fig. 17.

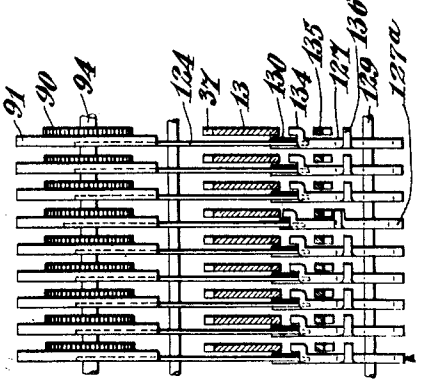


Fig. 20.

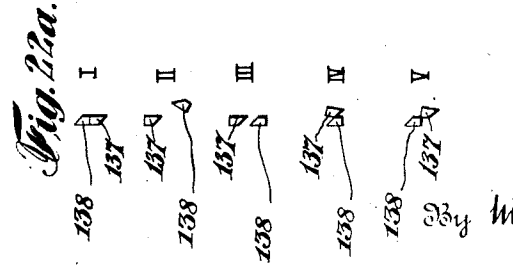


Fig. 22a.

Inventor
Francis A. Hosack
By his Attorney
Ramsay Hoguet

Sept. 15, 1931. F. A. HOSACK 1,823,859

CALCULATING MACHINE

Filed Aug. 11, 1925 5 Sheets-Sheet 4

Fig. 23.

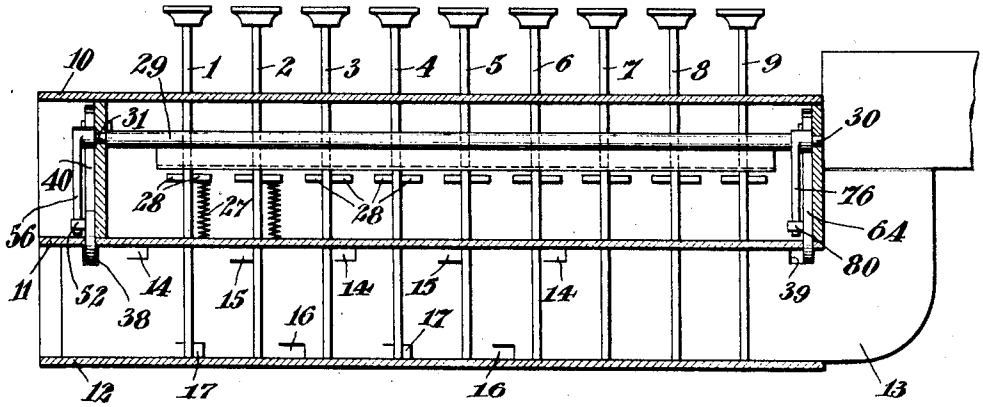


Fig. 24.

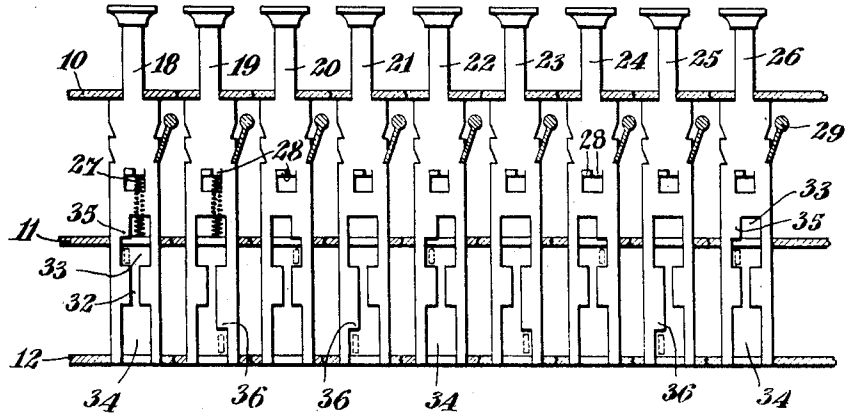


Fig. 25.

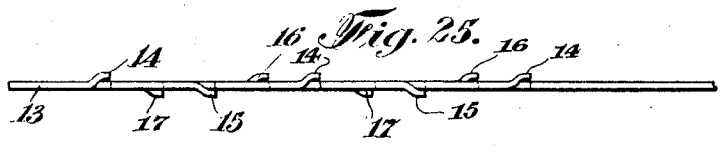
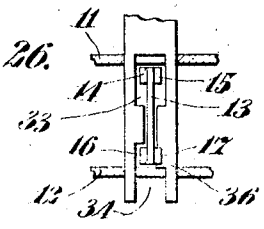


Fig. 26.



Inventor
Francis A. Hosack
By his Attorney
Ramsay Hoguet

Sept. 15, 1931. F. A. HOSACK 1,823,859

CALCULATING MACHINE

Filed Aug. 11, 1925 5 Sheets-Sheet 5

Fig. 27.

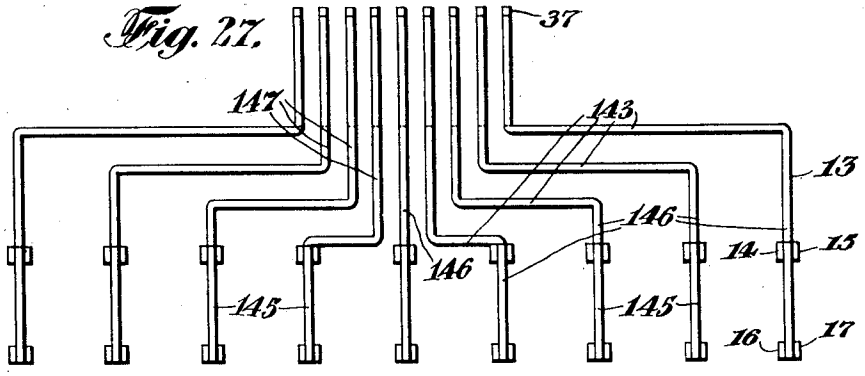


Fig. 28.

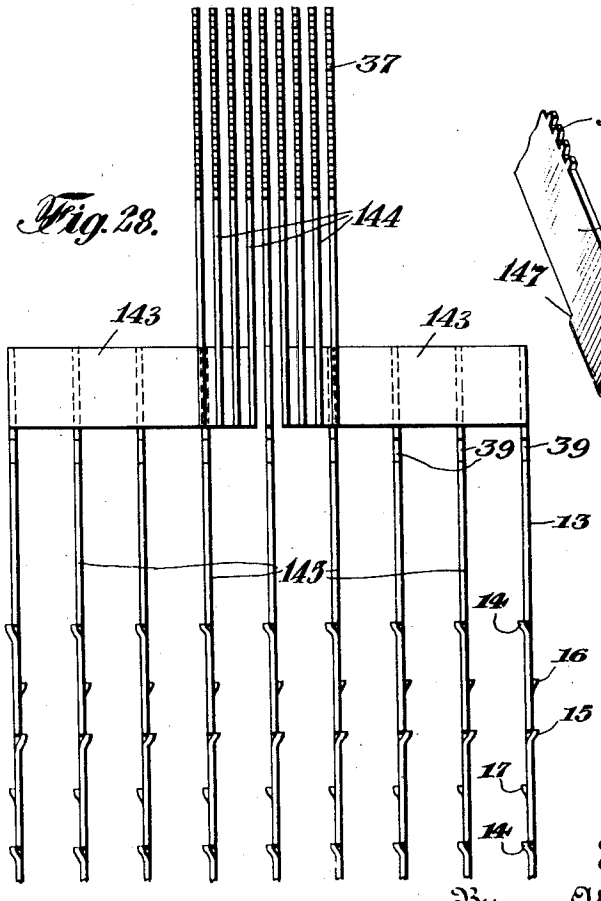
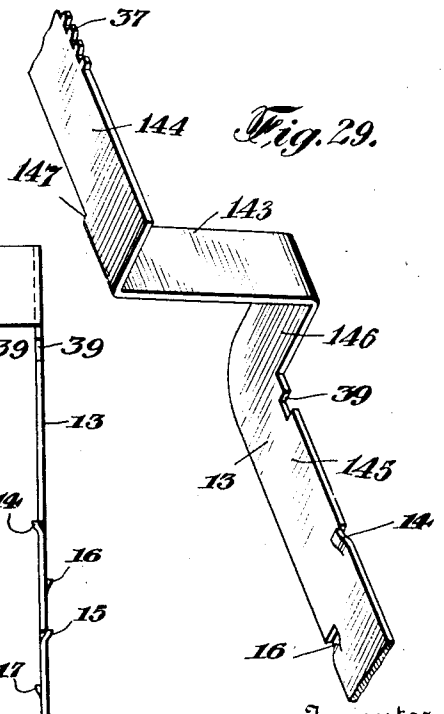


Fig. 29.



Inventor
Francis A. Hosack
By
Attorney
Ramsay Hoguet

Patented Sept. 15, 1931

1,823,859

UNITED STATES PATENT OFFICE

FRANCIS A. HOSACK, OF NEW YORK, N. Y.

CALCULATING MACHINE

Application filed August 11, 1925. Serial No. 49,565.

My invention relates to computing machines and particularly to that class where adding and subtracting operations are carried on in conjunction with totalling and listing. In the preferred form in which I illustrate my invention there are many new and useful features by which I can produce a machine of the widest application with simple construction and one adapted to low cost manufacture. Among the advantages are the keystems which are not only completely selective but of which only two forms are needed for a keyboard of any capacity while my convergence of the sector bars is so arranged that a large number may be included within a very small space. This, together with my improved type of keys, allows me to produce a light, compact and inexpensive machine. Another feature of my invention is that the selectivity of the keys is aided by the stop arrangement on the actuator bars for the reason that these stops are so arranged that only one on each actuator bar is effective for any key of that column; that is, each key of the column has its own stop on the actuator bar and no other stop will affect that key. Other features are the forward step motion for the transfer in addition and the backward step motion for the transfer in subtraction, both of these operations being positive and so related in their movements that they function the whole width of the keyboard without any special provision being made for an allowance of time in which this is done. The forms of my adding and subtracting mechanisms are somewhat different in the machine to be described but they are interchangeable to the extent that my subtracting mechanism may be equally well adapted to the adding operations; a decided advantage in particular respect of manufacturing and simplicity. Another advantage is found in the actuator locks which immediately withdraw from all actuator bars to the right of the key depressed while the others remain in and this withdrawal in coaction with the zero locks which are individually released on a key depression, permits the actuator movement in accordance with the number inserted without a complication of parts and involved movements of the mechanism. In the printing operation it has heretofore required ingenious combination of parts to prevent the printing of ciphers to the left of the number in the machine whereas I accomplish this by a very simple relation of the cipher locks of the actuator bars which act in sequence from the left and so act until that sequence is broken and no actuator bar can move and therefore no cipher be printed except on the columns corresponding to the number required to be printed. In general, the art uses only a solid and continuous frame for restoring the actuator bars whereas I provide a separate restoring frame for each actuator bar which also has a predetermined step motion separate from the motion imparted by the operating shaft; this step motion being of particular value in permitting me to effect the transfer in a simple and rapid manner. Other and further advantages and benefits will appear in the following specification and drawings. The form chosen is for the purposes of illustration and explanation only. Furthermore the drawings which form a part of the specification are diagrammatic and are to be taken only as illustration of the principle of my invention as applied in a preferred form.

While I show my invention in its preferred form for the purposes of illustration only, many changes and modifications may be made without departing from the principles which I disclose in the following specification of which the drawings form a part. In these drawings for the sake of simplification, I omit some operating elements which are well known in the art but which are not included in my invention and when I refer to such elements or means it will be understood that they are such as would be applied by one skilled in the art.

In the drawings:

Figure 1 is a fragmentary vertical longitudinal sectional view through the machine showing the relation of the keyboard actuator bar and printing and registering mechanism in normal position.

Figure 2 is a fragmentary vertical lon-

gitudinal sectional view taken on the same line as Figure 1 and showing the printing and registering mechanism in a slightly different position, the adding pinions being in mesh with the printing segment and the step lever being in closed or locked position.

Figure 3 is the same as Figure 2 but with the stop lever in open or unlocked position.

Figure 4 is a vertical fragmentary section taken on the line 4—4 of Figure 1 and showing part of the series of actuator bar locks.

Figure 5 is a smaller fragmentary section taken on the line 5—5 of Figure 1 and showing part of the series of zero locks.

Figure 6 shows a section through the restoring frames on the line 6—6 of Figure 1.

Figures 7–12 are detail views showing the related action of the step lever on the actuator bar and the foot of the step lever.

Figures 13–16 show the subtracting mechanism.

Figures 17 to 19 inclusive are side elevation views showing the cipher lock and cooperating elements in different positions assumed in the operation of the machine.

Figure 20 is an end elevation taken in the direction of arrow A of Figure 17.

Figure 21 is an end elevation taken in the direction of arrow B of Figure 17.

Figure 22 is a fragmentary perspective view showing the relation of the bevelled projections on the cipher locks.

Figure 22*a* is a diagrammatic view taken on a line through two of the cooperating projections 137 and 138, as on the line 22*a*—22*a* in Figure 22, said projections being shown in five different positions which are assumed during the operation of the machine.

Figure 23 is a fragmentary longitudinal sectional view through the keyboard portion of the machine showing the keystem lock, the actuator bar lock and the zero lock.

Figure 24 is a composite vertical sectional view taken at right angles to Figure 23 and showing the keystems and their relation to the actuator bar stops.

Figure 25 is an edge view of that portion of one of the rack bars carrying the keystem stops.

Figure 26 is a detail showing the relation of the actuator bar to a keystem when the key is in depressed position.

Figure 27 is a front elevational view of the actuator bar assembly with the several actuator bars disposed somewhat farther apart than in the assembled machine.

Figure 28 is a top plan view of the actuator bar assembly with a portion of that end of each of said bars which carries the key stops omitted.

Figure 29 is a perspective view of one of the actuator bars with a portion of the respective end sections omitted.

It will be understood that wherever I speak of front or forward it will mean in relation to a person facing the keyboard and rear or rearward would be away from such person. Also, when I speak of right or left, it means to the corresponding direction of the above person who faces the machine.

In Fig. 1, I show a column of keys 1 to 9 inclusive arranged longitudinally of the machine, their tops being smaller than usually used so that in conjunction with the type of actuator bar and keystem used, I am able to secure a smaller and more compact keyboard than would otherwise be possible. These keys are supported and guided in suitable plates 10, 11 and 12 which are superposed relative to each other and lie in horizontal planes. At 13 is one of the actuator bars of which there is one for each column of keys. This actuator bar 13 passes between the plates 11 and 78 which form horizontal guides for it. On the top and bottom edges of the keyboard ends of these actuator bars are stops such as at 14 and 15 and 16 and 17, these stops extending alternately to right and left in both the top and bottom series (see Figs. 25 and 26). The actuator bars pass through the keystems (see Fig. 26) which form vertical guides for the actuator bars and prevent their lateral movements so that if no key is depressed in their path, the actuator bars, assuming that they are not otherwise held, may move freely through the keystems. In Fig. 23 at 1 to 9 inclusive I show a vertical row of such keystems and in Fig. 24 the numerals 18 to 26 inclusive indicate respectively one key in each of the longitudinally aligned rows, the figure representing a composite section taken at right angles to Figure 23, the key 18 representing the key in the lower or front left hand corner of the machine (the numeral 1), the key 19 representing the second key from the left in the row of twos, or second row from the front of the machine, and so on diagonally across the keyboard to 26, which represents that nine in the nine row which is positioned in the extreme upper right hand corner of the keyboard. Each key is held in its normal position by a compression spring such as 27 acting between the plate 11 and a double seat 28 which may be pressed from the body of the keystem as shown although many other means may be employed. To the one side of each keystem is a keystem lock such as at 29, supported at each end as at 30 and 31 (Fig. 23) so that it can swing in and out of engagement with the depressions on the keystems, these locks being controlled by mechanism (not shown) well known in the art. The keystems are shown as consisting of only two forms, the desired

selectivity being secured by associating part of the keystems in the assembly in the reversed position. Each keystem has a restricted opening as at 32 (Fig. 24) with larger openings 33 and 34 above and below. The restricted openings 32 serve as guideways for the actuator bars, maintaining them in alignment with one another as well as in position for engagement of their keystem stops with the appropriate stops on the keystems. The only difference in the two forms of keys is that those of 18, 20, 22, 24, and 26 have a projection 35 extending into the opening 33 while those of 19, 21, 23 and 25 have a projection 36 extending into opening 34.

The keystems 18, 20, 22, 24 and 26 correspond to those of the numerals 1, 3, 5, 7 and 9 and it will be observed that the keystems 20 and 24 (the 3 and 7 keys) are reversed in position, so as to bring projection 35 on the opposite side, from the keystems 18, 22 and 26 (the 1, 5 and 9 keys). The keystems 19, 21, 23 and 25 correspond to the numerals 2, 4, 6 and 8 and the reversal of position here is between keystems 19 and 23 (the 2 and 6 keys) and 21 and 25 (the 4 and 8 keys). As they are entirely reversible, I need only these two simple forms of keystems to make an entire keyboard thus producing economies in manufacture and making it possible to produce a machine of very much more compact form than is now possible and with a corresponding increase in effectiveness. Furthermore, each key has its stop on the actuator bar and no other stop, either top or bottom, of that actuator bar is effective for that key. This is apparent from Fig. 26 which shows either keystem 19 or 23 in its depressed position and the relation of the actuator bar thereto. In this position the projection 36 has come into the path of its stop on the actuator bar, thereby preventing further travel of that actuator bar whereas all other stops lie unobstructed in the apertures 33 and 34 of the keystems. It will also be noted that in Fig. 24, the particular stop on the actuator bar for each keystem is indicated by dotted lines in the upper or lower aperture in each of the keystems and while the actuator bars pass freely through the keystems in the position they are in as shown in Fig. 24, the depression of any key will bring one or the other of projections 35 and 36 in the path of its particular stop on the actuator bar to be affected and no other stop will be effective for any purpose. The actuator bars such as at 13 in Figs. 1 and 23 are of the flat strip type having stops on their upper and lower edges on their keyboard or outer or forward ends as previously explained and shown in Fig. 25 and their shape is as shown in Fig. 29 for a reason to be explained later. On the inner or rearward ends of these actuator bars are toothed racks 37 (Fig. 1) and near the outer end of each is a cut or slot 38 for the actuator bar locks and further inwardly is another cut or slot 39 for the zero locks. The actuator bar locks are shown in Figs. 1, 4 and 23 and consist of a series of pivoted members such as 40, 41, 42 and 43, there being one such for each actuator bar, see Fig. 4. Each lock is pivoted upon the keyboard frame as shown at 44, etc. and there is an opening as at 48, etc. Pins 52 etc. are provided, against which are adapted to lie the arms 56, etc. which are fixed to move with the keystem locks 29. The upper edge portions of these actuator bar locks are formed of two plane surfaces meeting at an angle to each other so that the 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. It will be evident that when no numbers are in the machine, the locks will depend perpendicularly as indicated by the position of 40 and 41 with the solid parts of their lower ends in the cuts 38 of the actuator bars and consequently all actuator bars are locked against movement. However, when a key is depressed, the keystem lock 29 is momentarily thrown out in the downward passage of the keystem and this movement of the keystem lock carries with it its arm, such as 58, which acts against pin 54 to swing the actuator bar lock 42 over so that the solid part moves out of the cut 38 on the actuator bar. The opening 50 of the lock will then register over the actuator bar to permit its free movement according to the number put in the machine, and the actuator bar lock which has been moved will remain unlocked by virtue of the flat spring 62 as described but these locks are returned to their normal position in the restoring action of the machine. It will be also seen that if a key to the left of the first column is depressed, the unlocking movement of the actuator bar lock in that column will carry with it and cause to unlock all of the actuator bar locks to the right while those to the left remain locked. This is shown in Fig. 4 where lock 42 has forced lock 43 to disengage from its actuator bar and this would follow for all other actuator bar locks to the right. The left hand actuator bar locks, such as 40 and 41 remain unaffected. Therefore it follows that all actuator bars to the right of any key depressed, including the one depressed, are immediately released to permit the actuator bars to move while all actuator bars to the left of the key depressed remain in and those actuator bars cannot move. Upon the restoring of the machine, all of the actuator bar locks which have been released are thrown in, upon return of the actuator bars, by any suitable means which would be apparent to one skilled in the art. For insuring the printing of zeros in those columns in

which no key is depressed to the right of the one in which a key has been depressed, zero locks are provided. The zero locks are also operated by the keystem locks as indicated in Fig. 5 where several of such locks are indicated at 64, 65, 66 and 67 and which are pivoted to the keyboard frame, as at 68, etc. as in the case of the actuator bar locks. Similarly, these zero locks have the flat springs 72, etc. to act on the top surfaces of these locks and retain them in either the locked or unlocked positions. 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. Consequently when any key is depressed to throw out the keystem lock 29, the zero lock of the actuator bar of that column will be thrown out of the cut 39 of the actuator bar, which is the position of lock 66 of Fig. 5. The action of these zero locks differs from that of the actuator bar locks in that they move independently of each other and remain locked except when they are individually thrown out by a key depression in their corresponding columns. As with the actuator bar locks, the zero locks may have any of the means well known in the art for again bringing them from the unlocked to the locked position in the restoring movement of the machine. The slot 39 in each of the actuator bars, into which the corresponding zero lock enters, is wider than the lock by an amount equal to the distance which the actuator bar must travel to bring the printing segment (to be presently described) into position to print a zero. It is the combination of the actuator bar locks and the zero locks which insures the printing of zeros to the right of any key depressed and inhibits the movement of any actuator bars to the left of that key. This is for the reason that any actuator bar lock which is thrown out will carry all of its right hand neighbors with it and so release those actuator bars while the zero locks only release individually. Consequently when the actuator bars are released by their locks, those having numbers in their columns will move rearward a corresponding distance while those having zeros, the zero locks remaining in, will only be able to move to the extent of the slot 39 which is just sufficient to bring the printing element from blank to zero position as will appear later. The actuator bars to the left of the amount will have their locks in engagement and cannot move and their printing segments therefore remain in the blank position.

As before mentioned, each actuator bar 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. On 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 although I am not limited to this but can add symbols of varied nature beyond the ones indicated by extending the printing portion 86.

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 adding pinions 90 and the adding 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 adding pinions are the pinion locks 95, having teeth into which the teeth of the adding pinions fit, and which are adapted to pivot about the shaft 96. On this adding pinion lock 95 is an extension or lip 97 which pertains to the subtracting operation to be explained later. 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 used to change from the 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 adding 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 highest 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. 6 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 but the keyways 106 are enlarged as shown 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 frames 104 within the limits of the keyway 106.

In Figs. 13 to 16 the subtracting mechanism is shown and which operates as a direct subtracting transfer throughout the machine. For each adding pinion cam there is a subtracting step lever 108 which is pivoted as at 109, the slot 110 in which the pivot acts being large enough to permit of some vertical movement of the lever 108 against the tension of the spring 111. The upper end of this lever 108 has a cam surface 112 and below is a pin or stud 113 on the side of the lever toward the pinion lock 95. Adjacent to each of the subtraction step levers is a subtracting transfer lever 114 arranged to move vertically on the pins 115 and 116, and normally held upward by the tension spring 117. On the upper end of the lever 114 is a seat 118 and on the lower end is the extension 119 pivoted at 120 and carrying the roller 121. This extension can swing freely in the direction toward the rear of the machine but cannot swing in the opposite direction because of the stop 122. Between the sector bars and under each roller of the subtracting transfer levers 114 is a subtracting bar 123 having a series of cam contours on its upper edge which I show in this instance as being approximately portions of circles. These subtracting bars move at the same time as the actuator bars but neither the rate nor the extent of their movement need be the same as the actuator bars for I may obviously have the subtracting bars move to any extent in any time relation within the range of movement of the restoring frame or separate actuating means. Also it will be understood that the subtracting transfer levers 114 extend from the subtracting bars to the pinion lock of the adding pinion of next higher order and likewise that this subtracting mechanism is brought into action or inhibited from action by a suitable lever or other device evident to one skilled in the art.

In order that no printing can occur in the totalling operation as to the columns to the left of the amount so to be printed, I provide a cipher lock for each of the actuator bars as follows, see Figs. 17 to 19. On each of the extensions 100 of the swinging frame 92 is pivoted a cipher lock lever 124 (the pivot being the same as for the step lever 101 in Fig. 1) having a cam surface 125 on its upper end and a bearing surface 126 on its lower end. Below each actuator bar 13 is a cipher lock 127 which has a slot 128 in which is the pivot 129. The leg 130 of this cipher lock is held against the lower end 126 of the cipher lock lever by the tension spring 131 while the superior spring 132 tends to force the upper end 125 of the cipher lock lever against the adding pinion cam 91. The bottom edge of the actuator bar 13 has a cut 133 adapted to receive the leg 134 of the cipher lock when it is raised. Mounted on and fixedly attached to the pivot 93 is a catch 135 which coacts with the lug 136 on the cipher lock to hold that lock firmly when it raises and enters the cut 133 of the actuator bar. On the opposite side of the cipher lock 127 from the lug 136 are the bevelled projections 137 and 138 (also see Fig. 22), the view in Fig. 22 showing relative location of these projections on the cipher lock and the relation of such projections on adjacent locks, the direction of their operation being from left to right in the machine as indicated by the arrow C in Fig. 22. Therefore these cipher locks 127 being as in Fig. 21, where the arrow indicates the left of the machine as in Fig. 20, the extreme cipher lock 139 will be the only one actuated in the totalling operation. As this lock 139 moves upward to engage its actuator bar (Fig. 19) it will carry with it all of the cipher locks to the left of it by reason of the overlapping bevelled projections as shown in Fig. 22. If there is no amount in the machine and the totalling operation is performed, all of the cipher locks will move up to lock their actuator bars as all of the bevelled projections will be in engagement from left to right as in the five right hand columns of Fig. 21 (left hand columns of the machine as viewed from the position of the operator) and no one of the actuator bars will move. Under these conditions, the cipher lock lever 124 remains as in Fig. 17 which is its normal position when the adding wheel and cam are at zero. However, if there be a number in any one of the columns, as the fourth from the left of the machine as indicated in Figs. 20 and 21, then the cipher lock lever is operated by the adding pinion cam (Fig. 18) and the cipher lock 127 for that particular column is thrown rearward so that a break is made in the continuity of the bevelled projections as shown in the fourth column of Fig. 21. Therefore, in the totalling operation, all cipher locks to the left of the fourth column where the break occurs will raise and lock their actuator bars (see 139, Fig. 19) while the cipher lock of the fourth column (such as 127*a* in Figs. 18

and 21) will be thrown rearward. This throwing of the one cipher lock breaks the continuity of the bevelled projections so that no cipher lock to the right of, and including the one thrown forward, will raise and their actuator bars will be free to move rearward according to the amount in the machine. It will be noted that the condition just explained and which is illustrated in Fig. 21 is where there is a numeral in the fourth column and zeros in the first three. If there were numerals in all of the first four columns, the same result would come about, for in that event all of the cipher locks would be thrown out by reason of their cipher lock levers being off their adding pinion cams and the actuator bars would go rearward as before. While I have illustrated the action of the cipher locks in a four digit figure, the action is the same for any number within the range of the machine. The reason for having the projections on the cipher locks bevelled is to bring them back into the overlapping position as in Figs. 21 and 22. This is illustrated in Fig. 22*a* where 137 and 138 correspond to the same projections in Fig. 22 on the section taken through 22*a*—22*a* which is position I. Where the left hand lock 138 is thrown forward and the right hand lock 137 raises, the projections are in position II. During the totalling operation, 137 does not move but 138 moves in so that the bevelled surfaces are in position III. After printing and during restoring these bevelled surfaces make it possible for the cipher lock springs 131 to cause the projections 138 to slide around behind the projections 137 as in positions IV and V until they again assume position I and are then ready to act from left to right in any succeeding totalling operation.

In order to obtain a compact machine, I provide a particular nesting and convergence of the actuator bars as illustrated in one form in Figs. 27 to 29, which bars have stops on their keyboard ends and racks on their rearward ends as previously described. These actuator bars are of the flat strip type and are of the general form shown in Fig. 29 except that the central actuator bar (for a nine bank machine) is without lateral bends such as 143 in Fig. 29 but the parts 144 and 145 would be joined by the part 146. Each actuator bar to the right and left of the central one would have a double nesting and convergence; that is each one would come up, over and up to extend from the keyboard parallelism to the compact parallelism of the printing mechanism. For instance, one of the intermediate actuator bars converges toward the center over its right or left hand bars at a sufficient height to give clearance, then upwardly and outwardly at the proper height. In other words, the actuator bars nest from the center outward and by so doing I secure a simple and very compact machine.

Addition.—When a number is put in the machine, the keys depressed will throw out their keystem locks 29 to move all actuator bar locks (Fig. 4), to the right of and including the key depressed, out of the paths of their actuator bars while only the zero locks (Fig. 5) corresponding to the depressed keys will swing away from their actuator bars. The registering and printing mechanism is in the position of Fig. 1, the subtracting mechanism is idle as shown in Fig. 13 and the cipher locks all are in their inoperative position of Fig. 17. When the operating handle (not shown) is drawn forward, the restoring frames 104 will swing and allow the actuator bars, which are under spring pull as is common in the art, to move rearward. The actuator bars being thus free to move, those in the columns having depressed keys will go rearward until their proper stops are selected by the keystems (Figs. 24, 25 and 26) and their printing segments will be rotated to register the proper numerals at the printing line. Those actuator bars to the right having their bar locks out and their zero locks in, will move one step rearward as is permitted by the slots 39 receiving the zero locks, thereby rotating the corresponding printing segments from blank to zero position. The actuator bars to the left, having their locks in, will not move and their printing segments will remain with blanks on the printing line. Printing now takes place by the platen 88 moving quickly against the type of the printing segments and as the platen resumes its position, the actuator bars previously locked by their bar locks (those to the left) are freed and move rearward to their zero positions, being held there by their zero locks. The frame 92 now swings to carry the adding pinions out of their pinion locks 95 into engagement with the toothed portions of their printing segments (Fig. 2). It will be understood that the pinion locks 95, in the adding operation, are held against movement as previously described by the cam lock 99 and the stop 98. The machine is now ready for the return or restoring stroke and there are zeros to the left on all columns in which there are no numbers so that the machine is in position for any carry-over which may take place. This carry-over is effected by the adding step levers 101 which extend, as previously described, from the adding pinion cams to the actuator bars of next higher order, coacting with the stop 102 on each actuator bar and the loose keyways 106 on the restoring frames 104. As the actuator bars return, the adding pinions are rotated in a counter-clockwise direction and the cams of those

pinions which are to give the carry-over will raise the step-lever 101 out of engagement with the stop 102 on the next higher actuator bar (see Fig. 3). Consequently those actuator bars having the stop 102 out of engagement with the foot of their adding step lever will move forward one step further than the others for the reason that while the adding pinions are engaged with the cams, those adding step levers which have not been raised prevent the actuator bars from moving forward past their zero position while those actuator bars whose step levers have been raised can move forward the full distance to their blank position. This explains the provision for individual restoring frames having the construction shown because in the movement being discussed, while the non carry-over actuator bars are held, the restoring frames of the free actuator bars, by virtue of the spring 107 and the keyway 106, move forward one step further which carries those printing segments of next higher order from zero to blank and gives the carry-over on the adding pinion. The carry-over having been accomplished, the adding pinions disengage from the cams and enter the locks 95 and as the frame 92 swings to do this, the adding step levers are carried back which gives the feet of those levers which were not raised in the carry-over, sufficient movement to allow their actuator bars to move forward to normal position. In doing this the printing segments are rotated from zero to blank but as the adding pinions are in their locks and out of engagement with the toothed portions 85, they are not affected by this movement. As the machine is completely restored to normal, the actuator bar locks and the zero locks re-enter the actuator bars, the keystem lock is released and the machine ready for another operation.

The action of the adding step levers in the carry-over operation is shown in Fig. 7 to 12. For the purposes of illustration, I show two actuator bars 13 and 13*a*, the step lever 101 acting between the stop 102*a* of actuator bar 13*a* and the adding pinion cam of the actuator bar 13 although I show only the foot of this step lever. In Fig. 7, the machine is at rest with all actuator bars forward so that the printing segments are in their blank position. In Fig. 8, actuator bar 13 has moved rearward (a number having been put in that column) while actuator bar 13*a* remains forward with step lever 101 in contact with stop 102*a*. In Fig. 9, all actuator bars have been released from their locks preparatory to the carry-over and go to their zero position so that actuator bar 13*a* moves one step rearward while neither actuator bar 13 nor step lever 101 has moved. In Fig. 10 the adding pinions have swung back to engage their printing segments carrying with them the adding step levers so that, while the actuator bars 13 and 13*a* do not move, the foot of the step lever 101 is drawn back against its stop 102*a*. In Fig. 11 the adding pinions have been rotated in the forward stroke of the actuator bars and the adding pinion cam corresponding to actuator bar 13 has thrown up the adding step lever 101 (as in Fig. 3) which removes the foot of that lever from the path of its stop 102*a*. Consequently the actuator bars, the step levers of which have not been thrown (such as 13) will return to their zero position while the actuator bars such as 13*a* will go forward one step further to their blank position and thereby rotate their adding pinion one numeral, thus effecting the carry-over. This is the position in Fig. 12. From Fig. 12, the adding pinions are disengaged which brings all of the step levers forward, all sector bars go to their blank positions and all step levers are thrown in again as in Figs. 1 and 7. In the case where there are all 9's in the machine and a 1 is put in the first column, the carry-over will first affect only the first step-lever to free the second actuator bar and adding pinion which, in making the necessary movement in carrying over will throw the second step lever so that the carry-over in such case would occur successively from right to left to the full extent of the 9's in the machine.

Subtracting.—The subtracting operation is covered in Figs. 13 to 16 and at the outset it will be understood that here the times of engagement and disengagement of the adding 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. 13. When the subtracting lever (not shown) is thrown on the machine the various parts assume the relative positions in Fig. 14 where the adding pinions have gone into engagement with their segments, the subtracting step lever 108 is thrown rearward, the cam lock 99 moves to free the pinion lock 95 and the adding step lever 101 is thrown up to its inoperative position. When the operating handle is brought forward, the actuator bars move rearward, the adding pinions are rotated in a counter 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 rotation of the adding pinions and their cams, some of the subtracting step levers 108 will remain as in Fig. 14 while those subtracting step levers whose cams have rotated subtractively through the zero registering position with the pinions will be thrown back as in Fig. 15 so as to bring the stud 113 of the subtracting step lever 108 under the projection 97 in the lock 95 and on the seat 118 of the subtracting transfer lever 114 so as to force this subtracting transfer lever downward in the path of the subtracting bar 123 and as these come rearward no effect is produced on the subtracting transfer lever 114 because the pivoted knuckle or extension 119 on that lever allows the roller 121 to swing freely whenever contacted by the cam surfaces of the subtracting bars. Of course, those subtracting transfer levers 114 which have not been depressed, as in Fig. 14, will not contact the subtracting bars in any way. Consequently when the rearward motion of the actuator and subtracting bars is complete and the carry-over to be made, the adding pinions first leave their printing segments and enter the locks and the actuator and subtracting bars start to move to the front. In the first part of this movement, the pinions being in their locks and the printing segments free, the cam surfaces of the subtracting bars will contact the rollers 121 of the subtracting transfer levers 114 (Fig. 15) and as these rollers cannot move forward because of the stop 122 on the pivoted extension 119, the subtracting transfer 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 numeral pinion one step (Fig. 16) to effect the subtracting transfer. It will be understood that this undercarry acts from one subtracting bar to the cam of next higher order for the reason that the extension 97 on the pinion lock 95 extends far enough to come above the stud 113 on the subtracting step lever 108 of the next lower order. Furthermore, this subtracting transfer occurs at substantially simultaneous times throughout the machine because each subtracting bar moves at the same time and affects its subtracting transfer lever accordingly so that all columns of the machine may be so affected without having to regard the factor of time in which the operation takes place. Also, by using the principle described I make the subtraction directly and simply because the one which would ordinarily remain in the machine is taken out by the subtracting transfer step motion just described so that only the correct amount remains in the machine after subtraction has taken place. It will be noted that the subtracting mechanism just described could equally well be used for adding operations by substituting it for the adding mechanism described and thus I may further simplify the machine as to parts and manufacture.

Cipher lock.—In the totalling operation it is desirable not to print ciphers to the left of the amount to be totalled and the cipher locks operate to do this as follows, as shown in Figs. 17 to 22*a*. The accumulation in the machine has left the adding cams in various positions. Those cams having zeros in them will have their cipher lock levers 124 in the position shown in Fig. 17 while those having numerals in them will be in the position shown in Fig. 18 with their cipher locks 127 thrown rearward accordingly. The action of the cipher locks occurs immediately the total key is depressed and will be described in detail at a later point. Therefore, the first step in the totalling operation is the depression of the total key which actuates the cipher locks. On the first movement of the operating handle, all actuator bar locks are thrown out and all of those actuator bars which are not held by their cipher locks move to their zero position. The adding pinions then go into mesh with their printing segments followed by the release of all of the zero locks on the actuator bars. The actuator bars thus freed will move forward, the numeral pinions will be rotated in a counter clockwise direction accordingly until the straight faces of the adding pinion cams come into contact with and abut their adding step levers in the zero position, as shown in Figure 1. Those actuator bars in which there are zeros would not move, their adding pinions being held in the position of Fig. 1. While those actuator bars in which there are numerals would move rearward and rotate their numeral pinions until they were stopped in the zero position by contact of the cams with their adding step levers. The printing segments having been thus brought to the proper printing positions according to the number in the machine, printing takes place, the platen moves away from contact with the type and the numeral pinions disengage from the printing segments. This completes the stroke of the operating handle and on the return stroke the actuator bars go forward to their blank position and all of the actuator bar locks and zero locks are restored.

During the totalling operation the cipher locks have functioned as follows. As heretofore, described these cipher locks have bevelled projections, as 137, 138, in Fig. 17, which overlap from right to left (Fig. 22), so that the raising of the leftmost lock would raise them all and any break in the sequence of overlapping would prevent such

raising from going to the right past the point of break. For instance, in a total of four columns the fourth column would have its cipher lock thrown rearward (as in Fig. 18) for there is a numeral in that column, its adding pinion cam is not at zero and the cipher lock lever 124 is against the cam. Consequently, this throwing rearward of the fourth cipher lock has broken the sequence of overlapping projections as at 127*a* in Figs. 20 and 21. In both of these figures the left of the machine is indicated by an arrow. Therefore, in the totalling operation all cipher locks will raise from the left to lock their actuator bars and will so raise successively until the point of break at 127*a* in Fig. 20 and 21 is reached. The bevelled projection of this lock being out of line, neither it nor the locks to the right of it will raise and those actuator bars will be free to move rearward to print the correct total. The action described is followed throughout, the point of break depending upon the total in the machine and if all columns are used, no cipher lock will raise for it will be understood that each lock is actuated from its left hand neighbor, the leftmost one being actuated from the total lever mechanism.

While I have described my invention in its preferred form there are many changes and variations which may be made, without departing from the spirit thereof and I desire to include all such changes and variations within the scope of my claims.

I claim:

1. In a calculating machine, the combination of a keyboard and depressible keys arranged thereon in series, the keys of each series having alined stems provided with lock-engaging means, pivotally mounted keystem locks common to the respective series of keys, means to swing said locks into locking engagement with the keystems of depressed keys, longitudinally movable actuator bars common to the respective series of keys, a series of pivoted actuator bar-locking members normally in delayed locking relation to said bars, each member being responsive to movement of any key in its series through movement of the corresponding keystem lock to move out of locking relation with its bar, and a second series of pivoted actuator bar-locking members normally in locking relation to said bars and responsive to movement of any key in their respective series through movement of their corresponding keystem locks, the members of said second series being so associated that on movement of one member of the series like movement is imparted to each member of the series at one side thereof.

2. In a calculating machine, the combination of a keyboard and depressible keys arranged thereon in series, the keys of each series having alined stems provided with lock-engaging recesses, pivotally mounted keystem locks common to the respective series of keys, means to swing said locks into locking engagement with the keystems of depressed keys, longitudinally movable actuator bars common to the respective series of keys, a series of pivoted actuator bar-locking members disposed adjacent one end of the keyboard and each having its lower end normally disposed within a recessed portion of an actuator bar, said members being responsive to movement of any key in their respective series through movement of their corresponding keystem locks, and a second series of pivoted actuator bar-locking members disposed adjacent the opposite end of the keyboard and likewise responsive to movement of any key in their respective series through movement of their corresponding keystem locks, each said member of said second series having its lower end normally disposed within a second recessed portion of an actuator bar, and each also contacting with the next adjacent locking member in the series, so that when one of said members of said second series is moved all of the other members of said second series on one side thereof will be simultaneously moved.

3. In a calculating machine, a row of keys having alined stems provided with lock-engaging means, a pivotally mounted keystem lock extending longitudinally of said row of keys and in position to be swung, on depression of any key of the row, into locking engagement with the stem thereof, a longitudinally movable actuator bar associated with said keys, a pivoted actuator bar-locking member normally in delayed locking relation to said bar, and a second pivoted actuator bar-locking member normally in locking relation to said bar, and means carried by said keystem lock and adapted to swing therewith to move said actuator bar-locking members on their pivots out of locking relation to said bar.

4. In a calculating machine, a row of keys, a slidable actuator bar nested within alined openings defining a guideway therefor in the stems of said keys, said openings being so shaped that guiding contact is provided by each keystem on both sides of said bar both when the keys are in normal and in depressed position.

5. In a calculating machine, a row of keys, a slidable actuator bar nested within alined openings defining a guideway therefor in the stems of said keys, said openings being so shaped that guiding contact is provided by each keystem on both sides of said bar both when the keys are in normal and in depressed position, and stops arranged in staggered relation on the keystems and said bar, a single stop on each bar co-acting only with

a stop common thereto on a particular depressed key while other stops carried by said bar are permitted to pass through the stem of said depressed key.

6. In a calculating machine, a row of keys, a slidable actuator bar nested within alined openings defining a guideway therefor in the stems of said keys, said openings being so shaped that guiding contact is provided by each keystem on both sides of said bar both when the keys are in normal and in depressed position, stops arranged in staggered relation on both the top and bottom edges of said bar, and stops carried by the keystems, the stop on each keystem being adapted to co-act only with a stop common thereto on a particular depressed key while adjacent stops carried by said bar on both the top and bottom edges are permitted to pass through cut-away portions of said keystem adjacent said guideway.

7. In a calculating machine, a row of keys, a slidable actuator bar nested within alined openings defining a guideway therefor in the stems of said keys, and stops arranged in staggered relation on the keystems and said bar, a single stop on each bar co-acting only with a stop common thereto on a particular depressed key while other stops carried by said bar are permitted to pass through the opening in the stem of said depressed key.

8. In a calculating machine; a row of keys; a slidable actuator bar nested within alined openings defining a guideway therefor in the stems of said keys; stops extending alternately from opposite sides of said bar along the length of said bar near the upper edge thereof: similar stops near the lower edge of said bar, the stops near the upper edge of said bar being staggered with respect to the stops near the lower edge thereof; and a stop on each keystem, the keystem stops of said row of keys being staggered relatively to each other for causing the keystem stop of a depressed key to engage a single stop provided therefor on said bar and for permitting other stops on said bar to pass freely through the stem of said depressed key.

9. In a calculating machine having a registering member, a printing member and a longitudinally movable actuator bar for effecting operation of said members; a plurality of stops on said bar, said stops extending alternately from opposite sides of said bar at the top and bottom edges thereof; each of said stops corresponding to a single registering and printing value; a depressible key having a stem formed with an opening therein for receiving and guiding said bar; and a stop formed on said keystem and extending into said opening for engagement with said stops for limiting the movement of said actuator bar, said keystem being positioned transversely of said bar at a point corresponding to the registering and printing value of said key for causing said keystem stop, upon depression of said key and movement of said actuator bar, to engage a stop extending from either side of said actuator bar to limit the movement of said bar to an amount corresponding to the registering and printing value of said key.

10. In a calculating machine having a registering member, a printing member, and a longitudinally movable actuator bar for effecting operation of said members; a plurality of stops on said bar, said stops extending from opposite sides of said bar along the length of said bar at the top and bottom edges thereof; each of said stops corresponding to a single registering and printing value; a depressible key having a stem formed with an opening therein for receiving and guiding said bar; and a stop on said keystem extending into said opening for engagement with one of said stops for limiting the movement of said actuator bar, said keystem being positioned on said bar at a point corresponding to the registering and printing value of said key for causing said keystem stop, upon depression of said key and movement of said actuator bar, to engage the stop on said actuator bar which corresponds to the registering and printing value of said key while other stops carried by said bar are permitted to pass through the stem of said key, said key-stem being reversible with respect to said bar for causing said keystem stop to engage stops at opposite sides of said bar.

11. In a calculating machine; a registering member; a longitudinally movable actuator bar for operating said member; a plurality of stops extending alternately from opposite sides of said bar at both the top and bottom edges thereof, each of said stops corresponding to a single registering value; a plurality of depressible keys for controlling said actuator bar in its movements to operate said registering member; a keystem for each key, said keystems having similarly formed openings therein; similarly positioned stops on each keystem extending into said openings for engagement with the stops on said actuator bar for limiting the movement of said bar to operate said registering member, each keystem being positioned longitudinally of said bar at a point corresponding to the registering value of the associated key and being reversible with respect to said bar for causing the stop on said keystem to engage that stop at one side and edge of said actuator bar which corresponds to the registering value of said key and for permitting the

stops on the opposite side of said bar and at the other edge thereof to pass through said keystem without engaging the stop on said keystem.

In testimony whereof, I have signed my name to this specification this 31st day of July, 1925.

FRANCIS A. HOSACK.

CERTIFICATE OF CORRECTION.

Patent No. 1,823,859. Granted September 15, 1931, to

FRANCIS A. HOSACK.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, line 12, for "smaller" read similar; line 62, for "key" read keystem; line 87, for the numeral "78" read 12; page 8, line 45, for "undercarry" read subtracting transfer; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 17th day of November, A. D. 1931.

M. J. Moore,
Acting Commissioner of Patents.

(Seal)