June 24, 1930. A. A. HORTON 1,767,674

TRANSFER MECHANISM FOR CALCULATING MACHINES

Filed June 16, 1928 5 Sheets-Sheet 1

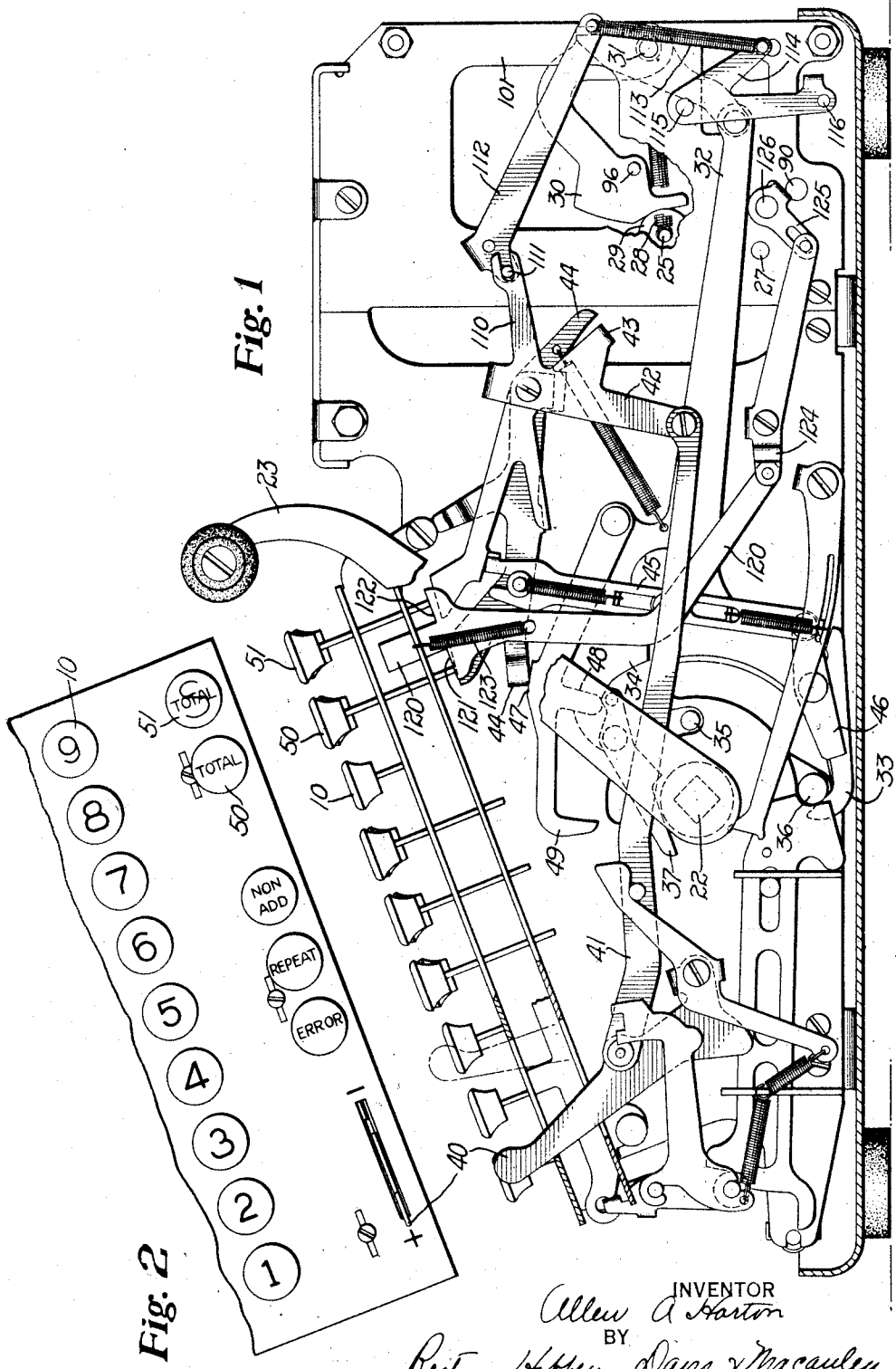


Fig. 1

Fig. 2

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TRANSFER MECHANISM FOR CALCULATING MACHINES

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Fig. 3

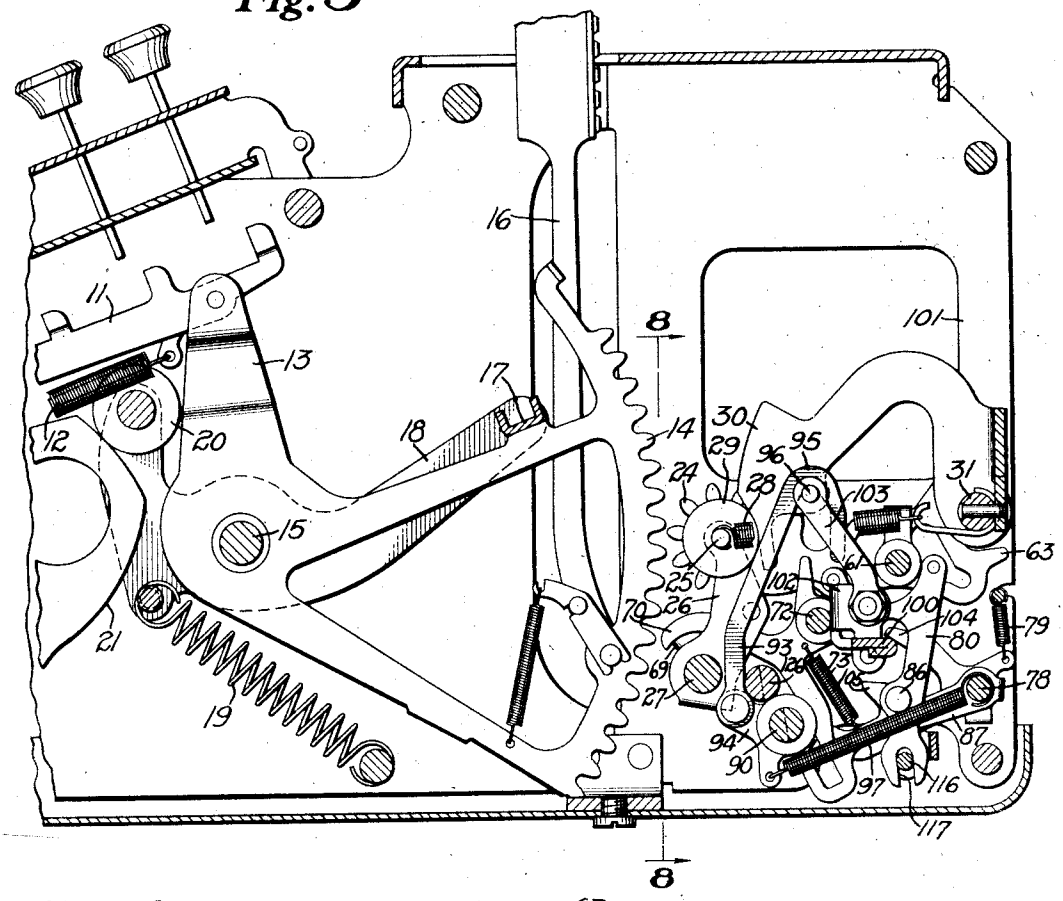
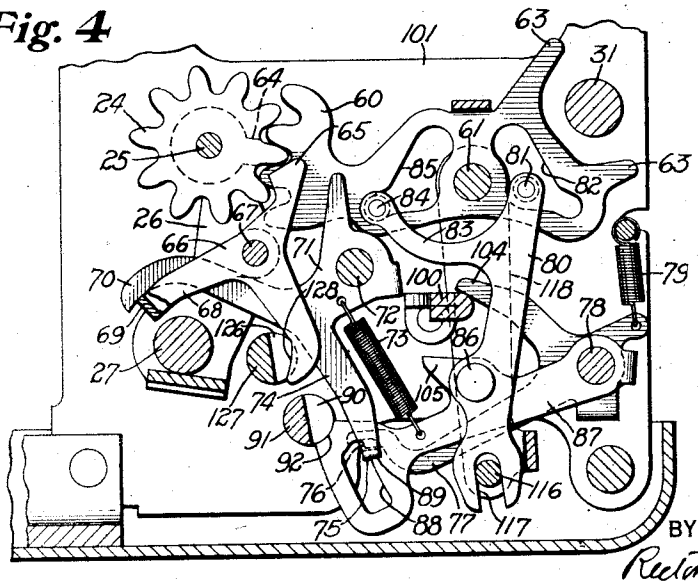


Fig. 4



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TRANSFER MECHANISM FOR CALCULATING MACHINES

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Fig. 5

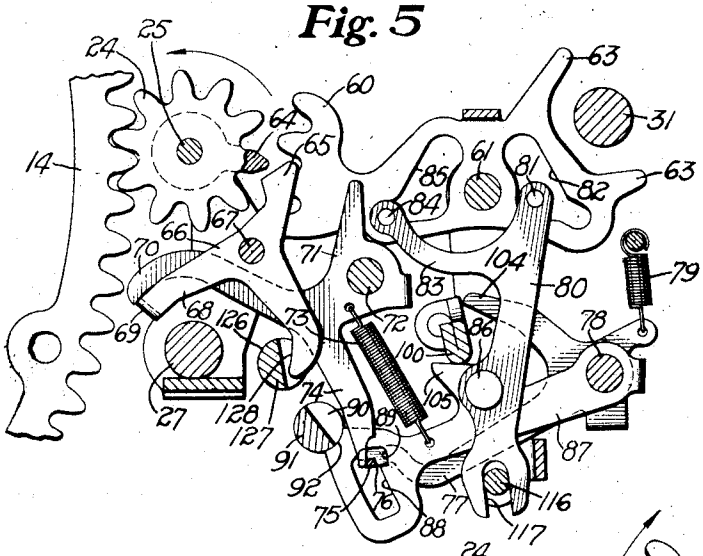


Fig. 6

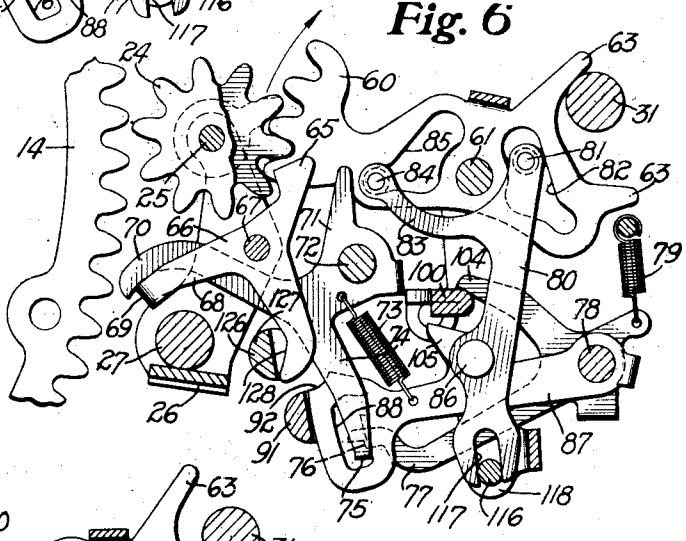
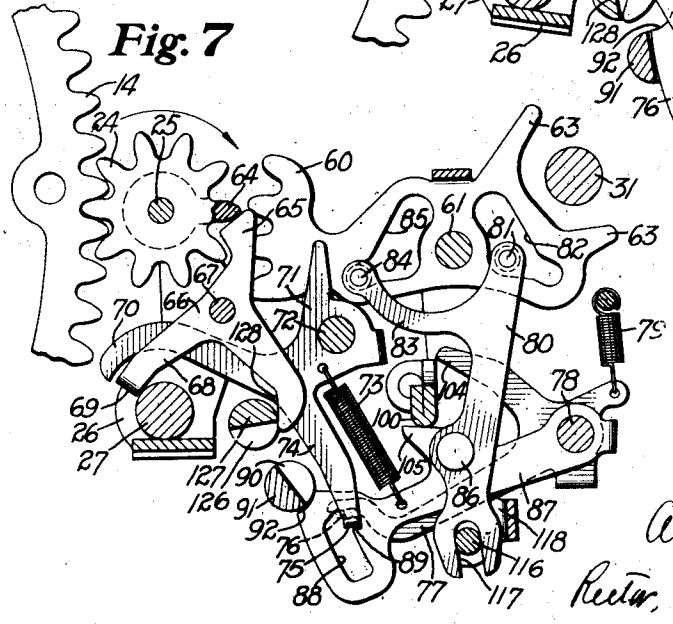


Fig. 7



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TRANSFER MECHANISM FOR CALCULATING MACHINES

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Fig. 8

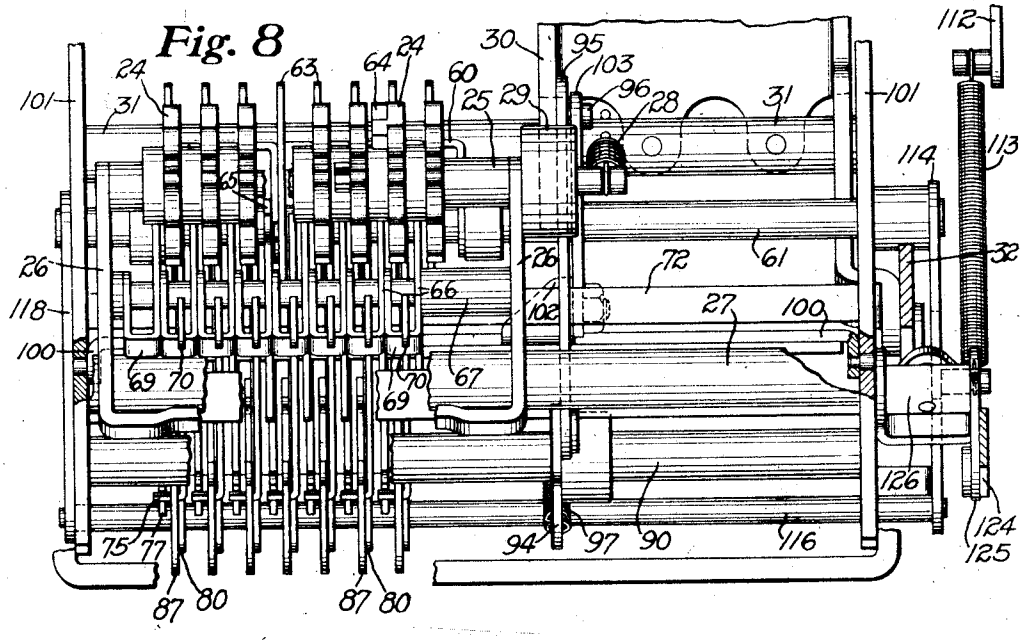
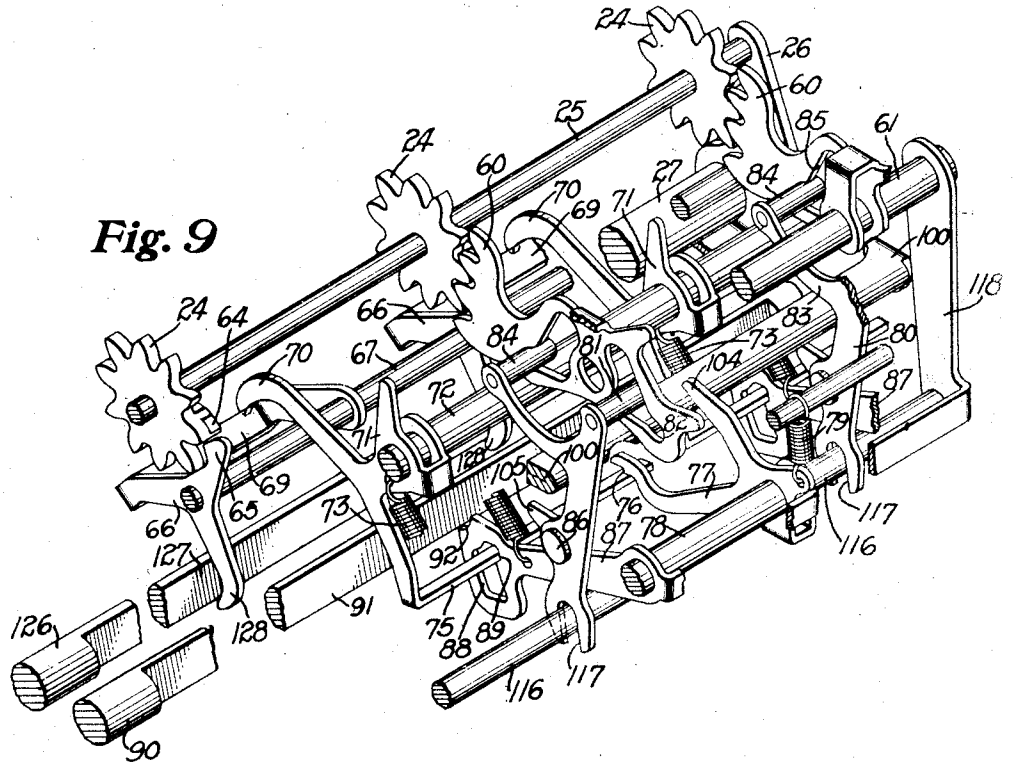


Fig. 9



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TRANSFER MECHANISM FOR CALCULATING MACHINES

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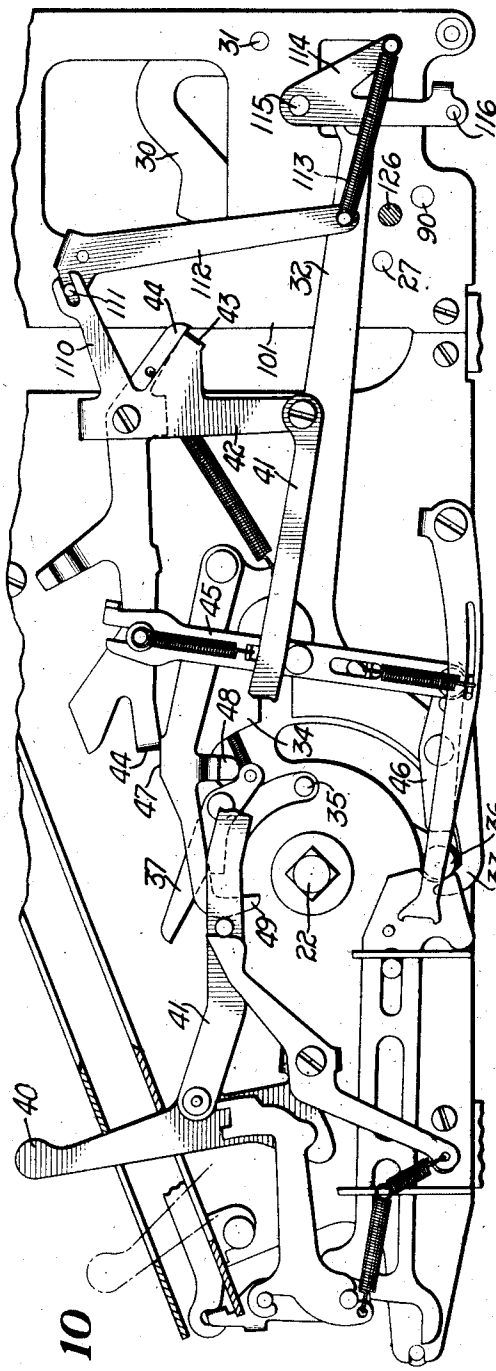


Fig. 10

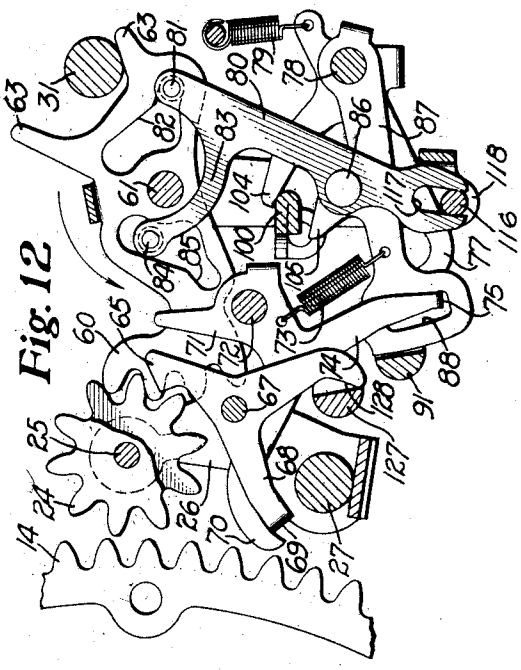


Fig. 12

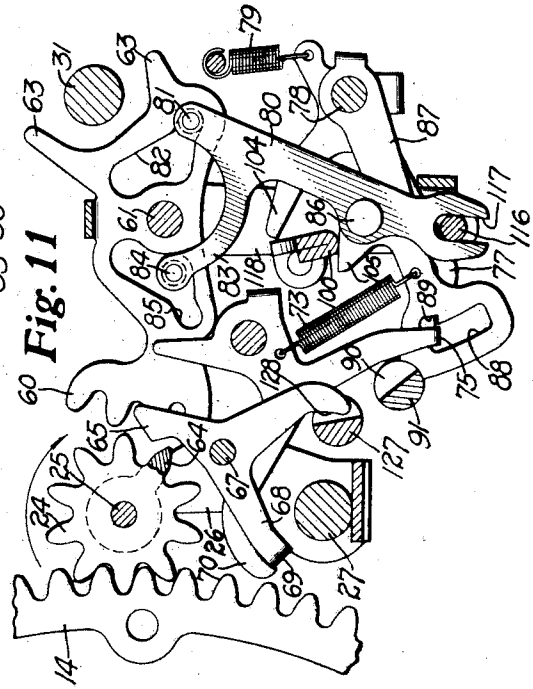


Fig. 11

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UNITED STATES PATENT OFFICE

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TRANSFER MECHANISM FOR CALCULATING MACHINES

Application filed June 16, 1928. Serial No. 285,806.

This invention relates to transfer mechanism for calculating machines, particularly to a transfer mechanism that is capable of borrowing as well as carrying and one that is automatically conditioned to borrow or carry, depending on whether the machine is conditioned to subtract or add.

The general object of the invention is to provide an improved transfer mechanism for calculating machines.

A more particular object is to provide an improved transfer mechanism that will borrow as well as carry, and one that, while being simple and devoid of complicated parts, is nevertheless reliable and efficient in its operation.

A further object is to provide a transfer mechanism that need not be built to such close limits and one that can be easily adjusted.

Other objects and advantages of the invention will appear from the specification and drawings.

An embodiment of the invention is shown in the accompanying drawings in which,—

Figure 1 is a right side elevation of a calculating machine to which the invention is applied, said view showing the machine with the cover removed and with certain of the controls visible, particularly the controls for the transfer mechanism.

Fig. 2 is a plan view of a portion of the key board showing the control keys and one bank of amount keys.

Fig. 3 is a longitudinal vertical section of the rear portion of the machine showing particularly the transfer mechanism and associated devices in normal condition.

Fig. 4 is a sectional side elevation of the transfer mechanism with the parts in normal position and the counter in engagement with the transfer segments.

Fig. 5 is a view similar to Fig. 4, but with the counter pinions moved out of engagement with the transfer mechanism and into engagement with the actuator racks, the parts being shown in the position they occupy when the counter pinion has passed from its "9" to its "0" position and caused an "initial carry" to be effected.

Fig. 6 is a view similar to Fig. 5 showing the counter rocked back into engagement with the transfer mechanism and illustrating the parts after a carry has been effected.

Fig. 7 is a view similar to Fig. 5, except that the parts are shown in the position they occupy in taking a total, the counter pinion illustrated being shown in contact with the pawl which stops it in its "0" position.

Fig. 8 is a front elevation of the counter section of the machine, the view being taken on the line 8—8 of Fig. 3.

Fig. 9 is a spread perspective view of a portion of the transfer mechanism and associated parts to illustrate more clearly the relation of the transfer mechanism between the different banks or orders.

Fig. 10 is a right side elevation similar to Fig. 1 showing the position of the controls when the machine is conditioned for subtraction.

Fig. 11 is a sectional side elevation of the transfer mechanism similar to Fig. 5 except that the parts are shown in the position they occupy for effecting a borrow instead of a carry, the counter pinion having moved from its "0" to "9" position.

Fig. 12 is another sectional side elevation similar to Fig. 5 showing the parts in the position they occupy after a borrow has been effected.

The invention is shown applied to a calculating machine that is already well known commercially as the Burroughs Portable. An understanding of the details of this machine is not necessary for an understanding of the present invention and the machine will, therefore, be described only briefly, it being understood that the invention is not limited to use with this machine, but may be employed with any other suitable type of calculating machine.

Calculating machine construction

The calculating machine has a plurality of rows of amount keys 10 which, when depressed, differentially position stop bars 11 (Fig. 3) that are urged forwardly by springs 12. Each stop bar is connected at

its rear end to the upstanding arm 13 of a toothed actuator segment or rack 14 pivoted at 15. Each actuator segment carries a type bar 16 which moves with the segment and is positioned adjacent a platen, not shown. The actuator segments 14 are normally held down by a cross bail 17 carried by arms 18 pivoted on the shaft 15. The bail 17 is urged counter-clockwise by a spring 19, but it is normally held against such movement by a cam roller 20 on one of the arms carrying the bail 17, said roller engaging the edge of a cam 21 operated by the main drive shaft 22 of the machine (Fig. 1). When the machine is given a stroke of operation, the drive shaft 22 is first rocked counter-clockwise by means of an operating handle 23 or a motor (not shown) after which it is returned clockwise to its original position. When the drive shaft 22 is rocked counter-clockwise during the forward stroke of the machine, the cam 21 moves with it and this releases the roller 20 whereupon the spring 19 moves the bail 17 counterclockwise to release the actuators 14 which are thereupon rocked counter-clockwise to differential positions determined by the engagement of their respective stop bars 11 with the stems of the depressed amount keys.

Cooperating with the actuator racks 14 is a counter comprising a series of toothed counter pinions 24 journaled on a shaft 25 carried by arms 26 pivoted on a shaft 27. The counter is rocked into engagement with the racks against the tension of a spring 28 through the camming action on a roller 29 on the shaft 25 of a cam arm 30 pivoted at 31. The arm 30 has a lower extension connected to the rear end of a pitman 32 (Fig. 1). The forward end of this pitman is branched, being provided with a lower branch 33 and an upper branch 34. The main drive shaft 22 has a drive plate fixed to it that carries two studs 35 and 36 respectively. As the handle is given a forward stroke, the main drive shaft 22 rocks the drive plate carrying the studs 35 and 36 counterclockwise and the stud 35 passes beyond a shoulder on a pass-by pawl 37 pivoted to the upper branch 34 of the piston. At the beginning of the return stroke the stud 35 engages the shoulder on the pass-by pawl and pushes the pitman 32 rearwardly, thereby rocking the cam arm 30 counter-clockwise and moving the counter into engagement with the racks. Near the end of the return stroke of the machine the stud 35 releases the pawl 37 and the stud 36 engages the hooked end of the branch 33 of the pitman and pulls the pitman forward again to return the arm 30 to normal position whereupon the spring 28 moves the counter out of engagement with the actuator racks into engagement with the transfer segments. In this manner, when the machine is conditioned for addition, the counter is rocked into engagement with the actuator racks at the beginning of the return stroke of the machine and while said racks are differentially positioned. The counter remains in engagement with these racks while they are returned to normal and then, at the end of the return stroke, it is rocked out of engagement with them.

The machine may be conditioned for subtraction by moving a lever 40 from the full line to the dot and dash line position of Fig. 1. This lever is connected to a link 41 which, in turn, is connected at its rear end to a pivoted member 42 having a rearwardly extending portion 43 that engages the tail of the pivoted lever 44. The lever 44 actuates a sliding link connection 45 with a pawl 46 pivoted to the lower branch 33 of the pitman. The lever 44 also engages a pivoted pawl 47 having a central projection 48 for disabling the pass-by pawl 37, and a hooked end 49. When the control lever 40 is moved to the dot and dash position of Fig. 1, the lever 44 is rocked counterclockwise which moves the pawl 46 clockwise into the path of the stud 36. At the same time the central projection 48 on the pawl 47 disables the pass-by pawl 37 and positions the hook 49 in the path of the stud 35. At the beginning of a forward stroke of the machine, with the parts in this position, the stud 36 engages the pawl 46 and moves the pitman 32 rearwardly to rock the counter into engagement with the actuator racks before they are released for upward movement. At the end of the forward stroke of the machine the stud 35 engages the hook 49 and pulls the pitman 32 forward to release the counter so that it is moved out of engagement with the racks by the spring 28. During the return stroke of the machine there is no action on the pitman 32 as the pawl 37 is disabled as in Fig. 10 and the pitman has already been moved to its normal position. It will thus be seen that, when subtraction is performed, the pitman 32 is moved rearwardly at the beginning of the forward stroke of the machine and pulled forwardly at the end of said forward stroke in contra distinction to the movement when addition is being performed where the pitman is moved rearwardly at the beginning of the return stroke of the machine and forwardly at the end of the return stroke.

The machine is provided with a row of control keys illustrated in Fig. 2 including a total key 50 and a sub-total key 51. When the total key 50 is depressed the lever 44 is moved downwardly in the same manner as when it is rocked to condition the machine for subtraction and the actuation of the pitman 32 is the same as in performing subtraction, that is, the counter is rocked into

engagement with the actuator racks at the beginning of the forward stroke and out of engagement at the end of said stroke. When the sub-total key 51 is depressed, the action is the same except that the lever 44 is not moved down far enough to position its hooked end 49 in the path of the stud 35 so that, while the counter is rocked into engagement with the actuator racks at the beginning of the forward stroke, it is not moved out of engagement at the end of said stroke, but is allowed to remain in engagement with the racks until the end of the return stroke when the engagement of stud 36 with the hooked end of the branch 33 of the pitman operates to permit such movement.

Transfer mechanism

Inasmuch as the same counter is used for both addition and subtraction, it is necessary to have two transfer mechanisms or else a single mechanism that will borrow as well as carry. A single mechanism is provided in the present invention, which mechanism will act to carry or borrow, depending upon whether the machine is conditioned for addition or subtraction.

The transfer mechanism includes a series of toothed transfer segments 60 (Figs. 4 and 9) pivoted on a shaft 61, there being a transfer segment for each pinion of the counter. These segments are positioned so that when the counter is rocked out of engagement with the actuator racks it is rocked into engagement with the transfer segments, whereupon the proper transfer segments are given a step of movement to effect the required transfer. The transfer segment for each pinion is controlled in its movements by the pinion of next lowest order. The controlling connections between adjacent pinions are alike and for purposes of simplicity only one set will be described. When a segment is moved clockwise (as it is in addition) one step from the position of Fig. 4, the pinion with which it is in engagement is moved ahead one step to carry or add one increment to said pinion. When the segment is moved one step counterclockwise from the position of Fig. 4, the pinion with which it is in engagement is moved backward one step to effect a borrow or to subtract one from said pinion. The movement of the transfer segment is limited to one step in either direction by the shaft 31 which engages one of the projections or tails 63 on the rear end of the segment, said shaft 31 being positioned midway between the projections 63 when the segment occupies a normal position. It will be appreciated that the question of whether or not a transfer is to take place from one order to another is determined by the rotation of the counter pinions. The pinions are rotated while they are in engagement with actuator racks, but it is not possible to effect an actual transfer while the pinions are in engagement with the actuator racks. It is, therefore, necessary to effect a preliminary setting of devices while the pinions are being rotated which setting will control the actual transfer when it takes place. This preliminary or initial setting is often called the "initial carry." In the present application the term "initial transfer" will be used for this preliminary setting in order to have a term broad enough to include both a carry and a borrow.

The "initial transfer" is controlled by the counter pinions, each of which has a wide tooth or transfer projection 64 (Fig. 5) that engages the cam-shaped end of one arm 65 of a three armed, yoke-shaped pawl 66 pivoted on a shaft 67 carried by the side arms 26. The end of the arm 65 is shaped so that the broad tooth 64 will cam the arm clockwise when the counter pinion is rotating in either direction, that is, the arm 65 will be moved rearwardly or clockwise when its pinion moves from its "0" to its "9" position in a subtraction operation and also when the pinion moves from its "9" to its "0" position in an adding operation. The pawl 66 has forwardly extending arms 68 which are connected by a bail 69 (Fig. 9) extending under the curved end of an arm 70 of a yoke-shaped member 71 pivoted on the shaft 72 and urged in a counterclockwise direction by a spring 73. The member 71 has a downwardly extending arm 74 provided with a lateral lug or extension 75 adapted to be engaged by a shoulder 76 on a yoke-shaped latch 77 pivoted on the shaft 78 and urged counterclockwise by a spring 79. From the construction thus far described, it will be observed that, when the counter pinion rotates from its "0" to its "9" position or from its "9" to its "0" position, the three armed pawl 66 will be rocked clockwise and it, in turn, will move the member 71 clockwise to a position such that the latch 77 will snap down behind the lug 75 and hold the member 71 in the position to which it has been moved. In other words, an "initial transfer" will have taken place. This occurs while the counter pinion is in engagement with its actuator rack as shown in Fig. 5, in which figure the parts are shown in the position they occupy after an "initial transfer" has occurred in adding condition.

An actual transfer is effected by moving the transfer segment 60 after a counter pinion has moved into mesh with it which is done by means of a pitman 80 having a stud 81 on its upper end operating in a slot 82 in the segment 60. The pitman has a lateral arm 83 carrying a stud 84 operating in a slot 85 in the transfer segment 60,

the latter slot being on the opposite side of the pivot 61 of the segment from the slot 82. The pitman 80 is pivoted near its lower end at 86 to an arm 87 pivoted on the shaft 78 and urged clockwise by the spring 73. The forward end of the arm 87 is enlarged and provided with an arcuate slot 88 having a lateral offset portion 89 as shown in Fig. 5. The lateral extension 75 on the arm 74 extends through the slot 88 and it normally occupies the position illustrated in Fig. 4 where the extension 75 is in the offset portion 89 of the slot and over the shoulder formed by said offset portion so that the extension prevents the arm 87 from moving clockwise which it tends to do under the influence of the spring 73, the spring 73 serving to act on both the arm 87 and the member 71. In other words, as long as no transfer takes place, clockwise movement of the arm 87 is prevented by the lateral extension 75 and the pitman 80 cannot be moved upwardly to move the transfer segment 60.

However, when an "initial transfer" takes place the member 71 is latched in the position illustrated in Fig. 5 by the latch 77, in which event the extension 75 on arm 76 is held out in the main portion of the arcuate slot 88 so that the member 87 may be moved relative to it. Accordingly, as soon as an "initial transfer" takes place, the arm 87 is free to be moved upwardly by the spring 73 and this would occur at once if means were not provided for preventing it until the appropriate time has arrived for such movement. It will be recalled that the "initial transfer" takes place while the counter is in engagement with the actuator racks, but it is not desired to move the transfer segments while the counter is in this position. Instead, the transfer segments must not be moved until the counter has been rocked out of engagement with the actuator racks and into engagement with the transfer segments. In order to prevent movement of the arm 87 and the pitman 80 together with the transfer segment 60 until after the counter has engaged the transfer segments, a shaft 90 is provided having a portion 91 of semicircular cross sections (Fig. 9). This shaft is located in the path of one corner of the forward ends of the arms 87, the forward ends of said arms having cutaway portions 92 as illustrated in Fig. 4. Normally, the shaft 90 occupies the position illustrated in Fig. 4 which permits the arm 87 to move upwardly, but as soon as the machine starts to operate, that is, at the beginning of the forward stroke, this shaft is turned counterclockwise to the position illustrated in Fig. 5, where it blocks all of the arms 87 against upward or clockwise movement. The shaft is moved by means of a link 93 (Fig. 3) connected at one end to an arm 94 fixed to the shaft 90 and having a hook-shaped portion 95 on its other end engaging over a stud 96 on the arm 30 which controls the engagement and disengagement of the counter with the actuator racks. The shaft 90 is urged in a counterclockwise direction by a spring 97 (Fig. 3) connected at one end to a portion of the arm 94 and at its other end to the shaft 78. It will be recalled that, in performing addition, the arm 30 is rocked downward or counterclockwise at the beginning of the return stroke of the machine. This lowers the stud 96 and the spring 97 rocks the shaft 90 counterclockwise, the link 93 following down with the stud 96. The shaft 90 is thus turned to a position to block all the arms 87 and its remains in this position until the end of the return stroke of the machine when, as previously explained, the arm 30 is rocked upward or clockwise to free the counter to permit it to be moved out of engagement with the actuator racks and into engagement with the transfer segments. As the arm 30 moves upwardly the stud 96 carries the link 93 upward and the shaft 90 is rocked back to the position illustrated in Fig. 4. This frees the arm 87 which is thereupon snapped upwardly by its spring 73 to the position illustrated in Fig. 6. As the arm moves upward, it carries the pitman 80 with it and the stud 84, being engaged in a short lateral portion of the slot 85, rocks the transfer segment clockwise to advance its counter pinion one step to the position illustrated in Fig. 6. The stud 81 is inactive at this time because it is located in such a position in the slot 82 that it does not contact the edge of the slot to effect any movement of the transfer segment.

After a transfer has taken place, it is necessary to restore the transfer mechanism to normal and this is accomplished in the following manner.

A restoring bail 100 is provided which is pivoted on pintles in the side frames 101. This bail has an upwardly extending lug 102 (Fig. 3) to which is connected a link 103 also connected to the stud 96. The bail is positioned so that when it is in one position, to wit, the position illustrated in Fig. 4, it contacts the tails 104 of the latches 77 and, when it is located in the position illustrated in Fig. 5, it contacts abutment portions 105 on the arms 87. Starting with the parts in the position of Fig. 6, which is the position they occupy after a carry has taken place and while the counter is out of engagement with the actuator racks, let it be assumed that the machine is given a stroke of operation. During the forward stroke nothing occurs to the parts in question because the arm 30 is not moved but, at the beginning of the return stroke, the arm 30 is rocked counterclockwise which moves the link 103 down and rocks the bail 100 clockwise to the posi-

tion of Fig. 5. In so moving, the bail contacts the abutments 105 of any of the arms 87 that have been moved upwardly in effecting a transfer and it moves these arms back to the normal position illustrated in Figs. 4 and 5. In other words, it resets or restores the transfer segments. When the arms 87 are moved to this position, the extensions 75 move into the lateral portions 89 of the slots 88 and hold the arms 87 in the position to which they have been restored. Assume now that an "initial transfer" takes place during the return stroke of the machine and that the arm 74 is moved to and latched in the Fig. 5 position. At the end of the return stroke the arm 30 is moved upwardly again and it pulls the link 103 upward to rock the bail 100 counterclockwise from its Fig. 5 to its Fig. 4 position. When so moved the bail strikes the tails of all the latches 77 and moves them clockwise to raise their shoulders 76 above the extensions 75 on arms 74 whereupon the springs 73 move the members 71 counterclockwise until the extensions 75 contact the inner side of the arcuate slots 88. This frees the members 71 of the latches 77 so that said members may move into the lateral extensions 89 of the slots 88 when the arms 87 are restored to normal as previously explained. It will be understood that when the member 71 moves back to normal, the pawl 66 is also moved with it by the bail 69.

In this manner the restoring bail 100 not only releases the latches 77, but it also restores the arms 87 and moves the pitman 80 to restore the transfer segments to normal.

Adjustment of transfer mechanism for subtraction

When the machine is conditioned for subtraction instead of addition, the transfer mechanism must borrow instead of carry and, in order to condition it to accomplish this result, certain connections are provided which are responsive to the means for conditioning the machine for subtraction.

Referring to Fig. 1, the link 41 connected to the subtraction control lever 40 is, as previously explained, connected to a pivoted member 42 toward the rear of the machine. The member 42 has a rearward extension 110 having a bifurcated end extending over the stud 111 on a pivoted arm 112. The outer end of the arm 112 is connected to one end of a spring 113 whose other end is connected to one arm of a V-shaped member 114 pivoted on the shaft 115. The second arm of this V-shaped member carries one end of a cross shaft 116 which extends through slots 117 in the lower ends of the pitmen 80. The other end of the cross shaft 116 is carried by the lower end of an arm 118 pivoted on the opposite end of the shaft 61 (Fig. 9).

When the subtraction control lever 40 is moved from its full to its dot and dash position as illustrated in Fig. 1, the arm 112 is rocked clockwise from its Fig. 1 to its Fig. 10 position. This brings the outer end of the arm 112 past the pivot of the V-shaped member 114 and causes the spring 113 to pull the V-shaped member 114 clockwise. This rocks each pitman 80 on its pivot 86 from the position of Fig. 4 to that of Fig. 11, where its stud 81 is in a short lateral portion of the slot 82 in the transfer segment 60 while its stud 84 is in the enlarged portion of the slot 85 in said segment. With the pitmen in this position, if the transfer mechanism is operated as previously described, the transfer segment 65 will be rocked counterclockwise instead of clockwise when the pitmen 80 are pushed upwardly as the result of the wheel of next lower order passing from its "0" to its "9" position to effect a borrow, and accordingly, a borrow will take place instead of a carry, the operation of the parts being the same as previously described for addition except for the fact that the transfer segment is moved in the opposite direction.

When the subtraction control lever is moved back to its addition position, the parts are again moved back to the Fig. 4 position where they are in condition to effect a carry instead of a borrow.

It will thus be observed that the transfer mechanism is automatically conditioned to carry or to borrow, depending upon whether the machine is conditioned to add or to subtract. The transfer mechanism operates the same in both cases, except that in addition the pitman 80 moves the transfer segment clockwise while in subtraction, it moves it counterclockwise.

Total taking

In the taking of a total it is necessary to provide some means for positively arresting the counter pinions in their "0" positions. This is provided for in a very simple manner in the present invention by making use of the pawls 66.

Referring to Fig. 1, an irregular shaped member 120 is provided having shoulders 121 and 122 located so as to be in the paths of the stems of the total and sub-total keys 50 and 51. This link is urged upwardly by a spring 123, its lower end being connected to one end of a pivoted lever 124, whose other end has a pin and slot connection with an arm 125 fixed to a shaft 126. Whenever the total or the sub-total key is depressed, the link 120 is moved downwardly, the lever 124 rocked counterclockwise, and the shaft 126 turned clockwise as in Fig. 7. The shaft 126 has a portion 127 of semi-circular cross-section as illustrated in Figs. 7 and 9 and this is located so that when the shaft 126 is turned clockwise, the edge of the semi-circular portion engages the ends of the

arms 128 of the three armed pawl 66 to cam said pawl counterclockwise to the position illustrated in Fig. 7. This holds all the pawls 66 in position such that they cannot be moved clockwise by the transfer projections 64 on the counter pinions. Instead, when the projections strike the pawls, the pinions are arrested in their "0" positions.

Accordingly, when the sub-total or the total key is depressed, the pawls 66 are moved to position to arrest the counter pinions at "0" position and, as the actuator segments are released, said segments move the pinions to "0" position where the racks are differentially positioned by the counter pinions to position the type bars to print the total or sub-total. In a totaling operation, the counter will move out of engagement with the actuator racks and the pinions will remain in their "0" position. In a subtotaling operation, the counter will remain in engagement with the actuator racks throughout the full forward and return stroke and the counter wheels will return to their previous registration.

It is to be understood that the construction shown is for purposes of illustration only and that variations may be made in it within the spirit and scope of the appended claims.

I claim:

1. In a transfer mechanism for a calculating machine having a plural pinion counter and a means for conditioning the machine for addition or subtraction; a transfer member adapted to engage one of the pinions of the counter, said member being movable in one direction to effect a carry and in the opposite direction to effect a borrow, an actuating means for said member acting in a fixed direction, and connections between said actuating means and said transfer member for transferring the actuating force of said actuating means to said member, said connections being controlled by the means for conditioning the machine for addition or subtraction and being movable to one position to cause said actuating means to act on said transfer member to move it in one direction and to another position to cause said actuating means to act on said transfer member to move it in the opposite direction.

2. In a transfer mechanism for a calculating machine that is provided with a plural pinion counter and with means for conditioning the machine to perform either addition or subtraction; a pivoted transfer segment adapted to engage one of the counter pinions and movable in one direction to effect a carry and in the opposite direction to effect a borrow, an operating means for said segment selectively engageable with the same on opposite sides of its pivot, and connections for automatically conditioning said operating means to selectively engage said transfer segment on either side of the pivot of said segment in accordance with whether the machine is conditioned for addition or subtraction.

3. In a transfer mechanism for a calculating machine that has a plural pinion counter and a means for conditioning the machine for addition or subtraction; a pivoted transfer segment adapted to engage one of the counter pinions, an operating means for said segment having provision for selectively engaging said segment on opposite sides of the pivot of the latter, and connections adapted to be operated by movement of said conditioning means for automatically conditioning said operating means to selectively engage said transfer segment on one side or the other of its pivot depending on whether the machine is conditioned for addition or subtraction.

4. In a transfer mechanism for a calculating machine that has a plural pinion counter and a means for conditioning the machine for addition or subtraction; a pivoted transfer segment adapted to engage one of the counter pinions, a pitman selectively engageable with said segment on opposite sides of the pivot of the latter, a pivoted arm connected to said pitman and urged in a direction to move the pitman to move said transfer segment, and connections adapted to be controlled by said conditioning means for selectively moving said pitman to engaging position relative to the pivot of said transfer segment such that, when said segment is moved, it will effect a carry or borrow, depending on whether the machine is conditioned for addition or subtraction.

5. In a transfer mechanism for a calculating machine that has a plural pinion counter and means for conditioning the machine for addition or subtraction; a pivoted transfer segment adapted to engage one of the counter pinions and having an irregular slot on each side of its pivot, a pitman for operating said segment having one stud positioned in one of said slots and another stud positioned in the other of said slots, an operating arm to which said pitman is pivoted, a spring for urging said arm in a direction to operate said pitman, and connections operated by said conditioning means for moving the pitman on its pivot to selectively position its studs to cause the pitman, when actuated, to engage said segment on the selected side of the pivot of the latter.

6. In a transfer mechanism for a calculating machine that is provided with a plural pinion counter; a transfer segment adapted to engage one of the counter pinions, a pitman for actuating said segment, a pivoted arm connected to said pitman, said arm having an arcuate slot in its end provided with an offset portion, means for urging

said arm in a direction to actuate said pitman, a detent for said arm including a member normally engaging in the offset portion of said slot in said arm, said detent being controlled by the pinion of next lower order to that with which said transfer segment is adapted to engage and being operated by said pinion, when a transfer is to take place, to move said member out of the offset portion of said slot in said operating arm, a latch for holding said member in its moved position, and a restoring bail for releasing said latch and restoring said operating arm.

7. In a transfer mechanism for a calculating machine having a plural pinion counter, a transfer segment adapted to engage one of said counter pinions, actuating means for moving said segment to effect a transfer, a detent normally restraining said actuating means, said detent being released by the pinion of next lower order to that with which the segment is adapted to engage, a latch for holding said detent in released position, a restraining means for restraining said actuating means, said restraining means being moved at each operation of the machine to release said actuating means during a portion of the machine operation, and a restoring bail for restoring said actuating means to normal after it has actuated said segment.

8. In a transfer mechanism for a calculating machine having actuator racks, a plural pinion counter, and means for moving the counter into and out of engagement with the racks; a transfer segment adapted to engage one of said counter pinions, actuating means for moving said segment to effect a transfer, a detent for restraining said actuating means, said detent being released by the pinion of next lower order to that with which said pinion is adapted to engage, a restraining means for restraining said actuating means, connections adapted to be operated by the counter moving means for releasing said restraining means each time the counter is moved out of engagement with the actuator racks, and a restoring bail for restoring said actuating means to normal after it has moved the transfer segment.

In testimony whereof I have subscribed my name.

ALLEN A. HORTON.