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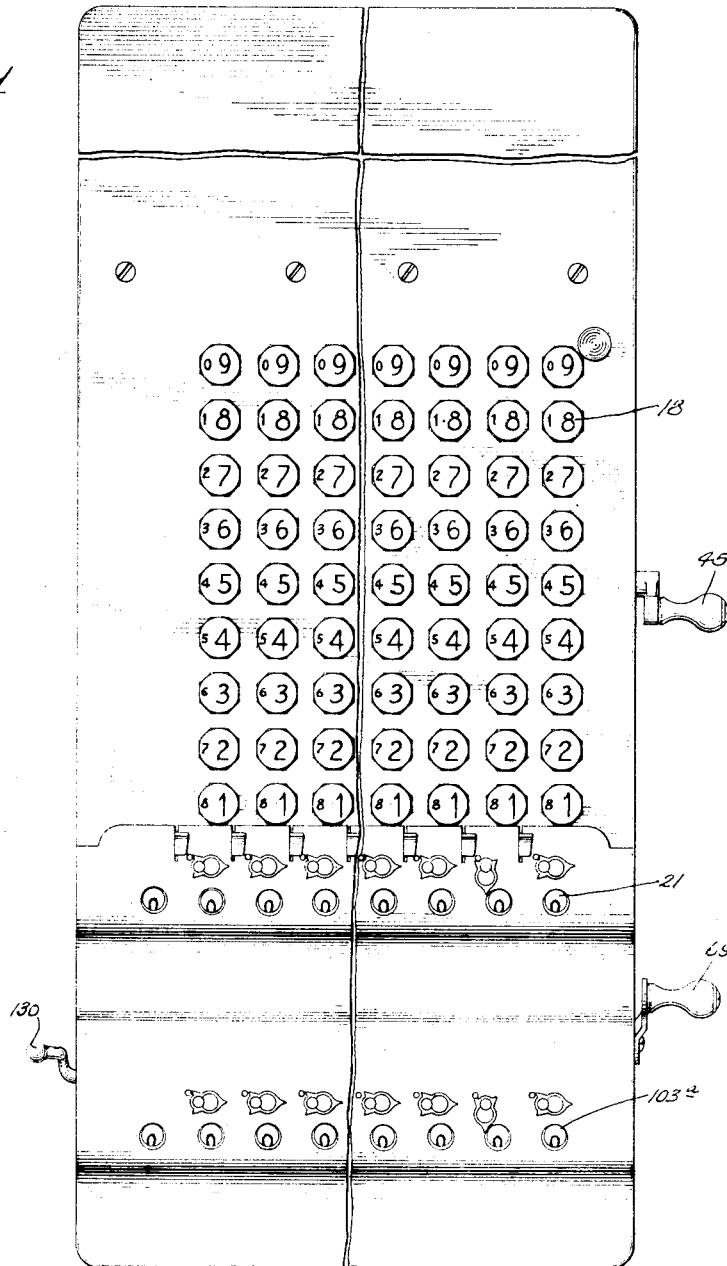
2,130,364

CALCULATING MACHINE

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4 Sheets-Sheet 1

Fig. 1



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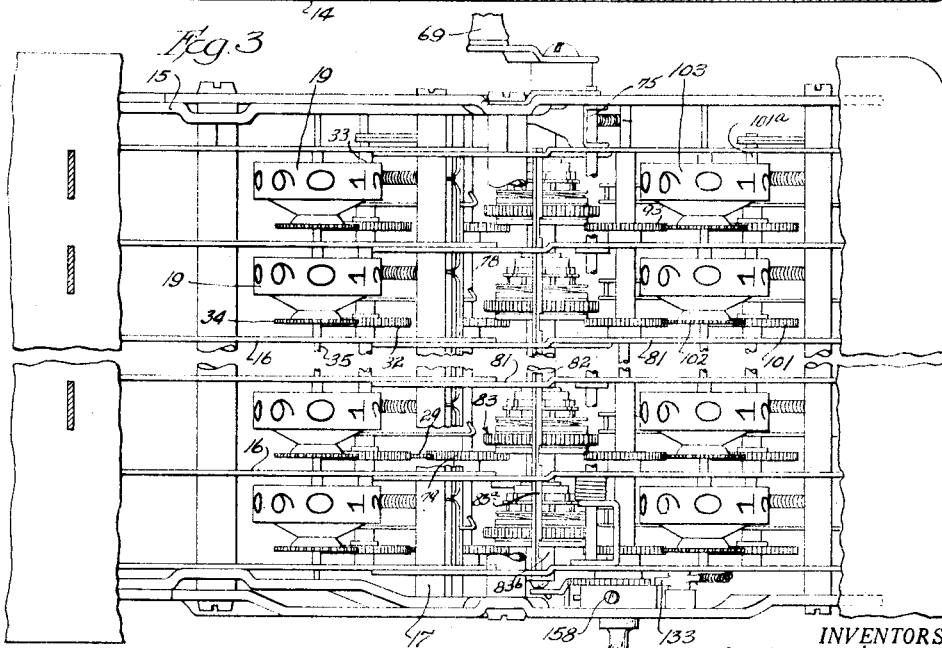
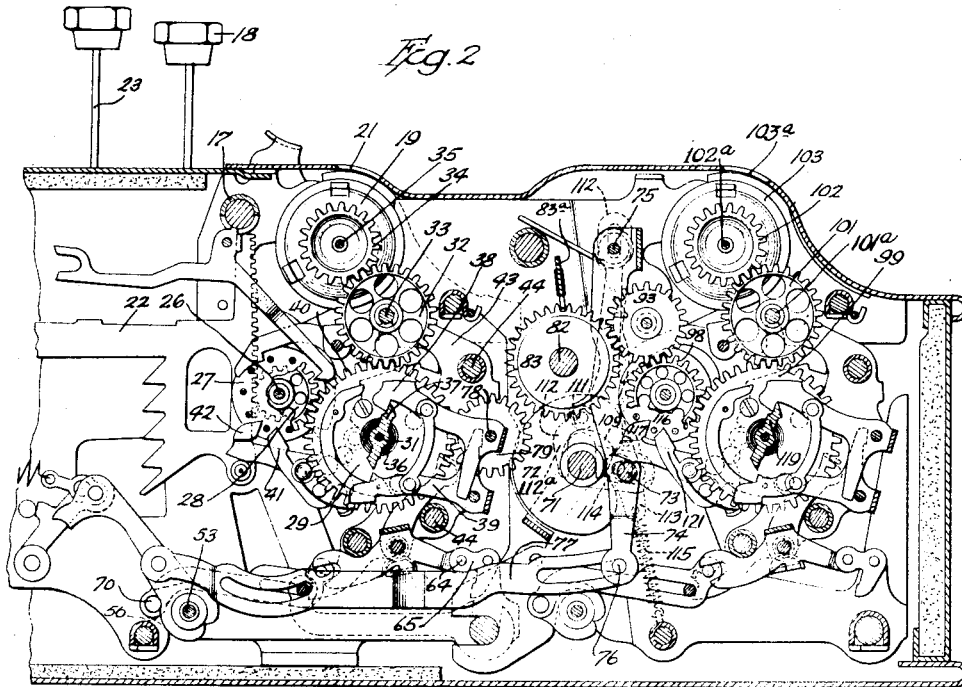
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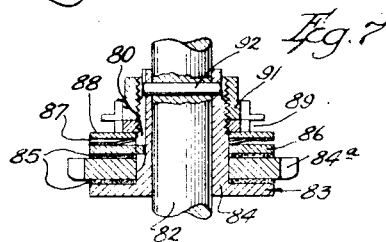
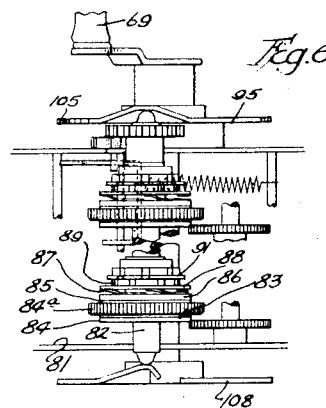
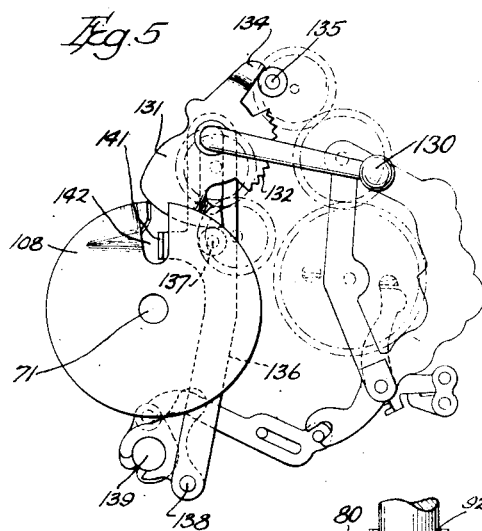
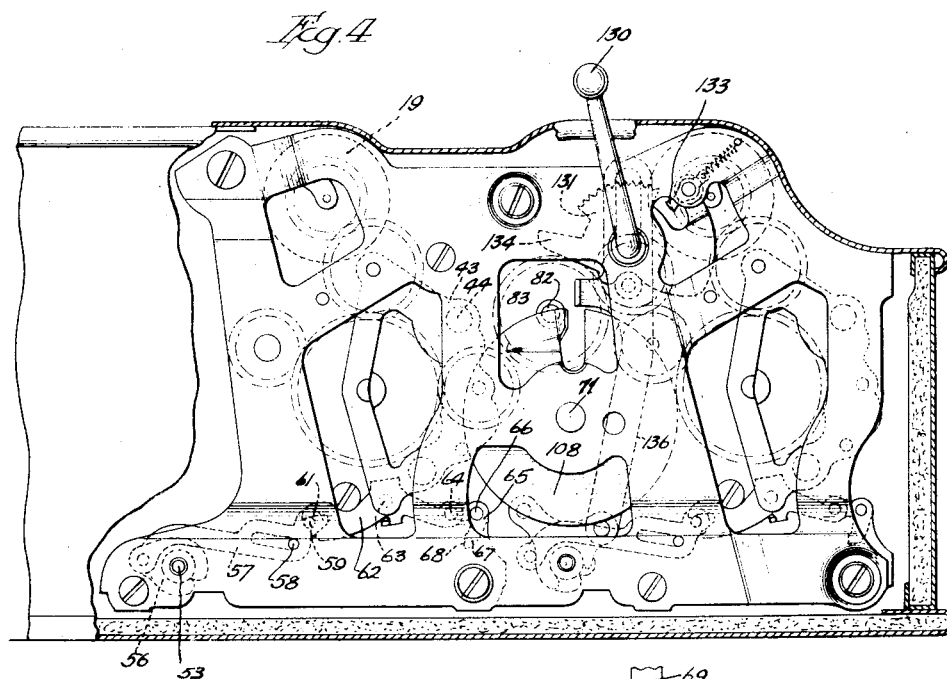
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CALCULATING MACHINE

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4 Sheets-Sheet 3



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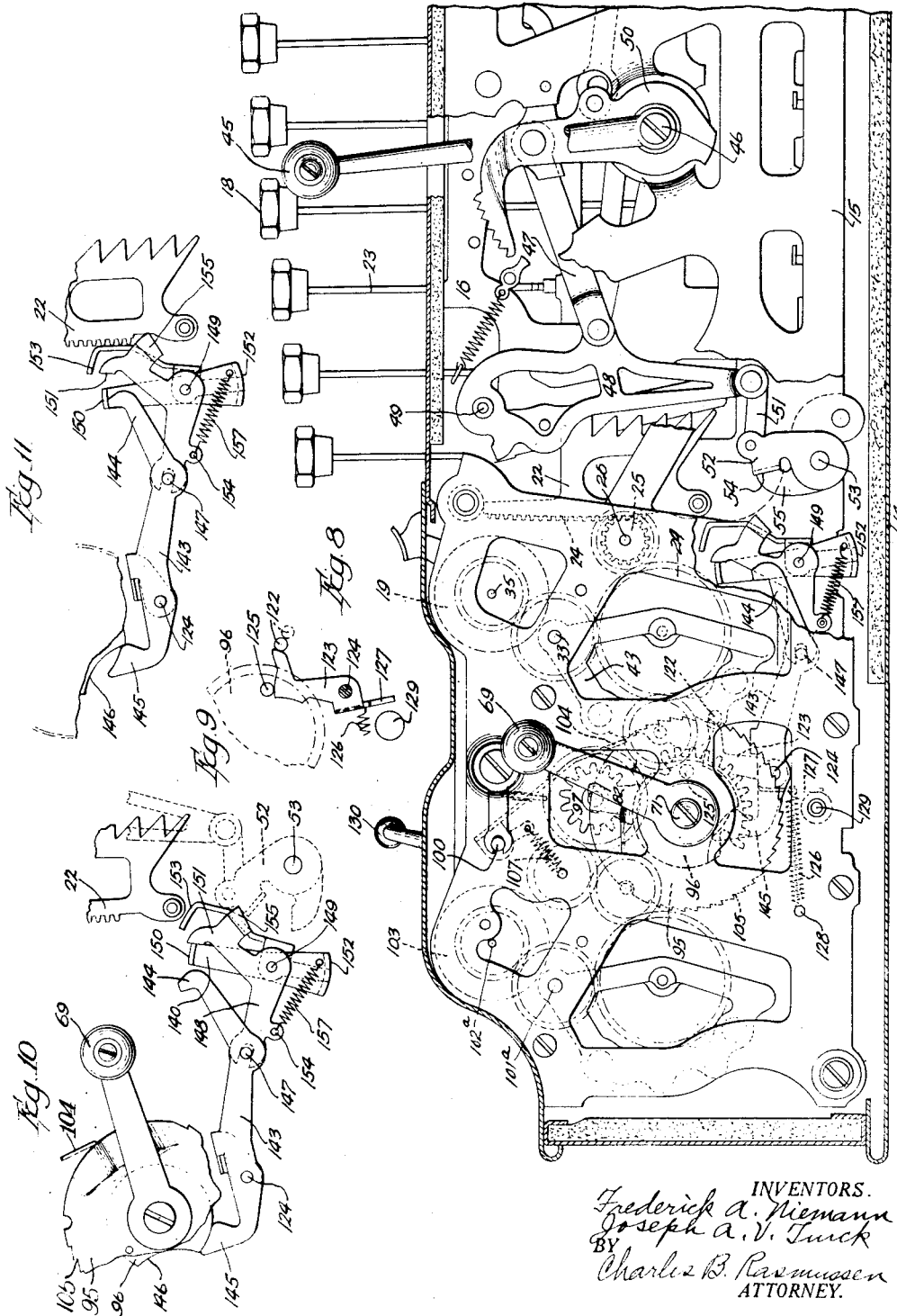
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CALCULATING MACHINE

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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,130,364

CALCULATING MACHINE

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Application November 5, 1934, Serial No. 751,526
Renewed December 10, 1937

6 Claims. (Cl. 235—82)

This invention relates in general to calculating machines and has more particular reference to the provision of an improved registering mechanism adapted to supplement the ordinary registering mechanism employed in calculating machines generally.

A principal object of the invention is the provision of a registering mechanism supplemental to the ordinary registering mechanism of a calculating machine.

Another important object of the invention is the provision of novel means interposed between the supplemental and ordinary registering mechanism whereby the totals from the ordinary registering mechanism may be readily transferred to the supplementary registering mechanism.

Another important object of the invention is the provision of a calculating machine of the character described, having normally disconnected registers and compensating means for operating said registers to transfer the totals of one register to the other, the said compensating means being normally disconnected from either of said registers.

Another important object of the invention is the provision of manually operable means to effect a transfer of totals from the ordinary registering mechanism to the supplemental registering mechanism.

Another important object of the invention is the provision of means for locking the total transfer lever during operation of the ordinary registering mechanism zeroizing lever.

Another important object of the invention is the provision in a machine of the character described of means preventing operation of the ordinary zeroizing lever while transfer of totals to the supplemental registering mechanism is being effected.

Another important object of the invention is the provision of locking means for locking the ordinary actuating mechanism against operation during the transfer operation.

Another important object of the invention is the provision of an error lock for preventing operation of the supplemental registering mechanism in the event of partial depression of a numeral key.

Another important object of the invention is the provision, in a machine of the character described, of locking features which eliminate the possibility of error in a transferring operation from the ordinary registering mechanism to the supplemental registering mechanism.

Numerous other objects and advantages of the

invention will be understood from the following description, which, when taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

On the drawings,

Figure 1 is a partial plan view of a calculating machine of the multiple-order key-driven type in which the present invention is embodied;

Fig. 2 is a partial vertical section taken at the left of the machine, showing details of the ordinary and supplemental registering mechanisms;

Fig. 3 is a partial top plan view showing certain details of the ordinary and supplemental registering mechanisms;

Fig. 4 is a partial sectional elevation of the machine with the left hand outer wall removed;

Fig. 5 is a detail view showing the supplemental register zeroizing mechanism;

Fig. 6 is a partial detail top plan view showing the compensating devices and connections and means for moving said devices into and out of engagement;

Fig. 7 is an enlarged section showing details of construction of the compensating device;

Fig. 8 is a partial sectional elevation of the machine with the right hand outer wall removed;

Fig. 9 is a full size sectional view showing details of the locking feature which insures halting of the control crank after a full rotation;

Fig. 10 is a full size section showing details of another locking feature; and

Fig. 11 is a similar view showing a further adaptation of the locking feature.

Referring to the drawings, the present embodiment of the invention is shown incorporated in a calculating machine of the multiple-order key-driven type, such as the well-known "duplex comptometer," the general character of which is shown and described in United States Letters Patent to Door E. Felt, Nos. 762,520, 762,521, 960,528, 996,009, 1,003,723, and the patent to Kurt F. Ziehm No. 1,110,734. The invention is particularly adaptable for use in connection with the multiple-order key-driven type of calculating machine in which is embodied a zeroizing mechanism having the general characteristics disclosed in United States Letters Patent No. 1,357,748 to Joseph A. V. Turck.

The details of construction of this type of machine are fully described in these earlier patents and it is not believed necessary to here set forth other than a brief description of the general features of the machine and such parts as are direct-

ly concerned with the operation of the present invention for a complete understanding thereof.

The various instrumentalities of the calculating machine are supported by a frame mounted on a base 14 of the casing. The frame consists of side skeleton plates 15 and intermediate skeleton plates 16 disposed between the various actuating mechanisms of the several orders of the machine and all tied together at suitable points by transverse tie rods 17. A number of columns of nine keys each are provided, each key being indicated by reference numeral 18, there being a column of nine keys for each numeral wheel 19 of the ordinary registering mechanism, together with the actuating mechanisms and attendant parts interposed between a column of keys and its corresponding numeral wheel. The registrations indicated by the several numeral wheels, which constitute the answer to a calculating operation performed by the machine, may be viewed through sight openings 21 in the cover plate of the casing above the respective numeral wheels.

Each column of keys forms a part of an actuating mechanism for transmitting to its numeral wheel an amount of travel varying with the particular key operated and the accumulator mechanism for each column of keys and its corresponding numeral wheel is actuated by a column actuator 22, in the form of a spring-returned segment lever, as shown in Figs. 2 and 8, adapted to be depressed an amount determined by the particular key 18 actuated by the operator.

Each key is provided with a stem 23 extending down and bearing upon a column actuator 22, and the key at the extreme front of the machine, being further from the pivotal axis of the column actuator than the key at the rear of the machine, moves the column actuator through a lesser arc than does the key last mentioned. The keys of each column bear the numbers "1" to "9" in front-to-rear order, together with their nines complements, and the key at the extreme front is adapted to effect actuation of the column actuator through an arc approximately one-ninth of that produced by the operation of the key at the extreme rear of the machine, and upon depression of intermediate keys the column actuator is moved through arcs proportionate with the value of the intermediate key depressed.

The column actuator 22 of each order or column of nine keys of the machine is adapted to impart calculating movement to an accumulator and for this purpose is provided at its forward end with a rack 24 which meshes with an accumulator pinion 25 journaled upon a transverse shaft 26 supported in suitable bearings in the skeleton frame.

The pinion 25 of each order forms a part of an internal ratchet mechanism disclosed in the prior patents hereinabove mentioned and which becomes effective upon the upstroke of the column actuator to clutch the pinion 25 to a lantern wheel 27 and a transmitting pinion or gear 28 that rotates with the lantern wheel and is adapted to mesh with a gear 29 journaled on a shaft 31 parallel with the aforesaid shaft 26.

The gear 29 meshes with an intermediate gear 32 on a transverse shaft 33 and the latter in turn meshes with the numeral wheel pinion 34 journaled on a transverse shaft 35 and fixed to the numeral wheel 19 of the registering mechanism. It will be understood that each time the column actuator is depressed the ratchet mechanism moves idly and no motion is transmitted to the gear train beginning with the transmitting pin-

ion 28 and ending with the numeral wheel pinion 34; however, upon the return or upward movement of the column actuator through its spring action, the transmitting pinion 28 is clutched to the accumulator pinion 25 and the gear train rotates the numeral wheel 19 through the arc determined by the particular key depressed.

Carrying mechanism is provided in each order of accumulator mechanism for the purpose of actuating the accumulator of the next higher order of the machine each time a carry is to be transferred from a lower order. For the present purposes it will not be necessary to give a detailed explanation of the carrying mechanism, and a brief reference to parts of the carrying mechanism, together with a general statement of their function, will be sufficient because ample description of the same will be found in the prior patents hereinbefore mentioned.

The carrying mechanism in each order is of the standard "duplex comptometer" type having provision for permitting ordinal keys to be depressed simultaneously and column actuator impulses delivered, in two or more adjacent orders, and yet for preventing any carrying impulses released from a lower order from being delivered to the next higher order until the column actuator movement of such higher order is completed. This operation of effecting simultaneous key-driven actuation of a plurality of column actuators in adjacent orders, the strokes overlapping each other in any manner, is the action that has been referred to as "duplexing".

In addition to its function as a member of the gear train for transmitting the motion of the column actuator to the numeral wheel 19, the gear 29 is a carrying motor winding gear and secured thereto is the usual carrying motor spring 36. The other end of this motor spring is secured to the usual carrying escapement 37 that is adapted to be engaged by first one and then the other of the pair of release detents 38, 39, so that when said escapement is released by one of the detents, it can make only one-half of a full rotation before being checked by the engagement of the escapement with the other of said detents, each said half rotation of the escapement imparting a carrying throw to the bell crank carrying transfer lever 40 (not fully shown) and carrying transfer pawl 41 mounted on the said bell crank carrying transfer lever. The bell crank carrying lever is fully shown at 48 in Figs. 5 and 6 of Patent #1,357,748. The ratio of the gears and various parts is such that a complete rotation of the numeral wheel 19 is accompanied by a half rotation of the carrying motor winding gear 29, and at each such half rotation of said gear 29, an 180° throw of the carrying cam escapement member, effected by a release of one or the other of the pair of detents 38, 39 in the usual way, shifts the bell crank carrying lever sufficiently to cause the carrying transfer pawl 41 to throw the lantern wheel ratchet of the next higher or left hand accumulator one numeral space, which movement of the lantern wheel is transmitted through the above mentioned train of gears ending with the numeral wheel pinion 34 to effect a carrying transfer from the accumulator mechanism of the lower order to the accumulator mechanism of the next higher order.

In order to prevent either cam on the carrying escapement from effecting a carrying throw of the cooperating bell crank carrying lever at a time when the accumulator of the higher order

impelled by said carrying lever is already in motion or is about to be moved by the column actuator that has been or is being depressed by one of the keys in that higher order, there is provided a detaining latch tooth formed on the front end of a stop detent 42, in said higher order, which stop detent 42 is pivotally mounted on the carrying bell crank lever and is adapted to be actuated by a spring to shift such detaining latch tooth into restraining engagement with either one of two stops formed on the carrying cam escapement 37.

Normally the detaining latch tooth is held out of engagement with the stop of the carrying escapement 37 by the dolly roll on the column actuator of said next higher order. On depression of such column actuator, however, the dolly-roll moves out of engagement with the stop detent 42, thereby permitting the spring to shift said stop detent 42 into such position that the detaining latch tooth formed at its opposite end is in engagement with the stop of the escapement member, and this relation of parts is maintained until the column actuator regains its normal elevated position. Hence, so long as a column actuator is in a position other than its normal elevated position, and notwithstanding a release of the escapement member by either one or the other of the releasing detents 38, 39, the carrying cam is prevented from making a carrying throw to lift the carrying lever until the detaining latch tooth is again moved out of engagement with the stop of the escapement, by the return to normal of the column actuator of the next higher order, the order that is to receive the released carrying throw. It is thus provided that keys may be depressed simultaneously and column actuator impulses released from a lower one of said orders will not be actually delivered to the next higher of said orders until the column actuator movement of such higher order is completed. The operation of effecting simultaneous key-driven actuation of a plurality of column actuators in adjacent orders, the strokes overlapping each other in any manner, is the action that has been hereinbefore referred to as "duplexing".

Such is, in brief outline, the manner in which prime actuations and carrying impulses are imparted to the actuator mechanisms in the duplex comptometers of the aforementioned patents. It will be understood that these actuating mechanisms are associated with various stop mechanisms set forth in these early patents, to limit the movements imparted to the actuator mechanisms by the prime actuations and carrying impulses. All of these mechanisms are shifted variously into and out of their various stop positions to impose additional restriction to the movements of the carrying devices and to the prime actuations of the accumulators.

The zeroizing mechanism illustrated on the drawings is, broadly stated, of the type disclosed in United States Letters Patent No. 1,357,748 wherein the zeroizing operation, i. e. the return of the numeral or register wheel 19 and associated parts to zero position, is accomplished by disconnecting the connections between the numeral wheels and the actuating devices so that while retaining the various stop devices in their normal relations to the accumulator mechanisms the stored power in the carrying springs may give to the numeral or register wheels backward rotations so as to move them rearwardly from the divers positions they may occupy and to

stop them when they individually arrive at zero position.

Zeroizing is effected by detrainning or disengaging the carrying spring winding gears 29 from the transmitting pinions 28. The shaft 26 of the transmitting pinions 28, as well as the shafts 35 and 33 of the numeral wheels 19 and the intermediate gears 32, are mounted in bearings fixed in the frame of the machine. In order to effect detrainning or disengagement of the gears 29 from the transmitting pinions 28, the shaft 31 of said gears 29 is carried by a swinging frame that is adapted to have a restricted outward pivotal movement on an axis coincident with the shaft 33. This swinging frame in general comprises partition plates 43 connected together at suitable points by transverse tie rods 44 to form a unitary structure and is under the control of the zeroizing lever 45 shown in Fig. 8.

A short transverse shaft 46 is journaled in a bearing in the right hand side plate 15 of the fixed frame and this shaft projects through the outer casing and carries at its outer end the zeroizing handle or lever 45. A segment 50 is fixed upon the inner end of said transverse shaft 46 and pivoted to said segment is a link 47 which in turn is pivoted to a depending lever 48 that is pivoted at 49 on the fixed frame. The lower end of said lever arm 48 is pivotally connected by means of a short link 51 with an arm 52 rotatably mounted with respect to a transverse shaft 53 that is journaled in the fixed frame. The arm 52 is provided with an engaging face 54 adapted to contact with a rocker arm 55 fast on the shaft 53. When the parts are in the relative position indicated in Fig. 8, a short pivotal movement of the zeroizing lever 45 toward the left will, through the segment 50, the link 47, lever arm 48, short link 51, arm 52 and rocker arm 55, impart a short rocking movement to the shaft 53 in a counter-clockwise direction.

Fixed on the shaft 53 and rotatable therewith are other rocker arms 56, shown in Figs. 2 and 4. These rocker arms 56 are pivotally connected with curved links 57 having slotted shifting pivots upon a transverse shaft 58. The forward end of each of said curved links 57 is provided with a pin 59 positioned within the spaced jaws 61 of the inner member of a toggle 62. The toggle member 62 is pivoted between its ends on a shaft 63 carried by the swinging frame and the outer end of each toggle member 62 is pivotally connected by a shaft 64 with the other member 65 of the toggle. The several toggle members 65 are pivoted on studs 66 mounted on the fixed frame and these toggle members 65 are respectively provided with depending arms 67 having stop projections 68 adapted to engage the toggle members 62 and to limit their movement upon rocking the shaft 63 in a counter-clockwise direction.

Upon operation of the zeroizing lever 45 to effect canceling, i. e. toward the left viewing Fig. 8, the link and lever connection imparts a counter-clockwise rotation to the shaft 53 which, through the above described toggles and other parts, is accompanied by an outward swinging of the swinging frame and a resultant detrainning of the winding gears 29 from the gears 28. Detrainning the gears 29 from the gears 28 leaves the carrying gear springs 36 free to unwind and such unwinding occurs until the numeral wheels 19 arrive at zero. The unwinding action of the springs is terminated by stops which are projected by the toggles into the path of lugs riveted

to the gears 29, all as fully set forth in Patent No. 1,357,748. The swinging frame is retained in its outward position after a zeroizing operation has been effected, and the gears 29 are maintained in disengagement with respect to gears 28 until the operation of one of the keys 18, as described in the aforesaid patent.

The present invention is more particularly concerned with the provision of a registering mechanism supplemental to the ordinary registering mechanism that is adapted to be operated in connection with the ordinary registering mechanism hereinabove described, whereby a set of figures indicated on the numeral wheels 19 may be quickly and efficiently transferred to the numeral wheels of the supplemental registering mechanism and the total indicated on the numeral wheels thus preserved. Improved carrying mechanism is provided in the supplemental registering mechanism, so that it has a capacity for successive registrations, with the result that several totals in successive or other order may be transferred from the ordinary numeral wheels to the numeral wheels of the supplemental registering mechanism and a grand total of the individual totals so transferred indicated on the numeral wheels of the supplemental registering mechanism. The supplemental registering mechanism is thus not only useful for preserving totals of individual calculating operations performed on the machine but also for giving the grand total of such individual totals as may be transferred from the ordinary registering mechanism to the supplemental registering mechanism.

On the right hand side of the casing (viewing Fig. 1) is an operating handle or crank 69 which actuates a control shaft 71 supported by and extending transversely through the frame of the machine and adapted to be rotated in a clockwise direction (viewing Fig. 8). Upon rotation of the handle 69, a heart-shaped cam 72, fixed on the shaft 71, is rotated, camming to the right (Fig. 2) a roller 73 on a vertical arm 74 which is pivoted at its upper end on a shaft 75. At its lower end the vertical arm 74 is provided with a stud 76 in engagement with a slot in a horizontal lever 77 extending rearwardly and pivoted at 70 to the rocker arm 56 fixed to the transverse shaft 53 earlier described.

Upon clockwise rotation of the handle 69 and shaft 71, the heart-shaped cam 72 cams the roller 73 forwardly, thereby swinging the lever 77 to the right and rocking the shaft 53 of the swinging frame to move the swinging frame forwardly for a purpose to be later described.

Mounted in the side plates 43 of the swinging frame is a transverse shaft 78 which carries a set of transfer pinions 79 in mesh with the carrying winding gears 29. The pinions 79 are for the purpose of transferring the totals of numeral wheels 19 through intermediate gears 32 and carrying winding gears 29, when the latter are being turned rearwardly to the zero position in the zeroizing action, to the gearing of the supplemental registering mechanism in a manner as will be fully set forth hereinafter. The unwinding of the carrying gear spring 36 in the zeroizing operation earlier described does not furnish the power needed to transfer the ordinary totals into the supplemental registering mechanism and means are provided to furnish the necessary power to effect the transfer.

Supported by the partition plates 81 of the supplemental registering mechanism frame is a

transverse shaft 82 provided with ball ends (Fig. 6), parallel to and in a plane slightly above the shaft 78 of the ordinary swinging frame, and journaled on this shaft are compensating devices, generally indicated at 83, with which the pinions 79 are adapted to engage upon the forward movement of the swinging frame.

These compensating devices 83 are interposed between the ordinary and supplemental mechanism to supply power in addition to the power of the carrying springs 36 to positively zeroize the ordinary numeral wheels 19 and transfer the totals indicated on the ordinary numeral wheels to the supplemental registering mechanism. As shown in detail in Fig. 7, each compensating device 83 comprises a hub portion 84 and a gear portion 84a, the hub portion being threaded adjacent one end and provided with a keyway 80 to receive a tongued washer 86. Graphite washers 85 are positioned on either side of gear portion 84a and a spring washer 87 is interposed between the tongued washer 86 and an ordinary washer 88. Threaded on the hub is a spring nut 89 and a lock nut 91. A dowel pin 92 is driven into the shaft 82 and is maintained in position by the flange portion 90 of lock nut 91.

The spring nut 89 is provided with notches adapted to receive a spanner wrench in adjusting the amount of friction necessary for the gear. The lock nut 91 is also provided with notches to receive a spanner wrench for locking the spring nut 89 in position. The compensating devices 83 are normally out of mesh with the supplemental mechanism transmitting pinions 93 journaled on a transverse shaft 94 supported by the partition plates 81, but upon initial rotation of the handle 69 the transverse shaft 82 and the compensating devices are moved axially to the left (viewing Fig. 1) by means of the cam face of the ratchet cam 95, camming the balled end of the shaft 82 axially to the left and moving the compensating devices into engagement with the transmitting pinions 93. Upon initial movement of the handle or crank 69, the compensating devices are moved into engagement with the transmitting pinions 93 and upon further rotation of the crank 69 the swinging frame of the ordinary mechanism is rocked forward, as already described, moving the pinions 79 into engagement with the gear portion 84a, thereby completely entraining the ordinary and supplemental mechanisms. Upon further rotation of the crank 69 the teeth of an intermittent gear 96 (Fig. 8), journaled on the shaft 71, mesh with an intermittent pinion 97 fixed on the shaft 82 rotating the shaft 82 one complete revolution and rotating the gear portion 84a an amount controlled by the carrying gears 29 equal to the amount registered on the numeral wheels 19.

The construction of the parts is such that one complete revolution of shaft 82 and compensating device 83 will transfer 9 from the ordinary numeral wheel 19 to the supplemental accumulator wheel 103. It will be apparent that if the total to be transferred is less than 9 on any individual wheel 19, the gear portion 84a will be halted in its movement by the halting of carrying gear 29, as described in Patent No. 1,357,748, and continued rotation of shaft 82 is permitted by the construction of the compensating device as already described.

A bar 83a notched as indicated at 83b (Fig. 3), extending transversely across the several orders of the supplemental mechanism and secured to the outer partition plates 81 is provided to insure

proper engagement of gear 84a with transfer pinion 79 and transmitting pinion 93.

Regardless of the power stored in carrying gear springs 36, which is normally used to return the numeral wheels 19 to zero, rotation of compensating device 83 through transfer pinion 79 and the train of gearing heretofore described drives the numeral wheel 19 to zero.

Simultaneously with zeroizing the ordinary numeral wheels, the compensating devices impart motion to transmitting pinion 93 and thence to lantern wheel 116 of the supplemental accumulator mechanism and a transmitting pinion or gear 98 which rotates with the lantern wheel and is adapted to mesh with a carrying gear 99 journalled on a shaft 100, thereby winding carrying gear spring 99a in the known manner.

The gear 99 meshes with an intermediate gear 101 on a transverse shaft 101a and the latter in turn meshes with the numeral wheel pinion 102 journalled on a transverse shaft 102a and fixed to the numeral wheel 103 of the supplemental registering mechanism. The numeral wheels 103 are provided with a set of figures or other indicia corresponding to the ordinary numeral wheels 19 and adapted to be viewed through a set of sight openings 103a formed in the cover plate of the casing above the respective numeral wheels of the supplemental registering mechanism.

Carrying mechanism is provided in each supplemental accumulator mechanism for the purpose of actuating the accumulator of the next higher order each time a carry is to be transferred from a lower order but as the mechanism employed is identical to that of the ordinary accumulator mechanism, further description is not thought necessary.

Counter-clockwise movement of the handle or crank 69 (Fig. 8) is prevented by means of a pawl 104 which idles over the teeth 105 of the ratchet cam 95 upon clockwise rotation of the handle 69. The pawl 104 is provided with a hub pivoted on the shaft 100 and is normally held in engagement with the teeth 105 of the ratchet cam by means of a spring 107.

Means are provided to disengage the compensating devices 83 from the transmitting pinions 93 after transfer of totals from the ordinary registering mechanism to the supplemental registering mechanism has been completed. Journalled on the shaft 71 at the left hand side of the machine is a cam 108 (Figs. 6 and 4) slotted for a purpose to be later described, which cam co-acts with ratchet cam 95 and is adapted to engage the ball end of the shaft 82 urging the latter to the right after the function above-mentioned has been accomplished.

The invention further provides means for releasing the carrying mechanism embodied in the supplemental registering mechanism in order to permit the transfer of a plurality of totals from the ordinary registering mechanism to the supplemental registering mechanism and the indication of a correct grand total on the supplemental accumulator mechanism. The releasing means provided in accordance with the invention is detained in its operation during the step of transferring the totals from the ordinary registering wheels to the supplemental accumulator registering wheels 103, i. e. while the compensating devices are engaged with the supplemental accumulator transmitting pinions 93.

Viewing Fig. 2 it will be noted that attached to and adjacent the ends of control shaft 71 by pins threaded through their hubs are cams 109

adapted, near the end of a complete revolution of the control shaft, to contact rollers 111 suitably secured to levers 112, two of which are provided, adjacent the fixed frames on either side of the supplemental accumulator mechanism. The levers 112 are pivoted at their upper ends upon the shaft 75 and are slotted to permit vertical movement. The lower ends of levers 112 are bifurcated and the jaws 112a embrace control shaft 71.

The lever 112 is provided with a depending arm 113 through which a shaft 114, extending across the machine, passes. A spring 115 attached to arm 113 normally restrains lever 112 and shaft 114 from upward movement. Near the completion of one full revolution of the control shaft the cams 109 engage the rollers 111, camming the levers 112 upwardly against the tension of spring 115 and raising the shaft 114, thereby elevating the stop detent 117 of the carrying bell crank lever 40 into engagement with the pins of lantern wheel 116. As the stop detent 117 is lifted, a detaining latch tooth, formed on its opposite end, is lowered releasing the escapement 119, allowing it to bear against a roller (roller 47 shown in Fig. 5 of Patent No. 1,357,748) mounted on the carrying lever urging it rearwardly, and through its pawl 121 moving the lantern wheel 116 one-tenth of a full rotation or enough to impart through the train of gears sufficient movement to turn the numeral wheel and complete the carry of one from a lower to a higher order.

As earlier described, means are provided for preventing counter-clockwise movement of the handle or crank 69. In addition, means are provided for halting the handle 69 after one full revolution of control shaft 71, and locking it against further clockwise movement until redepression of a numeral key 18. A lower detent shaft 122, journalled in the swinging frame plates 43 is adapted upon forward movement of the swinging frame to engage a stop 123 mounted on shaft 124, moving the stop 123 into the path of a stud 125 secured to the intermittent gear 96. Upon a full rotation of the crank 69 the stud 125 engages the stop 123 restraining the crank from further movement until operation of one of the keys 18, which, through various mechanisms described in the earlier mentioned patents, swings the rack frame and shaft 122 rearwardly permitting the stop 123 to return to its normal position out of the path of travel of stud 125 under the tension of a spring 126 attached to a depending arm 127 of the stop 123. At its opposite end the spring is attached to a stud 128 in the frame. As the stop is moved out of the path of the stud 125 the arm 127 engages a shaft 129 limiting further movement of the stop.

Zeroizing mechanism is provided for returning the numeral wheels 103 of the supplemental registering mechanism to zero positions. Located on the left hand side of the machine is the supplemental accumulator zero crank 130 (Fig. 4) extending through the outer casing and the fixed frame into the crank main piece 131 where it is held in place by a tapered screw 158 (Fig. 3). On the upper end of the crank main piece 131 are provided a plurality of teeth 132 adapted to ride over a pawl 133, on its down stroke and upstroke, preventing reversal of the zero crank before a full stroke has been obtained in either direction. Arms 134 (Fig. 5) on either side of the teeth 132 limit the movement of the zero crank by engaging a stud 135 fixed to the frame.

Adjacent the zero crank main piece 131 is a vertical lever 136 slotted at its upper end which

is adapted to be lowered and raised by means of the cam face of the crank main piece 131 bearing against a roll 137 secured to the lever 136. At its lower extremity the lever 136 is fastened to a stud in the arm 138 of the supplemental accumulator actuating shaft 139 of the supplemental accumulator swinging frame. Upon actuation of the cam crank 130 in a zeroizing operation the cam face of the zero crank main piece 131 bears against the roll 137 of the vertical slotted lever 136 urging the lever downward and oscillating the actuating shaft of the supplemental accumulator, thereby detrainning the gears and allowing the numeral wheels to return to zero in the manner described in connection with the ordinary registering mechanism.

An arm 141 of slotted lever 136 is adapted upon the lowering of the lever 136 to enter the slot 142 in the cam 108 thereby preventing any movement of the control shaft handle 69 until the zero crank has returned to its normal position after the zeroizing operation.

Likewise, upon rotation of the handle 69, any movement of the zero crank is prevented because the slot 142 in the cam 108 has been moved with the shaft 71 and upon attempting to operate the zero crank 130 the arm 141 strikes the outer edge of the cam 108 and is thereby restrained from further movement.

In accordance with the present invention, provision is made for locking all ordinal series of keys upon initial movement of the crank handle 69 in transferring totals from the ordinary registering mechanism to the supplemental registering mechanism.

A lever 143 located at the lower right hand of the machine is provided with a hub pivoted on the shaft 124 and has an upwardly extending arm 144. At its forward end the lever 143 has an arm 145 adapted to rest against a cam face 146 of the intermittent gear 96, as shown in Fig. 8. A stud 147 secured to lever 143 engages the bifurcated end of a link 148 pivoted on a shaft 149. An upwardly extending arm 151 of link 148 pivoted on a shaft 149 normally engages a bent over portion or hook 150 formed on a vertical arm 140 of transverse bar 152 extending across the several orders of the machine, said bar 152 being pivoted on the shaft 149.

Lock arms 153 which are secured to bar 152 are pivoted on shaft 149, one lock arm being provided for each order of keys. Upon initial operation of the crank 69 and rotation of the gear 96, the cam 145 of lever 143 will be cammed downwardly, as shown in Fig. 10, raising the link 148 and rocking it rearwardly on its pivot 149, allowing the transverse bar 152 to rock forwardly through the tension of spring 157, one end of which is attached at 154 to the link 148. This action rocks the lock arms 153 in each column rearwardly into the path of travel of the column actuators 22 and restrains any movement of the said column actuators through operation of the keys 18. As earlier described, upon full rotation of the crank 69, it is halted in its travel by the stop 123 at which time it again presents the cam face 146 to the arm 145 of the lever 143 lowering the rear arm of the lever and rocking the link 148 forwardly, oscillating the transverse bar 152 and rocking the lock arms out of the path of travel of the column actuators 22.

The locking mechanism for preventing depression of a numeral key while transfer of totals from the ordinary numeral wheels to the sup-

plemental accumulator numeral wheels is being effected, also functions to allow only a limited movement of the ordinary zero crank 45 during rotation of the crank 69 thereby preventing any chance of error through zeroizing of the numeral wheels in the ordinary registering mechanism while transferring the totals to the supplemental registering mechanism. The operation of zeroizing with the attendant forward rocking of the shaft 53 has been described. If a zeroizing operation is attempted the arm 52 attached to the shaft 53 will be rocked forward until it comes in contact with the shoulder 155 of arm 151 where it is restrained from further movement as shown in dotted lines in Fig. 10.

Means are provided for locking crank handle 69 and the supplemental registering mechanism in the event of a transfer being attempted while an error because of a partial key stroke is left in the ordinary mechanism. As has been fully described in the patents hereinbefore mentioned, when a partial key stroke has occurred, the column actuators 22 are held in a depressed condition until the key stroke has been completed or given its full depression. If an attempt is made to transfer the totals in the ordinary registering mechanism to the supplemental registering mechanism by rotation of the crank 69, it will be found that the crank is locked after an initial movement if an error has been made in the ordinary registering mechanism. As earlier described, upon movement of the crank 69, link 148 is raised and rocked rearwardly through its connection with the lever 143 with a coincident rearward rocking of the lock arms 153. If a column actuator 22 is depressed the lock arms 153 will bear against the column actuators 22 which are in its path thereby preventing further movement of the lock arm and permitting only a varied limited movement to the transverse bar 152 as shown in Fig. 11. The arm 144 of the lever 143, upon being raised upon the initial stroke of the crank 69, engages hook 150 on the arm 140 of transverse bar 152 and is restrained from further movement. Upon completing the key stroke the column actuator is fully depressed and then is allowed to rise to its normal position, leaving open the path of the lock arms 153 so that the crank 69 may be rotated.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

We claim:

1. In a calculating machine having an ordinary accumulator including zeroizing mechanism operatively associated therewith, and a supplemental accumulator; means for transferring amounts registered by said ordinary accumulator to said supplemental accumulator, comprising a driven member associated with each of the several denominational orders of said accumulators, said driven members being normally disconnected from both of said accumulators, means for connecting said driven members with said supplemental accumulator, means for connecting said ordinary accumulator with said driven members, means for sequentially rendering said last two means operative to connect said accumulators for transferring action, and a driving

member associated with each of said driven members including a friction device interposed between each of said associated members to compensate for the variable digital degrees of actuation transmitted to the several denominational orders of said supplemental accumulator during a transfer operation.

2. In a calculating machine having an ordinary accumulator including a zeroizing mechanism operatively associated therewith, and a supplemental accumulator; means for transferring amounts registered by said ordinary accumulator to said supplemental accumulator, comprising a driven member associated with each of the several denominational orders of said accumulators, said driven members being normally disconnected from both of said accumulators, means for connecting said driven members with said supplemental accumulator, means for connecting said ordinary accumulator with said driven members, means for sequentially rendering said last two means operative to connect said accumulators for transferring action, and driving means associated with each of said driven members including means for imparting an invariable increment of action and a friction device interposed between said last means and each of said driven members to compensate for the difference between the variable digital degrees of actuation imparted to said supplemental accumulator and said invariable increment of action during a transfer operation.

3. In a calculating machine having an ordinary accumulator, including denominational numeral wheels, gears connected therewith, and zeroizing mechanism operatively associated therewith, and a supplemental accumulator, including denominational numeral wheels and driving gears therefor; means for transferring amounts registered by said ordinary accumulator to said supplemental accumulator, comprising intermediate gears normally disconnected from the gears of both of said accumulators, means for moving said intermediate gears into mesh with the gears of said supplemental accumulator, means for moving the gears of said ordinary accumulator into mesh with said intermediate gears, means for sequentially rendering said two means operative, and means for driving said intermediate gears including means adapted to impart an invariable increment of action and means interposed between said last means and said intermediate gears for compensating for the variable digital degrees of actuation imparted to the several denominational numeral wheels of said supplemental accumulator during a transfer operation.

4. In a calculating machine having an ordinary accumulator, including denominational numeral wheels, gears connected therewith and zeroizing mechanism operatively associated therewith, and a supplemental accumulator, including denominational numeral wheels and driving gears therefor; means for transferring amounts registered by said ordinary accumulator to said supplemental accumulator, comprising intermediate gears normally disconnected from the gears of

both of said accumulators, means for moving said intermediate gears into mesh with the gears of said supplemental accumulator, means for moving the gears of said ordinary accumulator into mesh with said intermediate gears, means for sequentially rendering said two means operative, and means for driving said intermediate gears including a friction device interposed between said driving means and each of said intermediate gears to compensate for the variable digital degrees of actuation imparted to the several denominational numeral wheels of said supplemental accumulator during a transfer operation.

5. In a calculating machine having an ordinary accumulator, including denominational numeral wheels, gears connected therewith, and zeroizing mechanism operatively associated therewith, and a supplemental accumulator, including denominational numeral wheels and driving gears therefor; means for transferring amounts registered by said ordinary accumulator to said supplemental accumulator, comprising intermediate gears normally disconnected from the gears of both of said accumulators, means for moving said intermediate gears into mesh with the gears of said supplemental accumulator, means for moving the gears of said ordinary accumulator into mesh with said intermediate gears, means for sequentially rendering said two means operative, and driving means including means adapted to impart an invariable increment of action and friction devices interposed between said last means and said intermediate gears to compensate for the difference between said invariable increment of action and the variable digital degrees of actuation imparted to the several denominational numeral wheels of said supplemental accumulator during a transfer operation.

6. In a calculating machine having an ordinary accumulator, including denominational numeral wheels and gears connected therewith, denominational actuating mechanism for said accumulator, zeroizing mechanism adapted to disconnect said gears from said actuating mechanism to set said numeral wheels to zero, and a supplemental accumulator, including denominational numeral wheels and driving gears therefor; means for transferring amounts registered by said ordinary accumulator to said supplemental accumulator, comprising intermediate gears normally disconnected from the gears of both of said accumulators, means for driving said intermediate gears including driving members and friction devices interposed between said driving members and said intermediate gears, means for moving said intermediate gears into mesh with the gears of said supplemental accumulator, means for disconnecting the gears of said ordinary accumulator from said actuating mechanism and moving the same into mesh with said intermediate gears to render said zeroizing mechanism effective, means for actuating said driving means and means for sequentially rendering said last three means operative.

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