Feb. 9, 1943. C. M. F. FRIDEN 2,310,280

CALCULATING MACHINE

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FIG. 2.

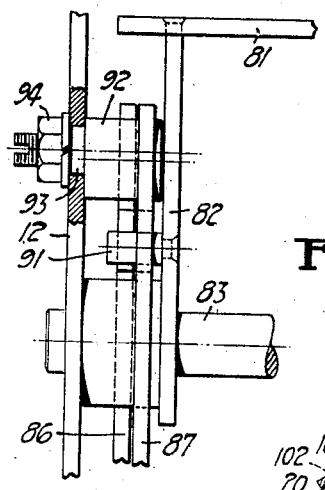

FIG. 3.

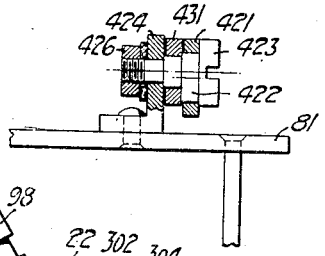

FIG. 1.

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CALCULATING MACHINE

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FIG. 4.

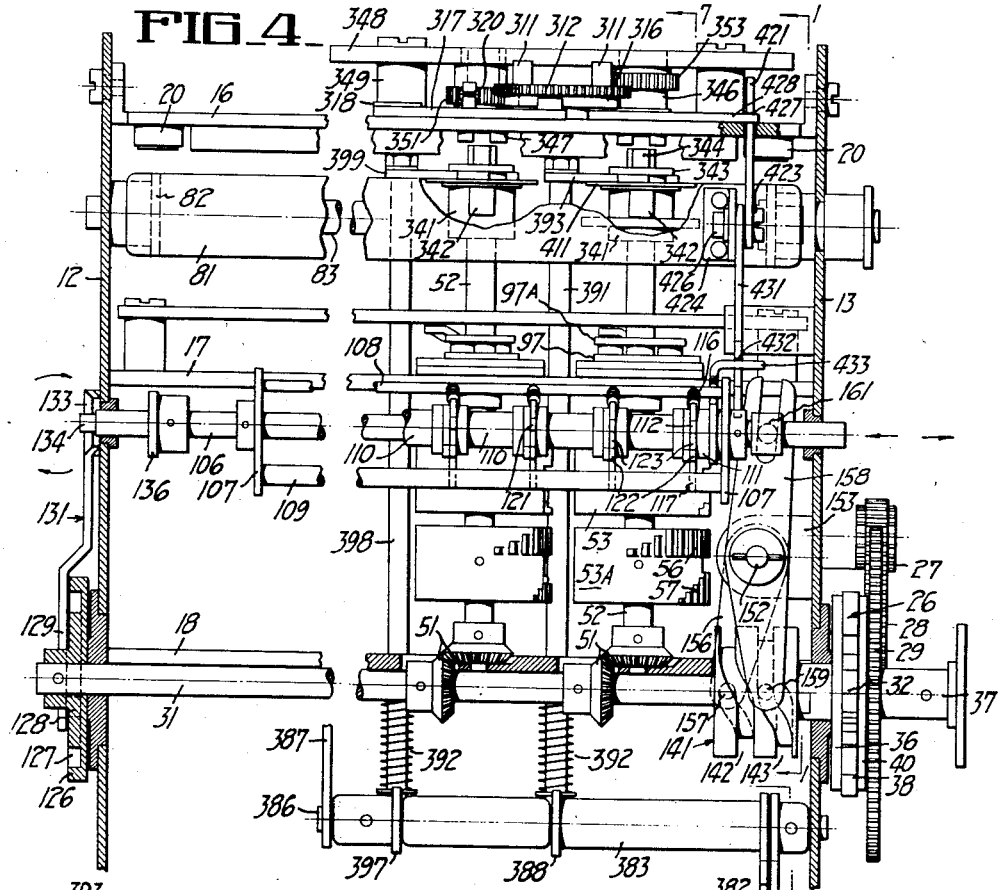
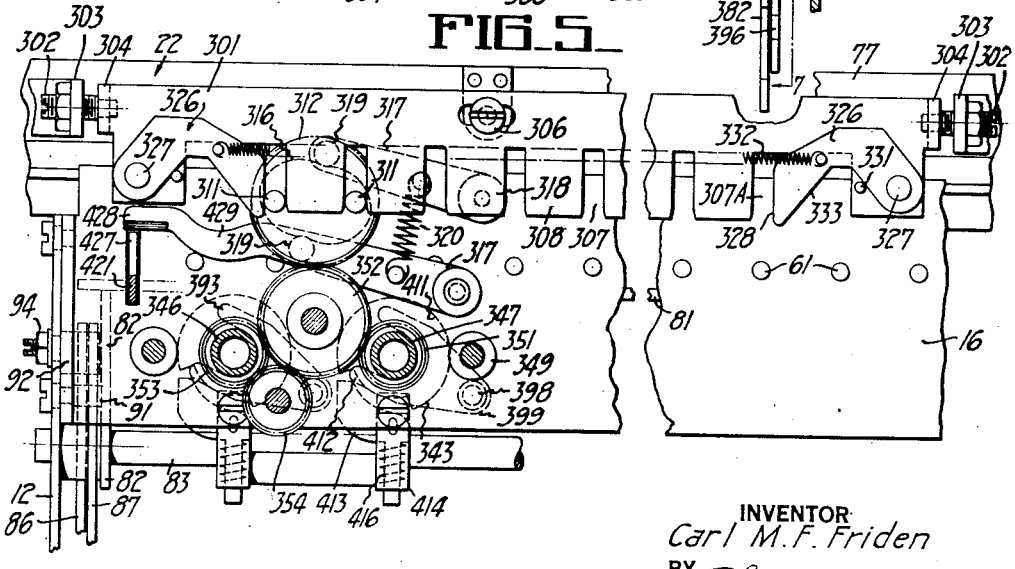


FIG. 5.



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CALCULATING MACHINE

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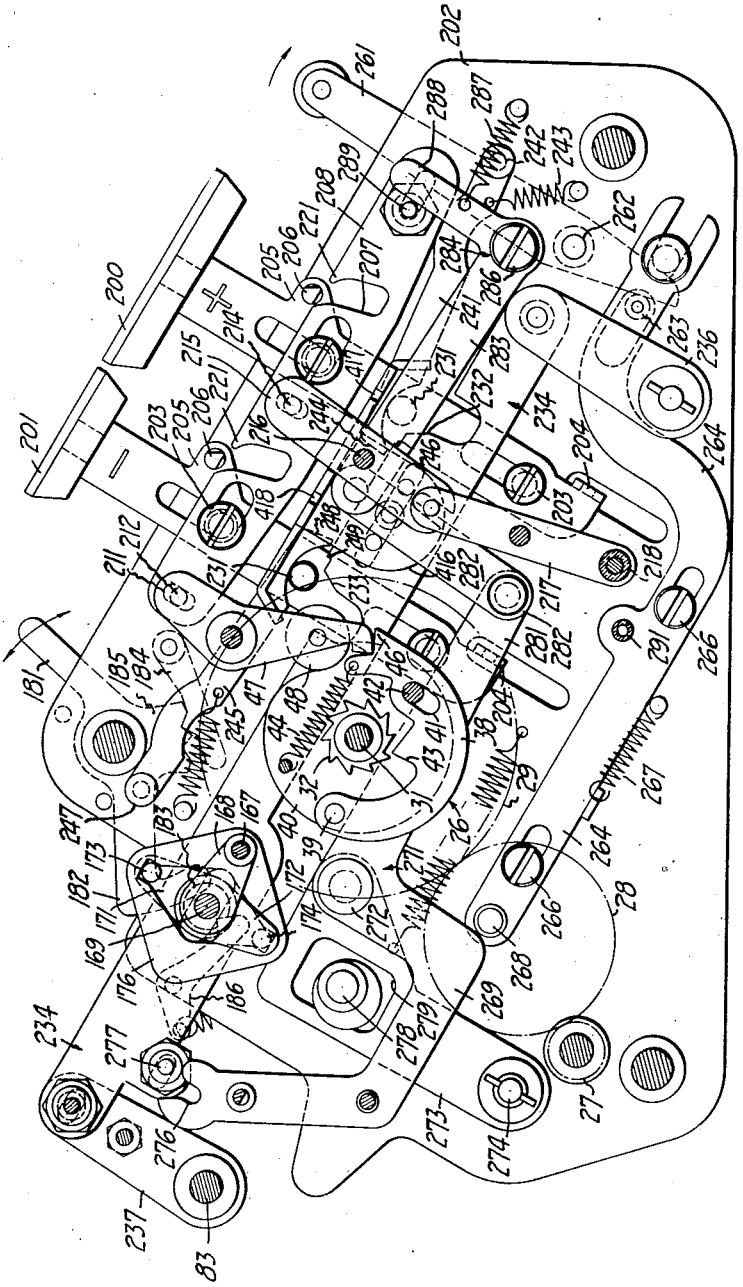
FIG. 6.



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CALCULATING MACHINE

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FIG. 8.

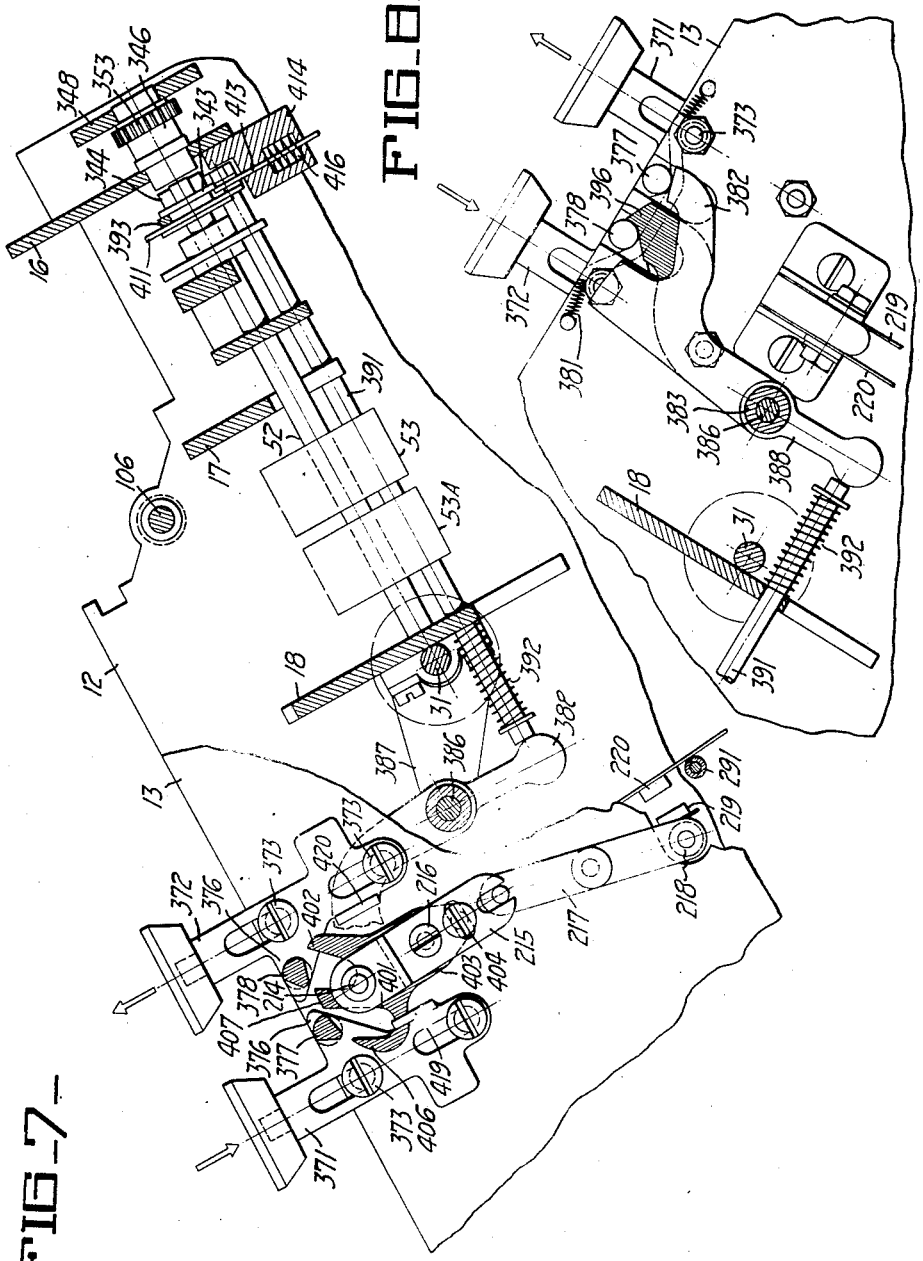

FIG. 7.

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CALCULATING MACHINE

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FIG_9_

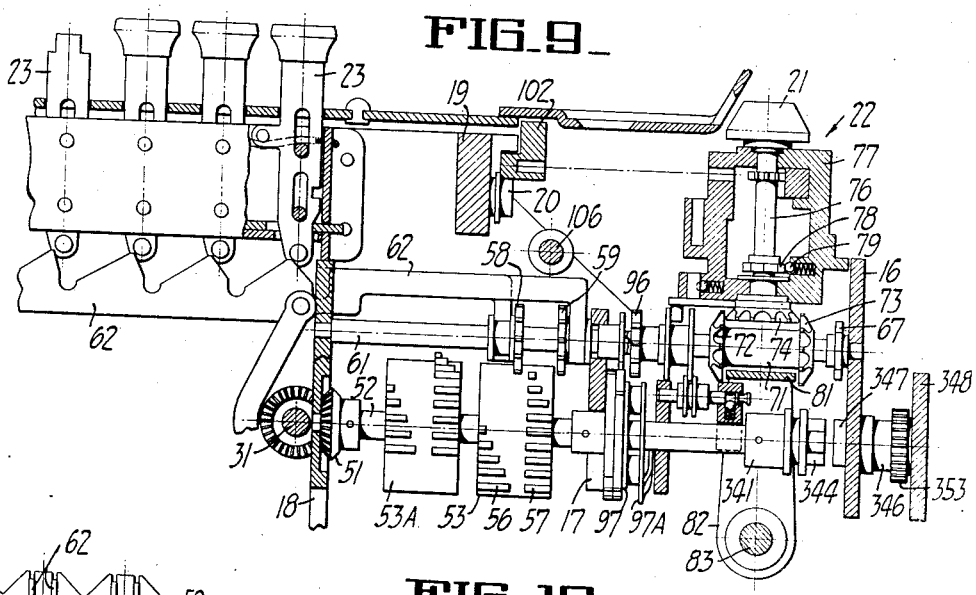
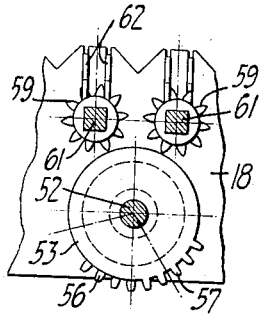


FIG_10_



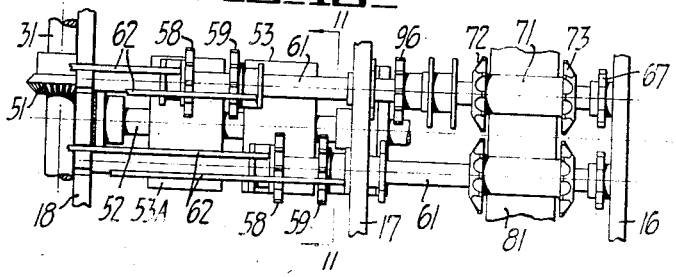
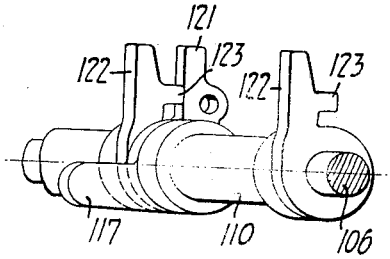
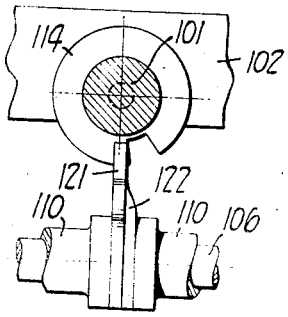


FIG_11_

FIG_13_

FIG_12_





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Patented Feb. 9, 1943

2,310,280

UNITED STATES PATENT OFFICE

2,310,280

CALCULATING MACHINE

Carl M. F. Friden, Oakland, Calif., assignor to Friden Calculating Machine Co., Inc., a corporation of California

Application June 19, 1935, Serial No. 27,338

18 Claims. (Cl. 235—63)

My invention relates to calculating machines for performing addition, subtraction, multiplication, and division, and more particularly to machines of the type having an ordinally shiftable accumulator or register carriage.

It is an object of the invention to provide a calculating machine having an improved register carriage shifting mechanism.

Another object of the invention is to provide an improved calculating machine having a register carriage which can be shifted easily and quickly by power driven means without the possibility of accidental interference with other parts of the machine.

Another object of the invention is to provide an improved calculating machine in which the carriage shifting mechanism is driven from the actuating mechanism which serves to introduce values into the machine.

Another object of the invention is to provide an improved calculating machine in which an incorrect registration cannot occur during shifting of the carriage.

Another object of the invention is to provide an improved calculating machine in which an incorrect registration cannot occur when the value entering actuating mechanism is operated while another machine operation such as carriage shifting is being carried out.

Another object of the invention is to provide an improved calculating machine of the type having a unidirectionally rotatable actuator and bidirectionally rotatable numeral wheels which attains the foregoing objects.

Another object of the invention is to provide an improved calculating machine of the type having a unidirectionally rotatable actuator and bidirectionally rotatable numeral wheels in which the shiftable carriage can be moved from one ordinal position thereof to any selected ordinal position by manipulation of control keys.

Other objects will appear from the following description and the drawings. In the drawings—

Figure 1 is a full-size vertical longitudinal section of the rear part of the machine taken in a plane immediately to the right of the mechanism of lowest order and illustrating the relation of the accumulator and revolutions counter to the actuating and selecting means therefor, certain gears being shown schematically. The plane of the section is indicated by the line 1—1 in Fig. 4.

Figure 2 is an enlarged detail elevational view of a portion of Figure 1 as indicated by the line 2—2 in Figure 1. The figure is partially broken away to illustrate the construction more clearly.

Figure 3 is an enlarged detail elevational view of a portion of Figure 1 as indicated by the line 3—3 in Figure 1, a part of the figure being shown in section to illustrate the construction more clearly.

Figure 4 is a fragmentary plan view of the portion of the machine illustrated in Figure 1 with the carriage and keyboard mechanism removed.

Figure 5 is a rear elevational view of the carriage and the carriage shifting mechanism as indicated by the line 5—5 in Figure 1.

Figure 6 is an elevational view of the operation controls of the machine as viewed from the left of the control plate on which such controls are mounted.

Figure 7 is a view illustrating a part of the carriage shift controls as viewed in elevation from the right, and showing another part in section as indicated by the line 7—7 in Figure 4.

Figure 8 is a fragmentary elevational view of a portion of the carriage shift controls as viewed from the left.

Figure 9 is a vertical longitudinal section of the rear part of the machine, similar to Fig. 1 but is taken through the axis of one of the actuating shafts with certain parts shown in elevation and with other parts omitted to obtain clarity.

Figure 10 is a fragmentary plan view of one of the actuating shafts and the mechanism associated therewith. The view is generally similar to Fig. 4.

Figure 11 is a transverse sectional elevation of mechanism shown in Fig. 10 as indicated by the line 11—11 in Fig. 10.

Figure 12 is a fragmentary perspective view of the actuating means for the revolutions counter.

Figure 13 is a fragmentary transverse sectional elevation of one order of the revolutions counter actuating means.

I have shown my invention as embodied in the type of calculating machine having a unidirectionally operable actuator and reversible or bidirectionally operable numeral wheels, as disclosed for example, in my co-pending application, Serial No. 724,482, filed May 8, 1934, to which reference is made for a complete disclosure of features of this type machine which are not disclosed herein. While certain features of my invention are adapted particularly for use in this type of machine, it is to be understood that certain of such features and other features of my invention can be applied to other types of calculating machines.

The machine disclosed herein includes base 10

(Fig. 1) which supports casing 11 and has side frame members 12, 13 (Fig. 4) mounted thereon. Side members 12, 13 are connected by cross frame members 16, 17, 18 (Figs. 1 and 4) and 19 (Fig. 1) which serve to mount various mechanisms described more particularly hereinafter. The accumulator register comprises a series of reversible numeral wheels 21 in register carriage 22 which is mounted for endwise shifting movement laterally of the machine in either direction to various ordinal positions thereof on rollers 20 journalled on cross frame members 16, 19. The values to be introduced into the machine are determined by a plurality of orders of settable value keys 23 and power driven actuating means controlled by plus key 200 and minus key 201. The number of actuations of accumulator numeral wheels 21 are registered in counter numeral wheels 24. The above identified mechanisms will now be described in greater detail.

The registration of values is effected cyclically by operation of the actuating means from electric motor 25 (Fig. 1) through a cyclic clutch 26 (Figs. 4 and 6). Motor 25 has driving pinion 27 which is connected by idler gear 28 with drive gear 29 of clutch 26.

The clutch determines cyclic operation of the machine and is constructed to provide for ready control thereof during high speed operation. Driving clutch gear 29 (Figs. 4 and 6) is mounted for rotation on driven shaft 31 (Fig. 6) and has driving element or ratchet 32 secured thereto. The driven element of the clutch includes disc 36 secured on transverse shaft 31 (Fig. 4) which is suitably journaled in side members 12, 13. Gear 29 and ratchet 32 are held in proper position on shaft 31 between disc 36 and gear hub 37 pinned on shaft 31. The connection between driven element 36 and ratchet 32 is provided by clutch pawl 38 (Figs. 4 and 6) pivoted on pin 39 between disc 36 and cam ring 40 secured thereto. To limit pivotal movement of pawl 38 (Fig. 6), slot 41 is formed therein to engage pin 42 secured between disc 36 and ring 40. Intermediate its ends, pawl 38 has nose or tooth 43 which is positioned for engagement with the teeth of ratchet 32 as controlled by the pivotal position of the pawl which is normally urged to clutch engaging position by spring 44, tensioned between the movable end of pawl 38 and disc 36. In the disengaged or full cycle position shown in Fig. 6, stop extension 46 of pawl 38 is engaged by pivotally mounted clutch control lever 47 to maintain nose 43 out of the path of the teeth of ratchet 32. To engage the clutch, lever 47 is oscillated out of engagement with the stop 46 so that spring 44 becomes effective to engage nose 43 with ratchet 32, and the clutch is engaged for one or more cycles of rotation depending upon the re-engagement of lever 47 with stop 46. Thus, disc 36 and transverse shaft 31 are operable cyclically and in one direction as controlled by lever 47. During rotation of the clutch, lever 47 is maintained in clutch engaging position by roller 48, mounted thereon in operative relation with cam ring 40. Ring 40 is provided with a peripheral depression into which roller 48 falls when the clutch is in full cycle position. The actuating means and the clutch are maintained in full cycle position by the engagement of lever 47 with stop extension 46 of pawl 38, and by spring urged pawl 49 (Fig. 1) which engages seat 50 in cam disc 126.

From transverse shaft 31 a plurality of longitudinally extending actuating shafts are driven in a one to one gear ratio to provide a drive for the actuating elements of the machine. Shaft 31 (Fig. 4) has suitable bevel gear connections 51 with longitudinal shafts 52 (Figs. 1, 4, 9 and 10) which are suitably journalled in cross members 17, 18. Each shaft 52 (Figs. 9–11) carries a pair of actuating elements 53, 53A, which are associated with the two adjacent orders of the machine. Each element 53 is identical and comprises a cylinder having respective sets of stepped teeth 56, 57 for cooperation with the selecting mechanism.

The values set into the machine are determined by the relative positioning of ten-tooth gears 58, 59 (Figs. 1 and 9–11) slidably mounted on two part square register driving shaft 61, which is journalled in cross members 16, 17 and 18 and can be disconnected at member 17. Gears 58, 59 have associated therewith respective slides 62 which extend rearwardly to cooperate with a bank of keys 23. Slides 62 are mounted for endwise movement on a plurality of similar pivoted links 63 (only one of which is shown) which are spring pressed as by spring 64 to urge slides 62 to their forward position where gears 58, 59 do not register with stepped teeth 56, 57. By depression of a key 23 one of gears 58, 59 is placed in alignment with the associated stepped teeth, 56 for example, so that shaft 61 is driven a number of increments of movement corresponding to the depressed key upon rotation of the associated actuating cylinder 53. Gears 58, 59 are maintained in proper relation to teeth 56, 57 by spring-pressed ball 66 and ten-tooth gear 67 on shaft 61. The structure of the actuating and selecting mechanisms is disclosed more fully in my copending application referred to above.

From the foregoing description it is seen that upon rotation of actuating cylinders 53 a value as determined by the depressed keys 23 is registered on numeral wheels 21 in terms of increments of rotation of associated shafts 61. Because of the axial off-setting of cylinders 53, 53A only one actuating shaft 52 is required for each two orders of the machine, the two associated register driving shafts 61 being spaced slightly to the right and left respectively of shaft 52.

To transfer the increments of movement of shaft 61 to corresponding numeral wheel 22, spool 71 is slidably mounted on shaft 61 between plates 16, 17 and has respective ten-tooth plus-minus gears 72, 73. Gears 72, 73 are adapted to mesh with ten-tooth gear 74 on numeral wheel shaft 76 suitably journalled in upright position in carriage frame 77. By shifting spool 71 either to the right or left as viewed in Figs. 1 and 9, either gear 72 or 73 can be meshed with gear 74 to cause rotation thereof selectively in either direction. To prevent overthrow of numeral wheels 21, each shaft 76 has ten-tooth gear 78 engaged by spring-pressed ball 79.

The shifted position of all spools 71 (Figs. 1, 4, 9 and 10) in the machine is controlled simultaneously by virtue of the positioning of spools 71 in parallel relation on strap or bail 81, which fits closely between gears 72, 73. Strap 81 is mounted for pivotal movement by arms 82 on shaft 83. Thus, by rocking shaft 83 and oscillating strap 81 the machine can be set for subtractive or additive registration. Strap 81 and gears 72, 73 are normally maintained in their central neutral position by centralizer arms 86, 87 pivoted at 88 and having spring 89 connected therebetween. Pin 91 on arm 82 is interposed between flat portions of arms 86, 87. To provide for accurate adjustment of arms 86, 87 with re-

spect to strap 81 and to accurately determine the neutral position thereof and of gears 72, 73, the upper ends of arms 86, 86 (Figs. 1 and 2) engage eccentrically mounted stop 92 having off center portion 93 positioned in side member 12. Stop 92 is held in adjusted position by nut 94 threaded thereon and compressing a suitable spring washer. Because of eccentric movement of stop 92, the position of centralizer arms 86, 87, and consequently of plus-minus gears 72, 73, can be easily and accurately adjusted.

Tens transfer mechanism for accumulator numeral wheels 21 is associated with plus-minus gears 72, 73, which may be conventional construction and as shown is generally of the form described in said co-pending application. Generally, such mechanism includes transfer gear 96 (Figs. 1 and 9) shiftably mounted on shaft 61 and movable by the numeral wheel of next lower order into the path of single tooth actuator 97 (Figs. 1, 4 and 9). Actuators 97, 97A (Fig. 4) for adjacent transfer gears 96 are offset axially on associated shaft 52. Numeral wheels 21 are zeroized as described in said application by manipulation of handle 98 (Fig. 1).

Revolutions counter mechanism

The revolutions counter or counting register including numeral wheels 24 (Fig. 1) is mounted in carriage 22 and has associated therewith an actuator mounted in the frame of the machine and which is constantly connected with the accumulator actuating means for registering both positive and negative increments on numeral wheels 24. Each numeral wheel 24 is secured on shaft 101 which has one end removably journalled in carriage frame 77 and the other end in cross bar 102 removably connected with frame 77 by suitable end plates (not shown). Spring 103 seated in bar 102 urges shaft 101 against carriage frame 77 to maintain proper positioning of numeral wheel 24 and associated parts. Shafts 101 are spaced ordinally to correspond to the spacing of accumulator numeral wheels 21.

In order to actuate or introduce values into the revolutions counter there is provided an actuator including a member 106 (Figs. 1 and 4) which has a compound motion having two major components, one a translatory reciprocation and the other a rotary oscillation. That is, the members or shaft 106 is mounted in side frame members 12, 13 to move from end to end and to be rocked back and forth about its axis. Mounted on shaft 106 (Fig. 4) is a pair of collars 107 each of which is extended to support a pair of parallel rods 108 and 109. Mounted freely on shaft 106 between rods 108, 109 is a plurality of actuator spools 110 (Figs. 1, 4, 12 and 13) which in general are identical and provide for ordinal spacing of the actuator elements thereon. Spool 111 of lowest order at the right end of shaft 106 is only partially complete and carries actuator element or finger 112 (Figs. 1 and 4) which projects radially between ten-tooth gear 113 (Fig. 1) and single-notch disc 114 secured in spaced relation on shaft 101.

Finger 112 (Fig. 1) is connected by spring 116 to rod 108 so that it is urged in a clockwise direction, as seen in Fig. 1, about the shaft 106. Such movement of finger 112, however, is restrained by projection 117 of spool 111 which engages beneath rod 109. By this means, spool 111 and finger 112 move positively with shaft 106 and rods 108, 109 during counter-clockwise movement thereof and move yieldingly therewith during clockwise movement. As seen in Fig. 1, clockwise movement of shaft 106 and rods 108, 109, under the urgency of spring 116 moves finger 112 between successive teeth of gear 113, which are maintained in proper alignment by an overthrow preventer including ten-tooth gear 118 and spring-pressed ball 119. When finger 112 is positioned between adjacent teeth of gear 113, the rotary oscillation of shaft 106 is interrupted and the shaft is translated axially toward the left, as seen in Fig. 4, for instance. Such movement, since finger 112 remains intermediate successive teeth on the ten-tooth gear 113, is effective to rotate the shaft 101 for one tenth of a complete revolution, and thus to advance the associated numeral wheel 24 positively for one successive digit.

At the conclusion of such axial movement toward the left, shaft 106 again oscillates, but in counter-clockwise direction, so that finger 112 is rotated positively, due to the contact of rod 109 against projection 117, into the position seen in Fig. 1 in which finger 112 is out of mesh with gear 113. The return axial movement of shaft 106 toward the right, as seen in Fig. 4, therefore, restores the parts to their original position. By the described operation, the numeral wheel 24 in ordinal alignment with finger 112 is advanced one unit.

It is especially pointed out that if, when shaft 106 initially rotates to mesh finger 112 with ten-tooth gear 113, such meshing movement is followed by an axial translation of the shaft 106 toward the left (Fig. 4), the numeral wheel is advanced in a positive direction. On the other hand, if, following the initial meshing movement of finger 112 with the gear 113, the axial translation of shaft 106 is toward the right, then the direction of movement of shaft 101 and numeral wheel 24 is subtractive or negative.

Spool 111 and its associated actuator finger 112 register on the aligned numeral wheel 24 the number of actuations occurring in that ordinal position of the carriage. The other spools 110 form part of the tens transfer mechanism which will now be described. Spool 110 (Figs. 4, 12 and 13) adjacent spool 111 of lowest order is provided at its left-hand end with actuator finger 121, similar to finger 112 of spool 111, and is also provided at its right-hand end with finger 122 (Figs. 1, 4 and 13) which is bent to be co-planar with finger 112 and has projection 123 engaging finger 112. Thus, spring 116 of the "tens" order, for instance, as seen in Fig. 4, is effective to urge finger 122, and particularly its projection 123, into contact with the finger 112 of the "units" order. However, spool 111 of the "units" order cannot yield because its projection 117 is in contact with rod 109. However, when rod 109 is oscillated about the axis of shaft 106, finger 122, under the urgency of its spring 116, is free to follow finger 112, providing the notch in disc 114 (Fig. 13) is in position therefor. Spools 110 of higher order are similarly formed, finger 122 of each spool 110 overlapping and engaging finger 121 of spool 110 of next lower order.

In order to effect the tens transfer, discs 114 (Figs. 1 and 13) are so positioned with respect to numeral wheels, that the single notch in each disc 114 is aligned with the associated finger 122 when its numeral wheel 24 stands at "9," and is aligned with such finger after its initial axial movement if its numeral wheel is at "0". If the notch is out of passing position so that the finger 122 can-

not pass by the barrier of disc 114, then the "tens" order spool 110 cannot rotate about the axis of the shaft 106 and, correspondingly, due to the interlocking relationship of fingers 121, 122 of the remainder of the spools 110 for the higher orders, maintains all such higher order spools stationary. But on the other hand, if the tens-carry notch in the "units" order disc 114 is in its "9" position during addition to permit passage of the finger 122, then such finger rotates along with the finger 112 and causes a corresponding rotation of the "tens" order spool 110, and finger 121 thereof is effective upon its initial axial movement thereof on gear 113 of the "tens" order in the revolutions counter to rotate shaft 101 and numeral wheel 24 through one-tenth of a rotation and thereby effect the tens-carrying operation. Correspondingly, if the "units" numeral wheel stands at "0" in a subtractive operation, the rocking movement of fingers 121, 122 is delayed until the initial axial movement thereof aligns finger 122 with the notch of the associated disc, so that finger 121 engages gear 113 of the "tens" order to effect a negative transfer during the return axial movement of the actuator. A similar action occurs in all higher orders to effect a tens-carrying operation.

The rotary oscillation of the shaft 106 is produced in synchronism with the rotation of the transverse shaft 31. At the end of the shaft 31 (Fig. 4) which projects through side frame member 12, there is mounted a cam disc 126 having cam groove 127 formed therein. Cam follower 128 (Fig. 1) projecting from one arm 129 (Figs. 1 and 4) of a bell crank generally designated 131 and pivoted as at 132 on side member 12 engages groove 127. Bell crank 131 is likewise provided with arm 133 which is forked to engage pin 134 on crank arm 136 secured on the shaft 106 inside of frame member 12. Pin 134 projects through a suitable aperture in plate 12 and is of sufficient length to maintain the operative relation of bell-crank 131 and arm 136. The contour of cam groove 127 is such that bell crank 131 is oscillated during each cycle of rotation of actuating shaft 31, and, through crank arm 136 causes a comparable oscillation of shaft 106.

The longitudinal or axial translation of the shaft 106 is provided by a mechanism illustrated in Figs. 1 and 4, by means of which the phase relationship of the oscillation and reciprocation of shaft 106 can be varied. Cam drum 141 (Fig. 4) is mounted on shaft 31 adjacent side member 13 and has a pair of grooves 142 and 143 cut therein. Cam grooves 142, 143 are of identical contour but are polarly or angularly spaced from each other, and means are provided for optionally engaging either of the grooves 142 and 143. To this end, I provide sleeve 151 (Fig. 1) mounted freely on vertical shaft 152 secured in a pair of spaced brackets 153 on side member 13. The lower end of sleeve 151 is united to lever arm 156 which carries follower pin 157 at its end in operative relation with groove 142 in drum 141. On the upper end of sleeve 151 is lever 158 at one extremity of which follower pin 159 is provided to cooperate with groove 143. The other extremity of lever 158 is forked to engage depending pin 161 secured by a suitable collar on shaft 106. It is seen therefore, that rotation of drum 141 serves to oscillate lever arm 156, sleeve 151, and lever 158, which through pin 161 reciprocates shaft 106. The phase relationship of the reciprocation of shaft 106 to its rotary oscillation depends on which of pins 157, 159 is engaged with its corresponding groove 142, 143 in drum 141. Sleeve 151 is shown in Fig. 1 in its central position when pin 157 is engaged slightly with groove 142 and pin 159 is just out of engagement with groove 143.

To place sleeve 151 in either desired extreme position, I provide on sleeve 151, annular groove 166, which is engaged by shifting pin 167 projecting through side member 13 from lever 168 (Fig. 6) on shaft 169. Thus, oscillation of shaft 169 serves to shift sleeve 151 along shaft 152. In this fashion, either pin 157 is introduced into groove 142 so that the shaft 106 reciprocates in phase relationship with the characteristics of the groove 142, or, conversely, pin 159 is engaged in groove 143 so that shaft 106 in such circumstances partakes of the reciprocatory movement imparted by cam groove 143.

Thus, as transverse shaft 31 rotates, it imparts to the shaft 106 an axial translation in either selected one of two different phase relationships with shaft 31. The phase relationship which is selected in a particular instance controls the direction of rotation of the numeral wheels 24 in the revolutions counter as described above.

Means are provided for manually setting the revolutions counter actuator to reverse the direction of actuation thereof irrespective of the type of actuation determined for the accumulator numeral wheels. Shaft 169 (Fig. 6) carries axially offset oppositely extending arms 171, 172 have pins 173, 174 on the facing sides thereof adapted for selective operative relation with opposite vertically spaced notches formed in diamond-shaped frame 176 secured on slide 234 in spaced relation therefrom. Arm 171 and pin 173 lie on one side of frame 176 and arm 172 and pin 174 on the opposite side thereof, so that axial shifting of shaft 169 is effective to determine which of pins 173, 174 is to be operatively engaged with frame 176 and slide 234. As described hereinafter, slide 234 is moved in one direction upon depression of plus key 200 and in the other direction upon depression of minus key 201. Therefore, if pin 173 be engaged with the corresponding notch in frame 176, depression of keys 200, 201 will serve to oscillate shaft 169 in opposite directions. As previously described, such oscillation of shaft 169, through arm 168, pin 167, and sleeve 151 (Fig. 1) controls the direction of actuation of revolutions counter numeral wheels 24. It will also be seen that by shifting shaft 169 (Fig. 6) to disengage pin 173 and engage pin 174 with frame 176, the direction of oscillation of shaft 169 for a given direction of movement of slide 234 is reversed and hence the direction of actuation of numeral wheels 24 is also reversed. Such axial movement of shaft 169 is controlled by control lever 181 pivoted on plate 202 and having arcuate cam sector 182 engaging enlarged end 183 of shaft 169 and operating in a manner fully disclosed in said co-pending application. Lever 181 is latched resiliently in either position thereof by spring-urged pawl 184. Spring-urged pawl 186 engages a notch in end 183 to maintain alignment of pins 173, 174 with the respective notches in frame 176. Thus, the revolutions counter can be set to give true figure results or complements thereof.

Plus and minus keys

Manually operable means in the form of plus and minus keys are provided for controlling selective positive and negative registration on the numeral wheels. Keys 200, 201 (Fig. 6) are simi-

lar and are mounted for endwise movement thereof on control plate 202 by suitable slots engaging pins 203. Suitable springs (not shown) connected to ears 204 on the key stems urge keys 200, 201 to their upper inactive position. Both keys 200, 201, upon depression thereon serve to engage the clutch and energize the motor to cause one or more cycles of movement of the actuating means. For this purpose, each of keys 200, 201, is provided adjacent the upper end thereof with a projecting portion 205 carrying a pin 206 associated with a cam surface 207 of clutch actuating slide 208. Slide 208 is mounted for endwise sliding movement by suitable slots formed therein and engaged by upper pins 203. Thus, upon depression of either key, slide 208 is moved to the left, as viewed in Fig. 6 by a pin 206 acting against a cam surface 207. Adjacent its left or rear end, slide 208 has vertical slot 211 which is engaged by pin 212 on the short upper arm of clutch control lever 47. Therefore, the movement of slide 208 caused by depression of a key 200, 201 is effective to oscillate lever 47 to engage the clutch.

To energize the motor by movement of keys 200, 201, slide 208 is slotted to receive pin 214 at the upper end of lever 215 which is suitably pivoted intermediate its ends at 216 on side frame member 13 (Figs. 6 and 7). At its lower end, lever 215 has a suitable pin and slot connection with the upper end of lever 217 also pivoted intermediate its ends on side member 13. At the lower end of lever 217, pin 218 of suitable insulating material is provided in overlapping relation with spring contact 219 (Fig. 7) which, with contact 220, forms part of the motor circuit. Through the described linkage, the movement of slide 208 caused by depression of a key 200, 201 is effective to engage contacts 219, 220 and energize the motor. The described linkage is also effective upon release of the depressed key to return slide 208 to the inactive position shown in Fig. 6 by action of the displaced spring contact 219, so that machine will stop at the end of the cycle of actuation then in progress because of the return of clutch control lever 47 to clutch disengaging position.

From the foregoing it is seen that depression of either key 200, 201 is effective by movement of slide 208 to engage the clutch and energize the motor. The movement of slide 208 also provides an interlock between keys 200, 201 as depression of one of such keys moves a lock portion 221 (Fig. 6) of slide 208 into blocking relation with the flat bottom surface of pin 206 of the undepressed key 200 or 201.

Keys 200 and 201 are also effective to select the direction of registration on the numeral wheels, plus key 200 being operable to effect additive operation and minus key 201 being operable to effect subtractive operation. To exercise such control, keys 200, 201 (Fig. 6) are provided intermediate their ends with respective rollers 231 which in the raised position of the keys are disposed above oppositely inclined cam surfaces 232, 233 on plus-minus slide 234. Slide 234 is supported for endwise movement by link 236 having respective pivotal connections with plate 202 and with one end of slide 234, and by arm 237 pivotally and adjustably connected to the other end of slide 234 and mounted on shaft 83. Thus, selective depression of keys 200, 201 serves to move slide 234 forwardly or rearwardly of the machine and to oscillate arm 237 and shaft 83 in opposite directions. As described above, oscillation of shaft 83 (Fig. 1) serves to engage gears 73, or gears 72 with numeral wheel gears 74. When gears 72 and 74 are meshed, positive registration is determined, and when gears 73 and 74 are meshed, negative registration is determined. Therefore, keys 200, 201 (Figs. 6) by selecting either set of gears 72 or 73 for meshing with gears 74 determine the sign character of the registration on the numeral wheels.

Latch means are provided in cooperative relation with the plus and minus keys to positively maintain the control exerted by such keys until a depressed key is released. Latch arm 241 (Fig. 6) is pivoted at 242 on plate 202 and has its free end held against the upper side of plus key roller 231 by spring 243 connected between arm 241 and plate 202. Nose 244 of arm 241 is adapted for latching engagement with notch 246 at the top of cam surface 232 upon depression of plus key 200 and the consequent rearward movement of slide 234. Latch arm 241, therefore, insures proper meshing of gears 72, 74 while plus key 200 is depressed. Upon release of plus key 200, roller 231 thereof strikes arm 241 and moves it to inactive position permitting return of slide 234 and gears 72 to inactive position. Because of the overlapping relation of slide 208 with pin 206 on key 200 and the fact that slide 208 is held in drive-establishing position until near the end of the cycle by clutch control lever 47 and roller 48 thereon, latch arm 241 is not engaged and released by roller 231 until after all increments of movement have been entered in the numeral wheels. Latch arm 245 pivoted at 247 on plate 202 and having nose 248 cooperable with notch 249 in slide 234 operates in connection with minus key 201 in the manner described above with respect to latch arm 241 and plus key 200. Thus, slide 234 and plus-minus gears 72, 73 are maintained positively in mesh throughout operation controlled by plus and minus keys 200, 201.

Division mechanism

The calculating machine is also preferably provided with automatic division mechanism for performing a plural order division operation as disclosed in my said co-pending application. Only a part of such mechanism is disclosed herein for illustrative purposes. Manually operable division control means is provided in the form of lever 261 (Fig. 6) pivoted at 262 on control plate 202. Movement of lever 261 from its illustrated position forwardly of the machine, in the direction of the arrow, serves to condition the machine for the division operation and return thereof serves to initiate such operation. The lower end of control lever 261 is positioned for engagement with roller 263 on slide 264 which is mounted for endwise movement by a plurality of suitable slots engaging pins 266 on plate 202. Spring 267 urges slide 264 to the right to hold roller 263 against lever 261. At its rear end, slide 264 has roller 268 abutting downwardly extending arm 269 of bell crank lever 271, which is pivotally supported on pin 272 at the upper end of division operation control arm 273. Arm 273 has its lower end pivoted at 274 on plate 202. Notch 276 is provided at the end of arm 269 for cooperation with pin 277 adjustably mounted on plus-minus slide 234 to connect slide 234 and division control arm 273. When division lever 261 is moved forwardly, slide 264 moves rearwardly, and through roller 268 rocks bell crank lever 271 to engage notch 276 with pin 277. Thus, the auto-

matic division control mechanism is enabled with respect to plus-minus slide 234 so that the setting thereof is determined in accordance with the positioning of arm 273 by eccentric control cam 278 which engages aperture 279 in arm 273. The operation of cam 278 is explained fully in said copending application.

The above described oscillation of bell crank lever 271 is also effective to engage the clutch. Forwardly extending arm 281 (Fig. 6) of lever 271 is connected by link 282 with horizontal arm 283 of bell crank lever 284 pivoted at 286 on plate 202 and having spring 287 associated therewith. Vertical arm 288 of lever 284 is operatively engaged with pin 289 adjustably mounted on clutch actuating slide 208 to provide for accurate positioning thereof with respect to arm 288. It is seen, therefore, that clockwise (Figure 6) movement of lever 261 through slide 264, bell crank lever 271, link 282, and bell crank lever 284 serves to move clutch actuating slide 208 rearwardly and thereby engage the clutch as previously described. It will be recalled that such movement of slide 208 through levers 215, 217 moves contact 219 (Fig. 7) toward contact 220 into circuit closing position. However, in division the circuit is not closed by such movement as contact 220 has been moved out of its normal circuit closing position by pin 291 (Figs. 6 and 7) formed of suitable insulating material and mounted on slide 264. Upon release of division lever 261, slide 264 moves forwardly to the position shown in Fig. 6 and contact 220 moves into engagement with contact 219 to close the motor circuit and start the division operation.

Shifting mechanism

Means are provided for shifting the carriage in either direction from one ordinal position to another by power driven means controlled by manually operable keys. Preferably, the power driven means comprises the actuating means for entering values into the accumulator register. Carriage 22 (Fig. 5) has plate 301 mounted along the rear side thereof by means of adjusting screws 302 threaded in brackets 303 on the carriage and having smooth ends pivotally engaged with projecting end portions 304 of plate 301. Plate 301 is secured against pivotal movement on screws 302 by clamping screw 306. Plate 301 has vertical slots 307 formed in the lower edge thereof by teeth 308, slots 307 being spaced apart a distance equal to the ordinal spacing of the machine and aligned with drive shafts 61. Slots 307 are adapted for engagement by opposite shift pins 311 on shift gear 312. Gear 312 is journalled on cross frame member 16 and is rotated by means described later to shift the carriage by virtue of the engagement of pins 311 in slots 307; such engagement also serves to lock the carriage in position. One half revolution of gear 312 effects one ordinal spacing of carriage 22 and to provide for accurate centering of the carriage at the end of a shift, centralizing cam 316 (Figs. 1, 4 and 5), is mounted for rotation with gear 312. Centralizing arms 317 (Figs. 4 and 5) pivoted at 318 on frame member 16 have respective rollers 319 engaging opposite sides of cam 316 under the influence of spring 320 tensioned between arms 317. When pins 311 are in horizontal alignment the carriage is properly positioned and rollers 319 (Fig. 5) are seated in opposite depressions formed between the high portions of cam 316. Accurate initial positioning of carriage 22 with respect to pins 311 is provided by adjusting screws 302 which are adjusted with the parts positioned as described.

Yieldable means are provided to prevent shifting of the register carriage beyond the lowest and highest ordinal positions thereof. End slots 307A are formed in part by plate 301 and in part by respective similar pawls 326. Each pawl 326 is pivoted at 327 on plate 301 and extends inwardly to position straight edge 328 thereof opposite an end tooth 308 to form an end slot 307A. Pawls 326 are held resiliently in the position shown against respective stop pins 331 by spring 332 tensioned between pawls 326. When carriage 22 is in an end position, one pin 311 lies in an end slot 307A and the other is positioned beneath adjacent pawl 326 opposite inclined edge 333 thereof. In this condition rotation of gear 312 in a direction to move the carriage beyond the end position merely results in lifting of pawl 326 by action of pins 311 on inclined edge 333. However, upon rotation of gear 312 in a direction to effect carriage shifting to an intermediate ordinal position, vertical edge 328 of pawl 326 positively resists the pin 311 in slot 307A and carriage shifting results. It is seen, therefore, that the carriage cannot be shifted beyond either end position thereof by operation of shift gear 312.

As stated above, shift gear 312 is rotatable in either direction by selectively operable drive connections with the actuating means of the machine. For this purpose, the two lowest order actuating shafts 52 (Fig. 4) are extended rearwardly and have respective collars 341 secured adjacent the ends thereof. Each collar 341 is provided with diagonally opposite slots slidably engaged by corresponding teeth 342 of a shiftable drive establishing collar 343 mounted freely on the end of shaft 52. Opposite teeth 342 thereof, each collar 343 has smaller teeth 344 adapted for engagement with corresponding slots in respective gear sleeves 346, 347, which are journalled in cross frame member 16 and small plate 348 mounted on member 16 by spacers 349 and suitable fastening screws. Gear sleeve 347 (Figs. 4 and 5) has gear 351 meshing with idler gear 352 (Fig. 5) journalled in frame member 16 and plate 348 and also meshing with shift gear 312. Gear sleeve 346 (Figs. 4 and 5) has gear 353 (Figs. 1 and 5) offset axially from idler gear 352 and meshing with wide reverse idler gear 354 suitably journalled in frame member 16 and plate 348 and also meshing with idler gear 352. Thus, rotation of gear sleeve 346 in a clockwise direction as viewed in Fig. 5 causes counter-clockwise rotation of shift gear 312 and shifting of carriage 22 to the right as viewed from the front of the machine. Correspondingly, rotation of gear sleeve 347 in a clockwise direction as viewed in Fig. 5 effects clockwise rotation of shift gear 312 and shifting of carriage 22 to the left as viewed from the front of the machine. Thus, by selective establishing of drive connections between gear sleeves 346, 347 (Fig. 4) and collars 341 upon selective shifting of respective shiftable collars 343 carriage 22 can be shifted in either direction. The gear ratios are so chosen that one rotation of actuating shafts 52 effects one-half rotation of shift gear 312.

Manually operable control means are provided for the carriage shifting mechanism described above to enable selective shifting of the carriage

in either direction through one or more ordinal spaces. Shift keys **371**, **372** (Figs. 7 and 8) are depressible to initiate shifting of the carriage to the right and left respectively as viewed from the front of the machine, and as indicated by the arrows. Depression of either key serves to enable a drive connection from the actuating means to the carriage shifting mechanism during the first part of its downward movement and thereafter to engage the clutch and energize the motor. Keys **371**, **372** (Fig. 7) are mounted for endwise movement by suitable longitudinal slots formed therein and engaged by a plurality of studs **373** secured on side frame member **13**. Keys **371**, **372** have adjacent ears **376** with respective studs **377**, **378** mounted therein and extending to either side thereof. To maintain the shift keys resiliently in raised position, coil spring **381** (Fig. 8) is provided having its ends fastened to side member **13** and passing over upper studs **373** and under the ends of studs **377**, **378** which extend through suitable slots in side member **13**. To enable the drive connection from the actuating means to the carriage shifting mechanism, stud **377** engages the upper end of arm **382** secured on sleeve **383** (Fig. 4). Sleeve **383** is journalled on transverse shaft **386** which is suitably journalled at its ends in side member **13** and bracket **387** (Figs. 4 and 7) on cross member **18**. At its left end, sleeve **383** (Fig. 4) is provided with depending arm **388** (Figs. 7 and 8) having its rounded end in engagement with the front end of rearwardly extending rod **391** (Figs. 4, 7 and 8). Rod **391** is mounted for sliding movement in cross frame members **17**, **18** and is resiliently urged to its forward position by spring **392** compressed between cross member **18** and a suitable washer on rod **391**. At its rear end, rod **391** (Figs. 4 and 7) has shift fork **393** secured thereon with its forked end in engagement with an annular groove in right-hand shiftable collar **343**. From the foregoing description, it is seen that depression of key **371** is effective through stud **377** to rock arm **382**, sleeve **383** and arm **388** to move rod **391** rearwardly. Such rearward movement of rod **391** is effective through shift fork **393** to engage teeth **344** of right-hand shift collar **343** with corresponding slots in gear sleeve **346**. Thus, initial depression of shift key **371** is effected to enable a drive connection from the actuating means to the carriage shifting mechanism. The drive connection between gear sleeve **346** and its associated collar **343** determines shifting of the carriage to the right.

A similar mechanism is employed in connection with shift key **372** to enable the drive connection to determine shifting of the carriage to the left. Pin **378** (Fig. 8) is engaged with the upper end of arm **396** (Figs. 4 and 8) having its hub secured on shaft **386**. At its left end, shaft **386** (Fig. 4) has depending arm **397** secured thereon in operative relation with shift rod **398** having shift fork **399** at its rear end in engagement with an annular groove in left-hand shift collar **343**. It is seen, therefore, that depression of key **372** results in rocking of shaft **386** and rearward movement of rod **398** to engage left-hand shift collar **343** with gear sleeve **347**. This conditions the carriage shift mechanism for shifting of the carriage to the left. It is to be noted that only a small amount of movement is required to engage teeth **343** with the corresponding slots in gear sleeves **346**, **347** so that the drive connection is enabled during the first part of the downward movement of keys **371**, **372**.

The latter part of the downward movement of keys **371**, **372** is utilized to engage the clutch and energize the motor. Studs **377**, **378** (Fig. 7) overlie respective cam surfaces **401**, **402** at the upper end of lever **403**. Lever **403** is adjustably secured on lever **215** by pivot **216** and by pin and slot connection **404** having suitable clamping means for maintaining the relative adjustment between levers **215** and **403**. From the relation of studs **377**, **378** and cam surfaces **401**, **402**, it is evident that depression of either of keys **371**, **372** is effective during the latter part of the movement to rock levers **403** and **215** in a clockwise direction. It will be recalled that lever **215** is connected at its upper end by pin **214** with clutch actuating slide **208** (Fig. 6) so that movement of slide **208** will result upon depression of either of the shift keys. Such movement is effective in the manner previously described to engage the clutch. It will be recalled that the motor in energized upon oscillation of levers **215**, **217**. Lever **403** (Fig. 7) also provides an interlock between shift keys **371**, **372** by means of lock portions **406**, **407** which are adapted to cooperate with studs **377**, **378**, respectively. For example, if key **371** is depressed, lock portion **407** moves into blocking position beneath stud **378**.

Means are provided for maintaining the drive connection from the actuating means to the carriage shifting mechanism throughout each cycle of movement even though the depressed shift key be released immediately after depression thereof and before complete shifting of the carriage. For this purpose each shiftable collar **343** is provided with a similar mechanism, only one of which will be described. Right-hand shiftable collar **343** (Figs. 4, 5 and 7) is provided with disc **411** having a cut-a-way portion **412** which, in the full cycle position of collar **343**, is in the position illustrated in Fig. 5. Immediately to the rear of disc **411** (Fig. 7), locking element **413** is provided mounted in bracket **414** for movement radially of collar **343**, and urged to its extended position by spring **416**. With shiftable collar **343** in its inactive position disc **411** is positioned forwardly of locking element **413** and when moved to its active position passes by element **413** which is in alignment with the cut-a-way portion **412**. Upon subsequent rotation of disc **411** the solid portion thereof engages element **413** and prevents movement of collar **343** forwardly of the machine so that teeth **342** are maintained in engagement with gear sleeve **347** irrespective of release of the associated shift key. Left hand shiftable collar **343** is held in drive establishing position for each cycle of rotation by similar mechanism.

From the foregoing description it is seen that keys **371**, **372** and the associated mechanism provide means for shifting the carriage selectively in either direction from one ordinal position of the carriage to another. Obviously, if a shift key be maintained in depressed position, shifting will continue until the carriage reaches an end position, when, as previously described, continued operation of the shifting mechanism in the same direction becomes ineffective. In a division operation, the carriage shifting mechanism may be controlled by any suitable means, for example in the manner described in said co-pending application, to shift the carriage to the right after each ordinal division is completed.

Shift-registration interlock

Locking means are provided between shift keys **371**, **372** and plus and minus keys **200**, **201** to prevent depression of either of keys **371**, **372** when a key **200**, **201** is depressed, and vice versa. For this purpose, plus-minus slide **234** (Fig. 6) has upwardly extending plate **416** mounted thereon having transverse notches **417**, **418**. When keys **200**, **201** are in raised position, notches **417**, **418** are aligned vertically with laterally projecting vertical ears **419**, **420** (Fig. 7) on keys **371**, **372**. Upon depression of key **371**, for example, ear **419** will enter slot **417** so that movement of plus-minus slide **234** by keys **200**, **201** is blocked. Depression of key **372** similarly locks slide **234** by placing ear **420** in slot **418**. Conversely, if either the plus or minus key be depressed plate **416** is translated with slide **234** so that slots **417**, **418** are not aligned with projections **419**, **420** and depression of either of shift keys **371**, **372** is prevented.

Accumulator and counter disabling mechanism

In a machine of the type disclosed having power driven shifting mechanism which can be controlled by keys to determine a carriage shift in either direction, and which is automatically controlled in division to shift the carriage after an overdraft and the additive correction thereof, and particularly when the shifting mechanism is driven by operation of the actuating means, it is desirable that precautions be taken to prevent any possibility of erroneous registration during a carriage shift. One essential feature is the positive positioning of the plus-minus gears in neutral position during the entire carriage shift so that no possible contact can occur between such gears and the numeral wheels gears through vibration of the parts after the rapid movement of the plus-minus gears to and from active position. Consequently, I have provided latch means positioned at the point of greatest movement of the plus-minus gears and which is operated by the carriage shifting mechanism to latch the plus-minus gears positively in neutral or inactive position. For this purpose, latch slide **421** (Figs. 1, 3 and 4) is mounted on strap **81** adjacent the right-hand end thereof by means of eccentric portion **422** (Fig. 3) of adjusting screw **423**. Screw **423** is clamped in bracket **424** on strap **81** by nut **426**. By turning screw **423** eccentric portion **422** thereof effects longitudinal movement of slide **421** to position slot **427** in accurate vertical alignment with nose **428** (Figs. 1, 4 and 5) of latch arm **429**. Latch arm **429** is formed as an extension of centralizing arm **317** so that, upon rotation of shift gear **312**, nose **428** is moved from the position shown into engagement with slot **427**. By this means plus-minus gears **72**, **73** are positively maintained in idle position during a carriage shift.

Another possible source of erroneous registration during a carriage shift lies in unintentional engagement of the continuously operated revolutions counter actuator with one of the numeral wheel gears of the revolutions counter. Such erroneous registration would occur when the carriage is moving oppositely to the direction of movement of the actuator in the active portion of the cycle. To obviate this condition, I have provided means for disabling the revolutions counter actuator when a machine operation is occurring other than an actuation of accumulator numeral wheels **21**. For this purpose, member or slides **431** (Figs. 1, 3 and 4) is pivoted on screw **423** and extends forwardly therefrom and has its forward end slidably supported in cross frame member **17**. Member **431** (Fig. 1) is provided with vertical extension **432** which, with gears **72**, **73** in their neutral position, is positioned beneath lateral projection **433** on spool **111** of the revolutions counter actuator. Because of the resilient actuation of the revolutions counter actuator in a clockwise direction, extension **432** prevents the rotary oscillation thereof which is ordinarily effective to move the actuator into operative position. It is to be noted that latch slide **421** and arm **429** also serve to latch member **431** in position to disable the revolutions counter actuator during shifting of the carriage. Thus, an erroneous registration cannot occur in the revolutions counter during carriage shifting or any other machine operation not involving operation of the plus-minus gears **72**, **73**. Also, the revolutions counter actuator is maintained in disabled condition whenever plus-minus slide **234** is in inactive position and is enabled by movement of slide **234** resulting from manipulation of an operation control member such as keys **200**, **201**, or automatically during a division operation.

From the foregoing description, it is seen that I have provided an improved machine in which a simple and efficient carriage shift mechanism is provided. In connection with the carriage shifting mechanism, I have also provided safety devices which prevent possible jamming of the machine or possible erroneous registration because of the operation of the shifting mechanism from the accumulator actuating means.

I, therefore, claim as my invention:

1. In a calculating machine having a frame, a register shiftable with respect to said frame, an actuator for said register mounted in said frame, cyclically operable driving means having constant operative connection with said actuator, means for shifting said register by cyclic operation of said driving means, means for rendering said actuator ineffective during shifting of said register, and means controlled by said shifting means for latching said last-named means in active position.

2. In a calculating machine having a shiftable accumulator, actuating means therefor, shifting means driven by an element of said actuating means for effecting relative shifting movement between said accumulator and said actuating means therefor, a revolutions counter, and an actuator for said counter having a constant drive connection with said actuating means; means for controlling a plural order operation of said shifting means, comprising means for determining operation of said shifting means with said actuating means in motion but ineffective to enter values in said accumulator, and means for rendering said counter actuator ineffective with respect to said counter during operation of said shifting means.

3. In a calculating machine having a shiftable accumulator, actuating means associated with said accumulator for selective operative connection thereto, means for shifting said accumulator relative to said actuating means, a revolutions counter, an actuator associated with said counter for selective operative connection thereto, and common drive means for said accumulator actuating means and said counter actuator, said drive means being connected thereto to provide invariable simultaneous operation of said accumulator actuating means and said counter actuator; means for controlling a plural order opera-

tion of said shifting means, comprising means for operating said shifting means by said drive means, whereby both said accumulator actuating means and said counter actuator are driven during operation of said shifting means, and means associated with said shifting means for rendering said accumulator actuating means and said counter actuator ineffective during operation of said shifting means without interrupting the drive therefor.

4. In a calculating machine, an accumulator comprising a series of numeral wheels, a gear carried by each numeral wheel; a pair of gears associated with each said numeral wheel gear and movable from an inactive position to mesh either gear of said pair with the associated numeral wheel gear; a bail associated with said pairs of gears for controlling simultaneously the adjustment thereof to and from their active and inactive positions, means associated with said pairs of gears for transmitting selected increments of movement thereto; a revolutions counter, an actuator associated with said counter for selective operative connection thereto, cyclically operable common drive means for said increment transmitting means and said actuator to provide for invariable simultaneous operation thereof whenever said drive means operates; means for simultaneously effecting ordinal shifting movement between said accumulator and said pairs of gears and between said counter and said actuator, said shifting means being driven by said common drive means; and means associated with said shifting means for rendering said pairs of gears and said actuator ineffective during operation of said shifting means.

5. In a calculating machine, an accumulator comprising a series of numeral wheels, a gear carried by each numeral wheel; a pair of gears associated with each said numeral wheel gear and movable from an inactive position to mesh either gear of said pair with the associated numeral wheel gear; a bail associated with said pairs of gears for controlling simultaneously the adjustment thereof to and from their active and inactive positions, means associated with said pairs of gears for transmitting selected increments of movement thereto; a revolutions counter, an actuator associated with said counter for selective operative connection thereto; resilient means for urging said actuator to active position with respect to said counter, cyclically operable common drive means for said increment transmitting means and said actuator to provide for invariable simultaneous operation thereof; means for positioning said bail to adjust said pairs of gears to inactive position, and blocking means associated with said bail and positioned thereby with said gears in inactive position to prevent movement of said actuator to active position under the urgency of said resilient means.

6. In a calculating machine, an accumulator comprising a series of numeral wheels, a gear carried by each numeral wheel; a pair of gears associated with each said numeral wheel gear and movable from an inactive position to mesh either gear of said pair with the associated numeral wheel gears; a bail associated with said pairs of gears for controlling simultaneously the adjustment thereof to and from their active and inactive positions, means associated with said pairs of gears for transmitting selected increments of movement thereto; a revolutions counter, an actuator associated with said counter for selective operative connection thereto, cyclically operable common drive means for said increment transmitting means and said actuator to provide for invariable simultaneous operation thereof whenever said drive means operates; means for performing a non-value-entering machine operation with said pairs of gears inactive and with said common drive means active, and means associated with said operation performing means for rendering said actuator ineffective during said machine operation.

7. In a calculating machine, an accumulator comprising a series of numeral wheels; a gear carried by each numeral wheel; a pair of gears associated with each said numeral wheel gear and movable from an inactive position to mesh either gear of said pair with the associated numeral wheel gear; a bail associated with said pairs of gears for controlling simultaneously the adjustment thereof to and from their active and inactive positions, means associated with said pairs of gears for transmitting selected increments of movement thereto; a revolutions counter, an actuator associated with said counter for selective operative connection thereto, resilient means for urging said actuator to active position with respect to said counter, cyclically operable common drive means for said increment transmitting means and said actuator to provide for invariable simultaneous operation thereof; means for performing a non-value-entering machine operation with said pairs of gears inactive and with said common drive means active, and blocking means associated with said bail and positioned thereby with said gears in inactive position to prevent movement of said actuator to active position under the urgency of said resilient means.

8. In a calculating machine, a shiftable carriage, a register in said carriage, cyclically operable actuating means for said register, a source of power, a cyclic clutch between said actuating means and said source of power and providing the only path of power flow therefrom, driven means having a normally disabled drive connection with said actuating means, an element on said carriage for receiving a drive from said driven means, and means including a manually operable key for enabling said connection and engaging said clutch to transmit a drive to said part by driving of said actuating means but with said actuating means ineffective with respect to said register.

9. In a calculating machine, a shiftable carriage, a register in said carriage, cyclically operable actuating means for said register including a shaft, means including a clutch for driving said shaft, driven means, an element on said carriage for receiving a drive from said driven means, normally disabled drive means between said shaft and said driven means, and means including a manually operable key for engaging said clutch and enabling said drive means to transmit a drive to said part by driving of said actuating means but with said actuating means ineffective with respect to said register.

10. In a calculating machine, a shiftable carriage, a register in said carriage, cyclically operable actuating means for said register including a pair of parallel shafts connected for simultaneous movement said actuating means being normally ineffective to enter values in said register, means including a clutch for driving said shafts, a rack on said carriage, a reversible shift gear cooperatively related to said rack, normally disabled drive means between each of said shafts and said gear, one of said drive means operating

to rotate said gear in one direction and the other serving to rotate said gear in the other direction, and means including a plurality of manually operable shift keys for engaging said clutch and selectively enabling said normally disabled drive means.

11. In a calculating machine having an accumulator and actuating means therefor, shiftable means movable from a neutral position for controlling positive and negative registration on said accumulator by said actuating means, a revolutions counter, an actuator for said counter including a counting element and a series of transfer elements cooperatively related thereto for simultaneous movement therewith, a constantly operative drive connection from said actuating means to said actuator, and means controlled by said shiftable means and active in said neutral position to disable said counting and transfer elements.

12. In a calculating machine having an accumulator and actuating means therefor, shiftable means movable from a neutral position for controlling positive and negative registration on said accumulator by said actuating means, a revolutions counter, an actuator for said counter having a drive connection with said actuating means for simultaneous operation therewith, yieldable means for operating said actuator, and means controlled by said shiftable means and active in said neutral position to prevent registering operation of said actuator by causing yielding of said yieldable means.

13. In a calculating machine having a shiftable carriage, a register in said carriage, actuating means for said register, said actuator means being normally ineffective to enter values in said register, means for performing a machine operation including an element on said carriage for receiving a drive, and a source of power; the combination with a cyclically operable clutch providing the sole path of power flow from said source of power, of a plurality of manually operable control keys for controlling cyclic operation of said clutch, means controlled by certain of said keys for causing registration on said register by operation of said actuating means, and means controlled by others of said keys for causing operation of said machine operation performing means, said last named controlled means including a normally disabled drive connection between said actuating means and said performing means for transmitting a drive to said element.

14. In a calculating machine having a shiftable carriage, a register in said carriage, actuating means for said register, said actuating means being normally ineffective to enter values in said register, shift means for said carriage having a drive connection with said actuating means, and a source of power; the combination with a cyclically operable clutch between said actuating means and said source of power providing the sole path of power flow therefrom, of means including a plurality of manually operable control keys for controlling cyclic operation of said clutch, certain of said keys having controlling connections with said actuating means for causing registration on said register, and others of said keys having controlling connections with said shift means for causing shifting of said carriage.

15. In a calculating machine having an accumulator, actuating means therefor, and means including a cyclic clutch for driving said actuating means, shiftable means for effecting positive and negative registration on said accumulator by said actuating means, a revolutions counter, an actuator for said counter having a constantly operative drive connection with said clutch to receive an invariable cyclic movement therefrom, and means controlled by said shiftable means for rendering said actuator ineffective irrespective of continued movement thereof during operative driving movement of said clutch.

16. In a calculating machine, a shiftable carriage, a register in said carriage, cyclically operable actuating means for said register, a source of power, a cyclic clutch between said actuating means and said source of power and providing the only path of power flow therefrom, carriage shift means for shifting said carriage in either direction, selectively settable means for driving said shift mechanism by said actuating means with said actuating means ineffective to enter values in said register, and means including a pair of manually operable shift keys for engaging said clutch and for selectively setting said settable means.

17. In a calculating machine having numeral wheels, cyclically operable actuating means therefor, and drive means for said actuating means including a cyclically operable clutch, means for effecting a machine operation including a manipulable control member, a drive connection between said actuating means and said effecting means, and means controlled by said control member for simultaneously enabling said clutch and said drive connection to impart a drive to said effecting means by operation of said actuating means with said actuating means ineffective to enter values in said numeral wheels.

18. In a calculating machine having numeral wheels, cyclically operable actuating means therefor, and drive means for said actuating means including a cyclically operable clutch, means for performing a machine operation including a reversible drive element having selectively engageable drive connections with said actuating means to control the direction of movement thereof, a pair of selectively operable manipulable control members for engaging said clutch and for selectively engaging said drive connections to control the direction of movement of said drive element, and means for maintaining said actuating means ineffective to enter values in said numeral wheels during said machine operation.

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