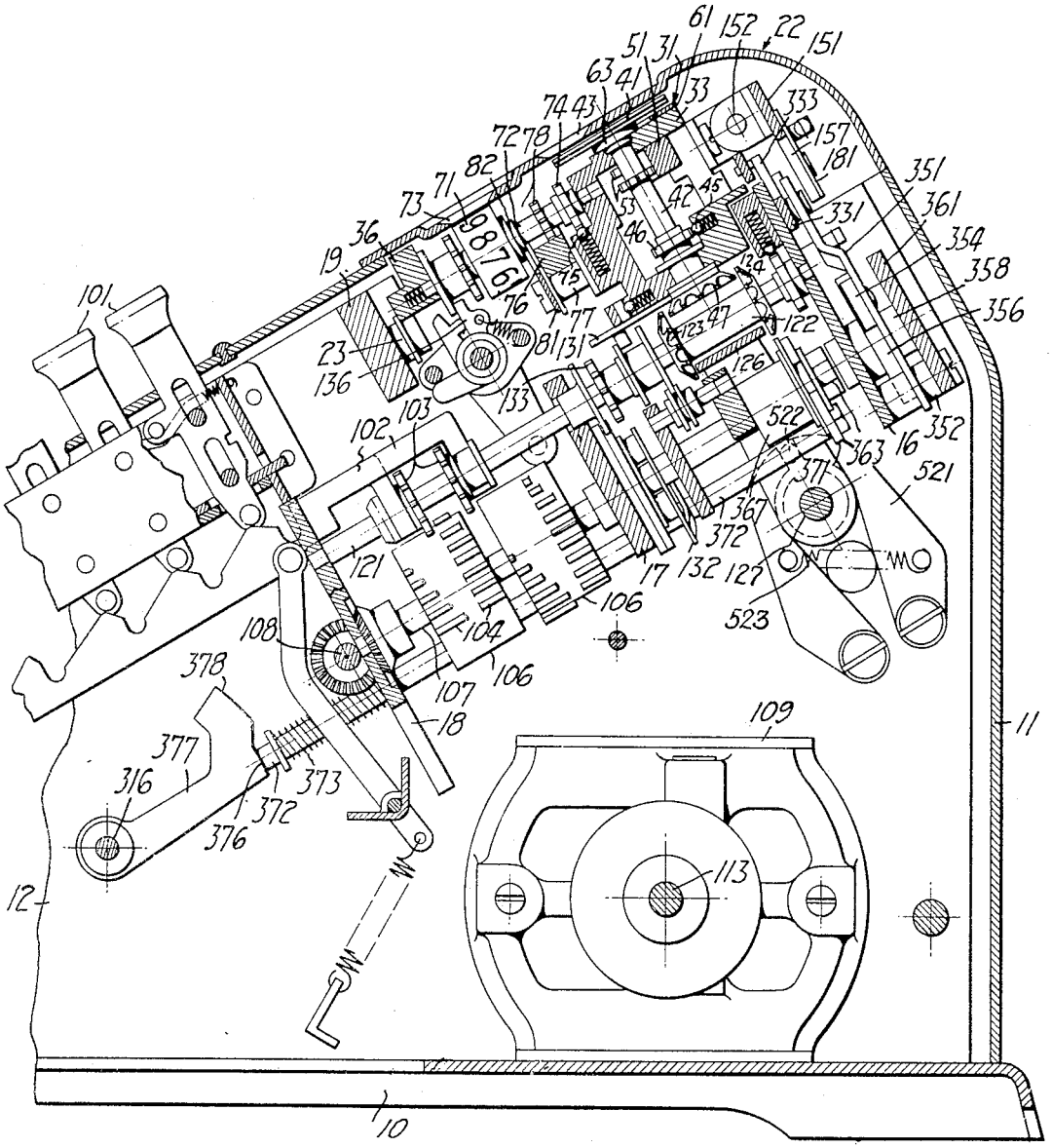
Feb. 9, 1943. C. M. F. FRIDEN 2,310,281

CALCULATING MACHINE

Filed Sept. 26, 1935 6 Sheets-Sheet 1

FIG. 1



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CALCULATING MACHINE

Filed Sept. 26, 1935 6 Sheets-Sheet 2

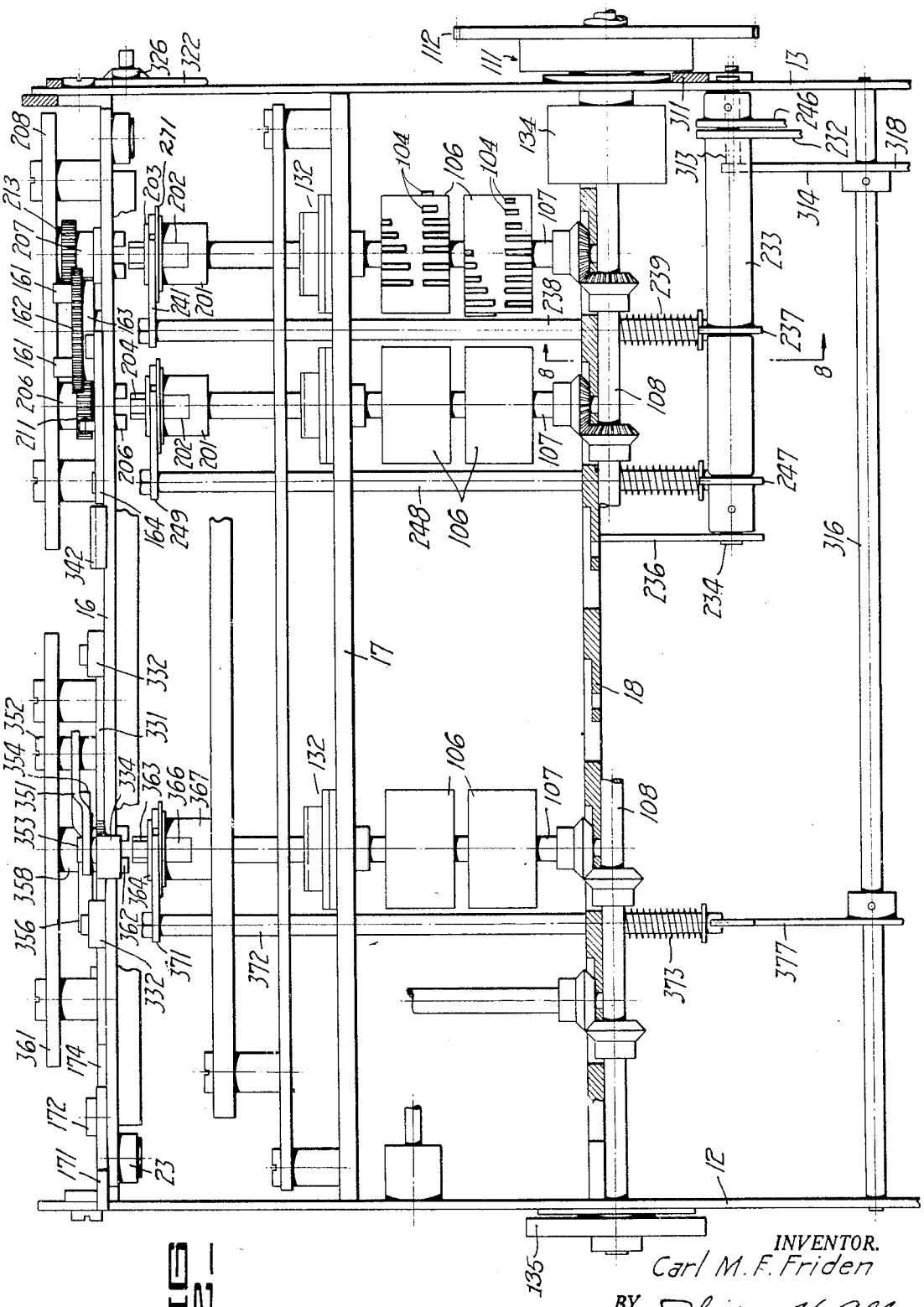

FIG 12

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CALCULATING MACHINE

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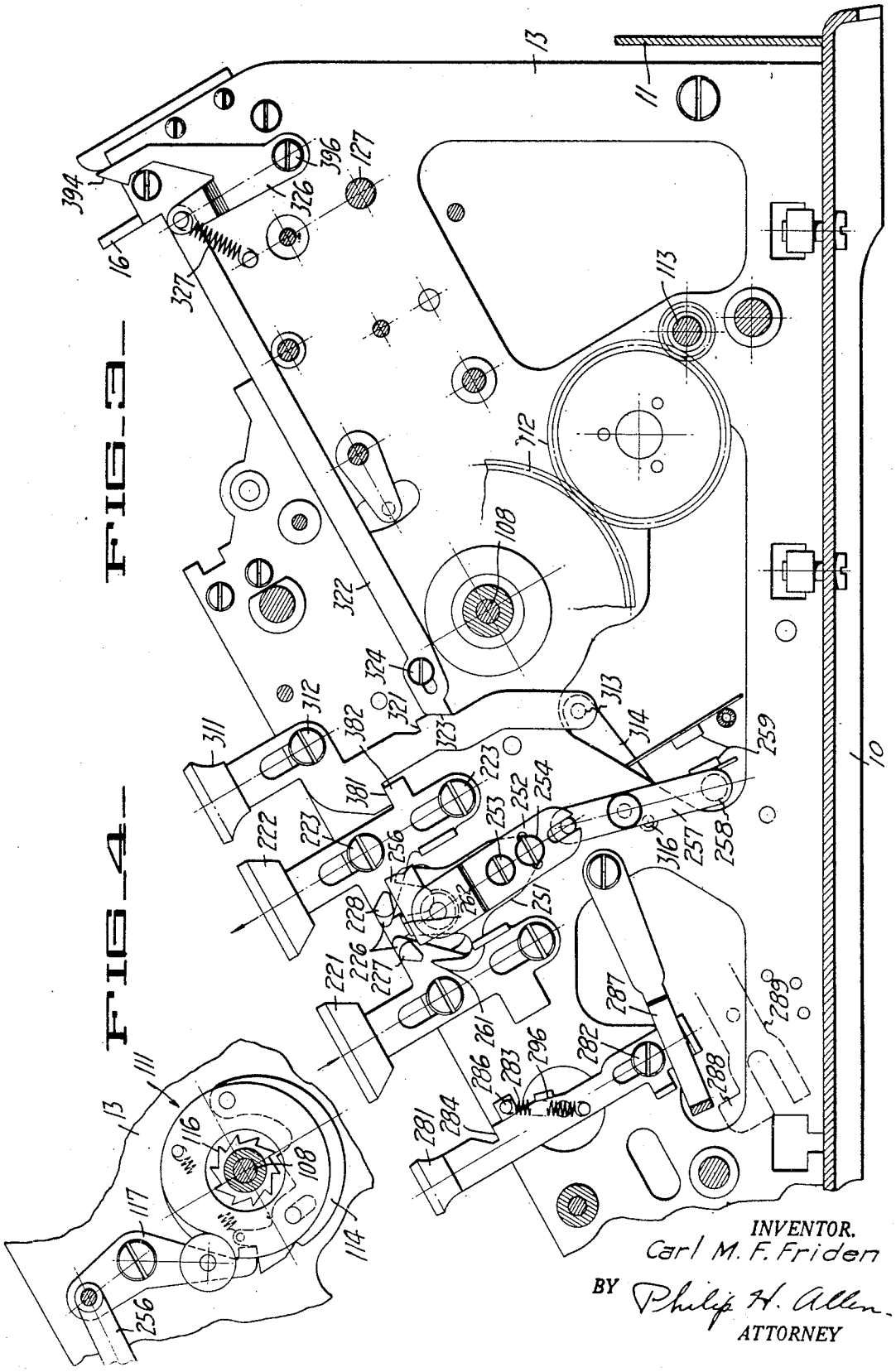
FIG. 3

FIG. 4



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CALCULATING MACHINE

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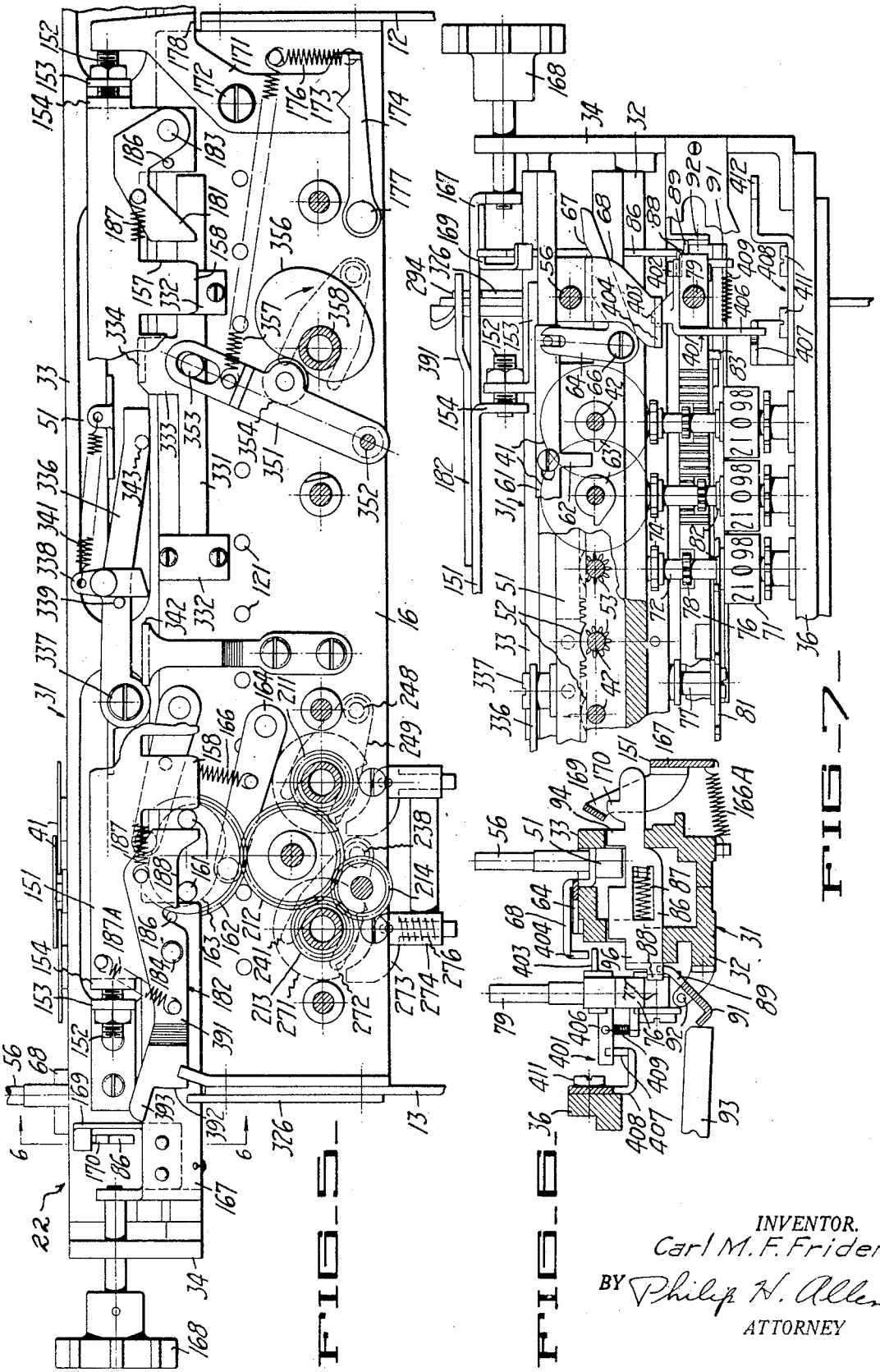

FIG 5

FIG 7

FIG 6

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CALCULATING MACHINE

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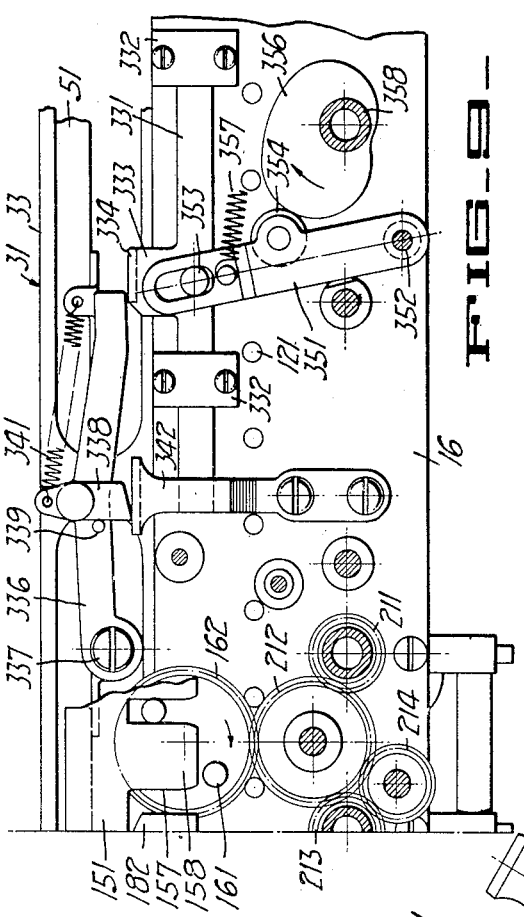

FIG. 9.

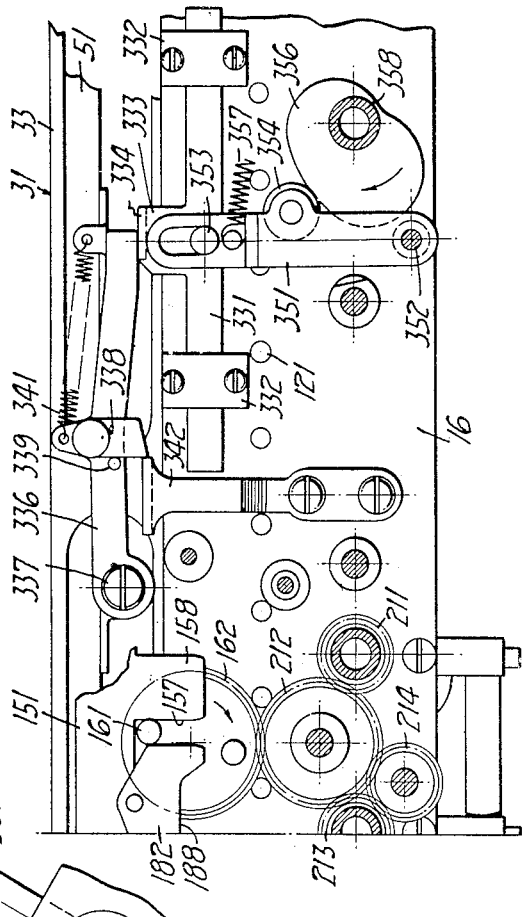

FIG. 10.

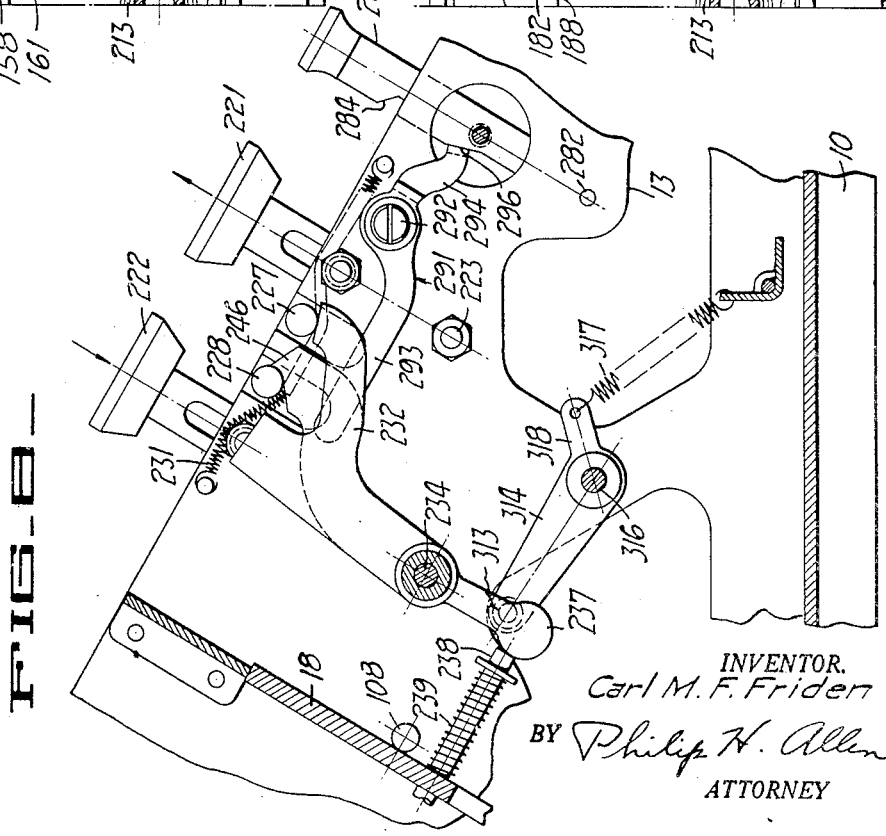

FIG. 8.

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CALCULATING MACHINE

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FIG. 11.

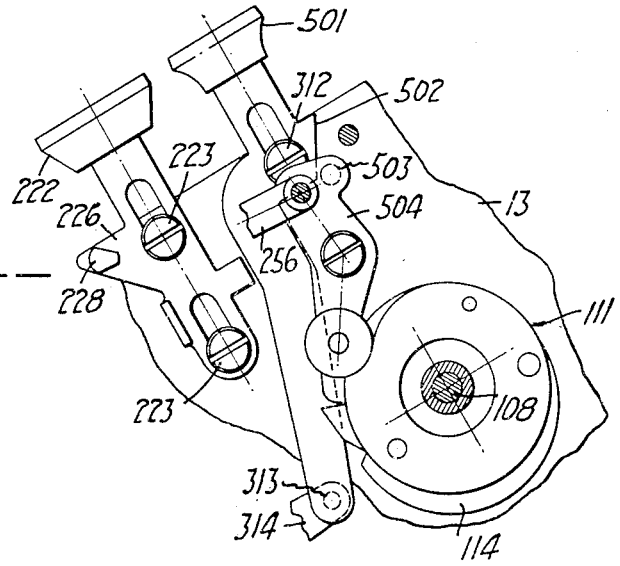


FIG. 12.

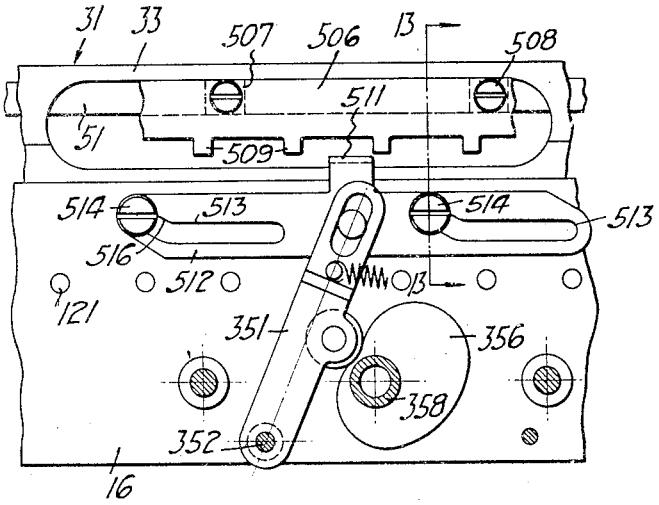
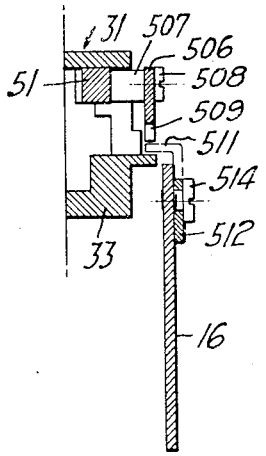


FIG. 13.



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UNITED STATES PATENT OFFICE

2,310,281

CALCULATING MACHINE

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

Application September 26, 1935, Serial No. 42,268

17 Claims. (Cl. 235—63)

My invention relates to calculating machines having shiftable numeral wheels and more particularly to means for restoring such numeral wheels to zero registration.

In calculating machines having an ordinally shiftable register carriage it is necessary at the end of a multiplication or division problem to return the carriage to its initial position and to zeroize the numeral wheels of the registers in preparation for solution of the next problem. In known machines, such functions have been performed separately so that the operator must make two separate operations to condition the machine between successive calculations. According to the present invention, these functions are placed under a single control and the operator has only one operation to perform in restoring the register carriage to the desired position and zeroizing the registers. In addition, the construction of the machine is such that while the carriage is being returned and the registers are being zeroized during operation of the actuating means, the next value can be entered in the keyboard.

My invention is especially useful in calculating machines having an actuator or actuating means of the universal operation continuous drive cycle type, where all power driven machine operations are performed under control of various means whose drive is effected by driving the main actuating means and where a single line of power flow is provided from the source of power, such power flow being continuous and uninterrupted during a machine operation irrespective of the various functions which may be imposed on the machine, such as carriage shifting, both positive and negative value entering, and numeral wheel resetting or zeroizing. During certain of these operations such as carriage shifting and zeroizing, the drive connection between the numeral wheels and the actuating means is in its normal ineffective position. With this type actuator, a single cyclically operable clutch is provided which is engaged at the beginning of an operation and remains engaged throughout the operation so that the actuator drive is continuous and uninterrupted.

It is an object of the invention, therefore, to provide improved means for restoring a calculating machine to normal condition between successive machine operations.

Another object of the invention is to provide an improved calculating machine which is restored to normal condition by operation of mechanism including the actuating means.

Another object of the invention is to provide an improved calculating machine in which values can be entered while the machine is being restored to normal condition by operation of mechanism including the actuating means.

Another object of the invention is to provide an improved calculating machine in which parts of the actuating means transmit the drive for all power driven machine operations.

Another object of the invention is to provide improved zero resetting means for the shiftable numeral wheels of a calculating machine which enables a simple and inexpensive construction.

Another object of the invention is to provide means for resetting the shiftable numeral wheels of a calculating machine by a power drive from a non-shiftable source of power, the construction of the resetting means lending itself to economical manufacture and assembly.

Another object of the invention is to provide improved means for resetting the shiftable numeral wheels of a calculating machine by a power drive from a non-shiftable source of power irrespective of the displaced position of the numeral wheels.

Another object of the invention is to provide improved shifting means for the shiftable carriage of a calculating machine.

Another object of the invention is to provide improved shifting means for the shiftable carriage of a calculating machine so that the carriage can be returned to a selected position from any other position thereof.

Another object of the invention is to provide a calculating machine having a universal operation continuous drive cycle type actuator and which attains the foregoing objects.

Another object of the invention is to provide improved safety devices for preventing misoperation of a calculating machine.

Other objects will be apparent from the following description, taken in connection with the appended drawings.

In the drawings:

Figures 1 through 10 illustrate the preferred form of the invention.

Fig. 1 is a vertical, longitudinal section of the rear part of the machine taken in a plane thru the axis of the actuating means of one order of machine.

Fig. 2 is a fragmentary plan view of the actuating means and the drive connections for the carriage shift and register zero resetting means.

Fig. 3 is an elevational view of the right side frame member and the operating controls mounted thereon as viewed from the right. The register carriage is omitted.

Fig. 4 is a fragmentary sectional view illustrating the clutch construction.

Fig. 5 is a rear elevational view of the upper part of the frame and the carriage, with certain parts shown in section.

Fig. 6 is a fragmentary vertical section through the carriage as is taken in a plane indicated by the line 6—6 in Fig. 5.

Fig. 7 is a plan view of the right end of the carriage with the casing removed and certain parts broken away to show the construction more clearly.

Fig. 8 is a fragmentary sectional view of certain of the operating controls. The view is indicated by the line 8—8 in Fig. 2.

Figs. 9 and 10 are rear views similar to Fig. 5 illustrating the zero resetting means at different stages of the operation thereof.

Figs. 11 through 13 illustrate a modified form of the invention.

Fig. 11 is a fragmentary side elevational view of the control means similar to Fig. 3.

Fig. 12 is a fragmentary rear elevational view of the resetting means similar to Fig. 5.

Fig. 13 is a sectional view taken in a plane indicated by the line 13—13 in Fig. 12.

My invention is disclosed as embodied in a calculating machine having an actuator of the universal operation continuous drive cycle type. A complete machine of this type is illustrated in my co-pending application Serial No. 724,482, filed May 8, 1934.

Generally, the machine comprises a frame and a carriage mounted for lateral shifting movement on the frame. The carriage mounts the registers of the machine comprising the accumulator and the revolutions counter, while the frame provides a support for the various mechanisms for entering values in the registers. The frame includes base 10 (Fig. 1) which supports casing 11 and has left and right side frame members 12, 13 (Figs. 1 and 2) mounted thereon. Side members 12, 13 are connected by various cross frame members 16, 17, 18 and 19 which serve to mount various mechanisms referred to hereinafter. Register carriage 22 (Fig. 1) is mounted on frame members 16 and 19 by rollers 23 for endwise shifting movement laterally of the machine in either direction to various ordinal positions as controlled by means described hereinafter.

Accumulator

Register carriage 22 (Figs. 1 and 7) includes carriage frame 31 formed of opposite U-shaped members 32, 33 which are secured together by suitable fastening means such as screws. Similar end plates 34 (Fig. 7) are secured to the ends of frame 31 and support cross member 36 (Figs. 1 and 7) in spaced relation from frame 31. The accumulator comprises disk type numeral wheels 41 (Fig. 1) secured at the upper ends of numeral wheel shafts 42 (Figs. 1 and 7) journalled in spaced relation between members 32, 33 of carriage frame 31. As seen more clearly in Fig. 5, numeral wheels 41 are axially offset and overlap radially to provide for a large size numeral while maintaining a small ordinal spacing of the machine. The numbers registered in wheels 41 (Fig. 1) are maintained in alignment with sight openings 43 by ten-tooth gear 46 on shaft 42 and a spring-pressed ball 45 mounted in carriage frame member 33 and engaged with gear 46. This mechanism also serves to prevent overthrow of wheels 41 after actuation thereof. To transmit increments of value to numeral wheels 41, each shaft 42 extends below carriage frame 31 and has ten-tooth numeral wheel gear 47 which is actuated by means described later.

Accumulator resetting means

Means are provided in carriage 22 for resetting numeral wheels 41 to zero registration which includes means for restoring any displaced wheels 41 to zero position and means for arresting such wheels positively in zero position. The restoring means includes rack bar 51 (Figs. 1 and 7) mounted for endwise sliding movement in carriage frame member 33 adjacent the upper ends of numeral wheel shafts 42. The teeth of rack bar 51 (Fig. 7) are cut away at 52 alternately at the top and bottom to form a plurality of separate racks for cooperation with mutilated gears 53 on numeral wheel shafts 42. Adjacent gears 53 are axially offset to cooperate with the adjacent vertically offset racks formed on rack bar 51 by cut away portions 52 thereof. When rack bar 51 is in normal inactive position, gears 53 register with cut away portions 52 so that numeral wheels 41 can be actuated without interference. If rack bar 51 is moved to the right as viewed in Fig. 7, the unmutilated parts of gears 53 of any numeral wheels 41 displaced from zero position will be engaged by the associated racks on bar 51 and such displaced numeral wheels 41 are turned until restored to zero position. In this connection it will be noted that any numeral wheels 41 in zero position will not be moved by rack bar 51 because the mutilated portions of gears 53 of such numeral wheels face the rack bar. For manual operation rack bar 51 is provided with handle 56 (Figs. 6 and 7) by means of which bar 51 can be actuated against the tension of a suitable spring (not shown) which normally maintains bar 51 in inactive position.

The movement of bar 51 to the right as viewed in Fig. 7 to restore any displaced numeral wheels 41 to zero position also enables the means for arresting wheels 41 in such position. Stop slide 61 (Figs. 1 and 7) is mounted for limited endwise movement on top of carriage frame 31 by suitable pin and slot connections, and is provided with a stop projection 62 (Fig. 7) for each numeral wheel 41. Each numeral wheel shaft 42 has a stop tooth 63 secured thereon for cooperation with projections 62 in the zero position of numeral wheels 41. Slide 61 is held normally in inactive position by suitable spring means (not shown) so each projection 62 is out of the path of the associated tooth 63. To provide for movement of projections 62 into path of teeth 63 when zeroizing the numeral wheels, bellcrank 64, pivoted at 66 on carriage frame 31, has a suitable pin and slot connection at one end with slide 61 and has cam surface 67 at its other end disposed in the path of arm 68 on rack bar 51. Thus, when bar 51 is moved to restore numeral wheels 41 to zero position, slide 61 is moved through bellcrank 64 to arrest wheels 41 in such position.

Thus, the accumulator can be reset to zero registration manually by manipulation of handle 56. The power operation of the resetting or zeroizing means is described hereinafter.

Revolutions counter

The revolutions counter which is also carried by carriage 22 comprises numeral wheels 71 on respective shafts 72, which are journalled in carriage frame member 32 and cross member 36.

A numeral wheel 71 is provided for each ordinal position of the carriage. The numerals of each wheel 71 (Fig. 1) are maintained in alignment with the associated sight openings 73 by ten tooth gear 74 and the spring pressed ball 75 engaged therewith, which also serve to prevent overthrow of numeral wheels 71.

Revolutions counter resetting means

Means are provided for resetting numeral wheels 71 of the revolutions counter to zero, and as such means is very similar to that described in connection with accumulator numeral wheels 41, a general description thereof will suffice. Rack bar 76 (Figs. 1 and 7), similar to rack bar 51, is mounted for endwise movement by flanged studs 77 on carriage frame member 32. Axially offset mutilated gears 78 (Fig. 7) on shafts 72 are associated with bar 76 so that movement of bar 76 to the right by manipulation of handle 79 serves to restore numeral wheels 71 to zero position. Slide 81, formed similarly to slide 81, is mounted for cooperation with stop teeth 82 of wheels 71 and is spring urged to active position, being restrained therefrom by pin 83 on bar 76. The operation of the above described zero resetting means is similar to that described in connection with the accumulator resetting means.

Interlock

An interlock is provided for the zero resetting means of both registers and the operating controls for determining entering of values in the registers. Locking slide 86 (Figs. 6 and 7) extends through suitable slots in carriage frame 31 closely adjacent the ends of rack bars 51, 76 and is urged to the position shown by spring 87 disposed in an aperture in slide 86 and compressed between slide 86 and carriage frame member 32. In such position rack bars 51, 76 are free for operation, being unobstructed by slide 86. If either of bars 51, 76 are operated, movement of slide 86 is prevented by virtue of its interengagement with the displaced bar. At its left end, as viewed in Fig. 6, slide 86 has lateral extension 88 with which is engaged extension 89 of bail 91 having spaced pivots 92 on carriage frame 31. Contacting bail 91 is a locking member 93 which is slidably mounted on the frame of the machine and is moved rearwardly (to the right in Fig. 6) when any operating control which effects a registration of values on the registers is operated. Bail 91 is of sufficient length (Fig. 7) to maintain its operative relation with member 93 in any shifted position of the carriage. Thus, if either of resetting bars 51, 76 is operated, slide 86 prevents movement of bail 91 and member 93 so that all such operating controls can not be operated. Conversely, if an operating control is in active position, member 93 through bail 91 displaces slide 86 so that locking portions 94, 95 thereof block movement of resetting bars 51, 76. It is seen, therefore, that the resetting means and an operating control for entering values in the register cannot be operated simultaneously.

From the foregoing description, it is seen that the shiftable register carriage provides a mounting for both the accumulator and revolutions counter, which are, therefore, shiftable with respect to the actuating means therefor which are mounted in the frame of the machine. Also, each register is provided with zeroizing means shiftable with the carriage. The actuating means and the associated driving and value selecting mechanisms for the registers will now be described. Such mechanisms will be described briefly as they are generally similar to those described in said application.

Selecting and actuating mechanisms

The values to be introduced into accumulator numeral wheels 41 are selected by means of a plurality of banks or orders of settable value keys 101, one of which banks is illustrated in part in Fig. 1. Each bank of keys 101 cooperates with selecting mechanism including a pair of parallel spring-urged slides 102 mounted for endwise movement to position gears 103 selectively with respect to stepped teeth 104 of the associated actuating cylinder 106 in accordance with the value of the depressed key. One gear 103 of each ordinal pair and the associated slide 102 cooperate with value keys 101 from "1" to "5" and the left hand set of teeth 104 on the associated cylinder 106 as viewed in Fig. 1, while the other gear 103 and slide 102 cooperate with value keys 101 from "6" to "9" and the right hand set of teeth 104 on such cylinder. Cylinders 106 (Figs. 1 and 2) are mounted on actuating shafts 107 having suitable bevel gear connections with transverse shaft 108 which is suitably journalled in side members 12, 13. Each shaft 107 serves for two orders of the machine and has a pair of cylinders 106 mounted thereon. Shaft 108 and shafts 107 are driven cyclically from motor 109 (Fig. 1) thru clutch 111 (Figs. 3 and 4) which is driven by suitable gearing 112 from motor shaft 113. As explained in my said co-pending application, clutch 111 is engaged or disengaged by oscillation of spring-urged clutch pawl or dog 114 (Fig. 4) mounted for rotation with shaft 108 and with respect to ratchet 116 journalled on shaft 108 and driven by gearing 112. Clutch control lever 117 pivoted on side member 13 determines engagement or disengagement of the clutch by releasing or engaging the nose of dog 114 in the full cycle position thereof.

From the above description, it is seen that the values set in the machine by depression of keys 101 will be entered in numeral wheels 41 by the cooperation of gears 103 with teeth 104 of cylinders 106 during cyclic operation of the clutch. Each pair of gears 103 is slidably mounted on a square shaft 121 (Fig. 1) supported in cross members 17, 18 and extending rearwardly of the machine thru cross member 17 and having its rear end journalled in cross member 16. Intermediate members 19, 17, a spool 122 is slidably and non-rotatably mounted on each shaft 121 and has opposite bevel gears 123, 124 at its ends positioned for cooperation with numeral wheel gear 47. Therefore, when one or the other set of gears 123, 124 is engaged with gears 47, numeral wheels 41 will be rotated forwardly or reversely to register a number of increments equal to the value of the depressed keys 101 in the aligned banks of keys.

To control the engagement of gears 123, 124 (Fig. 1) with gears 47, strap 126 is positioned between gears 123, 124 and is mounted by suitable arms for rocking movement with shaft 127. Thus, by rocking shaft 127 either set of gears 123, 124 can be moved on shaft 121 by strap 126 from the position shown in Fig. 1 into engagement with gears 47. Gears 123 transmit positive increments and gears 124 transmit negative increments. Any suitable control means can be provided for controlling the position of shaft 127 and

gears 123, 124 and for simultaneously enabling the drive through clutch 111, as for example, the plus and minus keys and the division control lever disclosed in said application.

Centralizing means is provided for resiliently urging strap 126 and gears 123, 124 to their central neutral position. For this purpose opposed arms 521 (Fig. 1) are pivotally mounted on side plate 12 with their upper ends engaging opposite sides of a pin 522 on a supporting arm for strap 126. Arms 521 are connected by spring 523 so that the arms yieldably resist movement of the plus-minus gears 123, 124 from their ineffective position shown in Fig. 1.

Transfer mechanism

Transferred increments in the accumulator are entered through gears 123, 124 (Fig. 1) by means of trip levers 131, transfer actuators 132 on shafts 107 and gears 133 on shafts 121 as fully disclosed in said application.

Counter actuator

The number of actuations of accumulator numeral wheels 41 are registered either positively or negatively in counting numeral wheels 71 by actuator 136 (Fig. 1) which is driven and operated by conventional means such as cam drum 134 (Fig. 2) and cam disc 135 in a manner fully described in said application to enter single increments in the active order of the revolutions counter and to carry from order to order in higher orders thereof.

Carriage shifting mechanism

Means are provided for shifting the carriage in either direction from one ordinal position to another manually by releasing the carriage for free shifting movement and also by power driven means controlled by manually operable keys. Preferably, the power driven means comprises a part of the actuating means for entering values into the accumulator. Carriage 22 (Fig. 5) has plate 151 mounted along the rear side thereof by means of adjusting screws 152 threaded in brackets 153 on carriage frame 31 and having smooth ends pivotally engaged with laterally projecting end portions 154 of plate 151. Plate 151 has vertical slots 157 formed in the lower edge thereof by teeth 158, slots 157 being spaced apart a distance equal to the ordinal spacing of the machine and aligned with drive shafts 121. Slots 157 are adapted for engagement by opposite shift pins 161 on shift gear 162. Gear 162 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 161 in slots 157; such engagement also serves to lock the carriage in position. One half revolution of gear 162 effects one ordinal spacing of carriage 22 and to provide for accurate centering of the carriage at the end of a shift, centralizing cam 163, is mounted for rotation with gear 162. Centralizing arms 164 suitably pivoted at one end on frame member 16 have suitable rollers at their opposite ends engaging opposite sides of cam 163 under the influence of spring 166 tensioned between arms 164. When pins 161 are in horizontal alignment the carriage is properly positioned and the centralizing rollers are seated in opposite depressions formed between the high portions of cam 163. Accurate initial positioning of carriage 22 with respect to pins 161 is provided by adjusting screws 152, which are adjusted with the parts positioned as described.

The manual release of the carriage for free shifting movement is effected by rocking plate 151 out of engagement with pins 161 of shift gear 162. Plate 151 is maintained resiliently in operative position by spring 166A (Fig. 6) tensioned between carriage frame 31 and end extension 167 of plate 151. Carriage release handle 168 (Figs. 5 and 7) is journalled in carriage end plate 34 in axial alignment with screws 152 forming the pivotal axis for plate 151, and has its inner end rigidly but removably connected to the bent end of extension 167 of plate 151. Thus by turning handle 168, plate 151 can be moved out of engagement with pins 161 to permit free shifting movement of the carriage. To prevent simultaneous operation of carriage release handle 168 and any operating control which determines entering of the values in the registers, extension 167 (Figs. 6 and 7) of plate 151 has arm 169 secured thereon with its bent end normally positioned above locking slide 86 as shown in Fig. 6. If handle 168 is operated to release the carriage, arm 169 moves into the cooperating recess in slide 86 formed by projection 170 thereof, thereby blocking movement of slide 86, bail 91 and locking member 93. Conversely, if such an operating control be manipulated, projection 170 is moved beneath arm 169 to prevent operation of carriage release handle 168. It is seen from the above description that the carriage cannot be released for free shifting movement if a value is being entered in the registers, and, conversely, if the carriage is so released the value entering operating controls cannot be operated.

Resilient bumper means is provided for preventing shifting of the carriage beyond its left hand end position, to which it is usually returned to begin a calculation. Bumper lever 171 (Fig. 5) is pivoted at 172 on cross frame member 16 and has its upper end positioned for engagement with the head of left adjusting screw 152 (to the right as viewed in Fig. 5) when the carriage is in its left end position. The lower end of lever 171 is notched at 173 for engagement by the nose of centering arm 174 under the tension of spring 176. Arm 174 is pivoted eccentrically at 177 to provide for accurate positioning of bumper lever 171. Thus, centering arm 174 maintains bumper lever 171 resiliently in place. The movement of lever 171 when struck by the carriage is limited by the engagement of abutment 178 thereof with the top of left side frame member 12.

Yieldable means are provided to prevent shifting of the register carriage beyond the lowest and highest ordinal positions thereof during power operation of the shifting means. End slots 157 are formed in part by end teeth 158 and in part by respective pawls 181, 182. Pawls 181, 182 are pivoted at 183, 184, respectively on plate 151 and extend inwardly to position the straight end edges thereof opposite end teeth 158 to form end slots 157. Pawls 181, 182 are held resiliently in the position shown against respective stop pins 186 by spring 187 tensioned therebetween. When carriage 22 is in the end position shown, one pin 161 lies in an end slot 157 and the other is positioned beneath adjacent pawl 182 in engagement with cam edge 188 thereof. In this condition rotation of gear 162 in a direction to move the carriage beyond the end position merely results in oscillating pawl 182 by action of pins 161 on cam edge 188. However, upon rotation of gear 162 in a direction to effect carriage shifting to an intermediate ordinal position, the end edge of pawl 182 positively resists the pin 161

in end slot 157 and carriage shifting results. A similar action occurs if the carriage is in its end position adjacent pawl 181. It is seen, therefore, that the carriage cannot be shifted beyond either end position thereof by operation of shift gear 162.

As stated above, shift gear 162 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 107 (Fig. 2) are extended rearwardly and have respective collars 201 secured adjacent the ends thereof. Each collar 201 is provided with opposite slots slidably engaged by corresponding teeth 202 of a shiftable drive establishing collar 203 mounted freely on the end of shaft 107. Opposite teeth 202 thereof, each collar 203 has smaller teeth 204 adapted for engagement with corresponding slots in respective gear sleeves 206, 207, which are journalled in cross frame member 16 and small plate 208 mounted on member 16 by suitable spacers and fastening screws. Gear sleeve 206 (Figs. 2 and 5) has gear 211 meshing with idler gear 212 (Fig. 5) journalled in frame member 16 and plate 208 and also meshing with shift gear 162. Gear sleeve 207 (Figs. 2 and 5) has gear 213 (Fig. 5) offset axially from idler gear 212 and meshing with wide reverse idler gear 214 suitably journalled in frame member 16 and plate 208 and also meshing with idler gear 212. Thus, rotation of gear sleeve 206 in a clockwise direction as viewed in Fig. 5 causes clockwise rotation of shift gear 162 and shifting of carriage 22 to the left as viewed from the front of the machine. Correspondingly, rotation of gear sleeve 207 in a clockwise direction as viewed in Fig. 5 effects counterclockwise rotation of shift gear 162 and shifting of carriage 22 to the right as viewed from the front of the machine. Thus, by selective establishing of drive connections between gear sleeves 206, 207 (Fig. 2) and collars 201 upon selective shifting of respective shiftable collars 203, carriage 22 can be shifted in either direction. The gear ratios are so chosen that one rotation of actuating shafts 107 effects one-half rotation of shift gear 162.

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 221, 222 (Figs. 3 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 221, 222 (Fig. 3) are mounted for endwise movement by suitable longitudinal slots formed therein and engaged by a plurality of studs 223 secured on side frame member 13. Keys 221, 222 have adjacent ears 226 with respective studs 227, 228 mounted therein and extended to either side thereof. To maintain the shift keys resiliently in raised position, coil spring 231 (Fig. 8) is provided having its ends fastened to side member 13 and passing over upper studs 223 and under the ends of studs 227, 228 which extend through suitable slots in side member 13. To enable the drive connection from the actuating means to the carriage shifting mechanism, stud 227 engages the upper end of arm 232 secured on sleeve 233 (Fig. 3). Sleeve 233 is fixedly mounted on transverse shaft 234 which is suitably journalled at its ends in side member 13 and bracket 235 on cross member 16. At its left end, sleeve 233 is provided with depending arm 237 (Fig. 8) having its rounded end in engagement with the front end of rearwardly extending rod 238 (Figs. 2 and 8). Rod 238 is mounted for sliding movement in cross frame members 17, 16 and is resiliently urged to its forward position by spring 239 compressed between cross member 16 and a suitable washer on rod 238. At its rear end, rod 238 (Fig. 2) has shift fork 241 secured thereon with its forked end in engagement with an annular groove in right-hand shiftable collar 203. From the foregoing description, it is seen that depression of key 221 is effective through stud 227 to rock arm 232, sleeve 233 and arm 237 to move rod 238 rearwardly. Such rearward movement of rod 238 is effective through shift fork 241 to engage teeth 202 of right-hand shift collar 203 with corresponding slots in gear sleeve 207. Thus, initial depression of shift key 221 is effected to enable a drive connection from the actuating means to the carriage shifting mechanism. The drive connection between gear sleeve 207 and its associated collar 203 determines shifting of the carriage to the right.

A similar mechanism is employed in connection with shift key 222 to enable the drive connection to determine shifting of the carriage to the left. Stud 228 (Fig. 8) is engaged with the upper end of arm 246 having its hub secured on shaft 234. At its left end, shaft 234 (Fig. 2) has depending arm 247 secured thereon in operative relation with shift rod 248 having shift fork 249 at its rear end in engagement with an annular groove in left-hand shift collar 203. It is seen, therefore, that depression of key 222 results in rocking of shaft 234 and rearward movement of rod 248 to engage left-hand shift collar 203 with gear sleeve 206. 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 204 with the corresponding slots in gear sleeves 206, 207 so that the drive connection is enabled during the first part of the downward movement of keys 221, 222.

The latter part of the downward movement of keys 221, 222 is utilized to engage the clutch and energize the motor. Studs 227, 228 (Fig. 3) overlie respective cam surfaces at the upper end of lever 251. Lever 251 is adjustably secured on lever 252 by pivot 253 and by pin and slot connection 254 having suitable clamping means for maintaining the relative adjustment between levers 251, 252. From the relation of studs 227, 228 and lever 251, it is evident that depression of either of keys 221, 222 is effective during the latter part of the movement to rock levers 251, 252 in a clockwise direction. Lever 252 is connected at its upper end by link 255 (Figs. 3 and 4) with clutch control lever 117 so that movement of link 255 will result upon depression of either of the shift keys. Such movement is effective in the manner previously described to engage the clutch. The motor is energized upon oscillation of lever 252 which has a pin and slot connection with lever 257 having pin 258 mounted adjacent contacts 259 of the motor circuit. Lever 251 (Fig. 3) also provides an interlock between shift keys 221, 222 by means of lock portions 261, 262 which are adapted to cooperate with studs 227, 228 respectively. For example, if key 221 is de-

pressed, lock portion 262 moves into blocking position beneath stud 228. Shift keys 221, 222 are also suitably interlocked with the plus and minus keys for determining positive and negative value entering as fully disclosed in my copending application, Serial No. 27,338, filed June 19, 1935.

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 203 is provided with a similar mechanism, only one of which will be described. Right-hand shiftable collar 203 (Fig. 2) is provided with disc 271 having a cut away portion 272 which, in the full cycle position of collar 203, is in the position illustrated in Fig. 5. Immediately to the rear of disc 271, locking element 273 is provided mounted in bracket 274 for movement radially of collar 203, and urged to its extended position by spring 276. With shiftable collar 203 in its inactive position disc 271 is positioned forwardly of locking element 273 and when moved rearwardly of the machine to its active position passes by element 273 which is in alignment with the cutaway portion 272. Upon subsequent rotation of disc 271 the solid portion thereof engages element 273 and prevents movement of collar 203 forwardly of the machine so that teeth 202 are maintained in engagement with gear sleeve 207 irrespective of release of the associated shift key. Left hand shiftable collar 203 is held in drive establishing position for each cycle of rotation by similar mechanism.

From the foregoing description it is seen that keys 221, 222 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.

Add key release mechanism

In operation of the machine, it is usually desirable that the "add" key, which in active position causes release of all depressed numeral keys after a single actuation, be disabled during operations, such as division, involving shifting of the carriage as a usual preliminary to the operation. To effect this end, means are provided under control of the shift keys for disabling the add key. Add key 281 (Figs. 3 and 8) is mounted for endwise and pivotal movement on side member 13 by stud 282 (Fig. 3) which engages a slot adjacent the lower end of key 281. Key 281 is held normally in raised inactive position by spring 283, which also serves to maintain notch 284 in key 281 engaged with pin 286 to latch key 281 in depressed position. In its depressed active position key 281 positions arm 287 in blocking relation to lug 288 of division setting slide 289 as fully disclosed in my co-pending application Serial No. 35,619, filed August 10, 1935. The mechanism for releasing automatically any depressed numeral keys 101 under control of key 281 is fully disclosed in said application Serial No. 724,482. To release add key 281 upon depression of one of shift keys 221, 222, lever 291 (Fig. 3) is pivoted at 292 on side member 13 and has one arm 293 disposed beneath and spaced from studs 227, 228 of shift keys 221, 222 and the other offset arm 294 with its laterally projecting end in operative relation with cam surface 296 of key 281, when key 281 is in raised position. With the parts positioned as illustrated in Fig. 8, depression of either of shift keys 221, 222 produces no movement of lever 291. However, when add key 281 is depressed, lever 291 is rocked in a clockwise direction as viewed in Fig. 8 to place arm 293 thereof immediately below studs 227, 228. Thus, if add key 281 is depressed, during the first part of the downward movement of either of studs 227, 228 caused by depression of a shift key, lever 291 will be rocked in a counter clockwise direction (Fig. 8) to move add key 281 to the left as viewed in Fig. 3 and disengage notch 284 and pin 286. Spring 283 then becomes effective to raise add key 281 to its inactive position. It is seen, therefore, that if the add key is depressed, depression of a shift key serves to normalize the add key by restoring it to raised inactive position.

Normalizing mechanism

As stated in the introduction, means are provided for restoring the machine to normal condition between successive operations. The restoring being effected by returning the carriage to its left hand position and by resetting the accumulator to zero after its return to such position. Both of these functions are controlled by a single manipulable member which is operated by a single manual stroke. Also, while the machine is being normalized, the value desired can be set in the keyboard for the next operation.

Carriage return and register resetting key 311 (Fig. 3) is operative upon depression thereof to establish a drive connection between the power driven resetting mechanism and the actuating means and to initiate a carriage shifting operation. Key 311 is latched in depressed position until the carriage return and resetting operation are effected when the latch is automatically released. Key 311 is mounted on side member 13 adjacent shift key 222 for substantially endwise movement. For this purpose, key 311 is slotted adjacent its upper end for engagement by stud 312 and at its lower end is pivotally connected at 313 to arm 314 (Figs. 3 and 8) on shaft 315. Key 311 is urged to its raised position by spring 317 (Fig. 8) secured to extension 318 of arm 314. Intermediate its ends, key 311 (Fig. 3) is provided with latching notch 321 for cooperation with latching slide 322. In the raised position of key 311, slide 322 has its nose engaged with cam surface 323 on key 311 below notch 321. Slide 322 is mounted for endwise sliding movement by means of pin 324 engaging a slot at the front end of slide 322 and by a pivotal connection at its rear end with latch releasing member 326 referred to hereinafter. Spring 327 tensioned between a pin on side member 13 and the rear end of slide 322 urges slide 322 to active position so that upon depression of key 311, slide 322 will engage latching notch 321 and maintain key 311 in depressed position until slide 322 is retracted by means described hereinafter.

As stated above, depression of key 311 enables a drive connection from the actuating means to zero resetting drive means. The zero resetting drive member comprises slide 331 (Figs. 2 and 5) mounted for endwise movement on frame member 16 by brackets 332. Slide 331 has vertical projection 333 terminating in lateral extension 334 which comprises the active part of actuating slide 331. When carriage 22 is in its left end

position as illustrated in Fig. 5, extension 334 is in operative relation with arm 336 pivoted at 337 (Figs. 5 and 7) on resetting bar 51 for numeral wheels 41 of the accumulator register. Arm 336 has "live" pawl 338 pivoted thereon intermediate its ends and urged against pin 339 by spring 341 tensioned between pawl 338 and a suitable lug on rack 51. Pawl 338 is adapted to cooperate with fixed ledge 342 mounted on frame member 16 for a purpose later described. Spring 341 also urges arm 336 to the position shown with pin 343 engaged with a surface of carriage frame member 33. With the parts positioned as illustrated in Fig. 5, it is seen that upon movement of slide 331 to the left, lateral extension 334 will engage the end of arm 336 to reciprocate resetting rack bar 51 and effect resetting of the accumulator wheels 42 in the manner previously described.

The means for actuating slide 331 (Fig. 5) includes arm 351 pivoted at 352 on plate 16 and having a slot at its upper end engaged by pin 353 on slide 331. Intermediate its ends, arm 351 has roller 354 journalled thereon for cooperation with cam 356 under the influence of spring 357. Cam 356 (Fig. 2) has hub 358 journalled in plate 16 and in small plate 361 mounted in spaced relation to plate 16 by suitable spacers and studs. Hub 358 of cam 356 extends thru plate 16 and has opposite notches 362 for cooperation with corresponding teeth 363 of collar 364 shiftably mounted on the end of an actuating shaft 107. Opposite teeth 363, shiftable collar 364 has similar teeth 366 constantly engaged with corresponding notches in collar 367 secured on said actuating shaft 107 adjacent the end thereof. Shiftable collar 364, therefore, provides means for establishing a drive connection from the actuating means to the zero resetting drive member. Collar 364 has an annular groove to receive shift fork 371 mounted at the rear end of rod 372 which is supported for endwise sliding movement in cross members 17, 18. Rod 372 is spring-urged to its forward position by spring 373 in the same manner as rod 238 and spring 239 of the carriage shifting mechanism. The front end of rod 372 is normally engaged with radial end surface 376 of arm 377 (Figs. 1 and 2) secured on shaft 316 which is movably supported in side members 12, 13. Arm 377 (Fig. 1) has a second radial end surface 378 of greater radius than surface 376 and connected thereto by a suitably inclined surface. Thus, clockwise movement of arm 377, as viewed in Fig. 1, causes endwise movement of rod 372 until it is engaged with surface 378. It is seen, therefore, that depression of return and reset key 311 serves, by rocking shaft 316 and arm 377, to engage teeth 363 (Fig. 2) of shiftable collar 364 with notches 362 of cam hub 358 thereby enabling the drive connection from the actuating means to the zero resetting drive member. As key 311 is latched in depressed position, such drive connection will remain enabled until release of the latch as described hereinafter.

To initiate the carriage return determined by depression of key 311, shoulder 381 (Fig. 3) is provided on key 311 overlying lug 382 of shift key 222. Thus, depression of key 311 also causes depression of shift key 222 and initiates a shifting operation as described in connection with key 222. Because key 311 is latched in depressed position, carriage shifting will continue until return of the carriage to its left end position.

As stated above, and it will be more apparent from the description of the operation, the carriage is returned to its end position if displaced therefrom, and the next revolution of the actuating means is effective to reset the accumulator to zero and to release the latch for key 311. To effect the latch release, pawl 182 (Fig. 5) has arm 391 terminating in shoulder 392 and latch releasing extension 393. Extension 393 overlies cam surface 394 (Fig. 3) of latch releasing member 326 which is pivoted at 396 on side member 13. It will be recalled that with the carriage in the end position shown in Fig. 5, pawl 182 is oscillated during each cycle of operation of the actuating means by the engagement of a pin 161 with cam surface 188. As arm 391 of pawl 182 moves downwardly shoulder 392 moves into operative engagement with side member 13 and extension 393 contacts cam surface 394 (Fig. 3). The engagement of shoulder 392 with member 13 blocks unnecessary movement of the carriage because of the actuation of resetting bar 51, and the engagement of the extension 393 with cam surface 394 rocks latch release member 326 so that latch slide 322 is moved to the right to release key 311. Spring 187A aids spring 187 in restoring pawl 182 quickly to the position shown.

Operation

The operation of the normalizing mechanism will now be described. Return and reset key 311 (Fig. 3) is depressed and is latched in depressed position by slide 322. The depression of key 311 thru arm 314, shaft 316 (Fig. 7) and arm 377 moved rod 372 rearwardly to engage shiftable collar 364 with cam hub 361. The drive connection for the zero resetting drive member is therefore established.

Depression of key 311 thru shoulder 381 and lug 382 also depresses shift key 222 to enable the carriage shifting mechanism for shifting the carriage to the left. Such depression of shift key 222 engages the clutch and enables the motor circuit. If the carriage is positioned in its left end or lowest order position as viewed from the front of the machine, depression of shift key 222 merely serves to enable the drive for one cycle of operation. During this cycle, slide 331 (Fig. 5) actuates resetting bar 51 to restore numeral wheels 41 to zero registration, and a pin 161 oscillates pawl 182 to actuate latch releasing member 326 to unlatch key 311 and thereby shift key 222. However, if the carriage is displaced from such left end position, shifting of the carriage to the left (as viewed from the front of the machine or to the right as viewed in Fig. 5) follows as well as reciprocation of arm 351 and slide 331. The reciprocation of slide 331 is ineffective until the carriage is returned to its left end position because the carriage is positioned so that arm 336 is not engaged by extension 334 of slide 331. Fig. 9 illustrates the condition of the parts when the carriage is moving into its next lowest order position. In such position the inclined end of pawl 338 has engaged ledge 342 so that pawl 338 and arm 336 have been raised by ledge 342 to position the end of arm 336 above extension 334 of slide 331. It will be noted that slide 331 is in its extreme left hand position and the extent of movement is such that arm 336 and resetting rack bar 51 would be actuated slightly if arm 336 were not raised.

Fig. 10 illustrates the parts as positioned in the cycle of operation when the carriage is being shifted from the next lowest order position to its lowest order or left end position. Thus, pawl 338 has moved off of ledge 342 and allowed

arm 336 to fall, the end thereof resting on actuating extension 334 of slide 331. During the remainder of the last shifting cycle, the parts move from the positions shown in Fig. 10, to those illustrated in Fig. 5. During such movement arm 336 drops to active position so that the next reciprocation of slide 331 is effective to engage extension 334 with arm 336 and effect the resetting operation. Also, during this cycle, pawl 182 is oscillated to actuate latch releasing member 326 and release key 311 so that key 311 and shift key 222 are free to rise and the operation stops at the end of that cycle.

Thus, depression of key 311 initiates a normalizing operation which includes the returning of the carriage to its left hand or home position, resetting of the accumulator and release of key 311. It is to be noted that during such operation, keys 101 (Fig. 1) can be depressed to change the positioning of gears 103 with respect to teeth 106 of actuating cylinders 107 in accordance with the desired value for the next succeeding operation. Obviously, by omitting the connections of key 311 with the zero resetting drive mechanism, such key would serve as a carriage return key only.

If desired, register wheels 71 of the revolutions counter can be cleared simultaneously with numeral wheels 41 of the accumulator and manipulable means are provided for connecting the resetting mechanisms of such registers together for simultaneous operation. For this purpose rack 76 (Figs. 6 and 7) is provided with connecting member 401 pivoted at 402 on bar 76. Member 401 has bent extension 403 which is normally positioned below bent end 404 of member 68 on rack bar 51. Extension 403 is maintained in such position by bent arm 406 of member 401 which extends across bar 76 and is normally engaged with the low portion of inclined cam surface 407 of control slide or member 408. Spring 409 maintains arm 406 in engagement with cam surface 407, being tensioned between arm 406 and a pin on rack bar 76. Member 408 is slotted to engage studs 411 on frame member 36 to provide for endwise movement thereof and has handle portion 412 which extends through the carriage casing to provide for manipulation thereof. Upon movement of slide 408 to the right from the position illustrated in Fig. 7, arm 406 of connecting member 401 moves up cam surface 407 against the urgency of spring 409 to rock connecting member 401 and position extension 403 thereof in the path of extension 404 of member 68 on rack bar 51. Thus, rack bar 76 can be connected for simultaneous movement with rack bar 51 so that power resetting of both registers can be effected simultaneously by depression of key 311.

Modified power resetting mechanism

Figs. 11 through 13 illustrate a modified form of the invention in which shiftable registers can be reset to zero registration independently of the carriage shifting operation and in any displaced position thereof. Such resetting is effected by a zero resetting drive member which is normally out of operative relation with the resetting mechanism in the carriage. Zero resetting key 501 (Fig. 11) is generally similar to key 311 and depression thereof serves to enable the drive connection from the actuating means to the zero-resetting drive member. Key 501 is mounted on side member 13 by stud 312 and arm 314 in the same manner as key 311 and operates similarly through arm 314 to establish the drive connection from an actuating shaft 107 to cam 356 (Fig. 12). To enable the motor circuit and engage the clutch, key 501 (Fig. 11) has cam extension 502 disposed in operative relation with pin 503 on clutch control lever 504, which is generally similar to lever 117 of Fig. 4 and operates to control clutch 111 (Fig. 11) in the same manner. Lever 504 is connected by link 256 to lever 252 (Fig. 3) which through lever 257 controls the engagement of contacts 259 of the motor circuit. Thus, depression of key 501 establishes a drive connection from the actuating means to the zero resetting drive member and enables the drive for the actuating means. It is to be noted that key 501 (Fig. 11) is not latched in depressed position and exerts no control over shift key 222.

The zero resetting drive member is adapted upon depression of key 501 to effect zero resetting of the accumulator in any displaced position thereof. Zero resetting rack bar 51 (Figs. 12 and 13) is identical in construction and operation as previously described except that means is associated therewith for operation by the zero resetting drive member on the frame in any displaced position of the carriage. Such means comprises strap 506 mounted on bar 51 by means of spacers 507 and screws 508. Strap 506 has a plurality of ordinally spaced projections or lugs 509, one for each ordinal position of the carriage. Lugs 509 are each positioned for operative relation with lateral actuating extension 511 on slide 512. To provide for endwise movement of slide 512, slots 513 therein are engaged by studs 514 on frame member 16. It will be noted that extension 511 in its inactive position is below lugs 509 to provide for unimpeded shifting of the carriage. To provide for movement of extension 511 into active position at the first part of the reciprocation thereof, slots 513 have upwardly slanted end portions 516 in which studs 514 are normally positioned. Upon depression of key 501 and subsequent rotation of cam 356, arm 351 moves slide 513 to the left. Slide 512 and extension 511 first move upwardly and to the left so that extension 511 engages a lug 509. Thereafter the movement of slide 512 and extension 511 is linear and strap 506 and rack bar 51 are moved therewith to effect resetting of the accumulator. Upon return movement of slide 512, extension 511 is restored to the position illustrated in Fig. 12 below lugs 509. Thus, the accumulator can be zeroized in any shifted position of the carriage by manipulation of key 501. The revolutions counter can be zeroized simultaneously with the accumulator as described in connection with the preferred form of the invention.

I, therefore, claim as my invention:

1. In a calculating machine, a shiftable register, actuating means therefor, driving means for said actuating means, means for shifting said register with respect to said actuating means by operation of said actuating means, means for resetting said register to zero registration by operation of said actuating means, and a manually operable control key for said driving means, said shifting means and said resetting means.

2. In a calculating machine, a frame, a register shiftable on said frame, actuating means on said frame for said register, zero resetting means associated with said register and shiftable therewith, a drive member on said frame having a drive connection with said actuating means and positioned for cooperation with said resetting

means in one position of said register, and control means including a manually operable key for enabling said drive connection and for causing operation of said actuating means.

3. In a calculating machine, a frame, a register shiftable on said frame, actuating means on said frame for said register, zero resetting means associated with said register and shiftable therewith, a drive member on said frame having a drive connection with said actuating means and positioned for cooperation with said resetting means in one position of said register, means for shifting said register, and control means including a manually operable key for determining operation of said shifting means and said actuating means and for enabling said drive connection.

4. In a calculating machine, a shiftable register, actuating means for said register, drive means for said actuating means including a source of power and a cyclically operable clutch providing the only path of power flow from said source of power, means for shifting said register with respect to said actuating means having a normally disabled drive connection with said actuating means, means for resetting said register to zero registration having a normally disabled drive connection with said actuating means, and selective control means for said clutch and for said drive connections between said actuating means and said shifting and resetting means.

5. In a calculating machine, a frame, a register mounted for endwise shifting movement on said frame, a source of power, means driven from said source of power for shifting said register, means driven from said source of power for resetting said register to zero, and control keys for said shifting and resetting means in cooperative relation to enable simultaneous operation thereof.

6. In a calculating machine, a frame, a register mounted for endwise shifting movement on said frame, a source of power, means driven from said source of power for shifting said register, a shift key on said frame for controlling said shifting means, means driven from said source of power for resetting said register to zero, and a resetting control key for said resetting means mounted on said frame adjacent said shift control key to provide for simultaneous manipulation thereof whereby to cause simultaneous operating of said resetting and shifting means.

7. In a calculating machine, a shiftable register, cyclically operable actuating means for said register, drive means for said actuating means including a source of power and a cyclically operable clutch providing the only path of power flow from said source of power, means for shifting said register with respect to said actuating means including a normally disabled drive connection with said actuating means, means for resetting said register including a normally disabled drive connection with said actuating means, said shifting means including yieldable means for preventing shifting of said register past an end position thereof irrespective of continued operation of said shifting means, and a control key for engaging said clutch and enabling said drive connections whereby to effect return of the register to an end position and then to effect resetting of said register during an overdrive cycle of said actuating means after the completion of the shifting operation.

8. In a calculating machine, a frame, a register shiftable on said frame, resetting means associated with said register and shiftable therewith, drive means positioned on said frame for cooperation with said resetting means in an end position of said register, means for shifting said register including yieldable means in said end position of said register for preventing shifting of said register past said end position while providing for continued operation of said shifting means, control means for enabling said shifting means and said drive means, means for latching said control means in active position, and means operated by said yieldable means for disabling said latching means during resetting of said register while in said end position.

9. In a calculating machine, a frame, a carriage mounted for endwise shifting movement on said frame, a register on said carriage, resetting means for said register on said carriage, actuating means on said frame for said register, means for shifting said register driven from said actuating means, normally disabled drive means on said frame for said actuating means, and means including a manipulable control for enabling said drive means and for first causing shifting of said carriage to an end position and then for causing operation of said resetting means to effect resetting of said register in said end position, said resetting means including a settable control element for disabling operation of said zero resetting means whereby with said settable element in active position operation of said manipulable control causes positioning of said carriage in said end position without resetting of said register.

10. In a calculating machine, a shiftable register, actuating means for said register including a plurality of parallel actuating shafts, drive means for said actuating means including a source of power and a cyclically operable clutch, means for shifting said register with respect to said actuating means including a drive element in axial alignment with one of said actuating shafts and shiftable means for establishing a drive connection between said drive element and said one shaft, means for resetting said register to zero registration including a second drive element mounted in axial alignment with another of said actuating shafts and shiftable means for effecting a drive connection between said second drive element and said another actuating shaft; and selective control means for said clutch and for said respective shiftable means.

11. In a calculating machine, a shiftable register, actuating means for said register, drive means for said actuating means including a source of power and a clutch, said actuating means including means settable to be ineffective to enter values in said register, selecting mechanism for entering values into said machine for entry in said register by said actuating means, and selectively operable means having a drive connection with said actuating means for resetting said register to zero registration with said actuating means in normal motion and operative to transmit a drive through said drive connection but ineffective to enter values in said register, said selecting mechanism being conditioned for value entering operation during resetting operation of said actuating means, and a control key for said selectively operable means operable to engage said clutch and enable said drive connection.

12. In a calculating machine, a frame, a register shiftable on said frame, cyclically operable actuating means on said frame for said register, drive means for said actuating means including a source of power and a clutch, zero resetting means associated with said register and shiftable

therewith, a drive member on said frame positioned for cooperation with said resetting means in one position of said register, a controllable drive connection between said drive member and a part of said actuating means, means for shifting said register by cyclic operation of said actuating means including a controllable drive connection between said shifting means and a part of said actuating means, and control means for determining operation of said shifting means to place said register in said one position if displaced therefrom and for determining operation of said drive member, said control means including a manually operable key having controlling connection with said clutch and said drive connections.

13. In a calculating machine, a frame, a register shiftable on said frame, cyclically operable actuating means on said frame for said register, drive means for said actuating means including a source of power and a clutch, resetting means associated with said register and shiftable therewith, a drive member on said frame positioned for cooperation with said resetting means in one position of said register, a controllable drive connection between said drive member and a part of said actuating means, means for shifting said register by cyclic operation of said actuating means including a controllable drive connection between said shifting means and a part of said actuating means, control means including a manually operable key for determining operation of said shifting means to place said register in one position if displaced therefrom and for determining operation of said drive member, and means enabled by said key upon operation thereof for latching said key in active position.

14. In a calculating machine, a frame, a register shiftable on said frame, cyclically operable actuating means on said frame for said register, drive means for said actuating means including a source of power and a clutch, resetting means associated with said register and shiftable therewith, a drive member on said frame positioned for cooperation with said resetting means in one position of said register, a controllable drive connection between said drive member and a part of said actuating means, means for shifting said register by cyclic operation of said actuating means including a controllable drive connection between said shifting means and a part of said actuating means, control means including a manually operable key for determining operation of said shifting means to place said register in one position if displaced therefrom and for determining operation of said drive member, means for preventing operative engagement of said drive member with said resetting means until said register is positioned in said one position by operation of said shifting means, means for latching said key in active position, and means for disabling said latching means during the cycle of operation of said actuating means in which said drive member operates said zero setting means.

15. In a calculating machine, a frame, a register, a carriage carrying said register shiftable on said frame to a plurality of operating positions, actuating means for said register, drive means for said actuating means including a source of power and a clutch, controllable means having a normally inactive drive connection with a part of said actuating means for returning said carriage to an end position thereof from any other position thereof, and control means for said returning means including a key operable by a single manual stroke to engage said clutch and enable said drive connection.

16. In a calculating machine having a frame, a register mounted for endwise shifting movement on said frame, resetting means for said register, and shifting means for said register, in combination with register return and resetting means for controlling simultaneous operation of said shifting and resetting means to cause resetting of register and return of said register to an end position if displaced therefrom, said controlling means including a resetting control key and a shift control key mounted on said frame in juxtaposed relation for simultaneous depression by a single manual stroke.

17. In a calculating machine having a shiftable carriage, a register in said carriage, in combination shifting means for said carriage including a key, resetting means for said register including a second key mounted in juxtaposed relation to said first key for simultaneous operation therewith, and means responsive to depression of both of said keys for initiating operation of both said shifting and resetting means to cause resetting of said register and to invariably cause shifting of said carriage to an end position thereof, whereby said register is positioned in said end position and stands at zero registration.

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