

Aug. 25, 1942.

C. M. FRIDEN

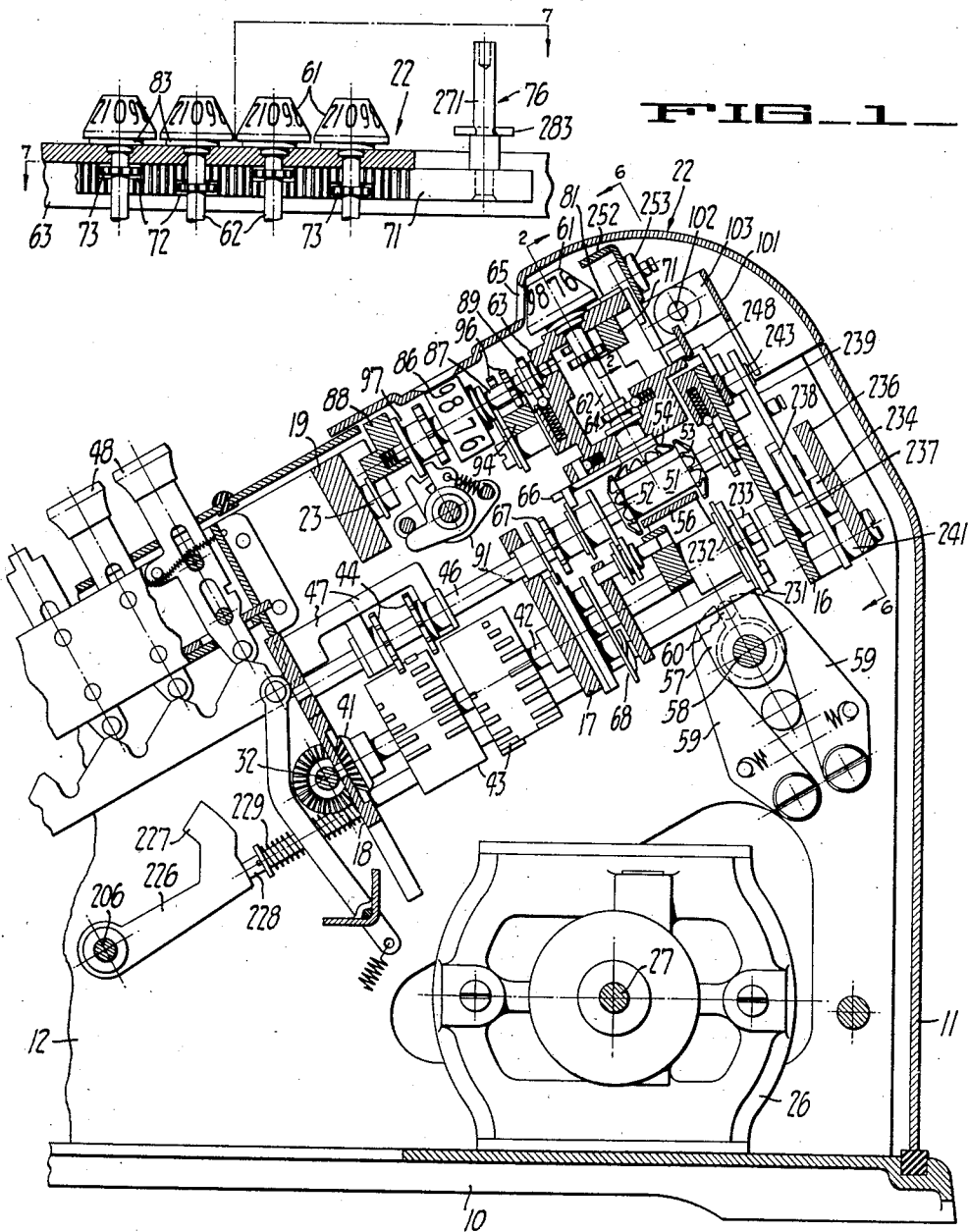
2,294,083

CALCULATING MACHINE

Filed Nov. 14, 1938

5 Sheets--Sheet 1

FIG. 2.



INVENTOR.
Carl M. Friden
BY Philip Harper Allen.
ATTORNEY

Aug. 25, 1942.

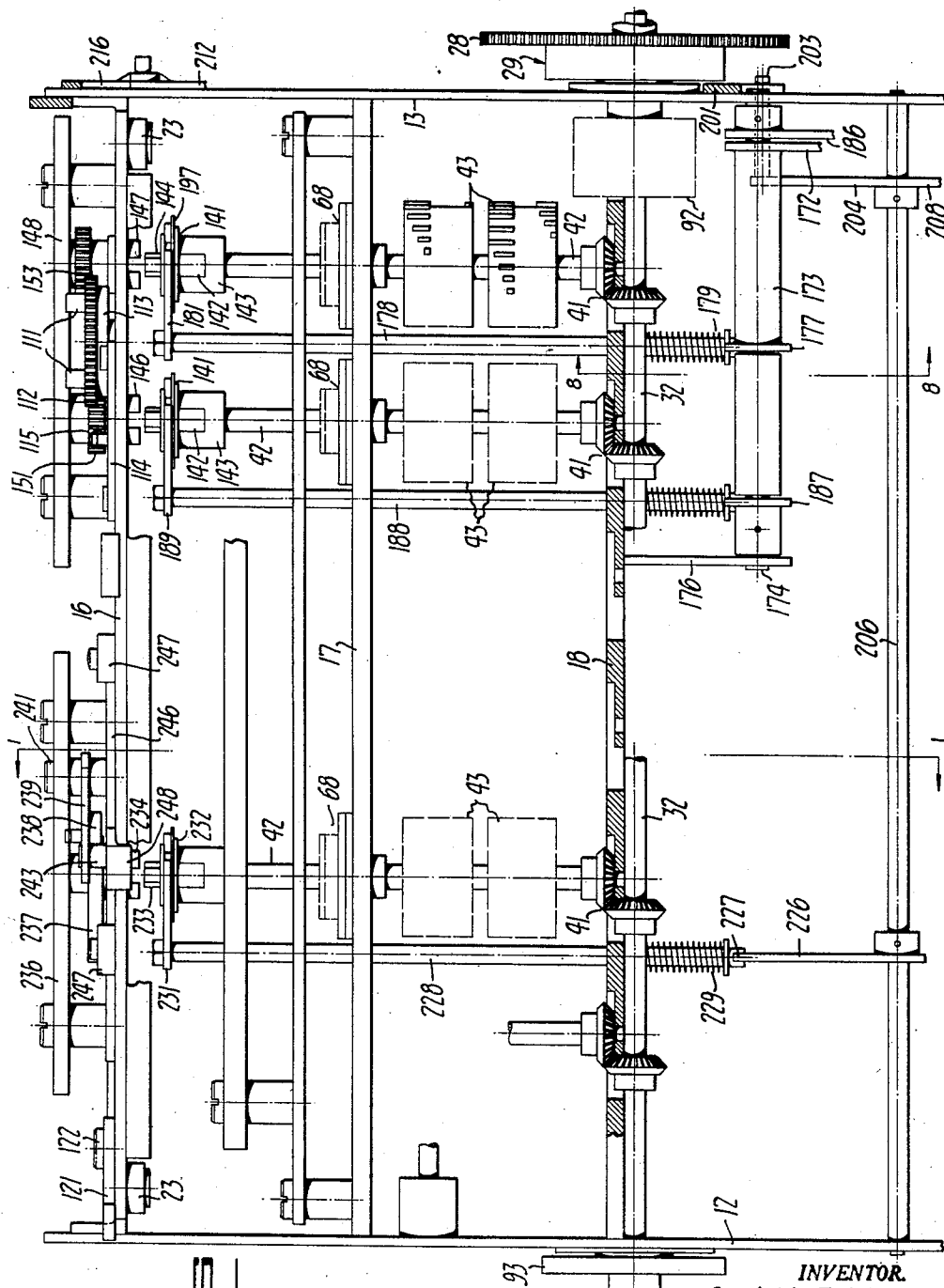
C. M. FRIDEN

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Filed Nov. 14, 1938

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FRIDEN

INVENTOR.
Carl M. Friden
BY *Philip Harper Allen*
ATTORNEY

Aug. 25, 1942.

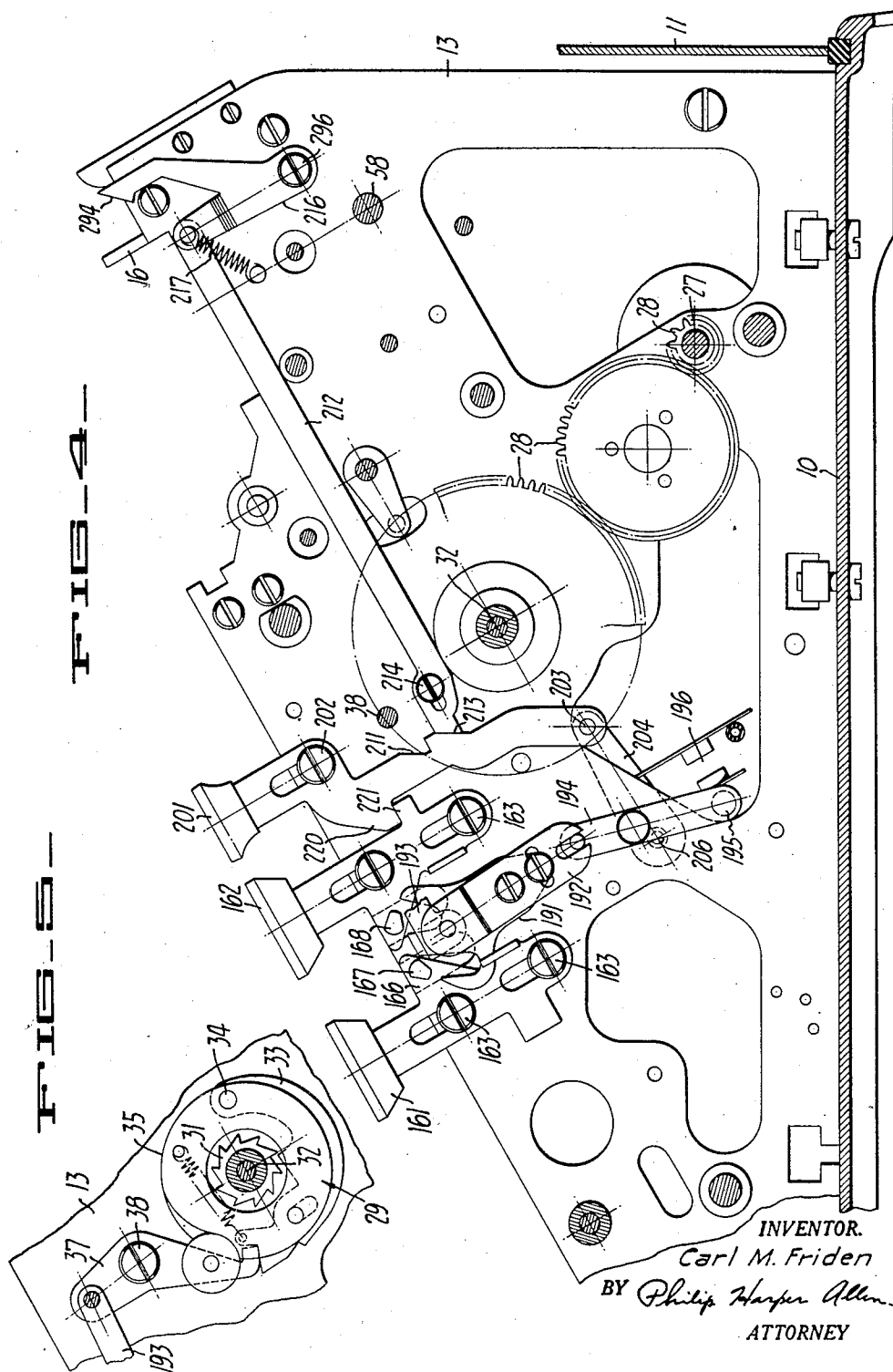
C. M. FRIDEN

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CALCULATING MACHINE

Filed Nov. 14, 1938

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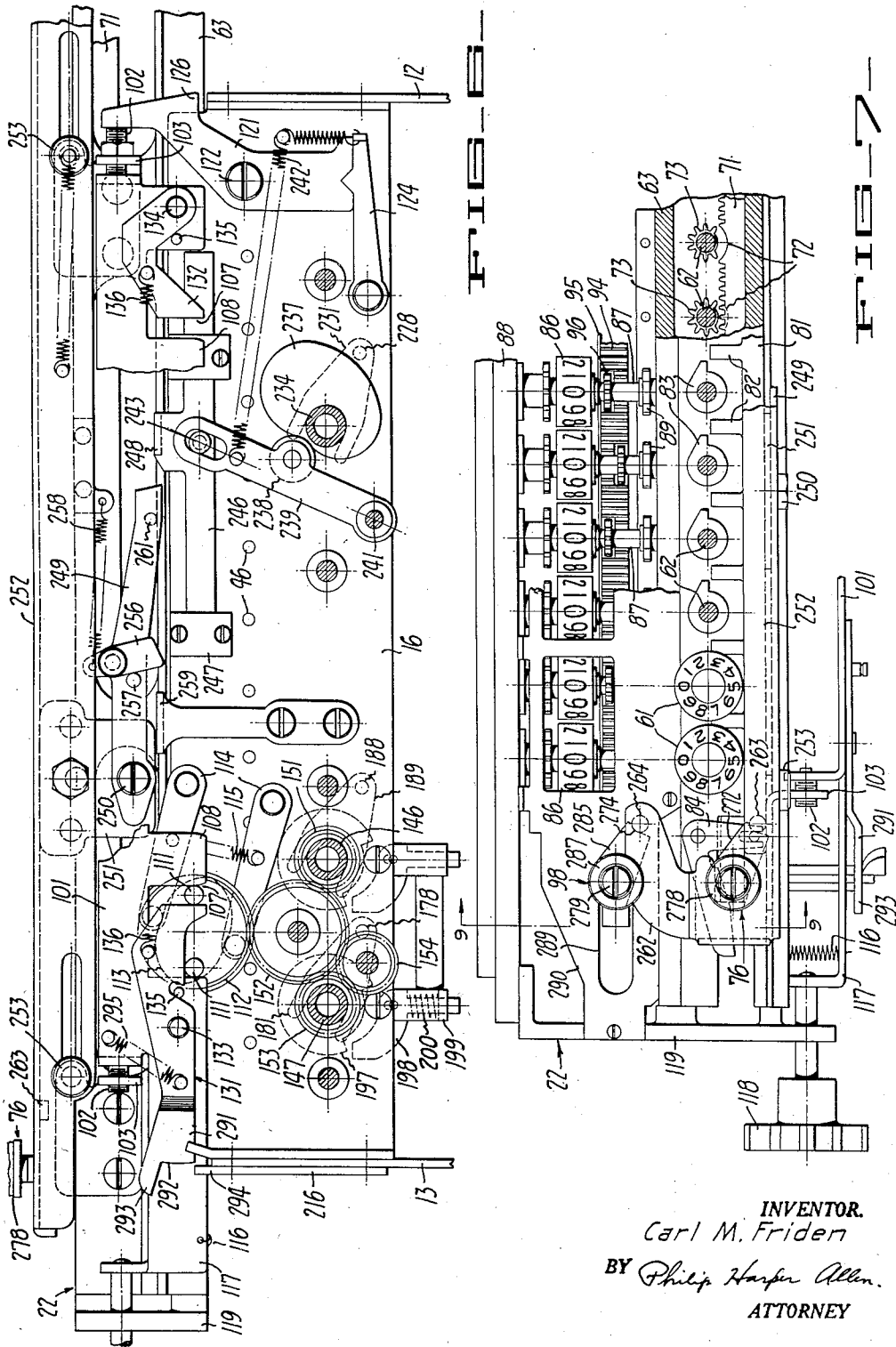
C. M. FRIDEN

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CALCULATING MACHINE

Filed Nov. 14, 1938

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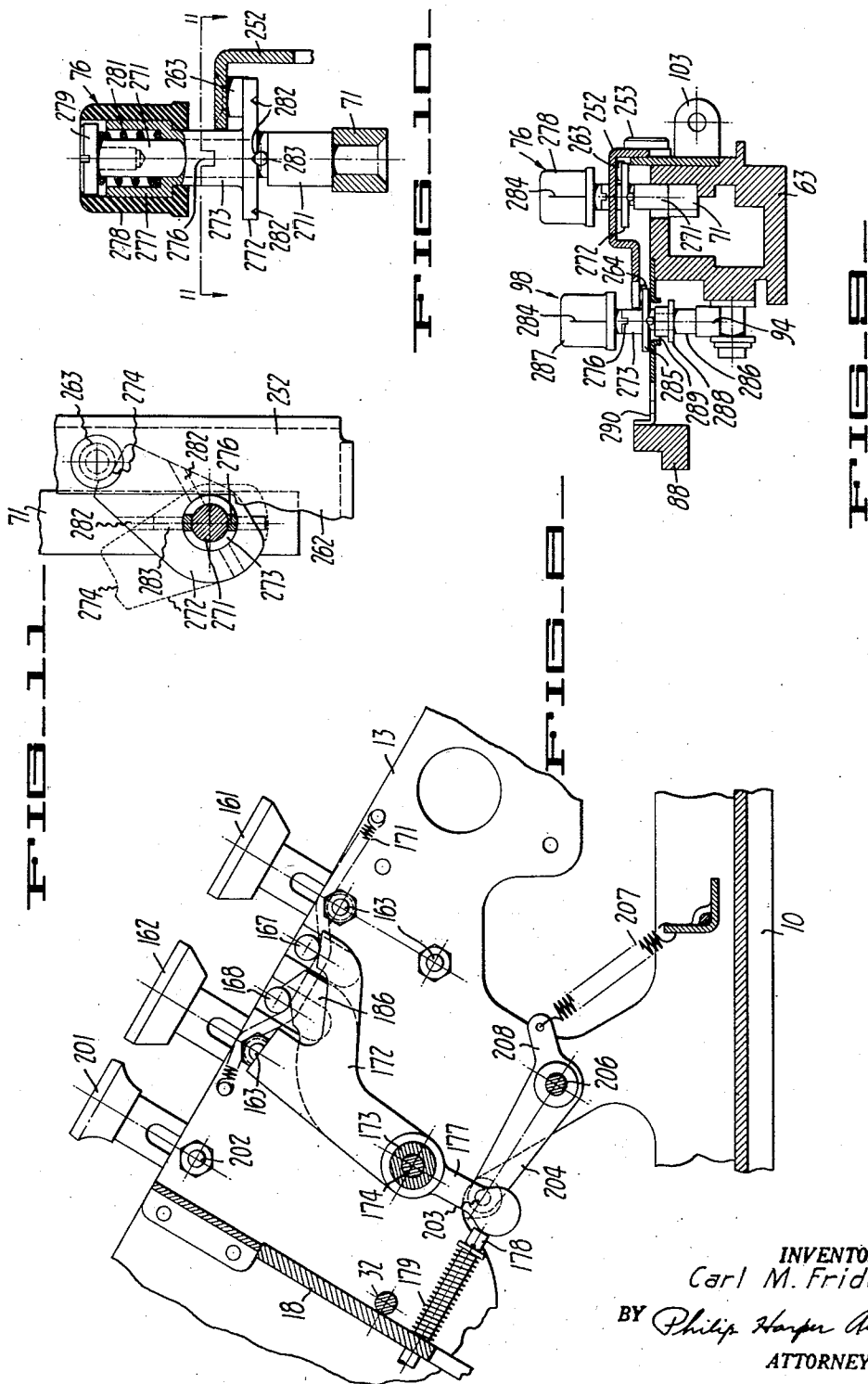
C. M. FRIDEN

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CALCULATING MACHINE

Filed Nov. 14, 1938

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INVENTOR.
Carl M. Friden
BY *Philip Harper Allen.*
ATTORNEY

UNITED STATES PATENT OFFICE

2,294,083

CALCULATING MACHINE

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

Application November 14, 1938, Serial No. 240,269

6 Claims. (Cl. 235—63)

This invention relates to calculating machines and is concerned more particularly with the provision of improved zero resetting mechanism for the registers thereof.

It is an object of the invention to provide an improved calculating machine in which one or more of a plurality of registers can be reset to zero by power operated mechanism.

Another object of the invention is to provide an improved calculating machine in which one or more of a plurality of shiftable registers can be reset to zero by a power operation including shifting of the registers to a predetermined position.

Another object of the invention is to provide an improved calculating machine in which one or more of a plurality of registers can be reset to zero by power operated mechanism having a single starting control key.

Another object of the invention is to provide improved power-operated normalizing mechanism for the registers of a calculating machine in which the normalizing operation can be performed selectively on any or all of the registers.

Another object of the invention is to provide a calculating machine having improved means for returning a shiftable carriage to a predetermined position.

Other objects will appear from the following description of a preferred embodiment of the invention, as illustrated by the accompanying drawings, in which:

Fig. 1 is a fragmentary longitudinal section thru the rear portion of the machine taken in the plane of line 1—1 in Fig. 3.

Fig. 2 is a sectional elevation of a part of the zero-setting means taken in the plane of line 2—2 in Fig. 1.

Fig. 3 is a plan view of the machine with certain parts such as the carriage and keyboard omitted, and others shown in section to show the frame and drive construction more clearly.

Fig. 4 is an elevational view of the shift and resetting controls.

Fig. 5 is an elevational view of the clutch mechanism, certain parts being shown in section.

Fig. 6 is a rear elevational view of the upper part of the machine, with certain parts omitted, and others shown in section, the plane of the view being indicated by the line 6—6 in Fig. 1.

Fig. 7 is a plan view of the right end of the carriage with the cover removed. Certain parts are broken away and others are shown in section to illustrate details of the construction, the sectionalized portions of the view being taken in planes indicated by the line 7—7 in Fig. 2.

Fig. 8 is a fragmentary sectional elevation of a part of the shift and resetting control means and is taken as indicated by the line 8—8 in Fig. 3.

Fig. 9 is a sectional view through the carriage taken in a plane indicated by the line 9—9 in Fig. 7.

Fig. 10 is an enlarged sectional view of a resetting control handle.

Fig. 11 is a sectional plan view taken in the plane of line 11—11 in Fig. 10.

Description of mechanism

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 controlling the entry of values in the registers. The frame includes base 10 (Fig. 1) which supports casing 11 and has left and right side frame plates 12, 13 (Figs. 1 and 3) mounted thereon. Side plates 12, 13 are connected by various cross frame brackets 16, 17, 18 and 19 which serve to mount various mechanisms referred to hereinafter. Register carriage 22 (Fig. 1) is mounted on frame brackets 16 and 19, as by rollers 23, for endwise shifting movement laterally of the machine in either direction to various ordinal positions as controlled by means described hereinafter.

Drive, actuating, and selecting mechanisms

The drive mechanism includes a source of power from which a single path of power leads to provide a cyclic clutch-controlled drive for all power driven parts of the machine. The source of power comprises electric motor 26 (Fig. 1) whose shaft 27 (Figs. 1 and 4) is connected by gearing 28 with a clutch indicated generally at 29 (Figs. 3 and 5). Clutch 29 comprises driving ratchet 31 journaled on shaft 32 and driven from gearing 28, and a driven element comprising spring-urged pawl 33 pivoted at 34 in disc means 35 carried by transverse shaft 32 journaled in side plates 12 and 13. The cyclic drive for shaft 32 is provided by engagement and disengagement of pawl 33 (Fig. 5) with ratchet 31 under the control of clutch control lever 37 pivoted at 38 on side plate 13. The clutch mechanism de-

scribed generally above is of the construction disclosed in my co-pending application Serial No. 145,979, filed June 2, 1937, but may be of any other suitable construction.

The clutch drives transverse shaft 32 to provide a cyclic uni-directional drive for the actuating means of both the accumulator and the revolutions counter, for the shift mechanism and for the zero resetting mechanism.

Shaft 32 (Figs. 1 and 3) has bevel gear connections 41 with longitudinally extending accumulator actuating shafts 42 suitably journaled in cross brackets 17 and 18. Each shaft 42 carries a pair of toothed actuating cylinders 43 for a pair of adjacent orders of the machine, and for cooperation with the teeth of each cylinder 43, a pair of ten tooth gears 44 are slidably and non-rotatably mounted on square shaft 46 which is suitably journaled in cross brackets 16, 17 and 18. As usual in this type of machine, a shaft 46 is provided for each order of the actuating means. Gears 44 are selectively positioned with respect to the associated stepped teeth of the actuating cylinder in a conventional manner by means including a pair of differential spring-urged slides 47 associated with each ordinal row of numeral keys 48. Intermediate brackets 16 and 17 each shaft 46 is provided with a spool 51 slidably and non-rotatably mounted thereon and having opposite bevel gears 52 and 53 for cooperation with numeral wheel gear 54 of the associated order of the accumulator mechanism.

It will be understood that a value corresponding to the value of the depressed key can be entered either positively or negatively in the accumulator by selective positioning of plus-minus gears 52, 53 in the conventional manner under control of transversely extending strap 56 which is carried by a pair of similar arms 57 secured on shaft 58, which is suitably journaled in the frame. Strap 56 and the series of plus-minus gears are urged to their central position shown in Fig. 1 by suitable centralizing means comprising opposed spring-urged arms 59 pivoted on plate 13 and engaging opposite sides of pin 60 on one of arms 57.

Accumulator mechanism

Accumulator.—The accumulator comprises a series of numeral wheels 61 (Figs. 1 and 2), each of which is carried at the upper end of a numeral wheel shaft 62 suitably journaled in carriage frame 63 and carrying a numeral wheel gear 54. Each shaft 62 has suitable spring-urged ball and gear centering means 64 to insure alignment of the displayed numeral on wheel 61 with sight opening 65 in the carriage cover.

Tens transfer.—Any suitable conventional form of transfer mechanism may be associated with the accumulator and its actuating means. In the form selected for illustration, the mechanism includes a transfer trip lever 66 (Fig. 1) mounted on carriage frame 63 in each order of the accumulator, a ten-tooth gear 67 on each of shafts 46 (except the lowest order), and a pair of transfer actuators 68 on each shaft 42. The above mechanism is of the type disclosed in said application Serial No. 724,482 and my co-pending application Serial No. 75,307, filed April 20, 1936.

Resetting means.—Means are provided in carriage 22 for resetting numeral wheels 61 to zero registration which includes means for restoring any displaced wheels 61 to zero position and means for arresting such wheels positively in zero position. The restoring means includes rack

bar 71 (Figs. 1, 2 and 7) mounted for endwise sliding movement in carriage frame 63 adjacent the upper ends of numeral wheel shafts 62. The teeth of rack bar 71 (Figs. 2 and 7) are cut away at 72 alternately at the top and bottom to form a plurality of separate racks for cooperation with mutilated gears 73 on numeral wheel shafts 62. Adjacent gears 73 are axially offset to cooperate with the adjacent vertically offset racks formed on rack bar 71 by cut away portions 72 thereof.

When rack bar 71 (Figs. 2 and 3) is in normal inactive position, gears 73 register with cut away portions 72 so that numeral wheels 61 can be actuated without interference. If rack bar 71 is moved to the right as viewed in Fig. 2, the unmutilated parts of gears 73 of any numeral wheels 61 displaced from zero position will be engaged by the associated racks on bar 71 and such displaced numeral wheels 61 are turned until restored to zero position. In this connection it will be noted that any numeral wheels 61 in zero position will not be moved by rack bar 71 because the mutilated portions of gears 73 of such numeral wheels face the rack bar. For manual operation rack bar 71 is provided with handle 76 (Fig. 2) by means of which bar 71 can be actuated against the tension of a suitable spring (not shown) which normally maintains bar 71 in inactive position.

The movement of bar 71 to the right as viewed in Fig. 2 to restore any displaced numeral wheels 61 to zero position also enables the means for arresting wheels 61 in such position. Stop slide 81 (Figs. 1 and 7) is mounted for limited endwise movement on top of carriage frame 63 by suitable pin and slot connections, and is provided with a stop projection 82 (Fig. 7) for each numeral wheel 61. Each numeral wheel shaft 62 has a stop tooth 83 secured thereon for cooperation with projections 82 in the zero position of the numeral wheels 61. Slide 81 is held normally in inactive position by suitable spring means so that each projection 82 is out of the path of the associated tooth 83. To provide for movement of projections 82 into the path of teeth 83 when zeroizing the numeral wheels, slide 81 is pivotally connected to bell crank 84 (Fig. 7) having one arm disposed in the path of bar 71, so that when bar 71 is moved to restore numeral wheels 61 to zero position, slide 81 is moved to arrest wheels 61 in such position.

Thus, the accumulator register can be reset to zero registration manually by manipulation of handle 76. The power operation of the resetting or zeroizing means is described hereinafter.

Revolutions counter mechanism

Counter and counter actuator.—The revolutions counter which is also mounted in carriage 22 comprises numeral wheels 86 (Figs. 1 and 7) on respective shafts 87, which are journaled in carriage frame 63 and bar 88 supported thereon by suitable end plates 119. A numeral wheel 86 is provided for each ordinal position of the carriage, and the displayed numeral of each wheel 86 (Fig. 1) is maintained in alignment with the associated sight opening by ball and gear means 89. The number of actuations of the accumulator are registered in counter numeral wheels 86 (Fig. 1) by an actuator of conventional construction indicated generally at 91 and driven in a well known manner from transverse shaft 32 by cam cylinder 92 (Fig. 3) and cam disc 93.

Resetting means.—Means are provided for resetting numeral wheels 86 (Figs. 1 and 7) of the

counting register to zero, which is similar in construction and operation to that described in connection with accumulator wheels 61, and may include manually operable rack bar 94 and stop slide 95 suitably mounted in the carriage for co-operation with mutilated gears 96, and stop teeth 97 on shafts 97. Rack bar 94 carries upright handle 98 to provide for manual operation thereof.

The revolutions counter mechanism is of the type shown and described in said application, Serial No. 724,482.

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 is driven from the clutch through the actuating means for entering values into the accumulator.

Carriage 22 (Figs. 6 and 7) has plate or rack 101 mounted along the rear side thereof by means of adjusting screws 102 threaded in brackets 103 on carriage frame 63 and having smooth ends pivotally engaged with the bent ends of plate 101. Plate 101 has vertical slots 107 formed in the lower edge thereof by teeth 108, slots 107 being spaced apart a distance equal to the ordinal spacing of the machine and aligned with shafts 46. Slots 107 are adapted for engagement by opposite shift pins 111 (Figs. 3 and 6) on shift gear 112, which is journaled on frame bracket 16 and is rotated by means described later to effect shifting of the carriage. One half revolution of gear 112 effects one ordinal spacing of carriage 22 and to provide for accurate centering of the carriage at the end of a shift, centralizing cam 113, is mounted for rotation with gear 112, and centralizing arms 114 pivoted on bracket 16 have suitable rollers at their free ends engaging opposite sides of cam 113 under the influence of spring 115 tensioned between arms 114. When pins 111 are in horizontal alignment the carriage is properly positioned.

The manual release of the carriage for free shifting movement is effected by rocking plate 101 out of engagement with pins 111 of shift gear 112. Plate 101 is maintained resiliently in operative position by spring 116 (Fig. 7), tensioned between carriage frame 63 and end extension 117 of plate 101. Carriage release handle 118 (Fig. 7) is journaled in carriage end plate 119 in axial alignment with screws 102 forming the pivotal axis for plate 101, and has its inner end rigidly but removably connected to the bent end of extension 117 of plate 101. Thus by turning handle 118, plate 101 can be moved out of engagement with pins 111 to permit free shifting movement of the carriage.

Resilient bumper means is provided for preventing shifting of the carriage beyond its left end position, to which it is usually returned to begin a calculation. Bumper lever 121 (Fig. 6) is pivoted at 122 on bracket 16 and has its upper end positioned for engagement with the head of adjusting screw 102 when the carriage is in its left end position, (to the right as viewed in Fig. 6). The lower end of lever 121 is notched for engagement by the nose of spring-urged centering arm 124 which maintains bumper lever 121 resiliently in the position shown. The movement of lever 121 when struck by screw 102 is limited by the engagement of abutment 126 thereof with the top of frame plate 12.

Yieldable means are provided to prevent attempted shifting of the register carriage beyond the lowest and highest ordinal positions thereof during power operation of the shifting means. End slots 107 are formed in part by end teeth 108 and in part by respective pawls 131, 132 which are pivoted at 133, 134, respectively on plate 101 and extend inwardly to position the straight end edges thereof opposite end teeth 108 to form end slots 107. Pawls 131, 132 are held resiliently in the position shown against stop pins 135 by spring 136, connected therebetween. When carriage 22 is in the end position shown in Fig. 6, one pin 111 lies in an end slot 107 and the other is positioned beneath adjacent pawl 131 in engagement with a cam edge thereof. In this condition rotation of shift gear 102 and pins 111 in a direction to move the carriage beyond the end position merely results in oscillating pawl 131. However, upon rotation of gear 112 in a direction to effect carriage shifting to an intermediate ordinal position, the end edge of pawl 131 positively resists the pin 111 in end slot 107 and carriage shifting results. A similar action occurs if the carriage is in its other end position to place shift gear 112 adjacent pawl 132. It is seen, therefore, that the carriage cannot be shifted beyond either end position thereof by operation of shift gear 112. The oscillation of pawl 131 is used in a manner described hereinafter to control stopping of the machine in carriage shifting operations after the carriage has entered the adjacent end position.

As stated above, shift gear 112 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 42 (Fig. 3) are extended rearwardly and have respective collars 143 secured adjacent the ends thereof. Each collar 143 is provided with opposite slots slidably engaged by corresponding teeth 142 of a shiftable drive establishing collar 141 mounted freely on the end of shaft 42. Opposite teeth 142 thereof, each collar 141 has smaller teeth 144 adapted for engagement with corresponding slots in respective gear sleeves 146, 147, which are journaled in frame bracket 16 and small plate 148 mounted on member 16 by suitable spacers and fastening screws. Gear sleeve 146 (Figs. 3 and 6) has gear 151 meshing with idler gear 152 (Fig. 6) journaled in bracket 16 and plate 148 and meshing with shift gear 112. Gear sleeve 147 (Figs. 3 and 6) has gear 153 (Fig. 6) offset axially from idler gear 152 and meshing with wide reverse idler gear 154 suitably journaled in bracket 16 and plate 148 and also meshing with idler gear 152. Thus, rotation of gear sleeve 146 in a clockwise direction as viewed in Fig. 6 causes clockwise rotation of shift gear 112 and shifting of carriage 22 to the left as viewed from the front of the machine. Correspondingly, rotation of gear sleeve 147 in a clockwise direction as viewed in Fig. 6 effects counter clockwise rotation of shift gear 112 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 146, 147 (Fig. 3) and collars 143 upon selective shifting of respective shiftable collars 141, carriage 22 can be shifted in either direction. The gear ratios are so chosen that one rotation of actuating shafts 42 effects one-half rotation of shift gear 112.

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 161, 162 (Figs. 4 and 8) are depressible to initiate shifting of the carriage to the right and left respectively as viewed from the front of the machine. 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 161, 162 (Fig. 4) are mounted for endwise movement by suitable longitudinal slots formed therein and engaged by a plurality of studs 163 secured on frame plate 13. Keys 161, 162 have adjacent ears 166 with respective studs 167, 168 mounted therein and extending to either side thereof. To maintain the shift keys resiliently in raised position, coil spring 171 (Fig. 8) is provided having its end fastened to side plate 13 and passing over upper studs 163 and under the ends of studs 167, 168 which extend through suitable slots in side plate 13.

To enable the drive connection from the actuating means to the carriage shifting mechanism upon depression of shift key 161, stud 167 (Fig. 8) engages the upper end of arm 172 secured on sleeve 172 (Figs. 3 and 3). Sleeve 173 is journaled on transverse shaft 174 which is suitably journaled at its ends in side plate 13 and bracket 176 on cross bracket 16. At its left end, sleeve 173 is provided with depending arm 177 (Fig. 8) having its rounded end in engagement with the front end of rearwardly extending rod 178 (Figs. 3 and 8). Rod 178 is mounted for sliding movement in cross brackets 17, 18 and is resiliently urged to its forward position by spring 179 compressed between cross member 16 and a suitable washer on rod 178. At its rear end, rod 178 (Figs. 3 and 6) has shift fork 181 secured thereon with its forked end in engagement with an annular groove in right-hand shiftable collar 141. From the foregoing description, it is seen that depression of key 161 is effective through stud 167 to rock arm 172, sleeve 173 and arm 177 to move rod 178 rearwardly. Such rearward movement of rod 178 is effective through shift fork 181 to engage teeth 144 of right-hand shift collar 141 with corresponding slots in gear sleeve 147. Thus, initial depression of shift key 161 is effective to enable a drive connection from the actuating means to the carriage shifting mechanism, and to determine shifting of the carriage to the right.

A similar mechanism is employed in connection with shift key 162 to enable the drive connection to determine shifting of the carriage to the left. Stud 168 (Fig. 8) is engaged with the upper end of arm 186 having its hub secured on shaft 174. At its left end, shaft 174 (Fig. 3) has depending arm 187 (similar to arm 177) secured thereon in operative relation with shift rod 188 having shift fork 189 at its rear end in engagement with an annular groove in left-hand shift collar 141. It is seen, therefore, that depression of key 162 results in rocking of shaft 174 and rearward movement of rod 188 to engage left-hand shift collar 141 with gear sleeve 146. 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 144 with the corresponding slots in gear sleeves 146, 147 so that the drive connection is enabled during the first part of the downward movement of keys 161, 162.

The latter part of the downward movement of shift keys 161, 162 is utilized to engage the clutch

and energize the motor. Stud 167, 168 (Fig. 4) overlie respective cam surfaces at the upper end of lever 191, which is adjustably secured by suitable means on lever 192 pivoted on side plate 13. From the relation of studs 167, 168 and lever 191, it is evident that depression of either of keys 161, 162 is effective during the latter part of the movement to rock levers 191, 192 in a clockwise direction. Lever 192 is connected at its upper end by link 193 (Figs. 4 and 5) with clutch control lever 37 so that movement of link 193 and lever 37 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 192 (Fig. 4) which has a pin and slot connection with lever 194 having pin 195 mounted adjacent contacts 196 of the motor circuit.

Suitable means of conventional construction 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 141 is provided with a similar mechanism, one of which will be described generally. Right-hand shiftable collar 141 (Figs. 3 and 6) is provided with disc 197 having a cut away portion which, in the full cycle position of collar 141 is in the position illustrated in Fig. 6. Immediately to the rear of disc 197, locking element 198 is provided mounted in bracket 199 for movement radially of collar 141, and urged to its extended position by spring 200. With shiftable collar 141 in its inactive position disc 197 is positioned forwardly of locking element 198 which is aligned with the cut away portion of disc 197. When collar 141 is shifted rearwardly of the machine to its active position it passes by element 198 and upon subsequent rotation of disc 197, the solid portion thereof engages element 198 and prevents movement of collar 141 forwardly of the machine so that teeth 144 are maintained in engagement with gear sleeve 147 for one or more complete revolutions or cycles irrespective of release of the associated shift key before the end of a cycle. Left hand shiftable collar 141 is held in drive establishing position for each cycle of rotation by similar mechanism.

From the foregoing description it is seen that keys 161, 162 and the associated mechanism provide means for shifting the carriage selectively in either direction from one ordinal position of the carriage to another. As will now be described, the shift mechanism is utilized in normalizing the machine after a calculating operation.

Normalizing mechanism

Means are provided for restoring the machine to normal condition between successive operations by shifting the carriage to a predetermined position and by then effecting zero resetting of either the accumulator or the revolutions counter or both of these registers, as determined by settable control means, the operation being carried out by power driven means under control of a manually operable register return and resetting key.

Return and resetting key 201 (Fig. 4) 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 201 is

latched in depressed position until the carriage return and resetting operations are completed when the latch is automatically released. Key 201 is mounted on side plate 13 adjacent shift key 162 for substantially endwise movement. For this purpose, key 201 is slotted adjacent its upper end for engagement by stud 202 and at its lower end is pivotally connected at 203 to arm 204 (Figs. 4 and 8) on shaft 206. Key 201 is urged to its raised position by spring 207 (Fig. 8) secured to extension 208 of arm 204. Intermediate its ends, key 201 (Fig. 4) is provided with latching notch 211 for cooperation with latching slide 212. In the raised position of key 201, slide 212 has its nose engaged with cam surface 213 on key 201 below notch 211. Slide 212 is mounted for endwise sliding movement by means of pin 214 engaging a slot at the front end of slide 212 and by a pivotal connection at its rear end with latch releasing member 216 referred to hereinafter. Spring 217 tensioned between a pin on side plate 13 and the rear end of slide 212 urges slide 212 to active position so that upon depression of key 201, slide 212 will engage latching notch 211 and maintain key 201 in depressed position until slide 212 is retracted by means described hereinafter.

To initiate the carriage return determined by depression of key 201, shoulder 220 (Fig. 4) on key 201 overlies lug 221 of shift key 162, so that the shift key is depressed with key 201 and will also be latched in depressed position as described above. It will be recalled that depression of shift key 162 serves to engage the clutch and enable the motor circuit so that the machine drive will start.

Before the drive starts, however, the depression of key 201 serves to enable the drive connection from the actuating means to the zero resetting drive means mounted on the frame of the machine. For this purpose, shaft 206 (Figs. 1 and 3) which is rocked upon depression of key 201 carries arm 226 having its cam end 227 operatively related to rod 228 slidably mounted in brackets 17 and 18 and normally positioned as shown in Fig. 1 by spring 229. At its rearward end, rod 228 carries fork 231 operatively engaged with shiftable toothed collar 232 similar to collars 141 of the shift mechanism and similarly mounted on one of actuating shafts 42. Teeth 233 of collar 232 are engageable with the slotted end of sleeve 234 (Figs. 1, 3 and 6) suitably journaled in bracket 16 and plate 236 secured thereon. Sleeve 234 (Fig. 6) carries cam 237 which is engaged by roller 238 on arm 239 pivoted at 241 on bracket 16 and urged toward cam 237 by spring 242.

The upper end of arm 239 (Figs. 1 and 6) is slotted to engage roller 243 suitably journaled on slide 246 mounted for endwise movement on bracket 16 by small brackets 247. Slide 246 has laterally bent actuating extension 248, and when carriage 22 is in its left end position as illustrated in Fig. 6, extension 248 is in operative relation with arm 249 pivoted at 250 on bracket 251 depending from a resetting drive member comprising slide 252. Slide 252 has an L-shaped cross section and is mounted for endwise sliding movement on carriage frame 63 by spaced studs 253. As described later, reciprocation of slide 252 can be utilized to reset either or both of the registers. Arm 249 has "live" pawl 256 pivoted thereon intermediate its ends and urged against pin 257 by spring 258 tensioned between pawl 256 and a suitable lug on slide 252. Pawl 256

is adapted to cooperate with fixed ledge 259 mounted on bracket 16 to lift arm 249 out of the path of extension 248 during movement of the carriage into its end position. Spring 258 also urges arm 249 to the position shown with pin 261 engaged with a surface of carriage frame 63. With the parts positioned as illustrated in Fig. 6, it is seen that upon movement of slide 246 to the left, lateral extension 248 will engage the end of arm 249 to reciprocate resetting drive slide 252. The reciprocation of slide 252 is effected in the first cycle during which the carriage is in the end position shown in Fig. 6.

Slide 252 (Figs. 6, 7, and 9) may be operatively related to either or both of resetting rack bars 71 and 94 by the adjustment of settable control means to adjust the connections therebetween. For this purpose one end of slide 252 is provided with lateral extension 262 (Figs. 7 and 9) projecting transversely of bars 71 and 94 and provided with respective pins 263 and 264 providing abutments for driving the rack bars. Preferably, the settable control means for engagement with pins 263 and 264 comprise the operating handles 76 and 98 for bars 71 and 94 and as these are of generally similar construction only one will be described in detail. Handle 76 (Figs. 9-11) comprises post 271 secured in upright position at one end of rack bar 71 and having its upper end of reduced diameter. Connecting arm 272 (Figs. 10 and 11) has its hub 273 pivoted on post 271 and at its end has seat 274 for engagement with pin 263 as shown in full lines in Fig. 11. Hub 273 is notched to receive teeth 276 of sleeve 277 which is pressed in knurled handle 278, all of the parts being held on post 271 by screw 279 threaded in the upper end of the post, and being urged downwardly by spring 281 compressed between screw 279 and sleeve 277.

Resilient latch means is provided for locating handle 278 and arm 272 in either of the adjusted positions shown in Fig. 11. For this purpose arm 272 is provided on its lower surface with angularly spaced radial grooves 282 for cooperation under the influence of spring 281 with pin 283 extending thru post 271. To indicate visually its adjusted position handle 278 may be provided with index 284.

Handle 98 is similarly constructed being provided with connecting arm 285 mounted on post 286 and having adjusting handle 287. Roller 288 is journaled on post 286 for engagement in flanged groove 289 of strap brace 290 secured between carriage frame 63 and bar 88, whereby an additional bearing is provided to guide the movement of rack bar 94.

From the foregoing it is seen that by selective adjustment of connecting arms 272 and 285, operation of either or both of rack bars 71 and 94 by slide 252 can be predetermined, so that both the accumulator or the revolutions counter, or either of them, will be reset to zero upon depression of key 201.

It will be recalled that key 201 is latched in depressed position during shifting of the carriage to its end position, if displaced therefrom, and means is provided to release the latch during the first cycle of operation of the actuating means when in said end position.

To effect the latch release, pawl 131 (Fig. 6) has arm 291 terminating in shoulder 292 and latch releasing extension 293. Extension 293 overlies cam arm 294 (Fig. 4) of latch releasing bell crank 216 which is pivoted at 296 on side plate 13. It will be recalled that with the car-

riage in the end position shown in Fig. 6, pawl 131 is oscillated during each cycle of operation of the actuating means by the pin 111 engaged therewith. As arm 291 of pawl 131 moves downwardly shoulder 292 moves into operative engagement with side plate 13 and extension 293 contacts cam end 294 (Fig. 3). The engagement of shoulder 292 with plate 13 blocks unnecessary movement of the carriage because of the actuation of either of resetting bars 71 or 94, and the engagement of the extension 293 with cam surface 294 rocks latch release bell crank 216 so that latch slide 212 is moved to the right to release key 201. Spring 295 aids spring 136 in restoring pawl 131 quickly to the position shown.

Operation

As a preliminary to the operation of the normalizing mechanisms, handles 278 and 287 must be adjusted in accordance with the desired resetting operations to be performed. Assuming that it is desired to reset both the accumulator and the counter handles 278 and 187 are adjusted as shown in Fig. 7 with connecting arms 272 and 285 operatively engaged with pins 263 and 264 on slide 252. With the parts properly adjusted, key 201 is depressed to initiate the normalizing operation. Return and reset key 201 (Fig. 4) when depressed is latched in depressed position by slide 212 until it is released as described hereinafter. The depression of key 201 thru arm 204 (Fig. 3), shaft 206 (Figs. 1 and 3) and arm 226 moves rod 228 rearwardly to engage shiftable collar 232 with cam hub 234. The drive connection for the zero resetting drive member is therefore established.

Depression of key 201 (Fig. 4) thru shoulder 220 and lug 221 also depresses shift key 162 to enable the carriage shifting mechanism for shifting the carriage to the left. Such depression of shift key 162 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 162 merely serves to enable the drive for one cycle of operation. During this cycle, slide 246 (Fig. 6) actuates drive member or slide 252 which thru connecting arms 272 and 285 operates resetting bars 71 and 94 to restore numeral wheels 61 and 86 to zero registration, and a pin 111 (Fig. 6) oscillates pawl 131 to actuate latch releasing member 216 to unlatch key 201 and thereby shift key 162. 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. 6) follows as well as reciprocation of arm 239 and slide 246. The reciprocation of slide 246 is ineffective until the carriage is returned to its left end position because arm 249 is not engaged by extension 248 of slide 246 until shifting of the carriage is completed. This action is provided by the engagement of pawl 256 with ledge 259 so that arm 249 is lifted during the portion of the carriage travel when premature actuation of arm 249 could occur.

During the last part of the last shifting cycle, arm 249 drops to active position so that the next reciprocation of slide 246 is effective to engage extension 248 with arm 249 and effect the resetting operation. Also, during this cycle, pawl 131 is oscillated to actuate latch releasing member 216 and release key 201 so that key 201 and

shift key 162 are free to rise and the operation stops at the end of that cycle.

Thus, depression of key 201 initiates a normalizing operation which includes the returning of the carriage to its left end position, selective resetting of either or both of the accumulator and the revolutions counter and release of key 201.

It will be seen that the above described mechanism can also be employed for returning the carriage to its left end position without resetting either of the registers. If this operation is desired, connecting arms 272 and 285 are both adjusted out of operative relation with studs 263 and 264. Key 201 will then operate as a carriage return key, and the reciprocation of slide 252 is idle.

I therefore claim as my invention:

1. In a calculating machine, a series of numeral wheels, a resetting member movable to reset said numeral wheels to zero registration, a manually operable handle on said resetting member, a second series of numeral wheels, a second resetting member movable to reset said second series of numeral wheels to zero registration, a manually operable handle on said second resetting member, an operating member for selective cooperation with said resetting members to effect resetting movement thereof, and an adjustable connection between each of said resetting members and said operating member including adjustable means carried by each of said handles for controlling the operative relation between the associated resetting member and said operating member.

2. In a calculating machine, a register frame, a series of numeral wheels mounted in said frame, zero resetting means for said numeral wheels including a rack mounted for endwise movement on said frame, a manually operable handle on said rack, an operating slide mounted for endwise movement on said frame, and adjustable means carried by said handle for connecting said rack to said slide for operation thereby.

3. In a calculating machine, a register frame, a series of numeral wheels mounted in said frame, zero resetting means for said numeral wheels including a rack mounted for endwise movement on said frame, a manually operable handle on said rack, an operating slide mounted for endwise movement on said frame, said handle, including a sleeve mounted for rotative adjustment, an abutment on said slide, and an arm movable by said sleeve into and out of operative relation with said abutment.

4. In a calculating machine, a frame, a carriage mounted for endwise shifting movement on said frame, means for shifting said carriage, a plurality of registers on said carriage, zero resetting means on said carriage for each of said registers, a drive member on said carriage, means for selectively connecting said drive member with any one or all of said resetting means, a drive element on said frame for operating said drive member in one position of said carriage, and control means for determining shifting of said carriage into said one position if displaced therefrom and for enabling the drive for said drive element.

5. In a calculating machine, a frame, a carriage mounted for endwise shifting movement on said frame, a plurality of registers on said carriage, zero resetting means for each of said registers, means for shifting said carriage, control means cooperatively related to said shifting and

resetting means for simultaneously initiating operation thereof, and settable means for determining operation of any one or all of said resetting means.

6. In a calculating machine, a frame, a carriage mounted for endwise shifting movement on said frame, a plurality of registers on said carriage, zero resetting means for each of said registers, means for shifting said carriage, and control means cooperatively related to said shifting and resetting means for controlling a combined oper-

ation thereof, said control means including a manually operable key and means invariably responsive to depression of said key for causing return of said carriage to an end position thereof, said control means also including a settable element operatively related to each of said resetting means for selectively controlling operation of the associated resetting means in combination with the return of said carriage.

CARL M. FRIDEN.