

Oct. 24, 1933.

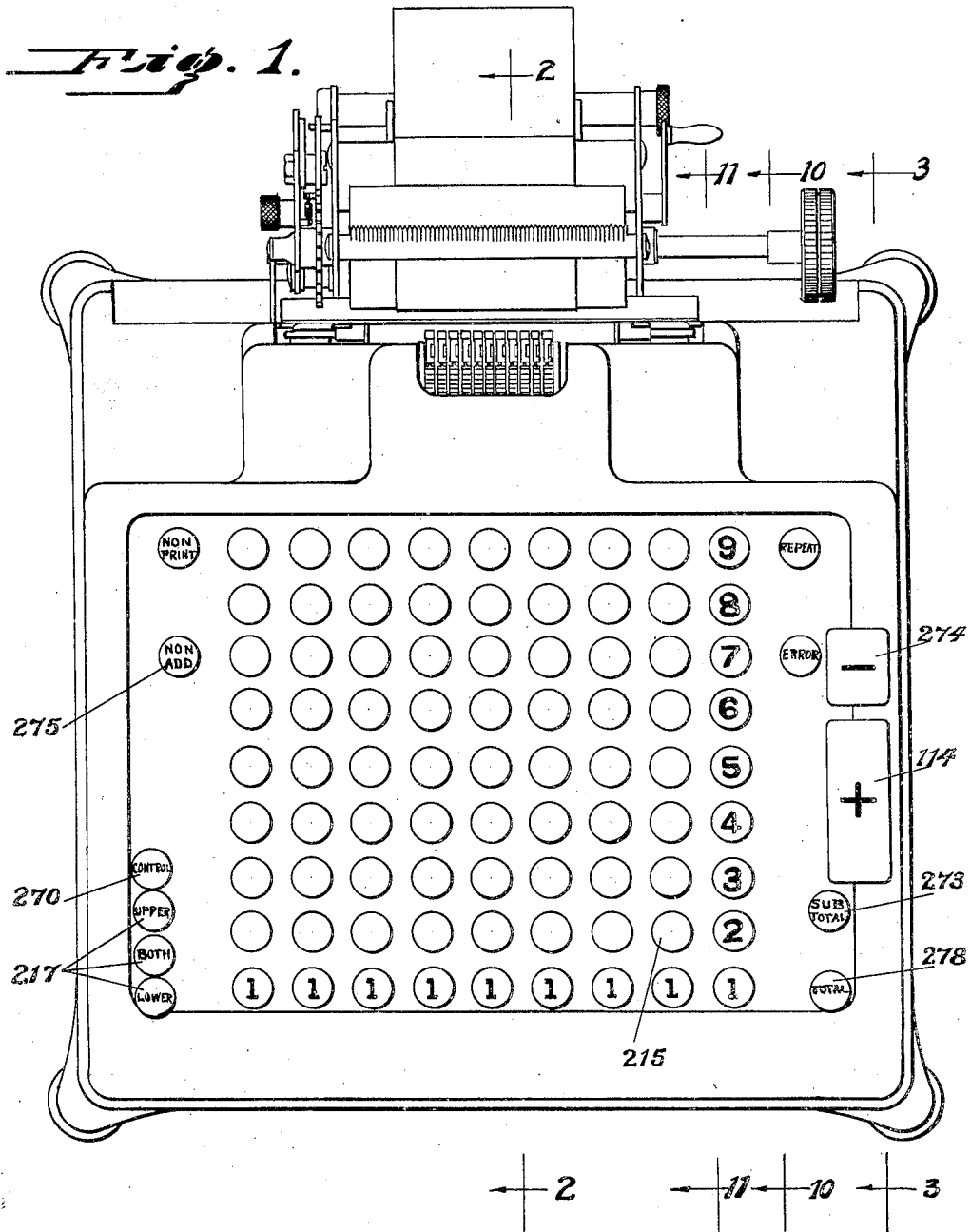
L. P. CROSMAN

1,932,013

REGISTER

Filed Feb. 25, 1931

8 Sheets-Sheet 1



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Oct. 24, 1933.

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8 Sheets-Sheet 2

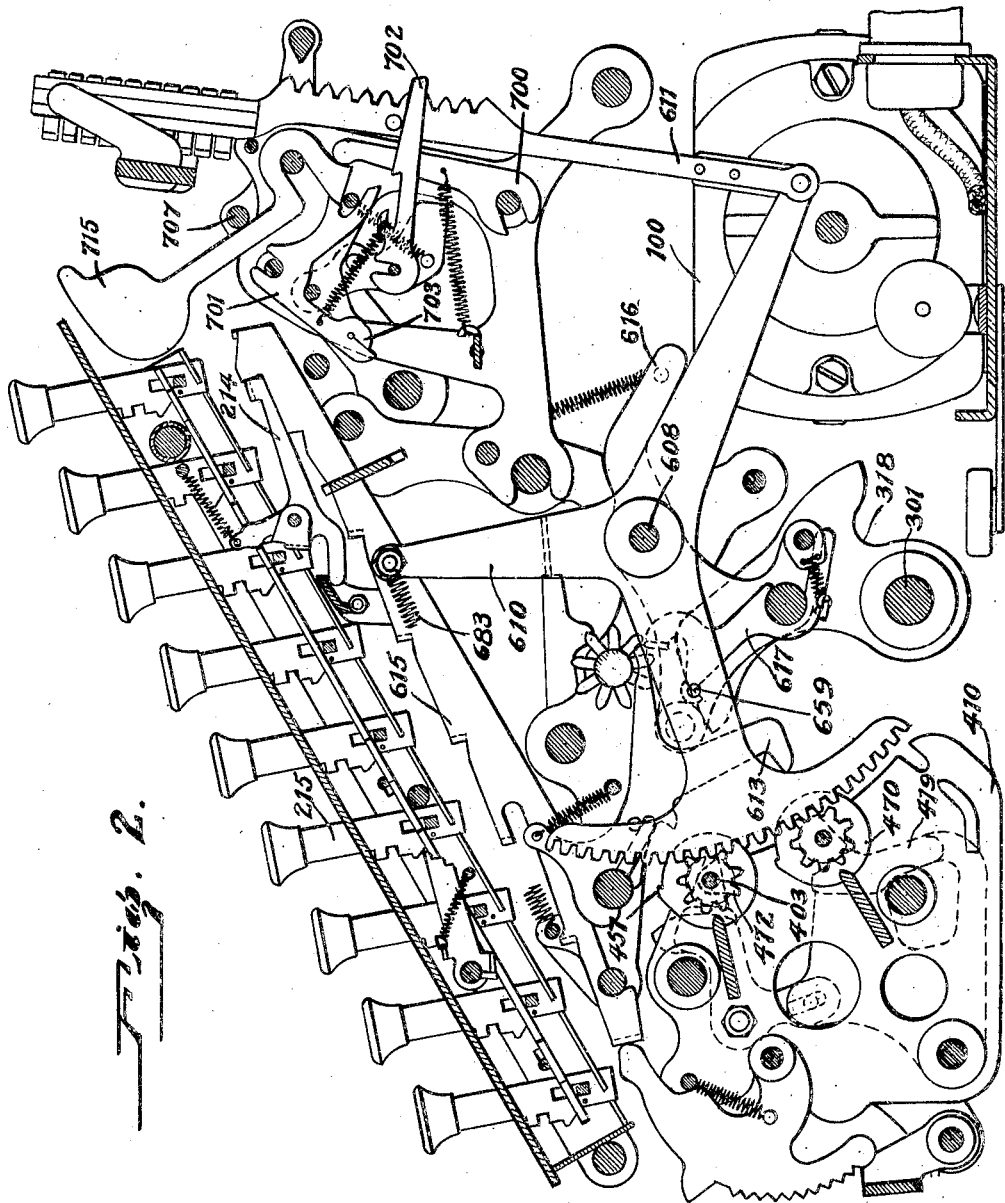


Fig. 2.

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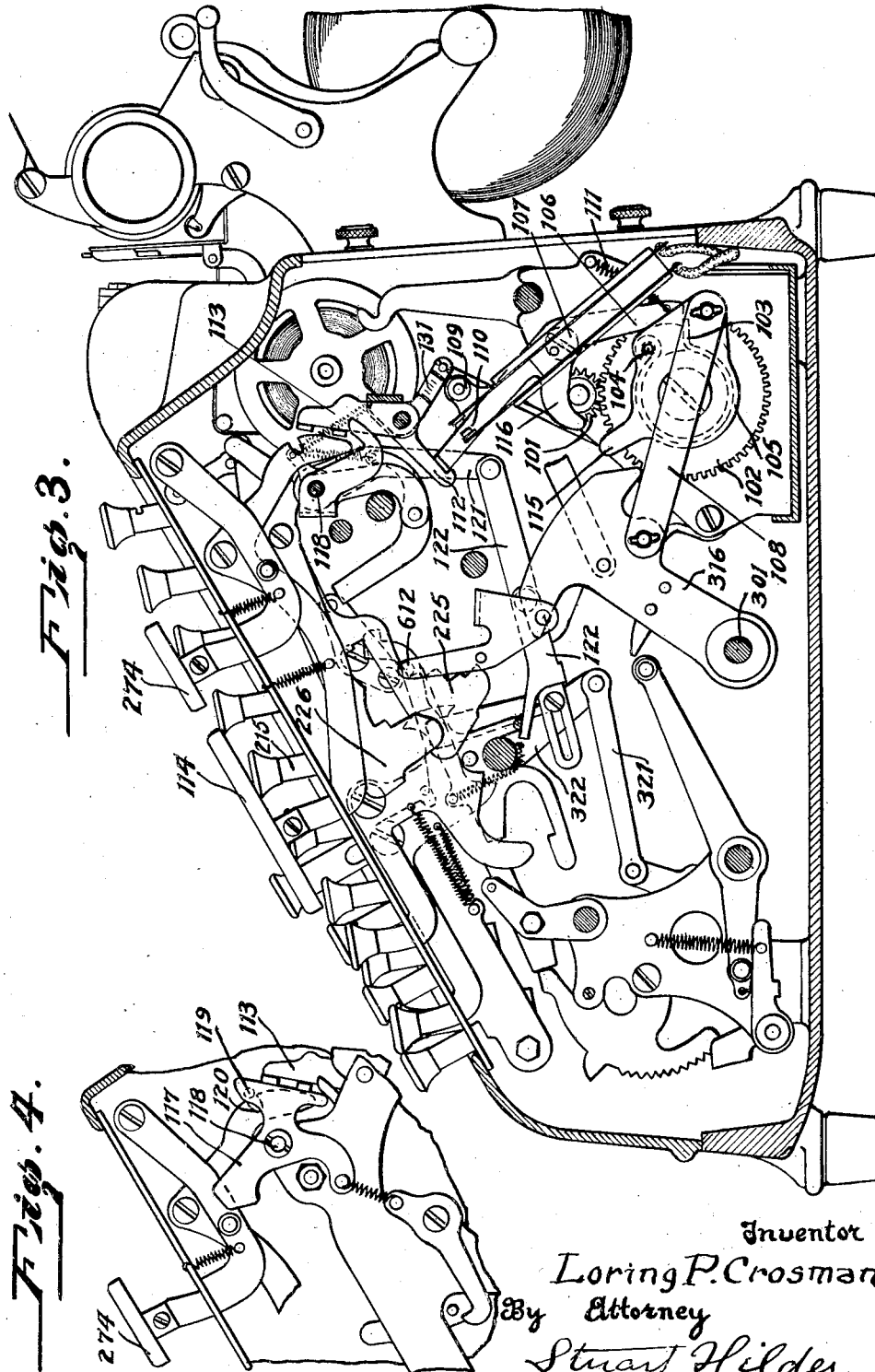
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8 Sheets-Sheet 3



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8 Sheets-Sheet 4

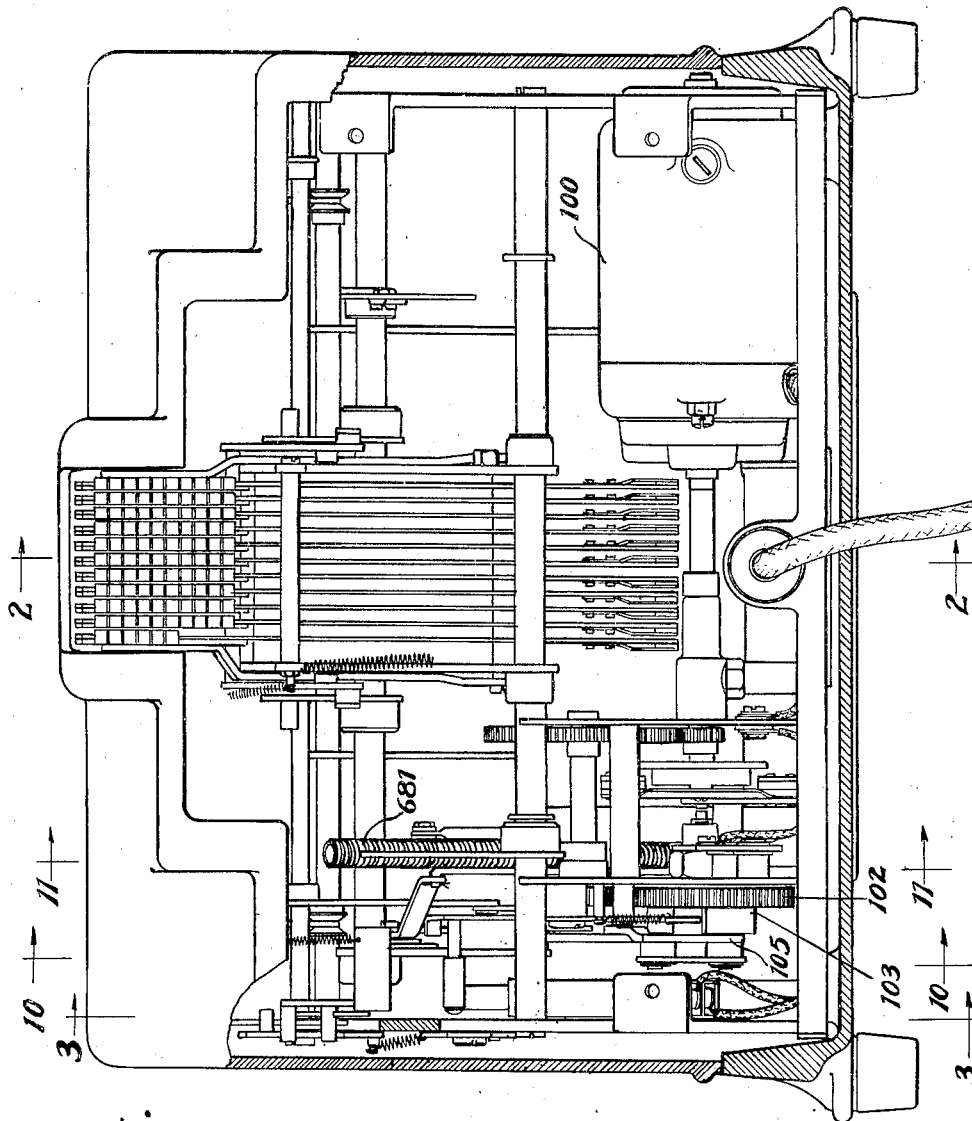


Fig. 5.

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Fig. 6.

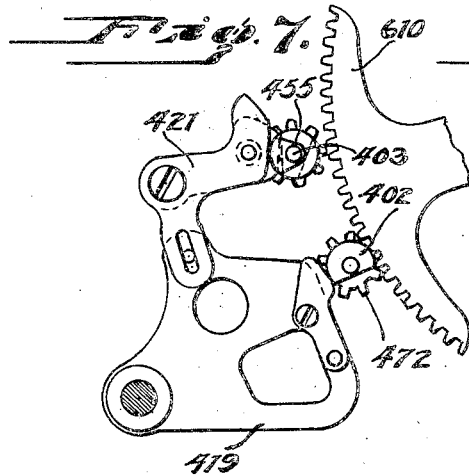
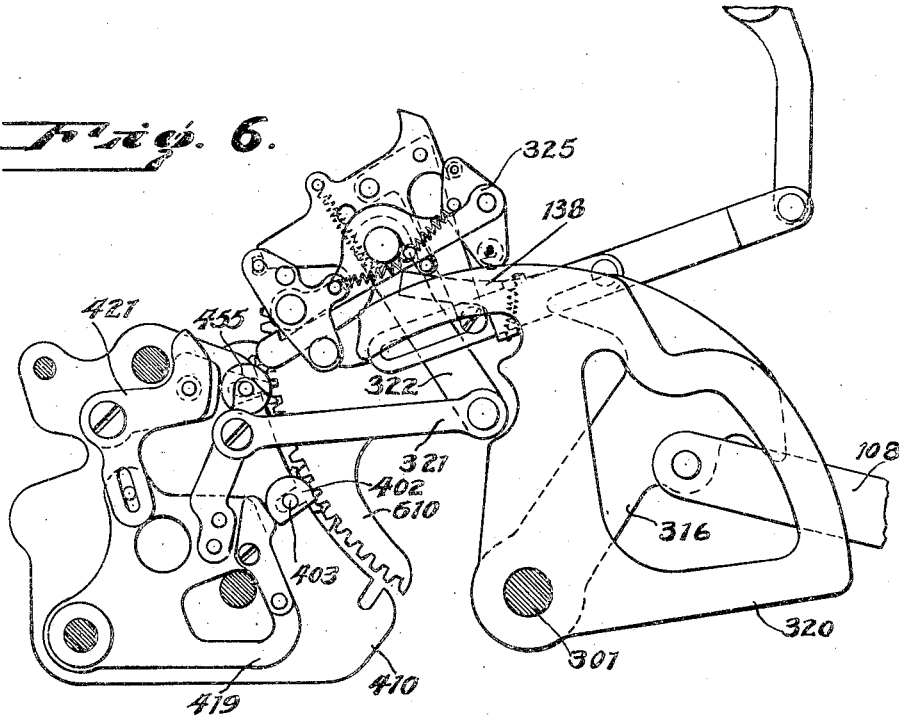
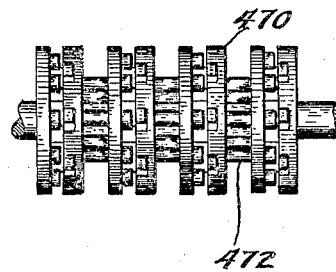


Fig. 8.



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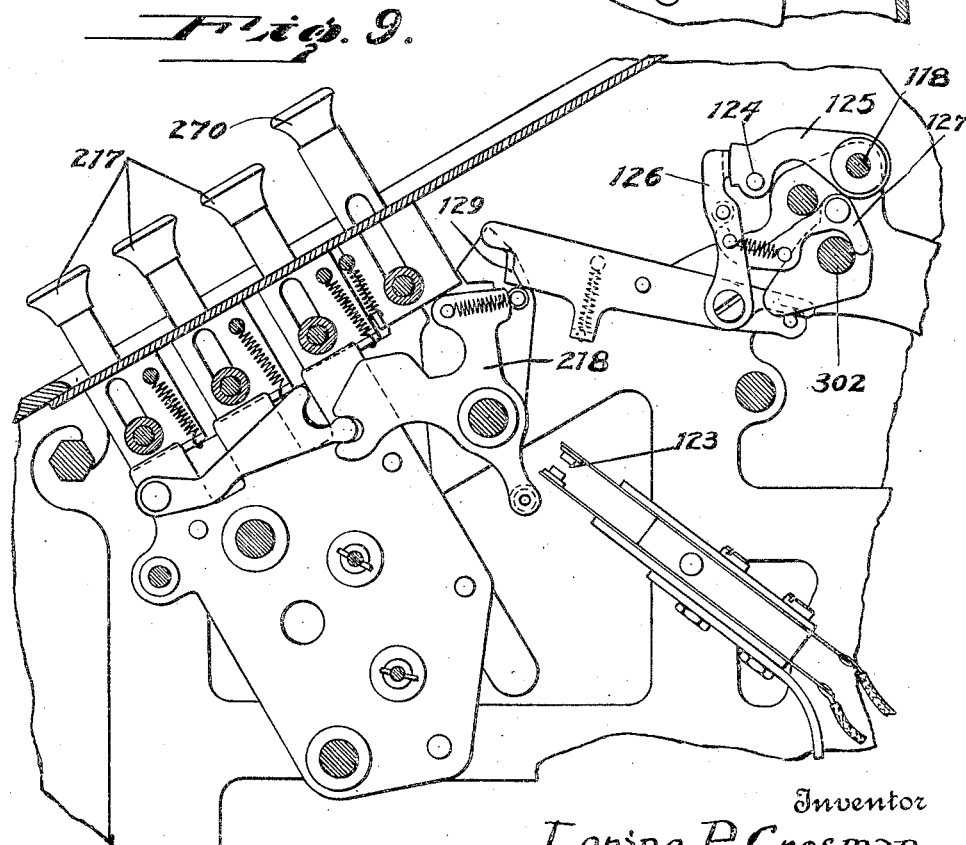
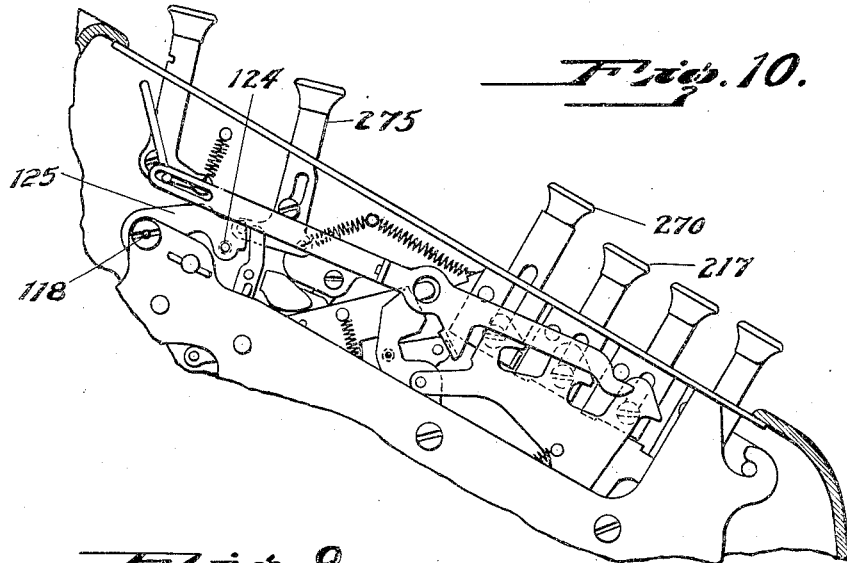
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8 Sheets-Sheet 6



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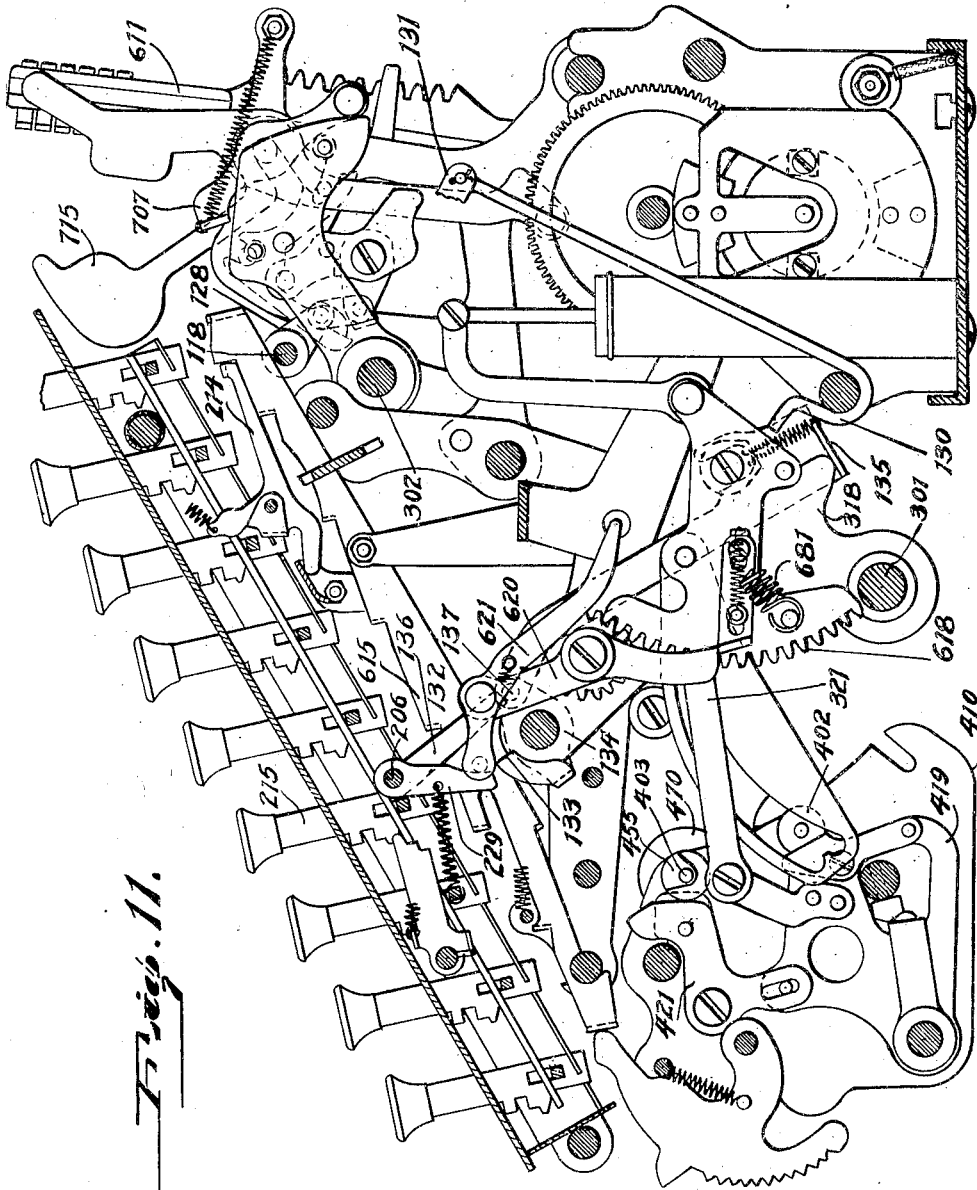


Fig. 11.

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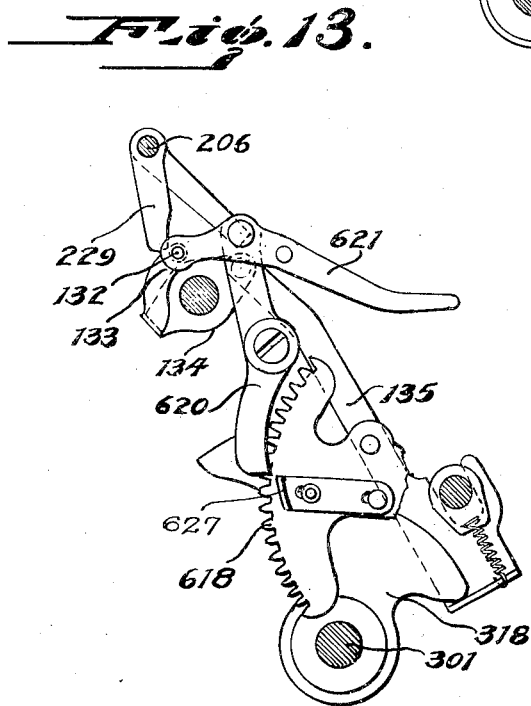
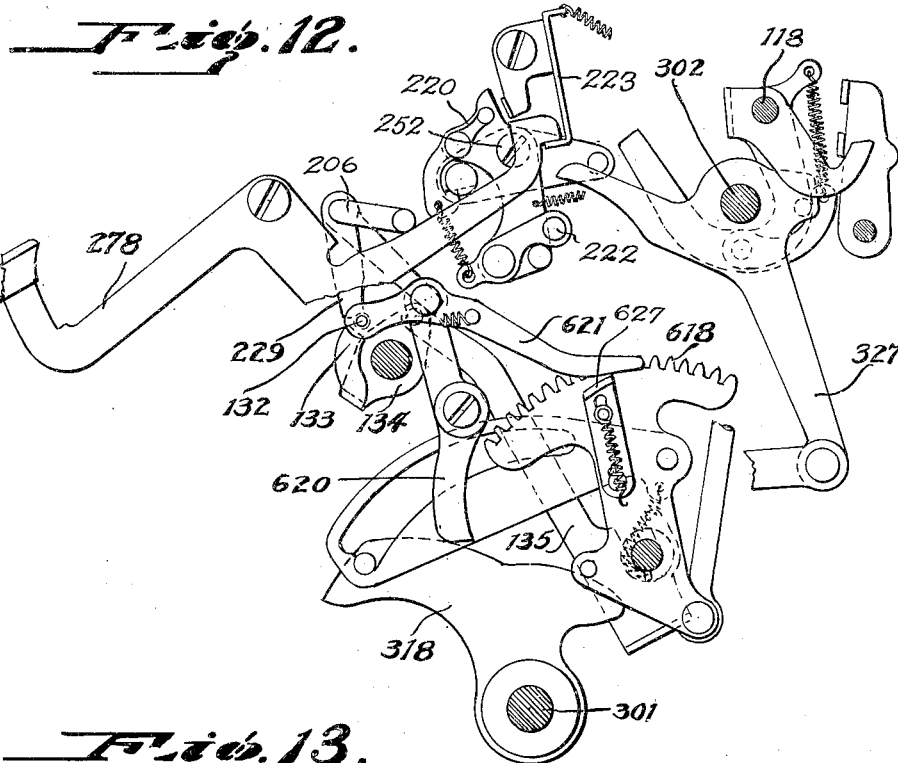
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UNITED STATES PATENT OFFICE

1,932,013

REGISTER

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Application February 25, 1931. Serial No. 518,061

10 Claims. (Cl. 235—60)

The invention has relation to registers, and more particularly to listing calculators, and it consists in the provision of improved motor drive means and to improved operation control devices for such machines.

The invention consists in the novel construction and combination of parts as set forth in the appended claims.

In the present application, the invention is shown as applied to a register of the Gardner type, disclosed in its essential features in the U. S. patent issued to Clyde Gardner, July 12, 1932, No. 1,867,002, entitled Calculating machines, (said patent being substantially similar to the disclosures of British Patent 272,569 and 293,080).

The invention is also shown as utilizing certain improvements upon the above-noted structure, disclosed in U. S. Patent No. 1,833,467, issued to Harold P. Mixer on November 24, 1931, entitled Calculating machine.

In the accompanying drawings, illustrating the invention:

Fig. 1 is a plan view of a calculating machine embodying the invention.

Fig. 2 is a section taken on line 2—2 of Fig. 1.

Fig. 3 is a section taken on line 3—3 of Fig. 1.

Fig. 4 is a detail side elevation of the minus bar mechanism.

Fig. 5 is a rear elevation of the machine with the casing broken away.

Fig. 6 is a side elevation of parts of the register control mechanism.

Fig. 7 is an elevational view, showing certain parts of Fig. 6 in a different adjusted position.

Fig. 8 is a detail plan view of the register wheels.

Fig. 9 is a fragmentary side elevation, showing the register control key and electric circuit mechanism.

Fig. 10 is a detail left side elevation of the left hand control key mechanism.

Fig. 11 is a section taken on line 11—11 of Fig. 1.

Fig. 12 is an elevation showing the total tripping and locking mechanism.

Fig. 13 is a similar view, showing the parts in another position.

For each denominational order, the machine is provided with a three-armed actuator lever, numbered 610 on the drawings (Fig. 2), these levers being loosely mounted on a shaft 608. The forward arm of each lever 610 terminates in a segmental registering rack: the rearward arm has a listing type bar 611 pivoted thereto, and the upper arm has pivotal connection with a differential stop bar 615 cooperating with a bank of

digit keys 215 to limit the movement of the lever 610.

The digit keys 215 which have been depressed to represent a value are latched in position with the bottoms of their stems lying in the path of movement of the related stop lugs of the bars 615, allowing such bars to advance a distance proportional to the value of the key, upon operation of the machine. Depression of a digit key will also remove a column latch 214 from the path of movement of its related bar 615, these latches preventing movement of a stop bar and lever 610 in any column in which no key is depressed.

A rock shaft 301 is provided with cam means 70 318 for governing the movement of a spring tensioned rocker frame 616, mounted on shaft 608, frame 616 carrying a series of dogs 617 normally engaged by studs 659 of the levers 610. As shaft 301 is rotated forwardly, frame 616 will be rocked, and any of the levers 610 which have been released by the depression of digit keys will be allowed to rotate, under the influence of their spring 683, until they are stopped by the lugs of bar 615 contacting with the stems of the keys. Upon rearward rotation of shaft 301, the dogs 617 will return the operated levers 610 to normal position. This excursion of the levers 610 serves to register amounts set in the keyboard upon one or more accumulators and to set up a similar amount on the printing line of the type bars.

Motor drive means

Shaft 301 is oscillated by means of an electric motor 100, connected through gearing 101 (Figs. 3 and 5) with a driver member 102, comprising a gear, provided with an extended hub, forming one element of a friction clutch. The other element of said clutch consists of a spring mounted at 104 upon a driven member or crank arm 105. Spring 103 extends arcuately around the hub of member 102, and is formed at its free end with a radially bent portion adapted to contact with the lower arm of a clutch lever 106, fulcrumed upon the framing of the machine at 107. Crank arm 105 is connected to an arm 316, fast with shaft 301, by means of a connecting rod 108, so that as crank arm 105 is rotated shaft 301 will be oscillated.

Clutch lever 106 is provided with an insulated roller 109, adapted to close contact members 110 after lever 106 is moved out of restraining engagement with clutch spring 103. Contacts 110, 110

constitute circuit breaking devices in the electrical connection of motor 100.

To establish the drive, clutch lever 106 being rocked about its fulcrum, roller 109 will force the contact members 110 into engagement, and thereby start the electric motor. At the same time the end of lever 106 will be disengaged from the free end of spring 103, which will allow the spring, wrapped firmly about the hub of member 102, to rotate, and drive the shaft 301. There will, however, be sufficient slippage between the spring and the hub to permit the motor to rotate in case of the machine becoming jammed in any manner. The clutching action of the spring is increased by the arrangement whereby the spring extends from the connection 104, around hub 102, in the direction of rotation, so that the rotation of the hub will tend to wrap the spring therearound.

Spring 111 tends to pull lever 106 away from clutch spring 103, the lever being normally held in engaging position by means of a latch 112. Latch 112 is controlled by a trigger 113, lying in the path of movement of a lever arm connected with an add key or plus bar 114. Upon depression of key 114, trigger 113 will release latch 112 and clutch lever 106 will be pulled out of engagement with clutch spring 103 to start the machine in operation.

Upon release of key 114 latch 112 will return under spring action into latching position, and toward the end of the cycle of operation an arm 115 connected with the crank member 105 will contact with a tooth 116 of the clutch lever 106 and will force said lever back into latching position, breaking the electric circuit and bringing the end of lever 106 into the path of movement of the rotating spring 103. As spring 103 contacts with lever 106, the friction will be relieved, until the motor is brought to rest by the flexing of the spring. In repeat operations, key 114 is held depressed so that latch 112 will be held out of engagement with clutch lever 106 and another cycle of operation will be started.

The above-described excursions of the levers 610 effect positive or negative registration of values set up in the keyboard in the following manner:

The segmental racks of the levers 610 are designed to operate the accumulator wheel gears 472 (Fig. 2) of one or more accumulators. These accumulators are shown in British Patent 293,080, as means for storing sub-totals, totals, or remainders, to be printed, but could, of course, be provided with visible numeral wheels, from which the accumulated amounts could be read. Tens carry mechanism 470 is provided, according to the disclosure of British Patent 272,569.

The accumulator shafts 403 are slidably mounted in slots of frame plates 410 (Fig. 6) and when either or both of the accumulators are set to active position, the gears 472 thereof are brought into mesh with the racks of the levers 610, where they are held, against spring tension exerted on shaft 403, by a rocking cam plate 419, engaging said shaft.

The cam plate 419 has connection through link 321 with an arm 322 of a rocker device 325, provided with two cam followers adjustable by key-set control devices to different positions relative to cam arms 316 and 320, respectively, of rock shaft 301.

Normally these control devices are set (as in Fig. 6) to provide for additive registration, wherein the accumulator shaft 403 will be moved away

from the racks of levers 610 before said racks are allowed to move, and will be moved to re-engage the gears 472 while the racks lie in the extreme positions permitted by the keys 215 and stop bars 615. As shaft 301 is returned, and the racks allowed to rise, the value set in the keyboard will be additively transferred to the register.

The type bars 611 are provided each with a row of type, representing the digits 1 to 9 and 0, the zero type being normally on the printing line. When the levers 610 are moved in accordance with a key setting, the related type bars will be raised to bring the appropriate type to the printing lines.

The type hammers 715 (Fig. 2) are adapted to be operated by spring actuators 700, but are normally held in tensioned position by latches 701. When a type bar is lifted, a tripping finger 702 is allowed to move into engagement with the corresponding latch 701, and at the end of the forward rotation of shaft 301, a frame upon which the tripping fingers are mounted is moved forwardly, releasing the hammers from those latches which have been engaged by the fingers 702. In order to print the zero characters in the lower order places wherein no amount from 1 to 9 has been set up, the higher order latches 701 are provided with offsets 703, lying in the planes of and designed to trip the lower order latches.

The hammers are restored and relatched during the return rotation of shaft 301 by means of a bail 707, operated through a reciprocatory cam.

Special operations

Automatic clearing means are provided, operating to release the digit keys 215 at the end of a cycle of operation, a settable repeat key serving to disable the automatic clearing means when repeat operations are to be performed. A manually operable means for releasing any digit keys 215 is also provided. Means whereby amounts may be stored in the registers without operation of the printing devices; means for printing in two colors according to the accumulator which is in operation, and paper and ink ribbon feeding devices may also be used. All of these means are fully described in the British Patent 293,080 hereinbefore referred to.

In order to register items negatively in one or both accumulators without special setting thereof, a subtract key or minus bar 274 is located adjacent the plus bar 114. The free end of the subtract key lever is adapted to contact with and rock a plate 117 in a clockwise direction as viewed in Figure 4, said plate in turn operating the trigger 113 to release latch 112 and start the machine in operation. A pin 119 in plate 117 cooperates with a notched surface 120 of key 114 to lock either key 114 or 274 when the other key is depressed, said pin moving out of line with the notch when key 274 is operated, and being engaged and held by the walls of the notch when key 114 is operated. Plate 117 is secured upon the end of shaft 118, which runs across the machine, said shaft having an arm 121 (Figs. 3 and 6) secured thereon and having a link connection 122 with the control plate 326 of the rocker 325. This control plate governs the position of the cam followers, as fully described in British Patent 293,080, and when readjusted by forward movement of link 122, upon depression of the minus bar, the time at which rocker 325 is operated to shift the accumulators out of and into mesh with the seg-

mental racks is changed, so that the accumulators remain in mesh during the first or downward stroke of the racks, and consequently register subtractively. During the upward stroke of the racks the accumulators are released from the action of the cam plate 419 and are pulled out of mesh by their springs.

The minus bar 274, like the plus bar 114, may be held depressed to accomplish a series of operations. Mechanism for printing a special symbol to indicate the subtractive nature of the operation, is associated with the minus bar devices. For this purpose a special type bar is provided to the right of the numeral type bars, said special bar being held in its lower position during addition operations by means of a stop lever 225 (Fig. 3) engaging a pin 612 on an arm rigidly connected with the symbol type bar lever. Operation of the rocker control plate 326 by the minus bar will through pin 352 cam stop lever 225 upwardly, permitting pin 612 to move into engagement with a second shoulder of the stop lever, thus allowing sufficient movement of the symbol type bar to bring the minus symbol to the printing line. The rise of the type bar will also trip a latch controlling the symbol type hammer in a manner similar to that of the number type. A cross-over between the symbol type bar and the adjacent or right hand number type bar serves to trip the latter when a symbol is to be printed, so that if no numbers had been set up when the machine is operated by a key 274, this will be indicated on the record sheet by printing of a 0 in association with the minus symbol.

Keys 217 serve to control the accumulators, so that the upper, the lower or both accumulators may be thrown selectively into operative position, in accordance with the disclosure of British Patent 293,080. This being done by means of racks on the key stems, rotating the supporting shafts of the accumulators and bringing cams 402 and 455 (Fig. 6) into or out of position to cooperate with the cam plate 419. In addition to this, a key 270 (Figs. 9 and 10) serves to throw both accumulators into operative position and to set the upper accumulator to register according to the opposite sign from that of the lower accumulator, in accordance with the disclosure of the Mixer patent hereinbefore referred to. Upon partial depression, key 270 is adapted to release any of the keys 217 which may be depressed at the time further depression of key 270 serving to rotate cam 455 into a third position. Cam 455 is a double cam, one portion of which cooperates with one cam face of a finger 421, pivotally moved by plate 419 and another portion of which cooperates with an oppositely inclined cam face of finger 421, so that when the cam 455 is set to cooperate with one cam face of the finger the upper register will be thrown into mesh as the lower register is thrown out while, upon a different setting of cam finger 455 the registers will be set identically.

In order to prevent operation of the machine when neither of the accumulators is in active position (which condition might occur as the result of a partial depression of key 270), a plate 218 (Fig. 9), operated by lugs of the keys 217, 270 is provided with an insulated pin adapted at the end of the key movement to close an auxiliary circuit breaker 123 interposed in the electric circuit of motor 100. To insure the retention of the auxiliary circuit breaker in closed position during the operative cycle of the machine, a com-

pound locking lever 416 will be pulled by plate 218 into engagement with studs of the keys, and a latch 129 will fall into position behind said locking lever to hold the keys depressed and thereby to hold the plate 218 in operated position when shaft 301 is rocked by the motor. Latch 129 is mounted on a stationary frame and is rocked by a cam on the hammer restoring shaft 302, said shaft being oscillated by a crank arm 327 (Fig. 12) secured thereon and having link connection with the cam arm 320. In order that an amount set upon the keyboard may be printed upon the record sheet without being entered in either totalizer a non-add key 275 is provided said key upon depression contacting with a pin 124 on an arm 125 rigidly secured to shaft 118 (Fig. 10). Thus upon depression of key 275 shaft 118 will be rocked in a direction opposite to that imparted by the minus bar, and plate 117 will trip the trigger 113 to start the machine in operation. A latch 126 (Fig. 9) engages arm 125 upon depression and serves to hold shaft 118 and the setting devices connected therewith in adjusted position during a cycle of operation. During the latter part of the cycle a cam arm 127, mounted on the rock shaft 302 will contact with latch 126 and release arm 125. Shaft 118, when rocked by the non-add key will, through arm 121 (Fig. 6), move link 122 rearwardly, thus setting a latch 138 in position to engage a pin of and disable the rear cam follower of rocker 325, so that the accumulators (being thrown out of mesh by the action of cam 320) will be held out of mesh during both the downward and upward strokes of the segmental registering racks.

A sub-total is taken by releasing the differential stop bars 615 and allowing their segment racks to rotate the accumulator gears subtractively until suitable pins on the accumulator wheels contact with zero stop members. This will set the sub-total in the type bars, and the hammers will be tripped to print the sub-total. The bars 615 are then reengaged with the oscillating frame and during the return stroke of said frame are moved rearwardly to normal position, rotating the accumulator wheels forwardly to restore the registration previously appearing in the accumulators. Obviously only one of the accumulators will be set to active position (by the appropriate control key 217) when a sub-total is to be taken. Totals are printed in a similar manner, except that the accumulators are disengaged from the racks before the return stroke is made, whereby the register which has been totalized will stand at 0.

To accomplish these operations a sub-total key 273 and a total key 278 both engage the rocker devices 325 to set the accumulator control devices to secure the proper sequence of meshing and unmeshing movements. The other operations following the depression of key 273 or key 278 are identical, and will be described without distinguishing between total and sub-total operations.

The final movement of the depressed total or sub-total key will trip a latch 620 (Figs. 140 11—12—13), through operation of a control arm 621 pivotally connected to said latch. Latch 620 normally engages a lug 627 on total segment 618, preventing movement of said segment under the influence of the total spring 681. Upon tripping of the latch, segment 618 will operate devices fully described in British Patent 293,080 to trip the column latches 214 and latching dogs 617 successively from right to left of the machine and will also bring a stop member 613 (Fig. 2) into

the path of the 0 stops 457 on the accumulator wheels. The successive release of the differential stop bars 615 by the latches 214 is essential because of the character of the tens transfer mechanism employed between the accumulator wheels. As described in British Patent 272,569, hereinbefore referred to, this carry mechanism is of the "crawl" type, wherein every unit of movement of a lower order wheel will transmit one-tenth of a unit of movement to the next adjacent higher order wheel. Therefore, in zeroizing as each lower order wheel is returned to 0, it will subtract from the higher order wheel the fractional movements previously transmitted.

When this zeroizing operation has progressed to the left hand side of the machine, a rearwardly extending arm of the total segment 613 will contact with a projection of a rod 130 (Figs. 3 and 11), connected at its other end to a trigger 131, adapted to release latch 112, to start the machine. The machine being put in operation, the differential stop bars 615 will be relatched, the hammers will be tripped, and the parts restored to normal position.

The total and sub-total keys are locked in depressed position by latch 223 (Fig. 12) and are released near the end of the cycle of motor operation by means of arm 327 (having link connection with cam arm 320) and dog 220, operated by said arm about pivot 252. When the parts arrive in full cycle position, arm 327 will have moved from the position illustrated in Fig. 12 into position beneath the contact pawl 222 of dog 220, said pawl having escaped from the arm and the dog 220 and latch 223 having been returned by their springs into normal position. In order that these keys shall not remain locked down indefinitely, in case the key is held depressed until after the releasing mechanism has operated, means are provided for repeating the total operation as long as the key is held depressed, this means operating as follows (Figures 11, 12, 13):

In tripping the total segment latch, crank-shaft 206 is rocked by the total or sub-total key as seen in Fig. 12, an arm 229 on said shaft contacting with a pin 132 in the latch-operating arm 621. The latch being tripped, and total segment 618 rising, the latching lug 627 of the segment will be brought in contact with lever 621, moving pin 132 out of contact with arm 229 and into contact with a shoulder 133 of a rock plate 134, pin 132 being held against said shoulder by the latch spring. During the following motor operation of the machine, the forward movement of rocker cam 318 will release a spring tensioned push rod 135 connected with rocker plate 134, and shoulder 133 will be rotated counterclockwise from the position shown in Fig. 13 until pin 132 comes below arm 229 as shown in Fig. 12. If the key is released at this time, latch 620 and arm 229 will be restored to normal position (pin 132 camming arm 229 forwardly), and the totalizing operation will be concluded. So long, however, as the key is held depressed, arm 229 will hold pin 132 in the path of movement of shoulder 133, and at the end of the cycle of motor operation, rocker cam 318 will contact with and retract push rod 135 and the shoulder 133 of plate 134, acting upon pin 132, again trips the total latch and the second totalizing operation will occur, at the end of which the key releasing mechanism will again operate.

The operation of the clutch is insured, following the rapid depression and release of a motor key, both by the action of latch 112 and by that of spring 103, these devices insuring that the

stopping arm 106 will not drop behind spring 103 before the driven parts of the clutch have been rotated by the motor. Parts 103 and 112 therefore constitute quick stroke devices, the employment of which leads to the requirement that the latch 126 for the subtract, non-add shaft 118 shall also be of a quick stroke nature, insuring the operation being of the character selected.

I claim:

1. In a register, a plurality of accumulators, actuators therefor, motor drive means for said actuators including electric circuit devices, and means selectively settable to render one or the other accumulator active with relation to the actuators; a circuit breaker interposed in said electric circuit devices, means cooperating with said settable means to close the circuit breaker upon rendering an accumulator active, and means for holding the circuit breaker closed during the operative cycle of the actuators.

2. In a register, a plurality of accumulators, actuators therefor, motor drive means for said actuators including electric circuit devices, and means selectively settable to render one or the other accumulator active with relation to the actuators; a circuit breaker interposed in said electric circuit devices, and means cooperating with said settable means to close the circuit breaker upon rendering an accumulator active, a latch for holding the circuit breaker closed and means for releasing the latch at the end of an operative cycle of the actuators.

3. In a register, an accumulator, motor driven actuators therefor, and means adjustable to determine plus or minus registration by said actuators upon the accumulator or to disable the accumulator during operation of the actuators; drive control means including a member operable in either of two directions to effect motor operation of said actuators, a key adapted to operate said member in one direction, a key adapted to operate said member in the other direction, means between one of said keys and the adjustment means operable to change the normal sign character of the registration, and means between the other key and the adjustment means operable to prevent registration upon said accumulator.

4. In a listing register, an accumulator, printing mechanism, setting means for said mechanism normally under spring tension, and means cooperating with said accumulator and operating to release said setting means for spring action to set up a total in said printing mechanism; motor operating means including a power transmission train to said printing mechanism and to said setting means, a clutch in said train, and means automatically operable at the conclusion of a setting operation to engage said clutch and thereby print the total and restore the setting means to normal condition.

5. In a listing register, an accumulator including means for advancing a higher order wheel a fraction of a step during each full step advance of a lower order wheel, printing mechanism and means for setting a total in said printing mechanism; motor operating means for said printing mechanism, a motor key and means controlled by said key adapted to render the total setting means and printing operating means successively effective.

6. In a listing register, an accumulator including means for advancing a higher order wheel a fraction of a step during each full step advance of a lower order wheel, printing mechanism, setting means for said mechanism including mem-

bers normally under spring tension, and means cooperating with said accumulator and operating to release said setting members successively to set up a total in said printing mechanism; motor operating means for said printing mechanism, a motor key and means controlled by said key adapted to render the total setting means and printing operating means successively effective.

7. In a register, the combination of an accumulator, motor driven reciprocatory actuators therefor, and movable motor driven means for timing adjustment of said accumulator and said actuators relatively to each other to determine a registration, freely retractible plus and minus keys, means operable by the manual depression of either of said keys to cause motor operation of said actuators, means set by one of said keys to change the timing movements of the adjustment means to thereby change the sign character of the registration, and cyclically operated devices for holding the last means in set position.

8. In a register, the combination of two accumulators, motor driven reciprocatory actuators therefor, and movable motor driven means for timing adjustment of said accumulators simultaneously or alternatively relative to said actuators to determine like or unlike registration, freely retractible plus and minus keys, means operable by the manual depression of either of said keys to cause motor operation of said actuators, means set by one of said keys to change the timing movements of the adjustment means to thereby change the sign character of the registration.

tration upon both accumulators, and cyclically operated devices for holding the last means in set position.

9. In a register, an accumulator, motor driven actuators therefor, movable motor driven means for timing said accumulator and said actuators relatively to each other to determine plus or minus registration or to disable the accumulator; a plus key, a minus key, a third motor key, means settable by one of said keys to change the timing movement of the adjustment means and thereby change the sign character of the registration, and differentially settable by another of said keys to prevent timing movement of the adjustment means and thereby prevent registration upon said accumulator, and cyclically operated devices for holding the last means in set position.

10. In a register, the combination of an accumulator, motor driven reciprocatory actuators therefor, movable motor driven means for timing adjustment on said accumulators and said actuators relatively to each other to determine a registration, freely retractible plus and minus keys, a clutch between the motor and the actuators, quick stroke latch mechanism releasable by manual depression of either of said keys to hold the clutch in engaged position, means set by one of said keys to change the timing movements of the adjustment means to thereby change the sign character of the registration, and cyclically operated quick stroke latch mechanism for holding the means set by one of said keys in set position.

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