Oct. 29, 1935. J. A. V. TURCK 2,018,933

IDLE LOCK FOR CALCULATING MACHINES

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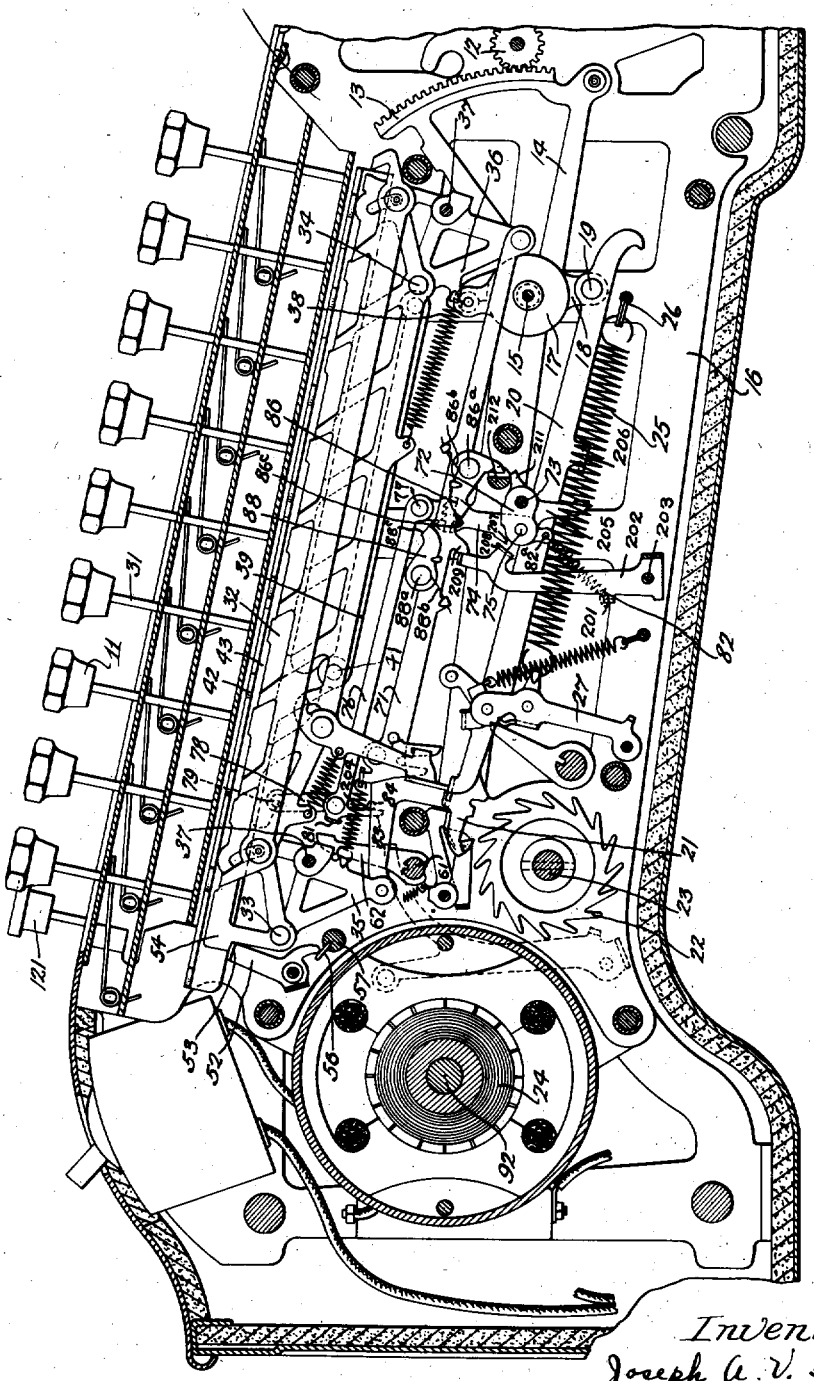
Fig. 1.



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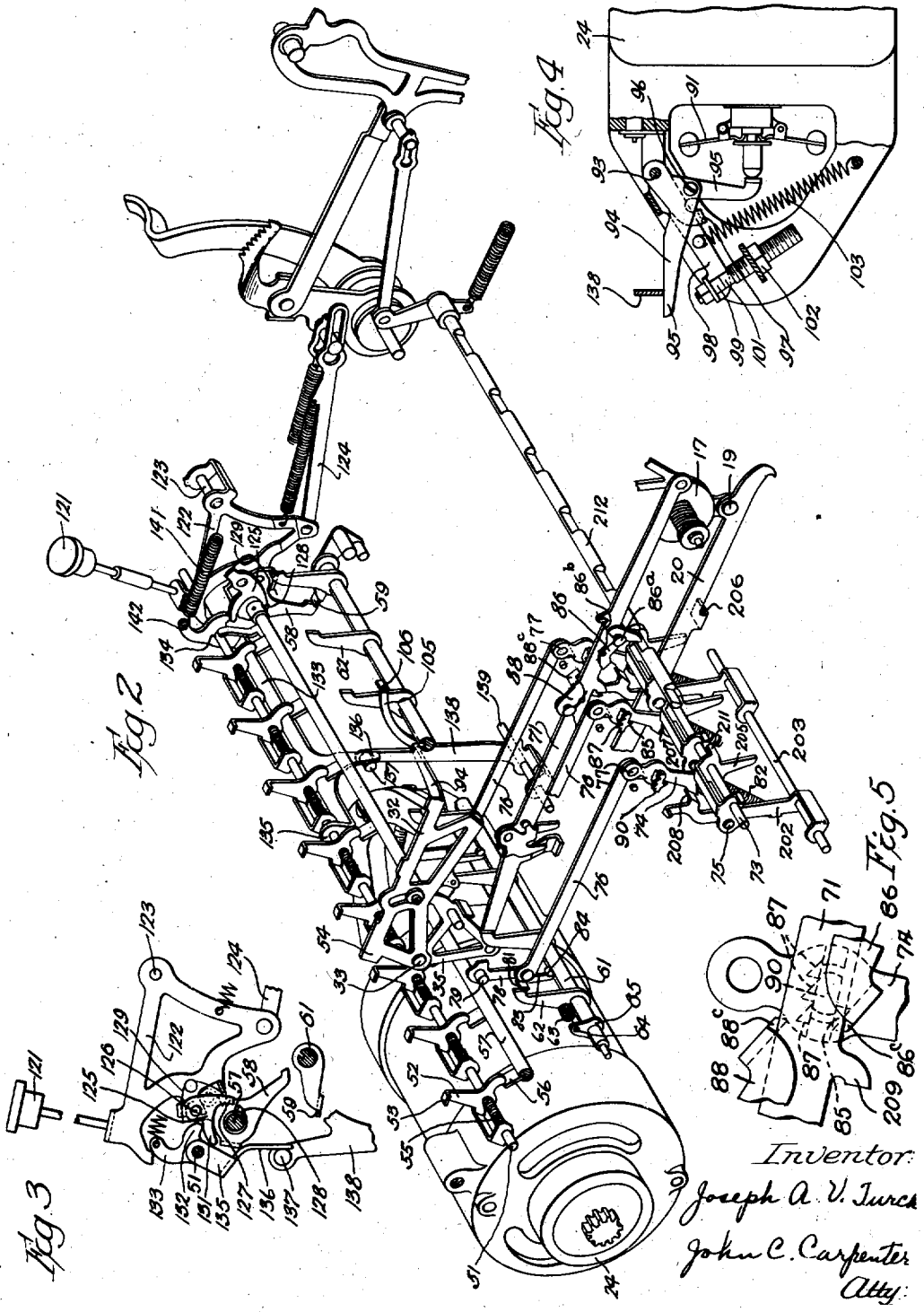

Fig. 2

Fig. 4

Fig. 3

Fig. 5

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IDLE LOCK FOR CALCULATING MACHINES

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Application October 29, 1932, Serial No. 640,229

18 Claims. (Cl. 235—130)

This invention relates in general to improvements in calculating machines and has more particular reference to improvements in calculating machines of the power operated, key-responsive type, i. e. the type of calculating machines wherein power mechanism such as an electric motor is provided to impart adding movement or accumulation in response to key depression and in digital amount determined by the particular key depressed.

The object of the invention, broadly stated, is to insure against overloading of the electric motor or other power source with resultant error in operation of the calculating machine or damage to its parts.

Another important object of the invention is the provision of a power driven calculator of multiple order, key-responsive type, the operation of which will be mechanically controlled to prevent manipulation of the keys or equivalent mechanism until the motor or other power means is operating and in condition to supply adequate power for imparting the desired actuation to the numeral wheels displaying the progressive results of the adding movement or calculations of the machine.

Another important object of the invention is the provision of a control for a calculating machine of the character described, which will prevent connection of the power means to the accumulator mechanism as a result of manipulation of the keys of the keyboard controlling additive movements of the accumulator prior to supply of power to the power drive and prior to a speed of operation of such drive sufficient to insure accurate actuation of the accumulator mechanism or until the power mechanism is in condition to sustain the resulting load without danger of damage.

The instant embodiment of the invention hereinafter to be described is particularly adapted for employment with the power driven key-responsive calculator shown on the drawings and described in co-pending application filed by this applicant, Joseph A. V. Turck, Serial No. 364,973 on May 22, 1927 for improvements in Calculating machines; and while the invention will hereinafter be more particularly described as embodied in mechanism particularly adapted to the accomplishment of the foregoing described results to insure against error and protection of the power means in calculating machines therein shown and described, it will be readily apparent that it has other and more general application and use.

In the earlier filed application of this applicant, Serial No. 364,973 filed May 22, 1929, error control devices are described and claimed which protect against continued operation of its calculating machine after inadequate or insufficient key-stroke and after effort to redepress a key prematurely and before desired accumulator action has occurred in the accumulator mechanism. Protection of this sort against key manipulation is desirable and perhaps essential in a commercial power driven key-responsive calculating machine and this invention has for one of its objects the employment of the mechanism provided to insure against such mismanipulation of the keys or other manipulative devices to insure against operation of the calculator while the power means is idle or until it has reached a predetermined safe speed of rotation.

A further object of the invention is the provision of mechanism and devices in calculating machines of the character described, of simple construction and effective operation, which will not require frequent repair, readjustment or replacement, for insuring against operation of the calculating machine while the power is shut off and against operation when and while predetermined speed or other power movement is below predetermined rate.

Numerous other objects and advantages of the invention will be understood from the following description, which, when taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

Referring to the drawings,

Figure 1 is a partial front-to-back sectional view through a power driven key-responsive calculating machine embodying the instant invention;

Fig. 2 is a perspective view of the locking mechanism embodying the instant invention and associated parts;

Fig. 3 is a transverse sectional view taken adjacent the release devices provided to permit operation of the calculating machine embodying the present invention after the power means (electric motor) has started and attained desired rotation; and

Fig. 4 is a side elevation, parts being shown in section of the motor governor controlling operation of such release devices.

Fig. 5 is an enlarged fragmentary detail of a portion of the error control mechanism.

The calculating machine shown on the drawings for the purpose of illustrating the instant invention is of power driven, multiple order, key-responsive type. It consists, generally, of a plurality of series of manually operable keys 11 arranged in rows extending from front to back of the calculator, there being a series of such keys for each numerical order of the machine. Associated with each series of keys is an order of accumulator mechanism generally indicated by pinion 12 adapted for actuation by racks 13 of a column actuating mechanism individualized to the associated series of keys. Particular construction of the accumulator mechanism and its actuation by the keys 11 is not believed necessary

to a full understanding of the present invention. It is however mentioned that the pinion 12 associated with each ordinal series of keys through proper gearing imparts adding or accumulative movement to the accumulating mechanism in accordance with depression of the particular key of the series 11, and of course usual or preferred carrying mechanism is provided between the several orders of accumulator mechanism. The accumulator mechanism, the devices constituting its several orders, and the control of their movements preferably is that described in co-pending application of this applicant Serial No. 364,974 filed in the United States Patent Office on May 22, 1929, for improvements in Key-responsive calculating machines.

Generally described, it may be said that adding or calculating movement is imparted to the accumulator of each order through pinion 12 which forms a part of it by the rack 13 which is carried by a triangular lever 14 loosely pivoted upon a shaft 15 extending through the frame plates 16 arranged between adjacent orders of the machine. Reference character 17 indicates a friction clutch which connects an arm 18 pivoted at 19 to a reciprocating link 20.

The rack 13 is normally arranged in the position shown in Fig. 1 of the drawings and on each depression of a key of its series of keys a hook 21 is adapted to be lowered into engagement with a toothed wheel 22 fixed upon a shaft 23 which is constantly rotated from an electric motor 24 through gearing not shown on the drawings but fully described in my co-pending application. Various devices which need not be here described but which are fully explained in said co-pending application, accomplish engagement of the hook 21 with the toothed wheel 22 throughout a predetermined arc of revolution to impart a downward movement or throw of the rack 13 into a position determined by the particular key depressed for imparting calculating or additive movement to the accumulator. Engagement between the toothed wheel 22 and the hook 21 continues throughout a fixed arc of movement for all adding movements of the machine, downward movement of the rack being determined by the particular key of the series depressed and the remainder of the power stroke being absorbed or permitted by frictional slippage in the clutch 17.

Immediately upon release of the hook 21 by the toothed wheel 22 a spring 25, fast at one end at 26 to the frame of the machine and at the other to a lever 27 which is movable with the link 20, returns the column actuating mechanism to normal position and in such movement the rack 13 imparts an accumulative rotation to the pinion 12.

To accomplish an adding or calculating operation, the appropriate key of the series of keys 11 is depressed and its stem 31 in its downward thrust engages and moves down a bar 32 pivoted at 33 and 34 to levers 35 and 36, in turn pivotally carried upon cross rods or shafts 37 which extend across the several orders of the calculator and have pivotal movement in the frame plates 16. An arm 38, carried by a member of the clutch 17 and rigid with the lever 14, is connected by a link 39 with the bar 43 at 41.

Upon initial downward movement of the bar 32 the hook 21 is released by its restraining devices, which need not here be described in detail, for engagement with the toothed wheel 22 to arrange the rack 13 in position to actuate the accumulator on its return stroke. The rack 13 is permitted to move downwardly only an amount determined by the numerical value of the key depressed, its movement being halted by engagement of differentially arranged stop lugs 42 of a control bar 43 which moves forward in the machine as the bar 32 is depressed.

The lugs 42 are arranged rearwardly of the keys progressively increasing amounts and upon engagement of the key stem by its companion lug further downward movement of the bar 32 is halted and the rack 13 raised in set position, from which position the parts are returned to normal position through the power stored in the spring 25 as soon as the hook 21 has completed its movement resulting from its engagement with the ratchet 22.

As in my co-pending application Serial No. 364,973, mechanism is provided to prevent operation of the manipulative devices (depression of the keys) after an insufficient key stroke and also until full up movement of a depressed key has occurred. This mechanism will generally hereinafter be referred to as error control devices and means and comprises a shaft 51 extending across the machine and provided at each order of ordinal mechanism with a pivoted locking member 52 having a lip 53 adapted to swing under a shoulder or projection 54 on the rear end of the companion bar 32 to prevent its downward movement as the result of effort to depress any of the keys of its series. A spring 55 is associated with each lock 52 and normally urges it into locking position.

The locks 52 are held normally in retracted or inoperative position by leaves or projections 56 mounted upon and rotatable with an error lock retainer bar 57 mounted for oscillation in the frame of the calculator. These parts are held in this position by a trigger 58 fixed upon and extending down below the error lock retainer bar 57 which in turn is normally in engagement with an arm or projection 59 fixed upon a touch-off rod or shaft 61 which extends across the calculator and is provided at each order of the machine with an upwardly extending arm 62.

A spring 63 fast at 64 to an arm 65 fixed on the touch-off rod 61 normally holds the arm 62 in the position shown in Fig. 2 of the drawings. Upon incomplete key stroke or upon premature redepression of a key mechanism is provided which will now be described to engage the particular arm 62 of the order in which mis-manipulation has occurred to rotate the shaft or bar 61 in a counterclockwise direction, viewing Fig. 2, to move the arm 59 out of engagement with trigger 58, such movement resulting in release of the error lock retainer bar 57 and permitting springs 55 to move the locks 53 underneath their companion bars 32 to prevent subsequent manipulation of the calculator.

As in my co-pending application Serial No. 364,973, the locking is immediately accomplished in all orders of the calculator except that in which the error has occurred. The reason the locking of the series of keys mis-manipulated is not accomplished is because the bar 32 of the particular order affected is at the moment arranged to depress its shoulder 54 in advance of and below the end 53 and its associated lock 52 and remains in such position until correction of the error, whereupon its series of keys is also immediately locked against subsequent manipulation.

In the operation of the calculating machine illustrated on the drawings as embodying the instant invention, mis-manipulation of a key, which

might result in error, is accordingly readily apparent to an operator and readily correctable.

The mechanism for insuring complete key strokes of the digital keys 11 will now be described. The levers 35 and 36 are connected beneath their pivotal axes 37 by a bar 71, which in the movement of the levers is carried rearwardly. A latch or dog 86 is pivoted at 86a on bar 71. A spring 86b normally presses a lip 86c of latch 86 up into contact with the lower edge of bar 71. A ratchet tooth 85 is provided upon a ratchet member 90 arranged upon the upper end of a lever 74. The lever 74 is pivoted at 75 in a bracket 72 which in turn is pivoted on a cross rod 73 arranged through the side plates 16. A spring 82 is attached at 82a to the lever 74 and to a lip 201 upon a lever 202 pivoted upon a cross-rod 203. Upon depression of one of the keys 11 the bar 71 is moved toward the front of the machine, i. e. toward the right (viewing Fig. 1), and the latch 86 being carried by it moves with it and past the ratchet tooth 85.

If a key be released without fully effective depression, the forward movement of the link or bar 71 will be incomplete and a spring 204 tends to return the parts to their original position without accomplishing the calculating operation. In order to advise the operator that an incomplete key stroke has been made and to insure redepression of the particular key in necessary amount, locking mechanisms are provided, which will now be described. As a result of an incomplete movement, all of the columns of keys, except that in which the insufficient key stroke has occurred, are locked against operation as a warning or notice to the operator of an insufficient or incomplete key stroke.

A link 76 is pivoted at 77 to the upper end of the lever 74 and to a downwardly extending arm 78 which may be oscillated about a pivotal mounting 79 on an adjacent frame member. At the rear the link 76 is provided with a lip 81 arranged in registration with the companion arm 62 fixed on the touch-off rod or shaft 61. The spring 82, earlier described, tends to swing lever 74 to the right viewing Fig. 1, and to bring a detent 83 into contact with a stop 84 to limit forward movement of the lever 74. If insufficient downstroke of a key occurs, latch 86 engages tooth 85 and through lever 74 moves link 76 rearwardly with bar 71 until lip 81 engages arm 62 rocking shaft 61 to lower its arm 59 out of engagement with the trigger to release locks 53, locking all orders of the machine except that in which the insufficient key stroke has occurred. Correction of the error by the complete and proper depression of the key permits the parts to return to normal position, whereupon the lock 53 of the column affected moves to locked position and the complete locking of the keyboard is accomplished.

Means are provided for moving the ratchet tooth 85 out of the path of the latch 86 if and when full key stroke is accomplished. Each bracket 72 is provided with a downwardly extending arm 205 which extends across the path of a lug 206 upon the link 20. As the parts near the end of the power stroke, the lug 206 engages the arm 205 of bracket 72 and lifts the bracket about its pivot 73 carrying up the lever 74 to raise the ratchet tooth 85 above the lower edge of the bar 71 and out of the way of the latch 86. The lever 74 has a portion 207 which is adapted to engage above a shoulder 208 on the lever 202 when the lever 74 is lifted by lug 206. This lever is held in this upper latched position until near the end of the return stroke when a lug 209 on the bar 71 engages the upper end of the lever 202 to disconnect it from the shoulder 207, arranging the parts for the next calculating operation. A forwardly extending lug 211 is provided on the bracket 72 for engagement with a rod 212 to limit downward movement under the pull of the spring 82 when the parts are moving from one position to another.

To prevent miscalculation from redepression of a key before the adding operation of a previous stroke is completed, a number of ratchet teeth 87 are arranged on the ratchet member 90 and in position to be engaged and locked by a latch 88 pivoted at 88a on the bar 71 as this bar and the key depressed return to normal. A spring 88b normally presses a lip 88c of latch 88 downwardly into contact with the upper edge of bar 71. After full depression of the key, the lever 74 is lifted and effort to depress the key before the adding movement is completed will cause engagement by the latch 88 with one or the other of the teeth 87 since during the return or adding motion of the bar 71 the lever 74 is held in raised position by the lever 202 and is adapted for engagement by the latch 88 if the depression of a key tends or attempts to move the bar 71 in the reverse direction, i. e., upon a new adding actuation.

As has been earlier explained, adding and calculating movements in the instant embodiment of the invention are accomplished by the storing of power in the spring 25 through engagement of the hook 21 with the ratchet 22, which is continuously rotated from the motor 24.

The invention contemplates prevention of key manipulation which might throw undue load upon the motor 34 and to this end mechanism is provided for the preventing of key manipulation when the motor is starting and until it has attained a predetermined speed. As a corollary the invention also contemplates prevention of key manipulation should the motor for any cause during operation of the apparatus drop below a predetermined rate of rotation.

In accordance with the preferred embodiment of the invention illustrated upon the drawings, prevention of key manipulation, until the motor has reached and only while the motor is operating at desired speed, is accomplished through a control of the locks 53 already described. A centrifugal governor 91 actuated by the armature shaft 92 is arranged to engage a bell crank lever, pivoted at 93 and composed of the arms 94 and 95, both pivoted upon the shaft 93 and connected together by a screw 96 for attachment. This bell crank lever is provided with a part 97 which is arranged beneath an arm 98 carrying a contact 99 which engages a contact 101 adjustably mounted at 102 for supplying current to the motor 24 under the control of the governor 91. Rotation of the armature at greater than predetermined speed interrupts delivery of current by separation of contacts 99 and 101. A spring 103 is provided to maintain contacts 99 and 101 in engagement upon starting of the motor and until the armature rotates at a speed greater than that desired.

The arm 94 of the governor control lever is provided with a forwardly extending arm 105 hooked at its end at 106 to extend in front of an appropriate arm 62 of the touch off bar 61. Dimension of the parts is such that the hook end 106 holds the touch off bar rotated to the left in a counter clockwise direction, viewing Fig. 2, so that the arm 59 is out of engagement with the trigger 58 and the locking devices 52 are operative when the motor 24 is idle or is rotating at insufficient

speed to cause the governor to move the hook 106 of the arm 105 into position to permit release of the locks 52. The parts themselves, accordingly are automatically arranged to prevent operation of the accumulator mechanism, the manipulative devices or keys being rendered inoperable when the motor is idle and until it attains a predetermined speed of rotation and through the governor control rotation of speed below predetermined rotation per minute automatically results in the locking of the keys against manipulation.

Means are provided to release the locks 52 to permit operation of the calculator. Such means include a push button 121 arranged at the side of the machine and adapted to depress a lever 122 pivoted at 123 in the frame of the machine. The lever 122 is connected to a link 124 for accomplishing zeroizing in the known or preferred manner.

A pawl or dog 125 is pivoted at 126 on lever 122 and is provided with a tooth 127 adapted for engagement with a projection 128 fixed on the error lock retainer bar 57 after or when the motor has attained or is running at desired predetermined minimum speed. Engagement of the tooth 127 with the projection 128 as the lever 122 is moved down by depression of the button 121 rocks the error lock retainer bar 57 to lift the leaves 56 and release the locks. When, however, the motor is idle or is running at less than the predetermined desired minimum speed the dog 125 is automatically arranged out of operative position. A spring 129 is provided to normally urge the dog 125 into position to engage the projection 128.

A tail 131, curved generally about the center of shaft 57 is arranged beneath a finger 132 of a lever 133 pivoted at 134 and 135 on shaft 51. The lever 133 is provided with a downwardly extending arm 136 arranged in front of a pin 137 at the upper end of an arm 138 pivoted upon a cross-shaft 139. The arm 138 is arranged in the direct path of movement of the arm 105 of governor lever 94 and a spring 141 is attached to the lever 133 at 142 to cause the arm 138 to press continually against the lever 94.

The arm 138 is thrust in a clockwise direction, viewing Fig. 2, as the motor attains desired running speed. Until such action occurs the finger 132 holds the dog 125 swung to a position where depression of the key 121 will cause it to clear the projection 128 on shaft 57 and fail to release the locks 52. Accordingly the machine cannot be freed of the locks to accomplish calculating movement until the motor is running at desired speed.

The zeroizing or clearing of the calculator is accompanied by movement toward the right (viewing Fig. 2) of the link 124 and companion rocking of the lever 122. If the motor be rotating at or above predetermined minimum speed, the tooth 127 of the dog 125 engages the projection 128 of the error lock retainer bar 57 with consequent release of the error control locks. If, however, zeroizing or the clearing of these locks by the pressing of the push button 121 be attempted while the motor is idle or rotating at less than predetermined speed, the lever 133 pressing upon the tail 131 of dog 125 prevents engagement of this dog with projection 128, and the machine remains in a locked condition.

It will be apparent that the locks 52 and attendant mechanism constitute an idle lock for the calculating machine and also constitute error control locks to guard against error from mismanipulation in the use of the calculating machine after starting.

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

I claim:

1. In a power driven calculator, the combination of multiple order key-responsive accumulator mechanism, power means for accomplishing accumulator movements of said accumulator mechanism, manipulative devices arranged in a plurality of orders for determining the accumulating movements in the performing of calculation, and means individual to each order for rendering said manipulative devices inoperative except when said power means is in motion.

2. In a power driven calculator, the combination of multiple order key-responsive accumulator mechanism, power means for accomplishing accumulator movements of said accumulator mechanism, manipulative devices arranged in a plurality of orders for determining the accumulating movements in the performing of calculation, and means individual to each order for rendering said manipulative devices inoperable except when said power means is in motion.

3. In a power driven calculator, the combination of multiple order key-responsive accumulator mechanism, power means for accomplishing accumulator movements of said accumulator mechanism, manipulative devices arranged in a plurality of orders for determining the accumulating movements in the performing of calculation, and means individual to each order for rendering said manipulative devices inoperative except when said power means is moving in excess of the predetermined minimum speed.

4. In a power driven calculator, the combination of multiple order key-responsive accumulator mechanism, power means for accomplishing accumulator movements of said accumulator mechanism, manipulative devices arranged in a plurality of orders for determining the accumulating movements in the performing of calculation, and means individual to each order for rendering said manipulative devices inoperable except when said power means is moving in excess of the predetermined minimum speed.

5. In a power driven calculator, the combination of multiple order key-responsive accumulator mechanism, power means for accomplishing accumulator movements of said accumulator mechanism, manipulative devices arranged in a plurality of orders for determining the accumulating movements in the performing of calculation, and means individual to each order for normally preventing accumulating movements and rendered inoperative by said power means.

6. In a power driven calculator, the combination of multiple order key-responsive accumulator mechanism, power means for accomplishing accumulator movements of said accumulator mechanism, manipulative devices arranged in a plurality of orders for determining the accumulating movements in the performing of calculation, means individual to each order for locking said manipulative devices inoperative under predetermined conditions of the calculator, and means operable by said power means for ren-

dering the means first above-mentioned inoperative.

7. In a power driven calculator, the combination of accumulator mechanism, power means for imparting accumulating movement to said accumulator mechanism in calculation, manipulative devices for controlling extent of accumulating movement, means locking said manipulative devices against action in the event of mismanipulation, and means actuating said locking means upon interruption of power to said power member.

8. In a power driven calculator, the combination of accumulator mechanism, power means for imparting accumulating movement to said accumulator mechanism in calculation, manipulative devices for controlling extent of accumulating movement, and locking mechanism for said manipulative devices and associated devices moving said locking mechanism into locking operative position upon mismanipulation of said manipulating devices and upon interruption of power to said power means.

9. In a power driven calculator, the combination of accumulator mechanism, power means for actuating said accumulator mechanism, manipulative devices for controlling the degrees of actuation of said accumulator mechanism, locking devices for rendering said manipulative devices inoperative, means for actuating said locking devices upon mismanipulation of said manipulative devices, and means connected with said power means for actuating said locking devices upon interruption of operation of said power means.

10. In a power driven calculator, the combination of accumulator mechanism, power means for actuating said accumulator mechanism, manipulative devices for controlling the degrees of actuation of said accumulator mechanism, locking devices for rendering said manipulative devices inoperative, means for actuating said locking devices upon mismanipulation of said manipulative devices, and means connected to said power means for actuating said locking devices until said power means has attained predetermined rotative movement.

11. In a calculator, the combination of accumulator mechanism, power means for imparting power to said accumulator mechanism in calculation, a multiple series of ordinal depressible keys for controlling accumulating movements of said accumulator mechanism, locking mechanism for said series of keys, and means for automatically tripping and setting said locking mechanism upon the interruption of power to said power means.

12. In a power driven calculator, the combination of multiple order key-responsive accumulator mechanism, power means for imparting accumulating movements to said accumulator mechanism in calculation, manually manipulative devices arranged in a plurality of orders for instigating and controlling accumulating movements of said accumulator mechanism, and an idle lock mechanism for preventing accumulator operation of said manipulative devices, comprising a governor actuated in accordance with the speed of said power means, and locking devices individual to each order for preventing manipulation of said manipulative devices.

13. In a power driven calculator, the combination of accumulator mechanism, power means for imparting accumulating movement to said accumulator mechanism in calculation, manipulative devices for controlling the accumulating movements of said accumulator, error control devices for preventing movement of said accumulator mechanism upon mis-manipulation of said manipulative devices, and a governor associated with said power means for actuating said error control devices to prevent movement of said accumulator mechanism when said power means is operating below predetermined speed.

14. In a power driven calculator, the combination of accumulator mechanism, power means for imparting accumulating movement to said accumulator mechanism in calculation, manipulative devices for controlling the accumulating movements of said accumulator mechanism, error control devices for preventing movement of said accumulator mechanism upon mismanipulation of said manipulative devices, a manually operable release for said error control devices, and means controlled by said power means for rendering said release inoperative when said power means is moving below predetermined speed.

15. In a power driven calculator, the combination of accumulator mechanism, power means for imparting accumulating movement to said accumulator mechanism in calculation, manipulative devices for controlling the accumulating movements of said accumulator mechanism, error control devices for preventing movement of said accumulator mechanism upon mismanipulation of said manipulative devices, zeroizing mechanism for said accumulator mechanism adapted normally to release said error control devices at a zeroizing operation, and means governed by said power means for preventing release of said error control devices by said zeroizing mechanism when said power means is moving below predetermined minimum speed.

16. In a power-driven key-responsive calculating machine, the combination of accumulator mechanism, power means for actuating said accumulator mechanism, manipulative devices arranged in a plurality of orders for controlling the degrees of actuation of said accumulator mechanism, locking devices individual to each order for rendering said manipulative devices inoperative, and means controlled by said power means for actuating said locking devices upon interruption of operation of said power means.

17. In a power-driven key-responsive calculating machine, the combination of accumulator mechanism, power means for actuating said accumulator mechanism, manipulative devices arranged in a plurality of orders for controlling the degrees of actuation of said accumulator mechanism, locking devices individual to each order for rendering said manipulative devices inoperative, and means controlled by said power means for actuating said locking devices until said power means has attained predetermined rotative movement.

18. In a power-driven key-responsive calculating machine, the combination of accumulator mechanism, power means for actuating said accumulator mechanism, manipulative devices arranged in a plurality of orders for controlling the degrees of actuation of said accumulator mechanism, locking devices individual to each order for rendering said manipulative devices inoperative, and means controlled by said power means for actuating said locking devices upon reduction of speed of said power means below a predetermined minimum.

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