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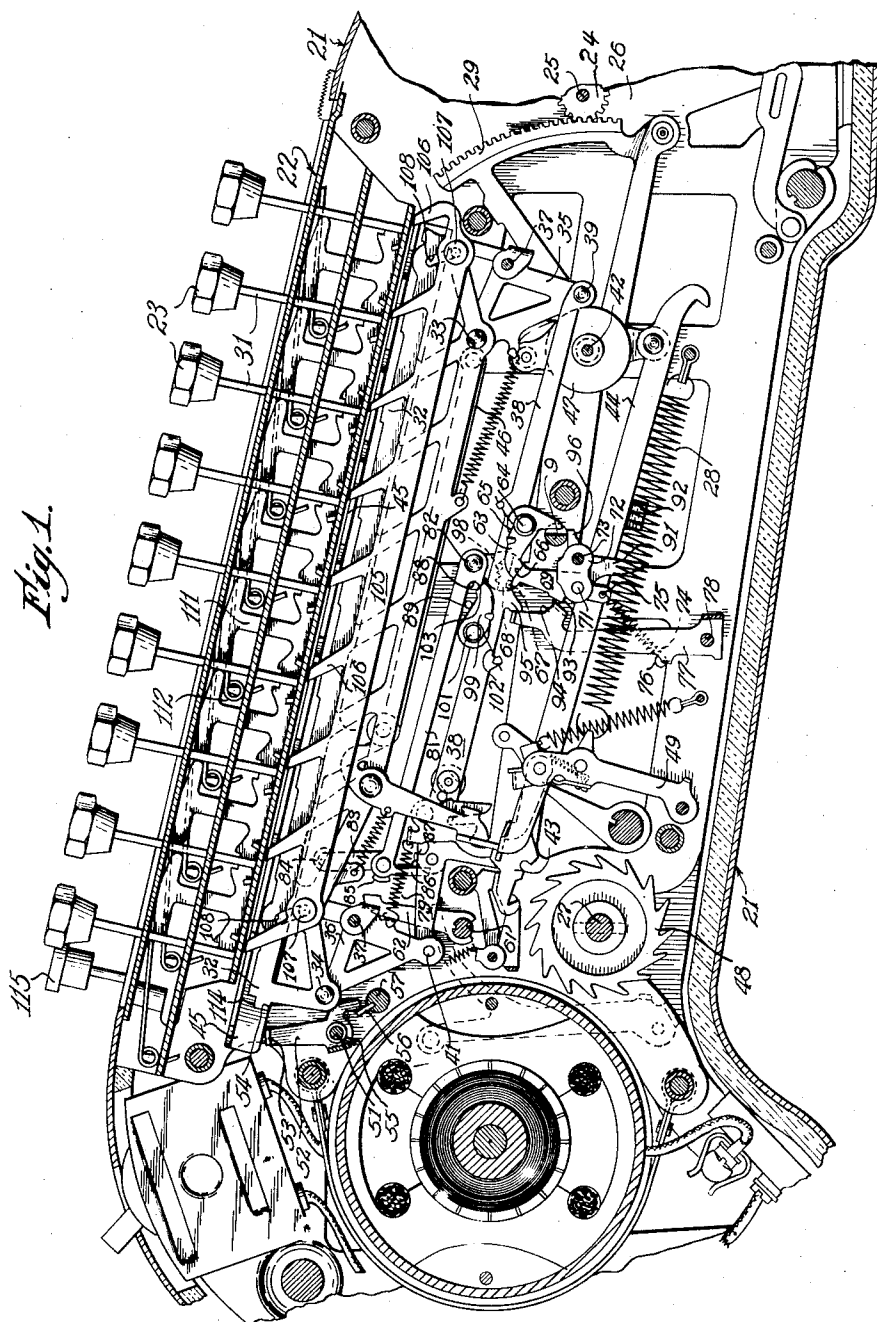
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2,224,203

LOCKING MECHANISM FOR CALCULATING MACHINES

Filed Nov. 19, 1936

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

Fig. 2.

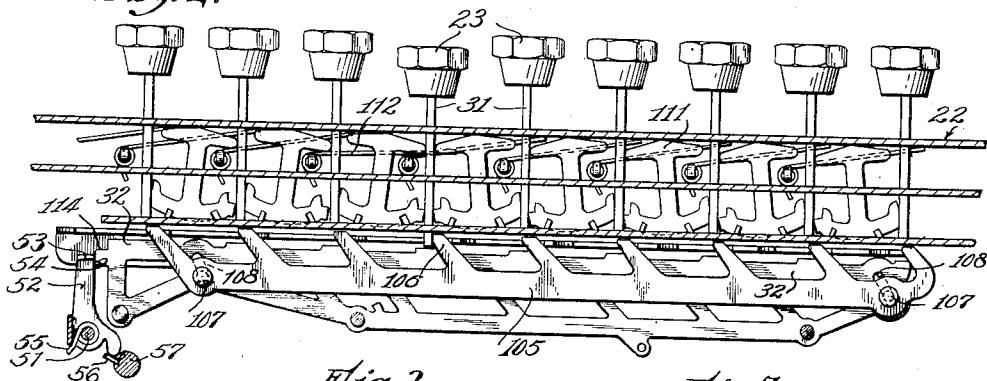


Fig. 3.

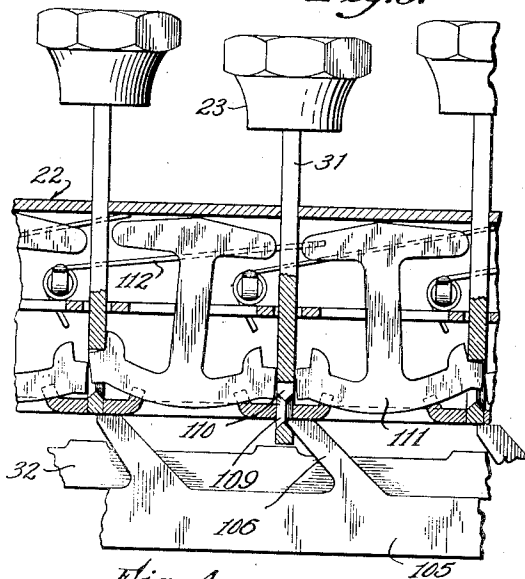


Fig. 5.

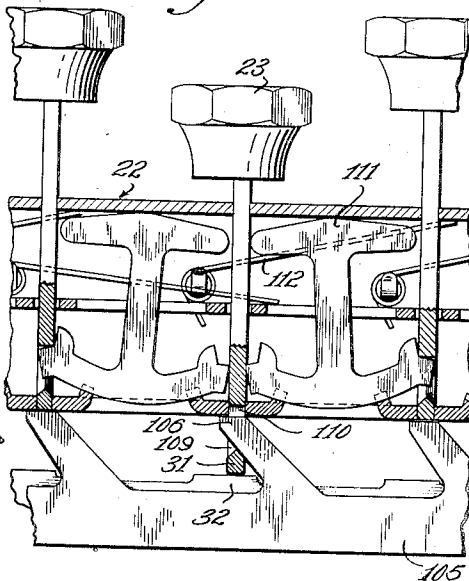
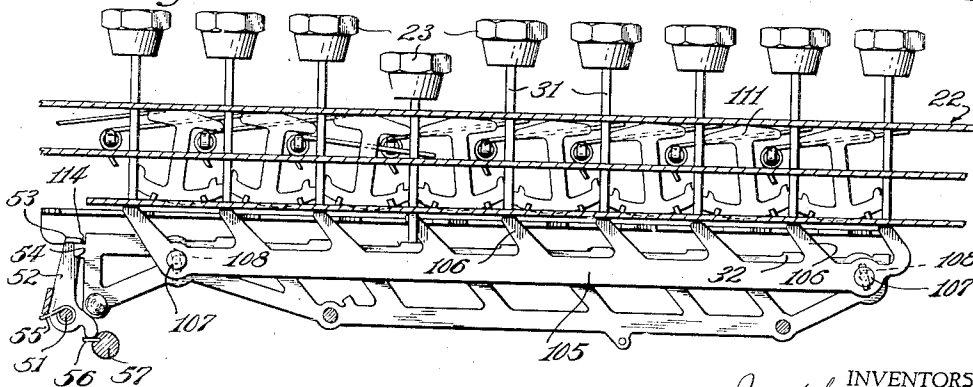


Fig. 4.



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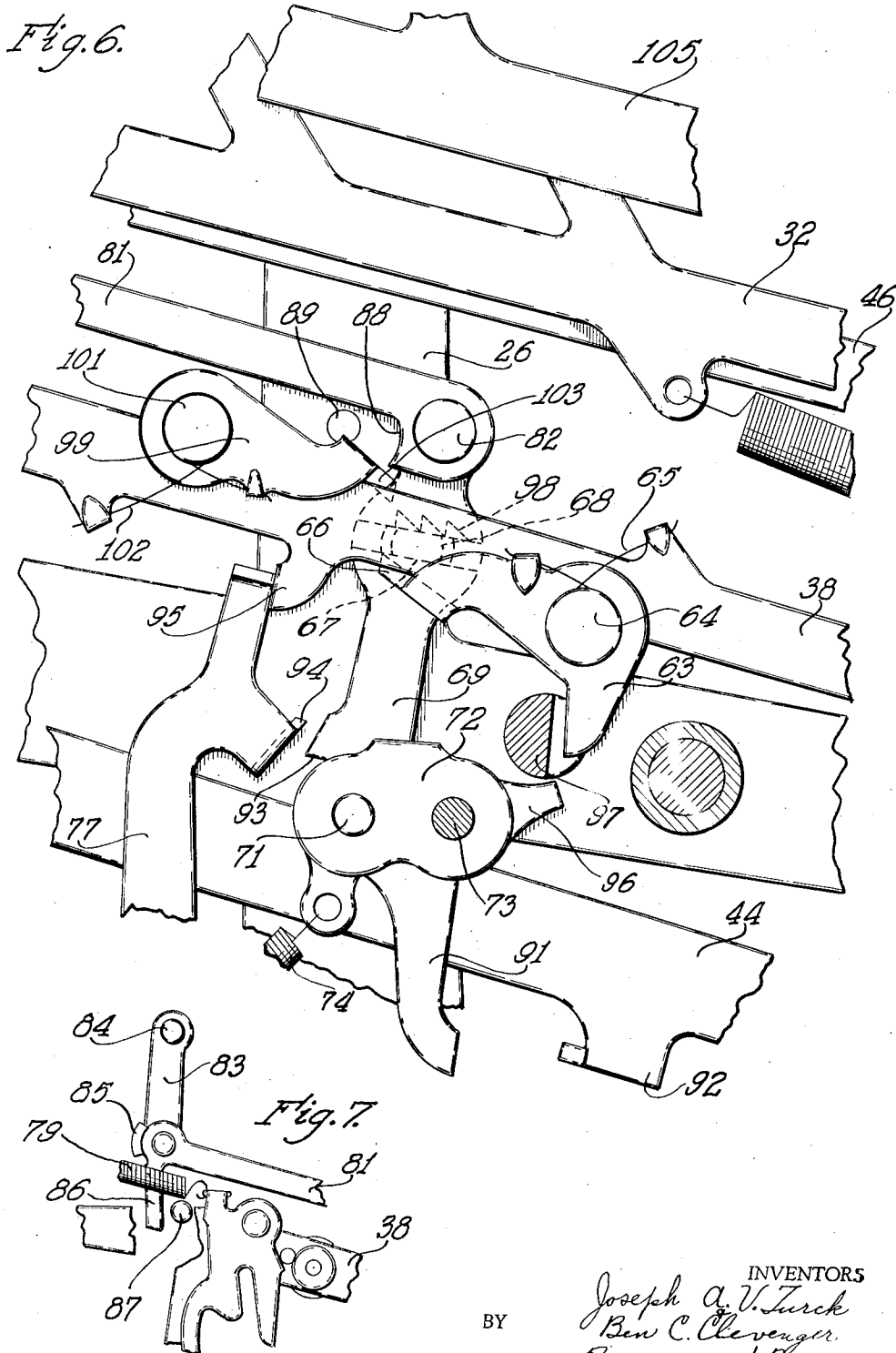
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UNITED STATES PATENT OFFICE

2,224,203

LOCKING MECHANISM FOR CALCULATING MACHINES

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Application November 19, 1936, Serial No. 111,624

12 Claims. (Cl. 235—130)

This invention relates in general to calculating machines, and more particularly to error control devices adapted to lock the machine in a novel manner after mismanipulation of one or more of the control keys therefor.

A principal object of the invention is to insure against miscalculation resulting from insufficient depression of a control key of a calculating machine.

Another important object of the invention is the provision in a calculating machine of means for indicating to the operator the particular key which has been mismanipulated.

A further important object of the invention is to maintain a digital control key in a power operated calculating machine, which has been insufficiently depressed in partially depressed position.

Another important object of the invention is the provision in a calculating machine having a keyboard with a plurality of denominational series or columns of keys of means for locking all of the keys against depression in the event of mismanipulation of any one key, except the mismanipulated key, and for maintaining the mismanipulated key in partially depressed position.

A further important object of the invention is to permit redepression of a mismanipulated key to correct the error in operation and to lock said key in fully depressed position after the error has been corrected.

Another important object of the invention is the provision in a key-responsive power driven calculating machine of means for preventing any power action in case of an incomplete down stroke of any digital key, except in response to the operation of the one key on which the error was made, together with means for holding such key in partially depressed position to register the key on which the error was made.

A further important object of the invention is the provision in such a machine of means for automatically releasing the means holding the mismanipulated key in partly depressed position by the power action resulting from full depression of such key to correct the error made.

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

In the drawings:

Figure 1 is a vertical sectional view taken on a longitudinal plane through a calculating ma-

chine embodying the features of the instant invention showing the mechanism associated with an individual denominational order of the machine;

Fig. 2 is a detail view similar to Fig. 1 of a column of keys and associated locking mechanism showing a mismanipulated key maintained in partially depressed position;

Fig. 3 is an enlarged detail view similar to Fig. 2 with parts broken away to show the key stem construction;

Fig. 4 is a view similar to Fig. 2 showing a mismanipulated and redepressed key locked in fully depressed position;

Fig. 5 is a view similar to Fig. 3 showing a key locked in fully depressed position as in Fig. 4;

Fig. 6 is a view similar to Fig. 1 showing certain parts of the latter on an enlarged scale; and

Fig. 7 is a similar enlarged view of other parts shown in Fig. 1, with parts broken away.

Referring more particularly to the drawings, the instant invention is disclosed as embodied in a key-responsive, power actuated calculating machine similar to those shown in United States Letters Patent Nos. 2,018,933, issued Oct. 29, 1935; 2,021,393, issued November 19, 1935; 2,043,021, issued June 2, 1936; and 2,063,962, issued Dec. 15, 1936. The machine comprises an outer casing generally indicated by reference numeral 21 and having a keyboard 22 in its upper portion. A plurality of keys 23 are arranged through the keyboard 22 and are adapted for manipulation to determine the digital degrees of the adding or calculating movements of the machine. These keys are arranged in the usual manner in denominational orders, only one such order of mechanism being disclosed in the instant drawings.

Each order of keys 23 is adapted to control the digital actuation of an accumulator or adding mechanism, the details of which are not shown in the drawings since they are not believed necessary to an understanding of the present invention. It may, however, be mentioned that each denominational order of the accumulator mechanism includes a pinion 24 mounted upon a cross rod or shaft 25, this shaft extending through partition plates 26 arranged between the various organizations of parts associated with each order of the machine.

Upon depression of a key, power is supplied from a power shaft 27 to extend a spring 28 associated with the particular denominational order of mechanism with which the key depressed is identified, release of this spring thereafter ac-

completing adding movement in an amount determined by the particular key depressed. Upon depression of said key, a gear segment 29 is arranged in position to impart proper and accurate digital accumulation to the mechanism. Depression of a key 23 causes its shank 31 to engage a bar 32 which is pivoted at the front at 33 (to the right in Fig. 1) and at the rear at 34 to levers 35 and 36, which levers are pivoted in turn upon cross shafts or rods 37. A link 38 is pivotally connected at 39 to the lever 35 and at 41 to the lever 36. The bar 32, levers 35 and 36 and link 38 are constructed and mounted as in United States Letters Patent No. 1,371,953, issued March 15, 1921. Further and more particular description of these parts is therefore thought to be unnecessary.

The rack sector 29 is pivoted upon a cross-shaft 42 and is respectively connected to a hook 43 by a link 44 and to a movement controlling bar 45 by a link 46, the former said connection being through a clutch 47. The operation of the parts is such that upon depression of a key, which, as has been explained, engages and depresses the bar 32, bar 45 is moved forward varying amounts, the particular amount in a particular instant being determined by the digital value of the key depressed. Thereafter and through suitable control mechanisms, which it is thought need not be here described in detail, the hook 43 is moved down into engagement with a toothed wheel 48 fast on the power shaft 27. This engagement pulls the link 44 toward the left, viewing Fig. 1, a set or uniform distance and until the hook is disengaged from the toothed wheel 48 automatically, as described in the above referred to Patent No. 2,063,962.

Such movement of the link 44 to the left in Fig. 1 extends the spring 28, the latter being connected to a lever 49 which is movable with the link 44, and moves the gear segment 29 downwardly on an idle stroke and into position to impart an adding movement upon release of the hook 43 and contraction of the spring 28. The downward movement of the segment 29 is under the control of the digital control bar 45 and is halted when it has been moved downward the selected distance, enabling it upon return movement to impart the degree of digital advancement to the adding mechanism which corresponds to the particular key depressed. The clutch 47 permits the continuation of the movement of the link 44 after movement of the segment 29 has stopped and until the end of the power stroke and automatic release of the hook 43. Upon the return stroke, the clutch 47 permits movement of the parts in reversed direction to the beginning of the adding movement, and thereafter accomplishes the adding actuation.

As in the Patents No. 2,018,933 and No. 2,021,393, mechanism is provided for preventing the operation of the manipulative devices (depression of the keys) after an insufficient key stroke and also until full return or upward movement of a depressed key has occurred. This mechanism will generally hereinafter be referred to as error control devices, and comprises a shaft 51 extending across the machine and provided at each denominational order of mechanism with a pivoted locking member 52 having a lip 53 at its upper end adapted to swing under a shoulder 54 formed on the rear end of the companion bar 32 to prevent its downward movement as the result of effort to depress any one of the keys 23 of its denominational 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, as shown in Fig. 1, by pins or projections 56 mounted upon and rotatable with an error lock retainer bar 57 mounted for oscillation in the partition plates 26. These parts are held in this position by a suitable trigger fixed upon and extending down below the error lock retainer bar 57, as shown in Fig. 2 of Patent No. 2,018,933, which in turn is normally in engagement with a suitable arm or projection fixed upon a touch-off rod or shaft 61 which extends across the calculator and is provided at each denominational order of the machine with an upwardly extending arm 62 secured thereto. A suitable spring is secured to an arm on the touch-off rod 61 to normally hold the arms 62 in the position shown in Fig. 1 of the drawings. Upon incomplete key stroke or upon premature depression of a key, mechanism is provided, which will now be described, to engage the particular arm 62 of the order in which mismanipulation has occurred to rotate the shaft 61 in a counter-clockwise direction, viewing Fig. 1, to move the arm thereon out of engagement with the trigger, such movement resulting in release of the error lock retainer bar 57 to permit springs 55 to move the locks 53 underneath their companion bars 32 to prevent subsequent manipulation of the machine.

This locking is immediately accomplished in all orders of the machine except that in which the error has occurred. The reason the locking of the series of keys containing that key which was mismanipulated 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 of its associated lock 52, as shown in Fig. 2, and remains in such position until correction of the error, as will be later described.

The mechanism for insuring complete key strokes of the digital keys 23 by moving the arm 62 in that order in which a mismanipulation of a key occurs will now be described. As has been pointed out above, downward movement of a key 23 carries its associated link or bar 38 forwardly. A latch or dog 63 is pivoted at 64 on the bar 38. A spring 65 normally presses a lip 66 of the latch 63 upwardly into contact with the lower edge of the bar 38. A ratchet tooth 67 is provided upon a ratchet member 68 arranged upon the upper end of a lever 69. The lever 69 is pivoted at 71 in a bracket 72 which in turn is pivoted on a cross-rod 73 arranged through the side plates 26. A spring 74 is attached at 75 to the lever 69 and to a lip 76 upon a lever 77 which is pivoted upon a cross-rod 78. Upon depression of one of the keys 23, the bar 38 is moved toward the right, as shown in Fig. 1, and the latch 63 being carried by it moves with it and past the ratchet tooth 67.

If a key be released without fully effective depression, the forward movement of the link or bar 38 will be incomplete, and a spring 79 tends to return the parts to their original position without accomplishing the calculating operation. A link 81 is pivoted at 82 to the upper end of the lever 69 and to a downwardly extending arm 83 which may be oscillated about a pivotal mounting 84 on an adjacent frame member 26. At the rear, to the left in Fig. 1, the link 81 is provided with a lip 85 arranged in registration with the companion arm 62 fixed on the touch-off rod or shaft 61. The spring 74, earlier described, tends to

swing lever 69 to the right, viewing Fig. 1, and to bring a detent 86 secured to the rear end of the link 81 into contact with a stop 87 to limit forward movement of the lever 69. If insufficient
 5 down stroke of a key occurs, latch 63 engages tooth 67 and through lever 69 moves link 81 rearwardly with bar 38 until lip 85 engages arm 62 rocking shaft 61 to lower its arm out of engagement with the trigger to release locks 53, locking
 10 all orders of the machine except that in which the insufficient key stroke has occurred. Such rearward movement of the link 81 is limited by a projection or shoulder 88 adjacent the forward end thereof coming in contact with a stop pin
 15 89 mounted in an adjacent frame member 26 for a purpose to be later more fully described.

Means are provided for moving the ratchet tooth 67 out of the path of the latch 63 if and when full key-stroke is accomplished. Each
 20 bracket 72 is provided with a downwardly extending arm 91 which is disposed across the path of movement of a lug 92 upon the link 44. As the parts near the end of the power stroke, the lug 92 engages the arm 91 and lifts the bracket 72
 25 about its pivot 73, carrying up the lever 69 to raise the ratchet tooth 67 above the lower edge of the bar 38 and out of the way of the latch 63. The lever 69 has a portion 93 which is adapted to engage above a shoulder 94 on the lever 77
 30 when the lever 69 is lifted by lug 92. This lever is held in such upper latched position until near the end of the return stroke, when a lug 95 on the bar 38 engages the upper end of the lever 77 to disconnect it from the shoulder 93, thereby
 35 arranging the parts for the next calculating operation. A forwardly extending lug 96 is provided on the bracket 72 for engagement with a rod 97 to limit downward movement under the pull of the spring 74 when the parts are moving from one
 40 position to another.

To prevent miscalculation from depression of a key 23 before the adding operation of a previous stroke is completed, a number of ratchet teeth 98 are arranged on the ratchet member 68
 45 and in position to be engaged and locked by a latch 99 pivoted at 101 on the bar 38 as this bar and the key depressed return to normal. A spring 102 normally presses a lip 103 of latch 99 downwardly into contact with the upper edge of bar 38.
 50 After full depression of the key, the lever 69 is lifted, and effort to depress the key or any other key in that column before the adding movement is completed will cause engagement by the latch 99 with one or the other of the teeth 98, since,
 55 during the return or adding motion of the bar 38, the lever 69 is held in raised position by the lever 77 and is adapted for engagement by the latch 99 if the depression of a key tends or attempts to move the bar 38 in the reverse direction, i. e.,
 60 upon a new adding actuation.

In the operation of the error control devices above described there is nothing to indicate to the operator which particular key has been mismanipulated. There is an indication of which
 65 column or denominational series of keys is the one containing the mismanipulated key, since all of the other columns of keys have been locked against depression, but the one key responsible for such locking of the other manipulative devices is not identified.
 70

The instant invention therefore provides means operating in conjunction with the above described error control devices for locking the particular key which has been mismanipulated in a partially depressed position to effectively identify it.
 75

A bar 105 having rearwardly extending pointed locking lugs or teeth 106 is pivoted upon studs 107 extending through slots 108 in the bars 32 and connected to the upper ends of levers 35 and 36 in each denominational order of the machine.
 5 Consequently, upon depression of a key 23, the bar 105 is moved rearwardly (to the left in the drawings) relative to the key stems 31. Referring more particularly to Figs. 3 and 5, each key stem 31 is provided adjacent its lower end with an
 10 aperture extending therethrough comprising a rounded lower portion 109 formed with oppositely bevelled or conical faces, and a slotted upper portion 110, as shown in Patent No. 2,043,021. This patent also fully describes the anchor-shaped
 15 key locks 111 which upon depression of any particular key in a column or denominational series of keys lock all other keys in that column against depression until the depressed key has been returned to normal position by its associated spring
 20 112.

As a key 23 is depressed from its normal position of Fig. 1, the lower end of its stem 31 passes its associated tooth 106 and impinges
 25 against the top of the bar 32 to lower the latter and move the bar 105 rearwardly. In this rearward movement of the bar 105, the end of the tooth 106 thereof associated with the selected key enters the aperture 109 in the key stem 31, as seen in Fig. 3. If the key is not completely depressed, the error control devices operate as above described, the link 81 being moved
 30 rearwardly until stopped by the shoulder 88 thereon engaging the stationary pin 89. This prevents the bar 32, and consequently the bar 105, from being returned upwardly beyond the position shown in Figs. 2 and 3, with the result that the mismanipulated key 23 is held in partially depressed position. All of the other
 35 keys in the affected column are thus locked against depression, and, as has been previously described, the keys in all the other columns of the machine are also locked against depression by the lips 53 of the lock members 52 engaging under the shoulders 54 on the bars 32.
 40

After a key 23 has been mismanipulated and released and is held in partially depressed position, as shown in Figs. 2 and 3, it may be completely depressed to correct the error in operation, and means are provided for locking the
 45 key on which the error has been made in fully depressed position after the error has been thus corrected. This is particularly important, because in the operation of the machine, especially in repeat additions for multiplication, the
 50 operator may redepess a mismanipulated key, without being aware that the key was erroneously operated, to correct such mismanipulation, and not know that an error had taken place until the locking up of the keyboard following
 55 such redepession. At such time the operator would have no knowledge of what particular key had been mismanipulated, and this is especially true if more than one column of keys is being operated simultaneously.
 60

In order to accomplish this result, the rear end of each of the bars 32 is provided with a shoulder 114, disposed above the shoulder 54, which will be positioned below the lip 53 on the associated lock member 52 when the bar 32
 65 is moved to its lowermost position by a complete depression of a key. The lip 53 of the lock member 52 in that denominational order in which a key 23 has been incompletely depressed and released will be resiliently held
 70 75

against the end surface of the bar 32, as shown in Fig. 2, by the spring 55. Therefore, upon complete redepression of the mismanipulated key to correct the error, the lock member 52 will swing forwardly to engage its lip 53 over the shoulder 114 to lock the bar 32 in fully depressed position, as shown in Fig. 4. In this lowermost position of the bar 32, the bar 105 is in its rearward position of Figs. 4 and 5, and it will thus be locked in this position to lock the mismanipulated and redepressed key 23 in fully depressed position.

Means are provided to return the locks 52 to their inoperative or normal position of Fig. 1 to release all of the bars 32 to permit continued operation of the machine. To this end a release or push button 115 (Fig. 1) is arranged at one side of the machine which, upon depression, rotates the error lock retainer bar 57 in a clockwise direction, viewing the drawings, to return the locks 52 to their position of Fig. 1 and allow all of the other parts to return to normal position. The bar or shaft 57 is maintained in this position by the trigger secured thereto engaging an arm on the touch-off rod 61, as above described and as shown in Patent No. 2,021,393.

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.

We claim:

1. In a calculating machine controlled in operation by depressible keys, locks for disabling said keys in case of an incomplete down stroke of any one of said keys, means conditioned by operation of said locks for holding the misoperated key partially depressed until the error has been corrected, and means conditioned by operation of said locks for holding said key fully depressed after the error has been corrected.

2. In a calculating machine controlled by denominational orders of depressible keys, means for locking all the keys of each order against further operation in case of an incomplete down key stroke, except the key on which the error was made, and means for holding the said key partially depressed until corrected and together with said first means for holding said key fully depressed after correction.

3. In a calculating machine having denominational orders of actuating mechanism controlled in operation by keys, locks for locking the actuating mechanism against operation when an incomplete key stroke is made, except that denominational order of mechanism controlled by the key on which the error was made, and mechanism conditioned by operation of said locks for holding the said key fully depressed when the error has been corrected.

4. In a calculating machine controlled by denominational orders of keys, locks for locking the machine against operation by any of said keys, in case of an incomplete down key stroke of any of the said keys, except by the one key on which the error has been made, means conditioned by operation of said locks for holding the said key fully depressed after the error has been corrected by fully depressing the said key, and manually manipulative means for simultane-

ously clearing the said locks and the depressed key.

5. In a key-responsive power driven calculating machine, locks for locking the machine against operation by any of its keys, in the event of a key stroke which has failed to produce a power actuation, except by the key on which the error was made, and mechanism conditioned by operation of said locks for holding the said key partly depressed to register the key that the error was made on.

6. In a key-responsive power driven calculating machine having denominational orders of keys, and means controlled by said keys in each of the denominational orders for effecting a power action; locking mechanism for preventing any power action in case of an incomplete down stroke of any of said keys, except in response to the operation of the one key on which the error was made, and mechanism conditioned by operation of said locking mechanism for holding said key in partly depressed position to register the key on which the error was made, said holding mechanism being released by the power action resulting from full depression of said key to correct the error made.

7. In a key-responsive power driven calculating machine, locks for locking the machine against operation by any of its keys, in the event of a key stroke which has failed to produce a power actuation, except by the key on which the error was made, means conditioned by operation of said locks for holding the said key partly depressed in case of such an error to register the key on which the error occurred, means conditioned by operation of said locks for holding the said key fully depressed after the error has been corrected, and means for automatically releasing said first holding means by the power actuation effected in the correction of the error.

8. In a calculating machine responsive to key action and having keys for operating said machine and adding mechanism responding to said key operation to register the result of key action, locks to prevent further operation of the machine, in case an adding action does not follow in response to a key action, except by the key from which the adding action failed to follow, and mechanism conditioned by operation of said locks for holding said key depressed after the error has been corrected to identify the key on which the error was made.

9. In a calculating machine responsive to key action and having keys for operating said machine and adding mechanism responding to said key operation to register the result of key action, locks to prevent further operation of the machine, in case an adding action does not follow in response to a key action, except by the key from which the adding action failed to follow, means conditioned by operation of said locks for holding said key partly depressed after the error to identify the key on which the error was made, and means conditioned by operation of said locks for holding said key fully depressed after the error has been corrected by an adding action.

10. In a calculating machine responsive to key action and having keys for operating said machine and adding mechanism responding to said key operation to register the result of key action, locks to prevent further operation of the machine, in case an adding action does not follow in response to a key action, except by the key from which the adding action failed to follow, mechanism conditioned by operation of said locks

for holding said key partly depressed after the error to identify the key on which the error was made, and means for unlocking the machine to allow continued operation thereof after the error has been corrected.

11. In a calculating machine having denominational orders of keys and denominational orders of adding mechanism responsive to said keys, locks for locking said adding mechanism against response to the action of any of the keys, in case there is a failure to produce an adding action in response to a key action, except the key from which the failure occurred, means conditioned by operation of said locks for holding the said key partly depressed to identify the key on which the error occurred, and means conditioned by operation of said locks for holding said key fully depressed after the error has been corrected, whereby the whole machine is locked against operation, with the key on which the error was made still indicating.

12. In a key-responsive power driven calculating machine having denominational orders of keys, and means controlled by said keys in each of the denominational orders for effecting a power action; locking mechanism for preventing any power action in case of an incomplete down stroke of any of said keys, except in response to the operation of the one key on which the error was made, mechanism conditioned by operation of said locking mechanism for holding said key in partly depressed position to register the key on which the error was made, said holding mechanism being released by the power action resulting from full depression of the said key to correct the error made, and means conditioned by operation of said locking mechanism for holding the said key fully depressed after the error has been corrected.

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