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CALCULATING MACHINE

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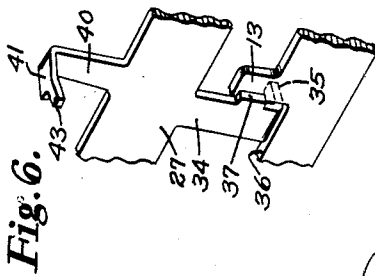


Fig. 6.

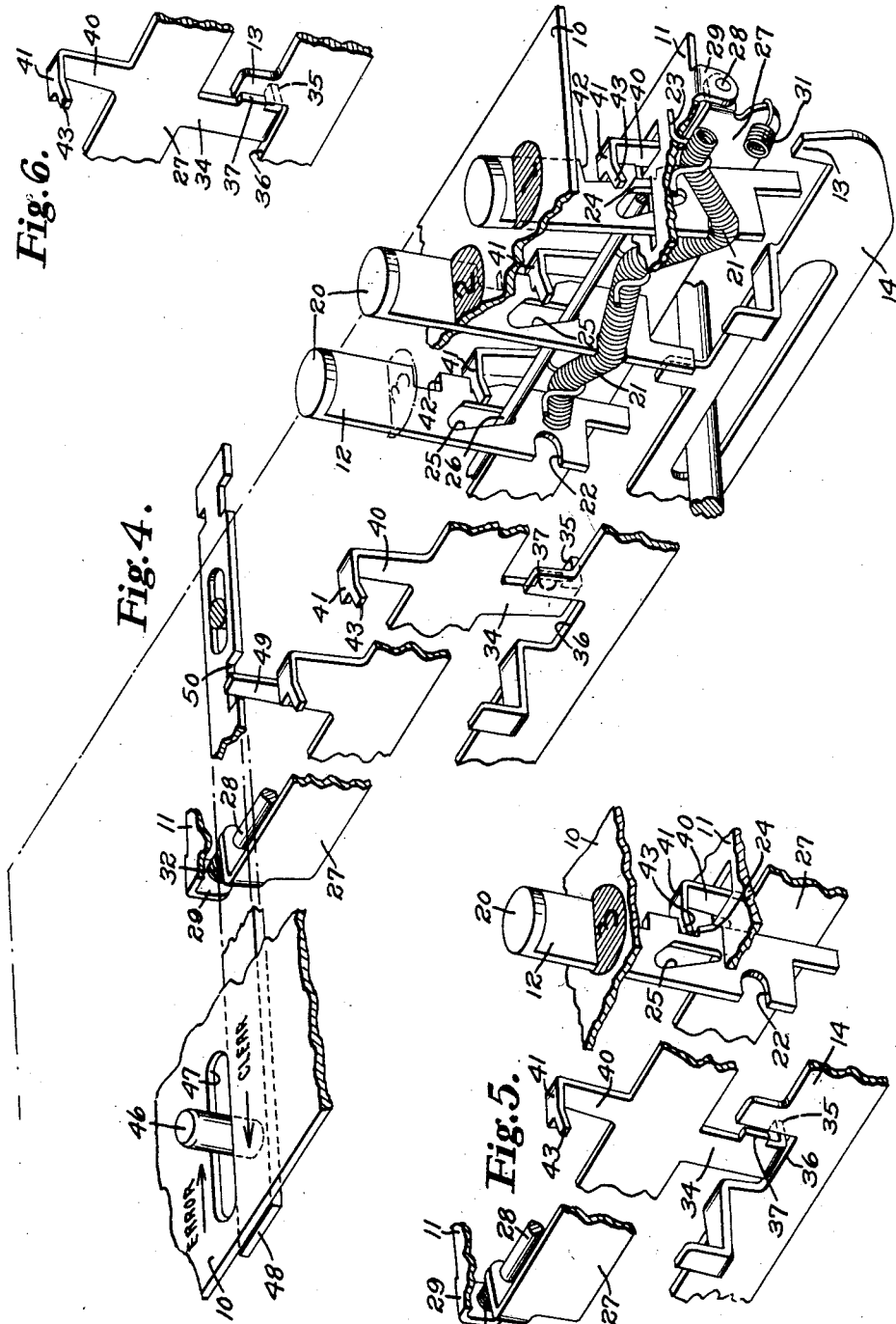


Fig. 4.

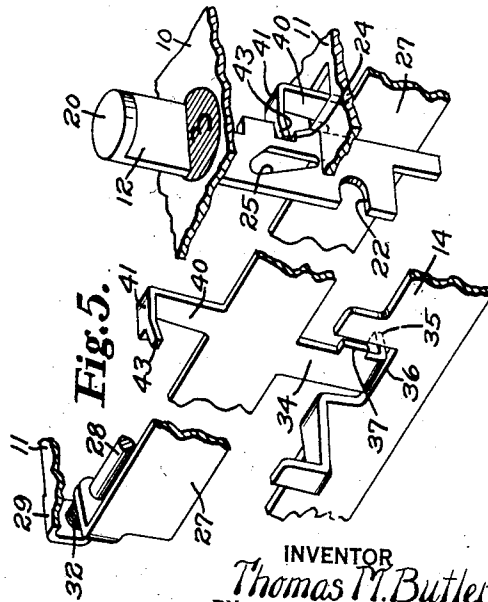


Fig. 5.

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## UNITED STATES PATENT OFFICE

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## CALCULATING MACHINE

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Continuation of application Serial No. 742,218,  
August 31, 1934. This application October 1,  
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17 Claims. (Cl. 235-145)

This invention relates to calculators and more particularly to the internal construction and arrangement of the interlocking mechanisms of a calculating machine and is a continuation of my prior application Serial No. 742,218, filed August 31, 1934.

It is the purpose of this invention to provide an improved calculating machine of small dimensions which can be manufactured economically.

It is a further purpose of this invention to simplify the mechanisms by reducing the number, size and complexity thereof.

A better understanding of this invention will be had from the following description in connection with the drawings which illustrate one embodiment thereof and in which,

Figure 1 is a right side sectional elevation of a calculating machine constructed in accordance with this invention, the figure being substantially actual full size of the machine;

Fig. 2 is a partial plan view of the keyboard;

Fig. 3 is an enlarged sectional detail of one of the keys and associated mechanism illustrating the key in normal position in full lines and in depressed position in dotted lines;

Fig. 4 is a partial perspective view of several keys of one bank illustrating one of the keys in depressed position and before the machine has been operated;

Fig. 5 is a detailed perspective of a portion of Fig. 4 showing the parts in the positions they occupy when the machine has been operated without depressing a key; and

Fig. 6 is a detailed perspective of a portion of Fig. 5 illustrating the machine in condition where another misoperation has been attempted.

Referring to the drawings, the machine is provided with an upper keyboard plate 10 and a lower keyboard plate 11 which guide and support key stems 12. The two plates are provided with a plurality of banks of slots through which the key stems project to support the stems and permit vertical sliding movement thereof.

Key stems 12 are adapted, when depressed, to be positioned in the path of stops 13 on index bars 14 which are movable longitudinally rearwardly or to the right in Fig. 1 when the machine is operated until the stops 13 limit against a depressed key stem. The rearward end of each index bar is attached to a pivoted actuator rack 15 which engages a pinion 16 carried by the register pinions 17. The pinions 17 are visible through a sight opening 18 in a casing 19 enclosing the entire calculating machine. For con-

venience, the index bars 14 and the racks 15, together with the connecting parts, will be called "differential actuators."

A compact keyboard is employed which may be manufactured economically, particularly in mass production. This is obtained by providing the upper plate 10 with a plurality of banks of index numerals 1 to 9, corresponding to the banks of keys projecting through the key slots instead of placing these numerals directly on the key tops. These numerals may be stamped or otherwise affixed directly or indirectly to the plate 10 or upon a member overlying the plate. The index numbers are of standard size and are arranged closely together in a plurality of closely adjacent banks corresponding to the key slots which can be and are so disposed as to bring the numerals proximate to each other, this being possible because of the location of the numerals and the size of the key tops as will be explained.

The key stems 12 are upset or swaged at their upper ends to provide relatively narrow heads or key tops 20 which are considerably smaller than the index numbers, this being possible because the key tops do not carry the index numbers. Although reduced in size to provide compactness and permit substantially full vision of the index numbers, the key tops are of sufficient size to permit depression of the key stems by the operator's finger tips.

This arrangement and construction permits reducing the actual keyboard size to dimensions just sufficient to include the reference numerals, eliminates the necessity of putting the reference numerals on the concave key top surfaces, and yet provides for sufficient space between the key tops for convenient and ready operation of all keys. The construction also permits of very economic manufacture of the keys themselves because the key tops can be formed very much in the manner of heading nails.

The keys are urged to normal position by a continuous coil spring 21 which extends longitudinally throughout one bank of keys passing through suitable slots 22 formed in one edge of the key stems. The spring is secured at each end to the edge of the lower keyboard plate and between each key by U-shaped wires 23 passing through slots in the lower keyboard plate 11 and supporting the springs at points approximately at the center of the key stems. The springs thus tend to urge the key stems upwardly and in a counterclockwise direction, i. e., the springs tend to move the lower portion of the stems to the right as viewed in Figs. 3, 4 and 5.

This sidewise movement of the key stems causes a notch 24 cut in the side of each stem to engage the lower plate 11 when the key is depressed and hold the key in depressed position, thus retaining the lower portion of the key stem in position to engage lug 13 of the index bar 14 when the machine is operated.

To insure counterclockwise movement of the key stems upon depression rather than any other movement thereof due to directional pushing by the operator, the key stems are provided with elongated openings 25 through which a shaft 26 extends. In normal position, shaft 26 occupies the bottom of the slot as shown in Fig. 3. Upon depression of the key, the upper edge of the slot therein engages the shaft and due to the inclined edge of the slot enforces counterclockwise movement of the key stem at the final portion of its downward movement to insure engagement of notch 24 with the lower plate 11. The lower edge of notch 24 is also beveled off to assist in counterclockwise movement of the key stem and to permit an easy release of the keys after each machine operation.

At the end of each machine operation all of the depressed keys are restored by means of bails 27, there being a bail for each bank of keys. Each bail extends the full length of plate 11 and is pivoted at each end to plate 11 by a shaft 28 supported by down-turned lugs 29 of the plate 11. The bails 27 are urged clockwise about their pivots (Fig. 4) and against the lower right edges of the key stems by springs 31. At the end of each machine operation the bails are moved clockwise by means, later described, to release all depressed keys by moving the stems free of plate 11. The bails are also mounted for limited axial movement along shaft 28 and are urged forward or to the right in Fig. 4, and to the left in Fig. 1, by springs 32.

Each bail 27 is also employed as a "zero stop" to prevent rearward movement of the index bars in the event the machine is operated without depressing any keys. For this purpose bail 27 is provided with a downwardly extending arm 34 having a laterally projecting end or lug 35. In normal position of the machine arm 34 and lug 35 lie within a notch 36 formed in the index bar 14 and prevent rearward movement of the index bar except for a slight movement permitted before lug 35 is engaged by the forward edge of notch 36. Upon depression of a key its stem is moved counterclockwise or to the right as viewed in Figs. 3, 4 and 5 under the influence of spring 21 and swings the bail 27 counterclockwise about its shaft 28, overcoming the action of spring 31, thus moving arm 34 and lug 35 out of notch 36 and out of the path of movement of index bar 14, permitting rearward movement of the latter to the limit determined by the depressed key.

Each bail 27 is also provided with a series of upwardly extending arms 40, there being one arm for each key in the bank, to prevent depression of a second key in any one column. For this purpose, the upper end of each arm 40 is bent over horizontally to provide a lug 41 for each key adapted to engage in slots 24 of the keys when undepressed and in upper notches 42 (Figs. 3 and 4) of the depressed keys each time any one key is depressed in a bank of keys. That is, prior to key depression the lugs 41 are clear of all notches, but engage therein according to whether the key is depressed or undepressed when the bail is swung about its pivot.

Provision is also made to prevent depression

of a key after the machine has started a stroke of operation. For this purpose lug 41 of each bail 27 is provided with a downwardly extending inclined finger 43. As can be seen from Fig. 5, if a key has not been depressed in a particular key bank and the machine is given a stroke of operation, index bar 14 is moved slightly rearwardly until the forward edge of notch 36 engages the lug 35 which action imparts a longitudinal movement to bail 27 on its shaft 28, thus moving finger 43 into the notches 24 of all undepressed keys preventing depression of any of the keys while the machine is being operated. At the end of a machine operation each index bar 14 is moved forward to its normal position by a shaft 44. Shaft 44 is supported by a swinging bail 44a and engages fingers 45 (Fig. 1) projecting from each index bar 14.

The bail is also utilized to prevent misoperation of the machine such as an attempt to depress one or more of the keys with the left hand while operating the machine with the right hand, with the result that a key is partially depressed when the machine starts to operate. Assuming such an attempted misoperation, it is apparent that a partial depression of a key would prevent entry of lug 41 in slots 24 or 42 and also prevent rearward movement of the bail because of engagement of finger 43 with the side of the key. To prevent this type of misoperation, arm 34 is provided with a forwardly projecting lip 37, which under the conditions mentioned prevents rocking of bail 27. At the first stage of such a misoperation, i. e., starting operation with a key partially depressed, bar 14 moves rearwardly slightly until the forward edge of notch 36 lies behind lip 37 as shown in Fig. 6 and prevents further rocking of the bail and thus prevents complete depression of said partially depressed key as well as release of bar 14. This prevents damage to the machine and an erroneous entry in the machine.

An error key is provided in the form of a button 46 projecting through an elongated slot 47 formed in the upper plate 10 and secured to a slide 48 mounted for horizontal sliding movements on the underside of plate 10.

Each bail 27 is provided near its rearward end with an upstanding arm 49 (Figs. 3 and 4) extending into a notch 50 cut in slide 48. To release any and all depressed keys when an error is discovered it is only necessary to move slide 48 to the right by moving button 46 to the right which movement of slide 48 moves arm 49 to the right (Fig. 3) swinging bail 27 clockwise (Fig. 4) to release the depressed keys from the lower keyboard plate, permitting raising of the keys by springs 21. It is understood, of course, that each bail 27 has a similar arm 49 engaging in a similar notch 50 so that all keys of all banks are released at each movement of slide 48.

Knob 46 and slide 48 are also used to clear or zeroize the machine. This is accomplished by moving the knob and slide to the left. This movement also moves the arms 49 of each bail 27 to rock all bails in a counterclockwise direction. This moves the downwardly extending arms 34 and the lugs 35 out of the path of index bars 14 so that when the machine is given a stroke of operation the index bars 14 will be released to move rearward under control of the zeroizing mechanism of the register pinions (not shown).

As previously stated, bail 27 is moved clockwise at the end of each operation to release all keys.

This is accomplished through slide 48 in the following manner.

In the normal position of slide 48, the finger knob or button 46 is yieldingly held in its center position, (Fig. 2) by a stud 46<sup>a</sup> which extends downwardly from the slide and is engaged by a crank 55 pivoted at 56 to the upper keyboard plate 10 and which is urged clockwise by spring 57. A second lever 58 also pivoted at 56 and engaging stud 46<sup>a</sup> has an arm 59 extending rearward where it contacts a fixed stud 60 extending from the keyboard plate 10, this latter arm is urged in a counterclockwise direction by a spring 61. Spring 61 is much stronger than spring 57 and serves to hold the arm 59 against the stud 60 and incidentally to position knob 46 in the center of its slot. Knob 46 may be moved to the left for total taking to rock lever 55 or to the right to rock all bails 27 to restore depressed keys.

When the machine completes its stroke of operation crank 55 is positively moved clockwise by lever 62 which results in releasing all depressed keys just as the machine arrives in normal position. Lever 62 is pivoted at 63, Fig. 1, to the left side of the machine and contains a downwardly extending lug 64 which under certain conditions engages a forwardly extending arm 65 fixed to the left end of shaft 44 and extending rearward where it is pivoted at 66 to a crank 67 secured to the shaft 68. Each time the machine is given a stroke of operation shaft 68 is rotated a single revolution in a clockwise direction and lever 65 is reciprocated and given an oscillating movement so that at the extreme end of the machine operation the forward end of lever 65 engages lug 64 and rocks lever 62 momentarily in a clockwise direction and then disengages it so as to allow the knob 46 (Fig. 2) to restore to its normal position.

It will be appreciated by those skilled in the art that the placing of the index numbers on the keyboard plate which permits reduction in size of the key tops which in turn permits moving the keys closer together makes it possible to provide a much smaller keyboard without sacrificing visibility or the necessary finger clearance between each key. For instance, the usual standard keyboard for the so-called portable calculating machines which have heretofore been considered small, requires a depth of approximately 6½", whereas the present arrangement reduces this distance to approximately 4". Likewise the width of the keyboard can be reduced from the conventional keyboard size of approximately 3" for a 5-bank machine to approximately 2½". It is understood, of course, that these dimensions are purely illustrative and relative to illustrate the actual possible reduction in size. As heretofore stated, Fig. 1 represents substantially a full size machine which may be made in accordance with this invention. The foregoing construction of the associated mechanisms, particularly the use of a single bail to perform five functions, is much simpler than that usually employed in calculating machines, eliminates many parts, occupies considerably less space, and may be manufactured at much lower cost.

It will also be obvious to those skilled in the art that minor changes may be made in the details of construction without departing from the spirit and scope of this invention as defined in the appended claims.

I claim:

1. A calculating machine keyboard comprising a frame, a key having a stem slidably mounted in said frame to enable said key to be depressed from a normal to a depressed position and to be restored to normal, said key stem also being so formed and mounted that its lower end may be swung laterally when the key is depressed to a predetermined position, spring means urging said key toward its normal position, cam means on said key stem acting against a fixed portion of said frame to positively move the lower end of said key stem laterally when said key is depressed to a predetermined position, latching means engaged by said key stem, when said stem is moved laterally, to thereby releasably hold said key in depressed position, and restoring means for returning the lower end of said key stem laterally toward normal to release it from said latching means to enable said spring means to restore said key to normal.

2. A calculating machine keyboard comprising upper and lower keyboard plates, a key having a stem slidably mounted in said plates to enable said key to be moved from a normal to a depressed position and to be restored to normal, said key stem also being so formed and mounted that its lower end may be swung laterally in said lower keyboard plate when said key is depressed to a predetermined position, a cam slot in said key stem whose edge engages a stud on said frame to positively move the lower end of said key stem laterally when said key is depressed to a predetermined position, spring means urging said key toward normal position, said key stem having a notch therein engaging over the lower keyboard plate when the lower end of said key stem is moved laterally, and means for moving the lower end of said key stem laterally to free it of said lower plate to enable said spring means to restore said key to normal.

3. A calculating machine keyboard comprising a frame, a bank of keys having stems slidably mounted in said frame to enable said keys to be selectively moved from a normal to a depressed position and restored to normal, each key stem also being so formed and mounted that its lower end can be moved laterally when the key is depressed to a predetermined position, a spring engaging the side edges of and operably connected to said stems, said spring being anchored at its ends and between each two key stems in such a manner that, when one of said keys is depressed, said spring tends to restore it to normal and also tends to move the lower end of said key stem laterally, latching means engaged by each key stem, when its lower end is moved laterally by said spring after the key has been depressed, to thereby releasably hold said key in depressed position, and means for moving the lower end of said key stem to free it of said latching means to enable said spring to restore said key to normal.

4. A calculating machine keyboard comprising upper and lower keyboard plates, a bank of keys having stems slidably mounted in said plates to enable said keys to be selectively moved from a normal to a depressed position and restored to normal, each key stem also being so formed and mounted that its lower end can be moved laterally in said lower plate when the key is depressed to a predetermined position, a coil spring positioned in notches in the side edges of said key stems, said spring being anchored at its ends and between each two key stems in such a manner that, when one of said keys is depressed, said

spring tends to restore it to normal and also tends to move the lower end of said key stem laterally, each key stem having a notch therein which engages over the lower plate, when the lower end of the key stem is moved laterally by said spring after its key has been depressed, to thereby releasably hold said key in depressed position, and means for moving the lower end of said key stem to free it of said lower plate to enable said spring to restore said key to normal.

5. In a calculating machine having differential actuators; the combination of a keyboard comprising a frame, a bank of keys having stems slidably mounted in said frame to enable said keys to be selectively moved from a normal to a depressed position and returned to normal, each key stem also being so formed and mounted that its lower end may be swung laterally when its key is depressed to a predetermined position, a bail positioned along said bank of keys and swingably mounted on said frame, said bail being normally positioned to act as a zero stop for the differential actuator for said bank of keys, means acting, when a key is depressed to said predetermined position, to swing the lower end of the key stem laterally to move it into the path of its differential actuator and cause it to swing said bail out of the path of said actuator, latching means engaged by said key stem when it is moved laterally to thereby releasably hold said key in depressed position, and means for moving said bail to return it to zero-stopping position and return said key stem laterally.

6. In a calculating machine having differential actuators; the combination of a keyboard comprising a frame, a bank of keys having stems slidably mounted in said frame to enable said keys to be selectively moved from a normal to a depressed position and returned to normal, each key stem also being so formed and mounted that its lower end may be swung laterally when its key is depressed to a predetermined position, spring means urging said keys toward normal position and also urging the lower ends of said key stems laterally, a bail positioned along said bank of keys and pivoted on said frame, said bail being normally positioned to act as a zero stop for the differential actuator for said bank of keys, each key stem having portions engaging said bail and acting, when a key is depressed to said predetermined position, to swing the bail out of the path of said actuator as the lower end of the key stem is swung into the path of said actuator, latching means engaged by said key stem when it is moved laterally to thereby releasably hold said key in depressed position, and means for swinging said bail laterally to normal zero-stopping position, said bail engaging the key stem of the depressed key to swing it laterally to release it from said latching means.

7. In a calculating machine having differential actuators; the combination of a keyboard comprising a frame, a bank of keys having stems slidably mounted in said frame to enable said keys to be selectively moved to a depressed position and returned to normal, each key stem also so formed and mounted that its lower end may be moved laterally when its key is depressed to a predetermined position, a bail positioned along said bank of keys and pivoted on said keyboard frame, said bail normally being in a position in which it acts as a zero stop for the differential actuator for said bank of keys, means acting, when a key is depressed to said predetermined position, to move the lower end of the key stem

laterally to place it in the path of said actuator and cause it to move said bail to disable the latter as a zero stop, said bail, when it is so moved, having portions entering notches in the key stems of undepressed keys of said bank to prevent their depression while the first key remains depressed.

8. In a calculating machine having differential actuators and adapted to be given cycles of operation; the combination of a keyboard comprising a frame, a bank of keys having stems slidably mounted in said frame to enable said keys to be selectively moved to depressed position and returned to normal, each key stem also being so formed and mounted that its lower end may be swung laterally when the key is depressed to a predetermined position, a bail positioned along said bank of keys, said bail being pivotally and slidably mounted on said frame and normally being in a position in the path of said actuator so that it acts as a zero stop for the differential actuator for said bank, means operating, when a key is depressed to said predetermined position, to move the lower end of the key stem laterally into the path of said differential actuator and cause said key stem to engage said bail and swing it on its pivot to thereby move said bail out of the path of said actuator, said bail having portions which, when said bail is so swung, engage with the undepressed keys of said bank to hold them against depression, means including said actuator and operating at the beginning of a machine cycle to slide said bail, said bail also having portions which, by said sliding of the bail, are moved to a position to lock all of the keys of said bank against movement during a portion of the machine cycle, and means operating later in the machine cycle to restore said bail to normal and to release said keys.

9. In a calculating machine adapted to be given cycles of operation and having differential actuators; the combination of a keyboard comprising a frame, a bank of keys having stems slidably mounted on said frame to enable said keys to be selectively movable from a normal to a depressed position and to be returned to normal, a zero stop for the differential actuator for said bank of keys, each of said key stems having portions acting, when its key is fully depressed, to move said zero stop free of said actuator, and means including said actuator acting at the beginning of a machine cycle to directly block said zero stop against movement to actuator-releasing position when no key in said bank is depressed and when a key in said bank is only partially depressed at the time a machine cycle starts.

10. In a calculating machine adapted to be given cycles of operation and having differential actuators; the combination of a keyboard comprising a frame, a bank of keys having stems slidably mounted on said frame to enable said keys to be selectively movable from a normal to a depressed position and to be returned to normal, a zero stop for the differential actuator for said bank of keys, each of said key stems having portions engaging said zero stop to move said zero stop free of said actuator when its key is fully depressed, and means acting at the beginning of a machine cycle to move said actuator to directly block said zero stop against movement to actuator-releasing position when a key in said bank is only partially depressed at the time a machine cycle starts, said zero stop, when blocked, preventing full depression of any of said keys by

reason of the engagement between said zero stop and said key stems.

11. In a calculating machine adapted to be given cycles of operation and having differential actuators; the combination of a keyboard comprising a frame, a bank of keys having stems slidably mounted on said frame to enable said keys to be selectively movable from a normal to a depressed position and to be returned to normal, and a zero stop for the differential actuator for said bank of keys permitting a slight movement of said differential actuator at the beginning of a machine cycle when said zero stop is in actuator-arresting position, each of said key stems having an operative connection with said zero stop acting, when its key is fully depressed, to move said zero stop free of said actuator, said actuator having portions acting, when said actuator is moved slightly at the beginning of a machine cycle while said zero stop is in actuator-arresting position, to directly block said zero stop against movement to actuator-releasing position, said zero stop then acting through the operative connections with the key stems to prevent full depression of any key.

12. In a calculating machine adapted to be given cycles of operation and having differential actuators; the combination of a keyboard comprising a frame, a bank of keys having stems mounted on said frame to enable said keys to be selectively movable from a normal to a depressed position and to be returned to normal, and a pivoted bail along said bank of keys acting as a zero stop for the differential actuator for said bank of keys, said zero stop, when in actuator-arresting position, permitting a slight movement of said differential actuator at the beginning of a machine cycle, each of said key stems having portions engaging said zero-stop bail to swing said bail on its pivot when said key stem is fully depressed to thereby free said actuator, said actuator having portions acting, when it is moved slightly at the beginning of a machine cycle while said zero-stop bail is in actuator-arresting position, to move in the path of said zero-stop bail to block movement of said bail to actuator-releasing position and to prevent full depression of any of said keys.

13. In a calculating machine adapted to be given cycles of operation; of a keyboard comprising a frame, a bank of keys having stems slidably mounted in said frame to enable said keys to be selectively moved from a normal to a depressed position and returned to normal, a key latching bail engageable by the stem of each key upon full depression thereof to move said bail to a position to latch the other keys of said bank against depression, and means normally operating at the beginning of a machine cycle when no key in said bank is depressed, to move said bail to position it to lock all of said keys, said means operating at the beginning of a machine cycle started with any of the keys in said bank partially depressed, to prevent movement of said latching bail by said keys, whereby said latching bail then prevents full depression of any of the keys in said bank.

14. In a calculating machine having differential actuators and adapted to be given cycles of operation; the combination of a keyboard comprising a frame, a bank of keys having stems slidably mounted in said frame to enable said keys to be selectively moved from a normal to a depressed position and returned to normal, and a key latching bail engageable by the stem of

each key upon full depression thereof to move said bail to a position to latch the other keys of said bank against depression, the actuator for said bank of keys moving at the beginning of a machine cycle when no key in said bank is depressed to move said bail to position it to lock all of said keys, said actuator, by its movement at the beginning of a machine cycle started with any of the keys in said bank partially depressed, acting to prevent movement of said latching bail by said keys, whereby latching bail then prevents full depression of any of the keys in said bank.

15. In a calculating machine having differential actuators and adapted to be given cycles of operation; the combination of a keyboard comprising a frame, a bank of keys having stems slidably mounted in said frame to enable said keys to be moved from a normal to a depressed position and returned to normal, a bail movably mounted on said frame along said bank of keys, said bail normally being positioned to act as a zero stop for the actuator of said bank but being movable by said keys, when one of them is fully depressed, to free said actuator, portions of said bail, when it is thus moved, engaging the stems of undepressed keys to prevent their depression, said actuator moving at the beginning of a machine cycle when no key in said bank is depressed to move said bail to position portions of it to block operation of all of said keys during a predetermined portion of the machine cycle, and means operating during said machine cycle to restore said bail to normal, said actuator, by its movement at the beginning of a machine cycle started with any of the keys of said bank partially depressed, acting to block movement of said bail to thereby prevent its movement to actuator-releasing position and also cause it to prevent full depression of any of said keys.

16. In a calculating machine having differential actuators and adapted to be given cycles of operation; the combination of a keyboard comprising a frame, a bank of keys having stems slidably mounted in said frame to enable said keys to be moved from a normal to a depressed position and returned to normal, said key stems also being so formed and mounted that their lower ends are movable laterally, a bail positioned along said bank of keys, said bail being pivotally and slidably mounted on said frame and being urged to a position in engagement with the lower ends of said key stems in which position a portion of said bail acts as a zero stop for the actuator of said bank, means acting, when a key is fully depressed, to move the lower end of the stem of said key laterally, latching means engaged by said key stem when so moved to releasably hold the key depressed, said key stem, when moved laterally, engaging said bail and moving it on its pivot out of the path of engagement of said actuator, said bail, when so moved, having portions moving into engagement with the stems of undepressed keys to latch them against depression, said actuator moving at the beginning of a machine cycle when no key in said bank is depressed to slide said bail to cause portions of it to enter notches in all of said keys to thereby lock all of the keys against movement during a predetermined part of the machine cycle, and means operating to restore said bail to normal, said bail during its restoring movement engaging the lower end of the depressed key to move it laterally out of

latching engagement with the latching means, said actuator by its movement at the beginning of a machine cycle started with any of the keys of said bank partially depressed, acting to block movement of said bail to thereby prevent its movement to actuator-releasing position and also cause it to prevent full depression of any of said keys.

17. In a calculating machine having differential actuators and adapted to be given cycles of operation; the combination of a keyboard comprising a frame, a bank of keys having stems slidably mounted in said frame to enable said keys to be moved from a normal to a depressed position and returned to normal, said key stems also being so formed and mounted that their lower ends are movable laterally, a ball positioned along said bank of keys, said ball being pivotally and slidably mounted on said frame and being urged to a position in engagement with the lower ends of said key stems, in which position a portion of said bail acts as a zero stop for the actuator of said bank permitting said actuator a slight movement at the beginning of a machine cycle when said bail is in zero-stopping position, means acting, when a key is fully depressed, to move the lower end of the stem of

said key laterally, latching means engaged by said key stem when so moved to releasably hold the key depressed, said key stem, when moved laterally, engaging said ball and moving it on its pivot out of the path of engagement of said actuator, said bail, when so moved, having portions moving into engagement with the stems of undepressed keys to latch them against depression, means normally operating automatically at the beginning of a machine cycle to move said actuator to slide said ball to cause portions of it to enter notches in all of said keys to thereby lock all of the keys against movement during a predetermined portion of the machine cycle, means operating to restore said ball to normal, said bail during its restoring movement engaging the lower end of the depressed key to move it laterally out of latching engagement with the latching means, and means rendered operative by said slight movement of said actuator at the beginning of a machine cycle started prior to full depression of any of the keys of said bank for blocking movement of said bail to thereby prevent its movement to actuator-releasing position and also cause it to prevent full depression of any of said keys.

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