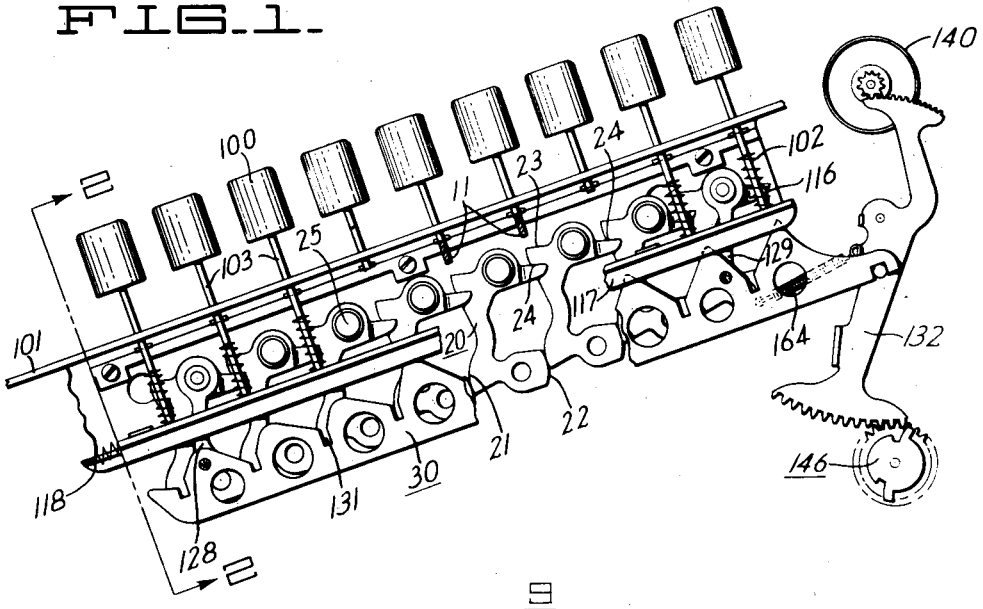
Jan. 22, 1952 G. K. HURNI 2,583,377

SELECTION MECHANISM

Filed March 17, 1947

FIG. 1.



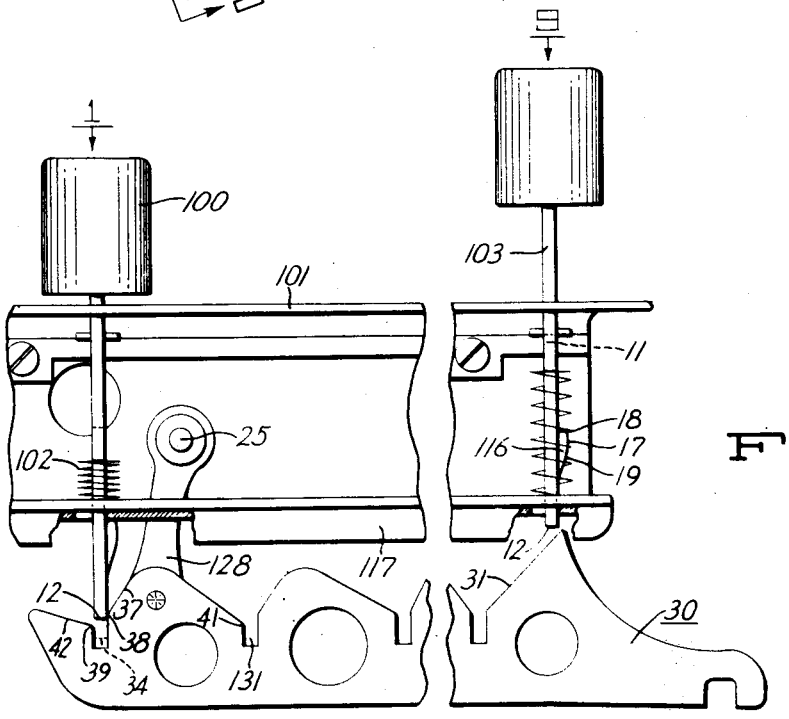


FIG. 3.

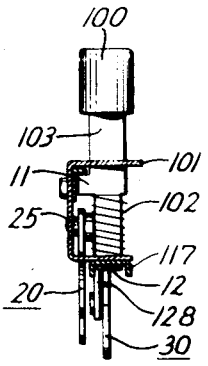


FIG. 2.

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SELECTION MECHANISM

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1 Claim. (Cl. 235—145)

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The present invention relates to value entering mechanisms for calculating machines and the like, and more particularly to keyboard mechanism for such machines.

The rapid and accurate depression of keys of the conventional keyboards of key-set calculating machines and other machines embodying flexible keyboards can be made more feasible, without eliminating functions desirably performed by the setting of such keys, only by mechanical improvement of the keyboard mechanism itself; and much effort has been directed toward such improvement. However, changes of an obvious nature, such as decreasing the force exerted by the springs which tend to hold the keys in raised position to thereby make them easier to depress, all introduce difficulties which limit the extent to which the key touch can be lightened by such expedients or else require the addition of special mechanism for overcoming the difficulties introduced, thus making the mechanism very complex.

It is the primary object of the present invention to lighten the key touch of the keys of flexible keyboards without impairing any operational features thereof and without the introduction of mechanical complications.

Flexible keyboards generally include a series of banks of spring raised depressible keys, usually nine in a bank, and a key latching member associated with each bank of keys in such a way as to be capable of latching any key in the bank in depressed position, but operable by any other key in the bank, upon depression thereof, to release the previously depressed key and latch down the second key. Preferably each bank of keys is also provided with interlocks effective to prevent simultaneous depression of two or more keys to latched position. The part of the value entering mechanism set by the depressible keys commonly, but not necessarily, includes what is known as a V-slot bar, having cam edged notches one of which is engaged by each key so that depression of a given key will move the bar a distance proportionate to the key value.

The present invention is based upon the principle of imposing upon certain of these conventional elements of a flexible keyboard, additional functions of such a character as to permit the lightening of the key springs and, optionally, the adoption of other expedients for lightening the key touch, without introducing operational difficulties such as would otherwise result from the adoption of such expedients.

In order to illustrate the extent to which the

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advantages may be realized by the application of this principle according to the present invention, it is disclosed herein as embodied in the commercially known Marchant calculating machine as shown and described in the Avery Patent No. 2,271,240, but while this disclosure illustrates the preferred mode of applying the principle outlined above, it will be understood that the invention is applicable as well to any key-set machine embodying a flexible keyboard.

Additional objects and advantages of the invention will also be apparent from the following description, reference being had to the accompanying drawings, in which:

Figure 1 is a right side view of one denominational order of the keyboard and selection mechanism of a Marchant calculating machine embodying the present invention.

Figure 2 is a sectional view taken on the line 2—2 of Figure 1.

Figure 3 is an enlarged fragmentary view of part of the mechanism of Figure 1, showing the number one key depressed and latched and the number nine key in normal raised position.

When a numeral key is depressed it sets or conditions selection mechanism prior to entry of a value into the accomulator by the actuator. In the case of the machine in connection with which the present invention is disclosed, the keys in a given order each effect movement of a differentially settable selection bar in predetermined amounts depending on which numeral key is depressed. Each selection bar rotates a segment 132 counterclockwise. The segment, in turn, sets a related selection unit 146 in accordance with the key depressed and also rotates a numeral wheel 140 to indicate the numeral value of the key depressed. The numeral key sections are provided with latch bars 117 to hold a key in depressed position, arranged so that the depression of any numeral key will cause the bar 117 to release any previously depressed key in that order.

More specifically, the keyboard mechanism disclosed for effecting the above operations includes a series of nine keys 100 (Figs. 1, 2, and 3) each of which is mounted for up and down movement in a frame 101 and is urged upwardly by a spring 102 as disclosed in Avery Patent No. 2,271,240.

In the machine of the present invention the key touch is lightened by making these springs of the minimum strength necessary to raise a respective key and to hold the same in its normal raised position. In order to insure the prompt rise of a depressed key upon depression

of another key in that same order (previously accomplished by springs 102, which had therefore to be made substantially stronger) the weaker spring is supplemented by utilizing the force of the depression of the key to positively raise a previously depressed key. This function is accomplished by means which also serves as an interlock between the keys so as to prevent two keys from being locked down either by such simultaneous depression or by rapid sequential depression of two keys.

This interlocking and key-raising means comprises a series of bellcrank levers 20, each of which is freely mounted on the frame 101 by a stud 25 and so related to the next adjacent bellcrank 20 that clockwise rotation of any one of them about its pivot 25 will cause all bellcranks 20 to its left as viewed in Figure 1, to rotate clockwise equal amounts about their respective pivots; conversely, if any bellcrank 20 be rotated counterclockwise, all bellcranks 20 to its right will be rotated counterclockwise an equal amount.

An extension 11 (Figs. 1 and 2) is provided on each of the key stems 103, which extension is adapted to cooperate with a shoulder 23 of one bellcrank 20 and shoulder 24 of an adjacent bellcrank 20. Thus, when a key 100 is depressed, extension 11 of stem 103 contacts shoulders 23 and 24 of two adjacent bellcranks 20, rotating one bellcrank counterclockwise and the other clockwise respectively, and each one of the two bellcranks so rotated exerts a similar motion to the adjacent bellcrank 20 to the right or left respectively by means of a radial heel 21 or toe 22, each of which cams its adjacent toe 22 or heel 21. The bellcranks initially rotated act upon the adjacent ones and so on throughout the series; the series in effect acting simultaneously.

Those bellcranks which are rotated clockwise raise their shoulders 23 under the extensions 11 of the key stems 103, and those which are rotated counterclockwise raise their shoulder 24 under the respective extensions 11. In either case the shoulders 23 and 24 will force up any previously depressed key, locking it and all keys except the one being depressed, in normal raised position.

Disposed beneath the numeral keys 100 in each bank or order is a differentially settable selection bar 30 (Figs. 1, 2, and 3) which is suspended from channel frame 101 by means of two parallel links 128 and 129, freely pivoted on studs in the frame 101, thus permitting endwise movement of the bar 30. This bar has nine V-shaped recesses, each of which terminates in a notch 131 proportioned to receive the end 12 (Figs. 2 and 3) of an associated key stem 103 so that the bar 30 will be accurately positioned. The key stems 103 are spaced equal distances apart, and these distances are slightly greater than the spacing between successive notches 131, so that each succeeding notch will be spaced one increment farther away from its cooperating key stem. Depression of a numeral key will therefore cam the selection bar 30 to the right a number of increments proportional to the value represented by the depressed key. The greater the value of the key depressed, the greater the number of increments the bar will be displaced from normal position. A spring 164 (Fig. 1) attached to segment 132 and suitably anchored to a part of the machine normally urges the selection bar 30 to the left which is the normal position of the bar, and which direction is opposite to that in which the bar is advanced by the keys.

Each key stem 103 also has a cam extrusion 116 (Fig. 3) which, upon depression of the associated key, cams a slotted key locking slide 117 toward the right as viewed in Figs. 1 and 3. This locking slide is supported for sliding movement on the bottom flange of channel frame 101 by studs fixed to the slide and extending through elongated holes in the frame. When a numeral key stem has been depressed the cam extrusion 116 passes beneath the slide and permits the latter to return to its initial position under urge of a spring 118, and by overlying the upper end of the extrusion 116 the slide latches the depressed key in its depressed position. The setting of any value in a keyboard order can be changed simply by depressing a different key in the same order. The depression of the second key cams the locking slide toward the right as described above and at approximately the mid-point of key depression the extrusion releases the key which was previously depressed and latched down.

Because of the provision for rapidly and surely raising a key by means of the previously described key raising means, it is possible according to the present invention to form the extrusion 116 so that the greatest width of the extrusion at point 17 (Fig. 3) is closer to the shoulder 18 than according to prior designs. This gives a reduced camming angle to face 19 and consequently lightens the key touch by easing the resistance of latch bar 117 against the key without lengthening the total stroke of the key, and also permits deeper depression of a key before a previously depressed key is released, thereby providing greater safety against inadvertent release of a depressed key by an accidental light depression of another key. But for the action of the positive key-raising means of the present invention, a steeper camming angle on face 19 would be necessary in order to enable even a heavier key spring to raise a depressed key clear of its notch 131 in the selection bar 30 before movement of said bar by depression of a second key in an interchange of setting keys in which one depressed key is released by depression of another.

Because of the provision for rapidly and positively raising a key by means of the previously described key raising means, it is also possible according to the present invention, to further lighten the key touch by making the camming surfaces of the V-shaped recesses in bar 30 somewhat steeper than in prior designs, without risk that one depressed key will not rise clear of its notch 131 before a second key engages the bar 30.

In the illustrated embodiment of the invention, in order to provide for easier setting of the selection mechanism by the keys 100, the camming angles of bar 30 have been made steeper by various amounts. With the exception of the camming angles underlying the number one, two, and three keys, this variation has been chosen so as to give the most favorable angles to those camming surfaces which, when moved by the keys, set the selection bar the greater number of increments from normal position. The camming angles underlying the one, two, and three keys on the other hand are given a less favorable angle in order to keep the key touch of those keys approximately the same as that of the higher value keys.

The steepening of the camming angles by the maximum amounts permitted by the key raising mechanism, however, presents certain added problems. When the displacement of the selection bar must be maintained the same as that attained by the prior mechanism of the afore-

mentioned patent, and the key notches 131 in bar 30 are equally spaced, any variation in the angles of the camming surfaces 31 requires that some of the latter be of different heights. Thus, in the present embodiment, the cam surfaces which act in moving the selection bar 30 the greatest amounts are increased in height and approach very closely to the bottom of the key stems.

The increased height and the variations in the heights of the cam surfaces creates a problem of clearance between the selection bar and a depressed key when a second key is depressed. For example, assume that with either the number one or number two key latched down with the bottom of the stem in its notch 131, the number nine key be depressed. The latter key normally lies closer to the selection bar than does any other key. This is because the nine key must displace the bar a greater number of increments than any other key. Thus, if the nine key were depressed it would almost immediately engage its cooperating camming surface of bar 30 and start to move the bar before the locking slide 117 could release either the number one or number two key. Consequently, a bind would exist between the number one or two key and the nine key through the selection bar. Similar binds would be possible between the one key and the six, seven, or eight keys, but the one and nine keys are referred to hereinafter as typically illustrating the example of interference.

The selection bar of the machine of the present invention is proportioned in the following manner so as to prevent the above mentioned interference. When the #1 key 100 (Fig. 3) is depresssed the lower edge of the key stem engages a primary camming surface 37 and moves the selection bar 30 one increment toward the right as described hereinbefore and then the bottom of the key stem moves down into the notch to the position shown by the dotted line numbered 34 to thereby positively locate the bar and prevent overthrow. When the operator releases the key, the spring 102 raises the key to the full line position of the end 12 shown in Fig. 3 where it is retained by the lock bar 117. The spring 164 (Fig. 1) urges the bar toward the left but such retrograde movement is blocked by the shoulder 38 pressing against the side of the key stem which thereafter holds the bar in the #1 position shown. In rising to the locked position shown in Fig. 3, however, the bottom of the key stem moves above and out of engagement with shoulder 39 since the latter shoulder has no part in maintaining the bar set once it is positioned.

Assuming now that the #9 key is depressed, the bottom of the nine key stem almost immediately engages the camming surface 31 and starts to move the bar before the extrusion 116 of the #9 key moves down far enough to release the #1 key from the lock bar 117 in a manner described hereinbefore. If the shoulder 39 for the #1 notch were at the same level as the shoulder 38 as shown in Avery Patent No. 2,271,240, the shoulder 39 to the left of the #1 key stem would block the immediate rightward movement of the selection bar and thus prevent depression of the nine key; and the pressure of the nine key against the selection bar and the consequent pressure of the left shoulder against the side of the #1 key stem would prevent the release of the #1 key, even if the #9 key could be forced low enough to release the latch bar, such as by a slow depression of the nine key. Since the

shoulder 39 and its adjacent secondary cam surface 42 are lowered, however, as in the case of the present invention, the selection bar 30 will be free to move to the right upon depression of the nine key, and the #1 key will be free to rise when the #9 key releases the same from the lock bar 117. The foregoing arangement, therefore, provides for positive positioning of the selection bar by the #1 key with means for retaining the bar in the #1 position, but at the same time permits the movement of the bar toward the #9 position before the #1 key is released by the nine key. The left shoulder 41 of the number two notch 131 is cut away similar to that of the number one notch in order to prevent a bind between the number nine key and the number two key as explained hereinbefore.

There can be no interference between any combination of the keys other than the ones described above because in all other cases the locking slide 117 effects release of a key before a depressed key can start to move selection bar 30, and if that part of the lightening of the key touch achieved by changing the camming angles of the selection bar is not desired to be availed of to the maximum extent, the shoulders 39 and 41 need not be made lower than their opposite shoulders; this being an optional feature of the invention.

The present invention therefore overcomes all objections inherent in lightening the key springs 102 and in giving the cam surfaces of the selection bar 30 and of the extrusions 116 more favorable camming angles.

I claim:

In a calculating machine having a keyboard comprising a series of depressible keys representative of the numeral values 1 to 9 respectively, each key including a key stem guided for up and down movement in the frame of the machine and manipulable from a normal to a fully depressed position, and a device effective upon manual depression of one of said keys for latching the same in an intermediate position substantially above the fully depressed position and effective upon depression of another key of said series for releasing the first key from restraint of said device and for latching said other key in depressed position; the combination of, a differentially settable bar mounted for movement to a plurality of positions each corresponding to the respective value of a depressed key, said bar including a plurality of recesses each composed of a primary camming surface which is engaged by the stem of a key of greater value than the first one depressed to advance the bar to a position corresponding to the second key depressed and a secondary camming surface which is engaged by the key stem of a key of lesser numeral value than the first one depressed to move the bar in the reverse direction to the position corresponding to the second key depressed, the slope of the secondary camming surface for the lesser value key being substantially less than the slope of the primary camming surface for the greater value key to permit the releasing means to release said greater value key from said latching device upon depression of the lesser value key before the latter engages its secondary camming surface, and a notch composed of two oppositely disposed shoulders at the bottom of the primary and secondary camming surfaces respectively which shoulders embrace the bottom of the key stem to positively locate the bar in the position corresponding to the key depressed, the shoulders of

the notch for a lesser value key being of such heights with respect to each other that when said key is latched in said intermediate position by said device the bottom of its key stem is in the path of the shoulder at the bottom of the respective primary camming surface but is above and out of the path of the shoulder at the bottom of the respective secondary camming surface to thereby permit the movement of the bar in response to depression of a greater value key while the lesser value key is latched in its intermediate position.

GEORGE K. HURNI.

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