May 14, 1968 O. HABERKORN ETAL 3,383,036

ARRANGEMENT FOR POSITIONING THE DECIMAL POINT IN CALCULATING MACHINES

Filed May 12, 1966 2 Sheets-Sheet 1

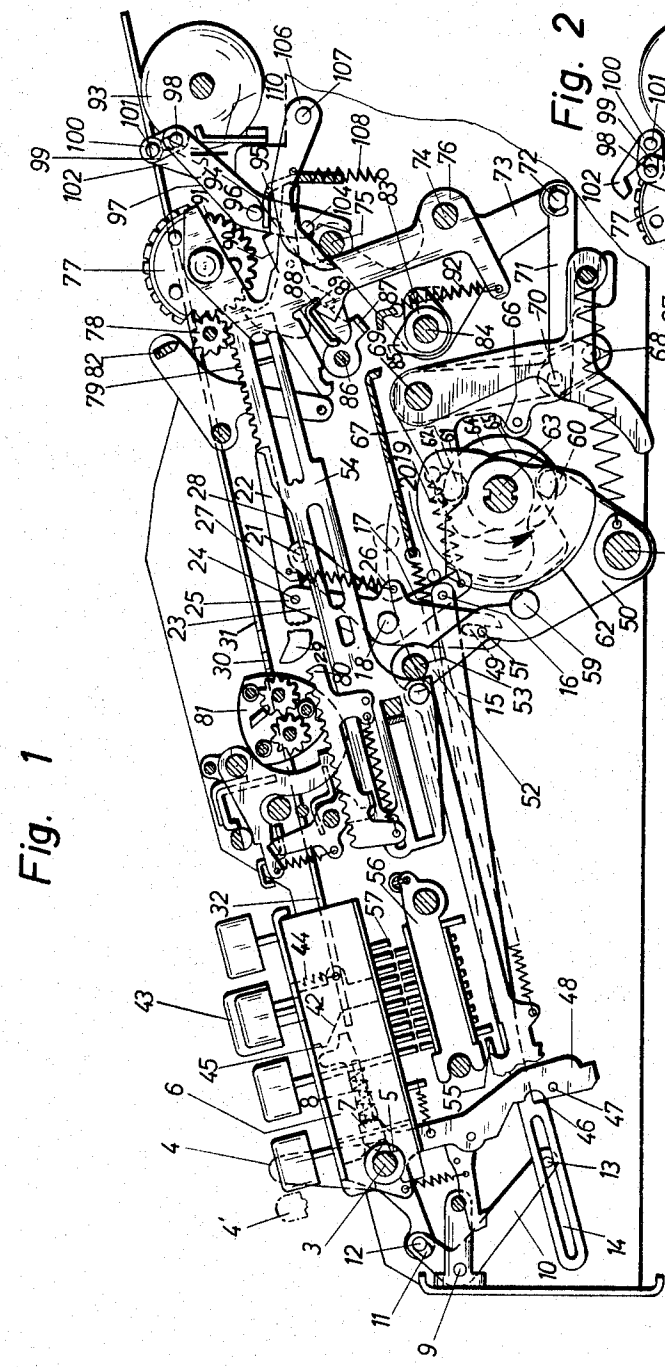

Fig. 1

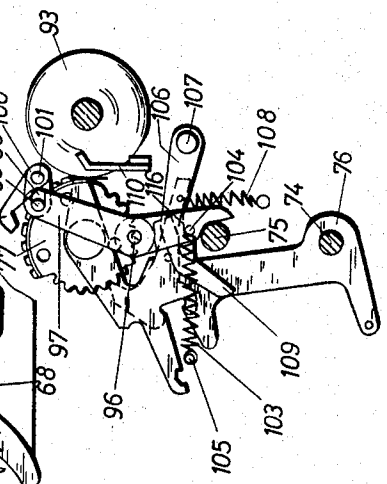

Fig. 2

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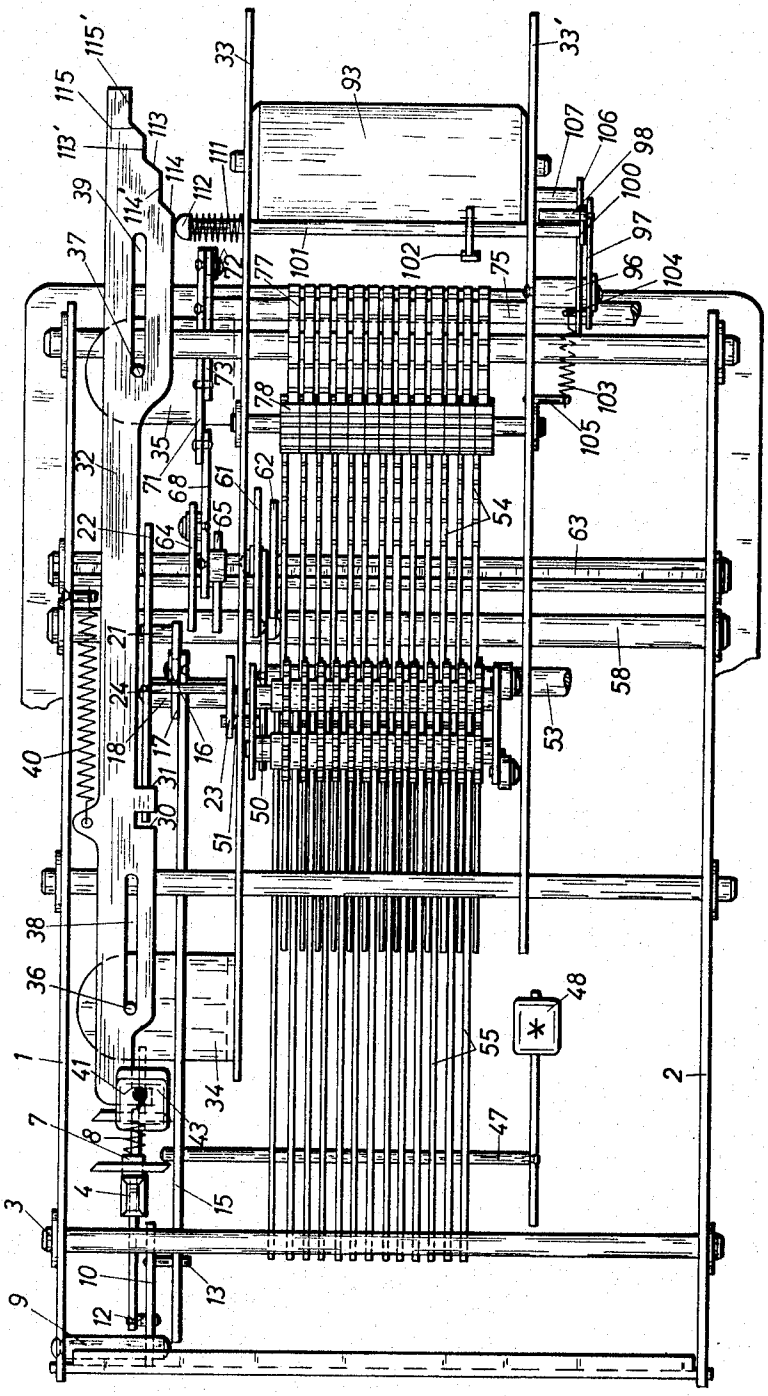

Fig. 3

INVENTOR:

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3,383,036

ARRANGEMENT FOR POSITIONING THE DECIMAL POINT IN CALCULATING MACHINES

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7 Claims. (Cl. 235—60.15)

The present invention relates to calculating machines having ten-key keyboards, more particularly, to an arrangement in such calculating machines for positioning and printing the decimal point to set off varying numbers of decimal places in the amounts recorded on the paper tape.

In calculating machines of this type the decimal point printing mechanism is usually located between or immediately adjacent the numeral type elements for recording amounts. Additional structure must then be provided to position the decimal point in the recorded amount in response to a decimal setting mechanism located on the set pin carriage. There is also provided a place selecting mechanism which operates in conjunction with the decimal setting mechanism to control the positioning of the set pin carriage. In order to provide the necessary operative connection between the set pin carriage and the decimal point printing mechanism located near or between the numeral type elements there results a cramped and close arrangement of the structural elements within the calculating machine. This cramped construction greatly increases the sensitivity of this type of calculating machine and usually reduces its reliability thereby increasing necessary repairs.

In addition, the use of the extremely thin numeral type segments employed on such calculating machines greatly increases the difficulty of reading with the eye the amounts printed on the paper tape.

It is therefore the principal object of the present invention to provide a novel and improved decimal point positioning and printing mechanism for a calculating machine having a ten-key keyboard.

It is another object of the present invention to provide a decimal point printing and positioning mechanism which functions independently of the position of the set pin carriage.

It is a further object of the present invention to provide a decimal point printing mechanism normally positioned to one side of the numeral type elements and swung into the printing position after the numeral type elements have printed the numerals and are returning to their non-printing position.

The present invention is described as being incorporated in a calculating machine of the type disclosed in U.S. Patent 3,081,938 issued Mar. 19, 1963. This patent discloses in detail the general drive control components which operate in conjunction with the structure constituting the present invention. In order to simplify the description of the present invention only those elements which are necessary for understanding of the present invention are illustrated in the drawings and disclosed herein. It will be understood that the present invention functions in conjunction with the structure disclosed and illustrated in the calculating machine of the above-mentioned patent.

The present invention is incorporated in a calculating machine which includes a set-pin carriage movable laterally to the left upon the depression of a key in the keyboard and a mechanism for printing the recorded amount on a paper tape. The printing mechanism comprises a plurality of closely adjacent numeral type sectors

each of which is pivoted through a predetermined distance in order to present a numeral to be printed on the tape. The structure of the present invention essentially comprises an axially movable and rotatably mounted shaft which is positioned to one side of the printing mechanism and extends transversely across the calculating machine. A decimal point type key is fixedly mounted on such shaft for movement therewith. One end of the shaft is biased by a spring into engagement with an edge of a longitudinally movable control bar. The edge of the control bar has successive stepped shoulders which are also engageable by the shaft end. Thus, as successive shoulders are brought into contact with the end of the shaft the decimal point type key is correspondingly moved one or more places to the left.

In modern calculating machines such as illustrated in the above mentioned United States patent the type elements are very closely spaced. Since in the present invention the decimal point type key is positioned outwardly of the type elements, the space between the elements may be further reduced without decreasing the width of the typed characters. It would be appreciated that if the width of the typed characters is further reduced, the numerals printed on the paper tape would become increasingly difficult to read.

When a calculating machine incorporating the present invention is being operated, the restoring bar is moved to the right to permit the pivotally mounted type levers to move into the printing position. By means of a linkage this movement of the restoring bar pivots the shaft to pivot the decimal point key upwardly out of its normal position. This linkage is locked into position by a locking lever until the return movement of the restoring bar to the left actuates the locking lever to release the linkage. While the decimal point type key is pivoted to its upper, and non-printing, position the numerals are printed on the paper tape. After the release of the locked linkage and just prior to the movement of the paper tape, the decimal point type key is pivoted to its printing position and the decimal point itself is printed. A leaf spring is provided to lift the decimal point type key away from the platen after printing of the decimal point.

Other objects and advantages of the present invention will be apparent by reference to the accompanying description when taken in conjunction with the following drawings wherein:

FIGURE 1 is a longitudinal sectional view through a calculating machine incorporating the present invention showing the several components and control structure for the decimal point printing mechanism in the normal position;

FIGURE 2 is a partial longitudinal sectional view showing the printing mechanism for the numerals in the printing position with the decimal point type key being in its raised position; and

FIGURE 3 is a top plan view of the interior of the calculating machine illustrated in FIGURE 1 showing the decimal point printing mechanism and the decimal point key on the keyboard in their normal positions.

Proceeding next to the drawings wherein like reference symbols indicate the same parts throughout the various views a specific embodiment of the present invention will be described in detail. As may be seen in FIGURES 1 and 3 the calculating machine of the present invention comprises sidewalls **1** and **2** between which there is fixedly mounted a shaft **3**. A place selector lever **4** is pivotally mounted on this shaft **3**. The hub of the place selector lever **4** has locking recesses **5** which are engaged by the point of the locking pin **7** mounted for longitudinal movement in the key frame **6** and being continuously urged against the hub of the base selector lever by a compres-

sion spring 8. The point of the locking pin 7 which is located at the end facing the front or operator's side of the calculating machine has a conical shape which conforms to the shape of the locking recesses 5.

A second but shorter shaft 9 is mounted on the sidewall 1 and has a bell crank lever 10 pivotally mounted thereon. One end of the bell crank lever 10 is provided with an elongated slot 11 which receives a pin 12 riveted on an arm of the place selector lever 4. The other arm of the bell crank lever 10 has a pin 13 riveted thereon which is received in an elongated slot 14 located in one end of a tierod 15 to limit the range of movement of the tierod. The other end of the tierod 15 has a pin 16 riveted thereon which is pivotally connected with one end of an intermediate lever 17. The lever 17 is pivotally mounted on a bearing pin 18 and urged by a tension spring 19 against a stop pin 20. The other arm of the intermediate lever 17 is provided with a pin 21 upon which rests the lower surface 28 of a pawl 22.

A second lever 23 is pivotally mounted on the bearing pin 18. A pin 24 is provided on the upper arm 25 of the lever 23 with the pawl 22 being pivotally mounted on the pin 24. The pawl 22 has its undersurface 28 continuously urged against the pin 21 by a tension spring 27 connected between the pawl 22 and an eye 26 located on the lever 23. The front end of the pawl 22 is pointed and curved upwardly as indicated at 29.

Located immediately above the pawl 22 is a longitudinally movable control bar 32 having cutout portions to define shoulders 30 and 31. The control bar 32 is slidably mounted on angles 34 and 35 which are fixed to the left internal sidewall 3 of the calculating machine, as may be seen in FIGURE 3. Pins 36 and 37 are riveted on the angles 34 and 35, respectively, and are received within slots 38 and 39, respectively, of the control bar 32 to guide and limit the movement of the control bar. As may be seen in FIGURE 3, a tension spring 40 urges the control bar 32 to the right with the movement being restrained by the pins 36 and 37 to position the control bar in its normal position.

The forward portion of the control bar 32 is provided with a shoulder 41 as may be seen in FIGURE 3. The shoulder 41 is operatively engageable with an inclined cam surface 42 on the decimal point key 43 which is movably mounted in a known manner in the keyboard 6 and is held in the upper or normal position by a tension spring 44 shown in FIGURE 1. The decimal point key 43 is also provided with a locking nose 45 on the upper end of the inclined cam surface 42. The decimal point key is held in its depressed or working condition by the nose 44 becoming lockingly engaged behind the control bar shoulder 41.

The forward portion of the tierod 15 is provided with a shoulder 46 which is engageable with a pin 47 on the totaling key lever 48 in a known manner.

The lower end of the lever 23 is bifurcated to form a downwardly extending jaw 49 which slidably receives a pin 51 riveted on a restoring lever 50. The restoring lever 50 has an upwardly extending arm 52 to which is attached a transversely extending restoring bar 53. A plurality of differential members 54 are slidably mounted by means of rectangularly shaped bars received in slots with these members having shoulders engaging the restoring bar 53 in a known manner by means of the spring biased hooks 55 which have their ends connected to the differential members 54. The lateral displacement of the set-pin carriage 56 and its set-pins 57 are positioned by depression of selected keys on the keyboard so that the set-pins are placed in the path of the hooks 55. The movement of the differential members 54 is thus controlled by the lateral displacement of the set-pin carriage, the position of the set-pins and the pull hooks. As shown in FIGURE 1 the differential members 54 are in their normal position.

The restoring lever 50 is pivotally mounted on a shaft 58 extending between the sidewalls 1 and 2 of the calculating machine. Mounted on the restoring lever 50 are

cam rolls 59 and 60 which are engaged by cams 61 and 62 mounted on a main drive shaft 63. Two additional cams 64 and 65 are mounted on the main drive shaft 63 to engage cam rolls 66 and 67 mounted on a roll lever 68 which in turn is pivotally mounted on a shaft 69. The lower arm of the roll lever 68 is provided with a pin 70 to which is pivotally connected a tierod 71. The other end of the tierod 71 is pivotally connected to a pin 72 carried on the lower end of the printing mechanism lever 73. Thus, the tierod 71 provides an operative connection between the restoring lever 50 and the printing mechanism lever 73.

The printing mechanism lever 73 is pivotally mounted at 74 and has mounted on its upper end a transversely extending restoring shaft 75 which rests against surfaces of pivotally mounted type segment levers 76. A type segment 77 is mounted on the upper portion of a type lever 76 and has a sector gear meshing with an intermediate gear 78 which is also in mesh with rack 79 on the differential member 54. As may be seen in FIGURE 1 the restoring shaft 75 retains the type segment 77 in mesh with the gear 78. The differential member 54 has a rack 80 mounted thereon which meshes with totalizing mechanism 81 so that the values registered by the differential members are transmitted to the totalizing mechanism.

In order to lock the intermediate gear 78 into position when the type segment 77 is pivoted away and disengaged from the gear 78 there is provided a locking rail 82 mounted on a lever which is actuated in a manner known in the art.

The printing mechanism lever 73 which is pivotally mounted at 74 carries thereon a catch 83 mounted on a pin 84 and having a nose 85 which is engageable with an escape leaf 87 pivoted at 86 and rotated by the nose 85 to disengage a hook 88 from a notch 89 in the type lever 76. This will release the type lever 76 to carry the type segment 77 into printing position against the platen 93 to be described below.

When the hook 88 is disengaged from the notch 89 as described above, a pivotally mounted locking lever 90 is also released to engage in the sector gear teeth 91 of the type segment 77 to fix the type segment in position as the type segment is being pivoted into the printing position.

As the restoring shaft 75 is moved to the right by the pivoting of the printing mechanism lever 73, the type lever 76 is pivoted by the force exerted by the tension spring 92 and carries the type segment 77 against the platen 93. At the same time locking lever 90 prevents any rotation of the type segment 77 and the nose 94 on the locking lever 90 becomes positioned beneath a stop bar 95.

A pin 96 is mounted on the right internal sidewall 33' of the calculating machine as can be seen in FIGURE 3 and a switching lever 97 is pivotally mounted on this pin. On the upper arm of the switching lever 97 there is a pin 98 which engages in an elongated slot 99 formed in an intermediate lever 100 which is fixedly mounted on a shaft 101. The shaft 101 is mounted for axial movement in the internal sidewalls 33 and 33' and has fixedly mounted thereon a decimal point type key 102. The lower arm of the switching lever 97 is held against the printing mechanism restoring shaft 75 by a tension spring 103 connected between a pin 104 on the lever 97 and a stationary pin 105.

There is also provided locking member 106 which has one end pivotally mounted on a pin 104 by a tension spring 108. The other, or left end, of the locking member 106 is indicated at 109 and is similarly in engagement with the printing mechanism restoring shaft 75 as may be seen in FIGURE 1.

A leaf spring 110 is positioned opposite the switching lever 97 so as to lift the decimal point type key 102 away from the platen 93 after printing of the decimal point.

A compression spring 111 surrounds the shaft 101 between the internal sidewall 33 and a hemispherical head 112 on the end of the shaft. Accordingly, shaft head 112 is continuously pressed against the control bar 32 as may be seen in FIGURE 3. The control bar 32 is provided with inclined surfaces 113, 114 and 115 between successive stepped shoulders 113', 114', and 115'. The positioning of the shaft 112 on these stepped shoulders of the control bar determines the position of the decimal point type key 102 and accordingly, the number of decimal places which will be printed in the amount recorded on the paper tape.

Operation of the decimal point printing mechanism

With the above-described structure of the decimal point printing mechanism of the present invention in mind, the comprehension of the present invention will be facilitated by a description of the operation of this decimal point printing mechanism and the functioning of the various components with respect to each other.

During calculating operations without use of the decimal point key 43 or the place selector lever 4, the decimal point type key 102 rests in its initial or normal position wherein two decimal places remain behind the decimal point. Thus, for adding operations of numbers having two decimal places the recorded amounts on the paper tape will have two decimal places.

For multiplying numbers having two decimal places it is readily apparent the result of such multiplication must have four decimal places in the recorded amount. For multiplication, the place selector lever 4 is moved from its initial "adding" position into the "multiplying" position as indicated by the dot-dash lines at 4' in FIGURE 1. This positioning of the place selector lever will cause the tierod 15 to be lowered and its shoulder 46 will become positioned in front of the pin 47 of the totalling key lever 48 through the interaction of the intermediate linkage comprising the lever 10, the pin 12 and the pin 13 co-acting in the slot 14 of the tierod. After multiplication, the totalling key 48 is depressed and the tierod moves to the left to bring about the clockwise pivoting of the lever 17 because of the pivotal connection 16. The pivoting of the lever 17 will lower the pin 21 and permit the pawl 22 to be rotated clock-wise under the action of the spring 27 so that the nose 29 is inserted against the shoulder 30 of the control bar 32.

Also, during the totalling operation the main drive shaft 63 will accomplish a full counter-clock-wise revolution under the control of the one revolution clutch. The cams 61 and 62 carried by the main drive shaft 63 will act against the cam rolls 59 and 60 to rotate the restoring lever 50 in a clockwise direction. The resulting movement of the restoring bar 53 will permit the differential members 54 to be moved to the right. Further, the pin 51 carried by the restoring lever 50 will rotate the lever 23 counter--clock-wise so that the pawl nose 29 which is already in engagement with the control bar shoulder 30 will move the control bar 32 to the left as viewed in the drawings. The control bar 32 will be moved a sufficient distance to the left so that the shaft head 112 under the influence of the spring 111 will slide along the inclined surface 113 to rest on the control bar shoulder 113'. The corresponding leftward movement of the shaft 101 will displace the decimal point type key 102 two additional decimal places to the left.

The rotation of the main drive shaft 63 and its cams 64 and 65 will similarly pivot roll lever 68 in a clockwise direction. The tierod 71 will then move to the left and pivot the printing mechanism lever 73 in a clockwise direction about its pivot point 74. The pivoting of the printing mechanism lever 73 will carry the restoring shaft 75 to the right so as to pivot the switching lever 97 in a counter-clock-wise direction. This counter-clockwise pivoting of the lever 97 will, through the intermediate linkage 100, rotate the shaft 101 to the position as shown in FIGURE 2 so as to raise the decimal point type key 102 upwardly away from the platen 93.

When the switching lever 97 is in this position, a locking notch 116 on the locking member 106 will engage the pin 104 on the lever 97 under the action of the tension spring 108 and will lock the switching lever 97 in the position as shown in FIGURE 2. Near the end of the cycle the movement to the left of the tierod 71 rotates the printing mechanism lever 73 to lift the catch nose 85 against the escape leaf 87 to release the hook 88 from the notch 89 in the type segment lever 76. This action frees the type segment lever and the type segment is brought into contact with the platen 93 by the action of the spring 92.

After printing, the printing mechanism lever 73 is rotated counter-clock-wise and the restoring shaft 75 bears against the type levers 76 to return the type levers to their initial positions as illustrated in FIGURE 1. Just before the type levers reach their initial positions the restoring shaft 75 engages the arm 109 of the locking member 106 to release the pin 104 from the locking notch 116. The lever 97 is then free to rotate and under the action of the spring 103 rotates in a clock-wise direction to bring the decimal point type key 102 into contact with the platen 93 to print the decimal point.

The leaf spring 110, acting against the upper arm of the lever 97 absorbs a portion of the impact of the decimal type key against the platen and then positions the decimal point type key a short distance from the platen after printing to insure that the paper tape and ribbon can be moved without being impeded by the decimal point type key.

When a calculation is to be made, such as multiplication, involving a number having more than two decimal places, the place selector lever 4 is moved into the "multiplying position" 4' and, in addition, the decimal point key 43 is depreseed. The depression of the decimal point key 43 moves its inclined surface 42 along the shoulder 41 of the control bar 32 a sufficient distance to the left as viewed in the drawings so that the shaft head 112 rests on the shoulder 114'. The decimal point type key 102 is now displaced one additional decimal place to the left so that three decimal places will be printed in the amount recorded on the paper tape. The locking nose 45 becomes engaged beneath the shoulder 41 of the control bar 32 and locks the decimal point key 43 in its depressed position. With the control bar 32 in this position, the nose 29 of the pawl 22 will then engage the shoulder 31 of the control bar during the totalling operation.

In totalling the product of a multiplying operation involving a value having more than two decimal places, a depression of the totalling key 48 will cause the nose 29 of the pawl 22 to engage the shoulder 31 of the control bar and move the control bar further to the left to its extreme position, in a manner described above. In this position of the control bar the shaft head 112 will slide down the inclined surface 115 to rest upon the shoulder 115' so that the decimal point type key lever 102 is displaced to the left two additional places and consequently five places or numerals will now be printed after the decimal point.

The displacement to the left of the control bar 32 will release the locking nose 45 of the decimal point key 43 so that this key will move upwardly to its normal or initial position under the action of the tension spring 44.

Thus, it can be seen that the present invention provides a novel and improved decimal point printing mechanism wherein the positioning and printing of the decimal point is independent of the position of the set-pin carriage. The positioning of the place selector lever to either the "adding" or the "multiplying" position, together with the depression of the decimal point key, will determine the position in which the decimal point will be printed.

Further, during the totalling operation of the multiplying process, the decimal point printing key will be displaced further to the left so that the number of decimal places printed in the product will correspond to the sum of the decimal places of the numbers being multiplied in a known manner.

The foregoing description is one embodiment of the invention and it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the scope of the invention.

What is claimed is:

1. In an arrangement for printing the decimal point for varying decimal places in the recorded amounts of calculating machines having a ten-key keyboard, a mechanism for printing the recorded amount, an axially movable and rotatably mounted shaft positioned laterally on the calculating machine adjacent said printing mechanism, a decimal point type key mounted on said shaft, a longitudinally movable control bar with an edge thereof normally engaged by one end of said shaft, spring means for urging said shaft end against said control bar edge, there being successive stepped shoulders on said control bar edge and engageable by said shaft end, and means operatively connected with said control bar for moving the same to bring successive stepped shoulders into engagement with said shaft end whereby said shaft and said decimal point type key are moved to the left to vary the number of decimal places in the recorded amount.

2. In an arrangement as claimed in claim 1 and further comprising a set pin carriage movable laterally to the left upon depression of a key in the keyboard, said printing mechanism printing the recorded amount independently of the position of said set pin carriage.

3. In an arrangement as claimed in claim 1 and further comprising a pivotally mounted actuating lever having one end operatively connected to said shaft to rotate the same, there being a pin at the other end of said actuating lever, a pivotally mounted locking lever having a locking notch on one edge thereof, a spring urging said locking lever notch against said actuating lever pin, means operatively connected to said printing mechanism for pivoting said actuating lever to engage said actuating lever pin with said locking notch during the printing of the recorded amount, the pivoting of said actuating lever also pivoting said shaft and decimal point key out of printing position.

4. In an arrangement as claimed in claim 3 and further comprising means operatively connected to said printing mechanism to return said printing mechanism to its original non-printing position, there being a surface on an end of said locking lever engageable by said pivoting means when the printing mechanism is returned to its original position to release said locking lever from said actuating lever pin whereby said decimal point type key is rotated to its printing position.

5. In an arrangement as claimed in claim 1 and further comprising means for retaining said decimal point type key in the printing position when said printing mechanism is in its non-printing position, and means operatively connected to said printing mechanism for moving said printing mechanism to the printing position and for actuating said retaining means to move said decimal point type key to the non-printing position.

6. In an arrangement as claimed in claim 1 and further comprising a decimal point key on the keyboard of the calculating machine, said decimal point key having an inclined cam surface and a locking nose at one end of said cam surface, said control bar having a shoulder engageable by said inclined cam surface so that depression of the decimal point key removes said inclined cam surface against said control bar shoulder to move said control bar longitudinally, said control bar being locked in position by the engagement of said decimal point key locking nose with said control bar shoulders.

7. In an arrangement as claimed in claim 6 and further comprising a totalling key on said keyboard, a place selector lever on said keyboard and having "adding" and "multiplying" positions, and means operatively connecting said totalling key and said control bar when said place selector key is in the "multiplying" position for moving said control bar upon actuation of said totalling key to release said decimal key locking nose from its locked position with said control bar shoulder whereby said decimal point key will return to its original position.

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