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REPEAT ADDITION MECHANISM FOR TEN KEY ADDING MACHINE

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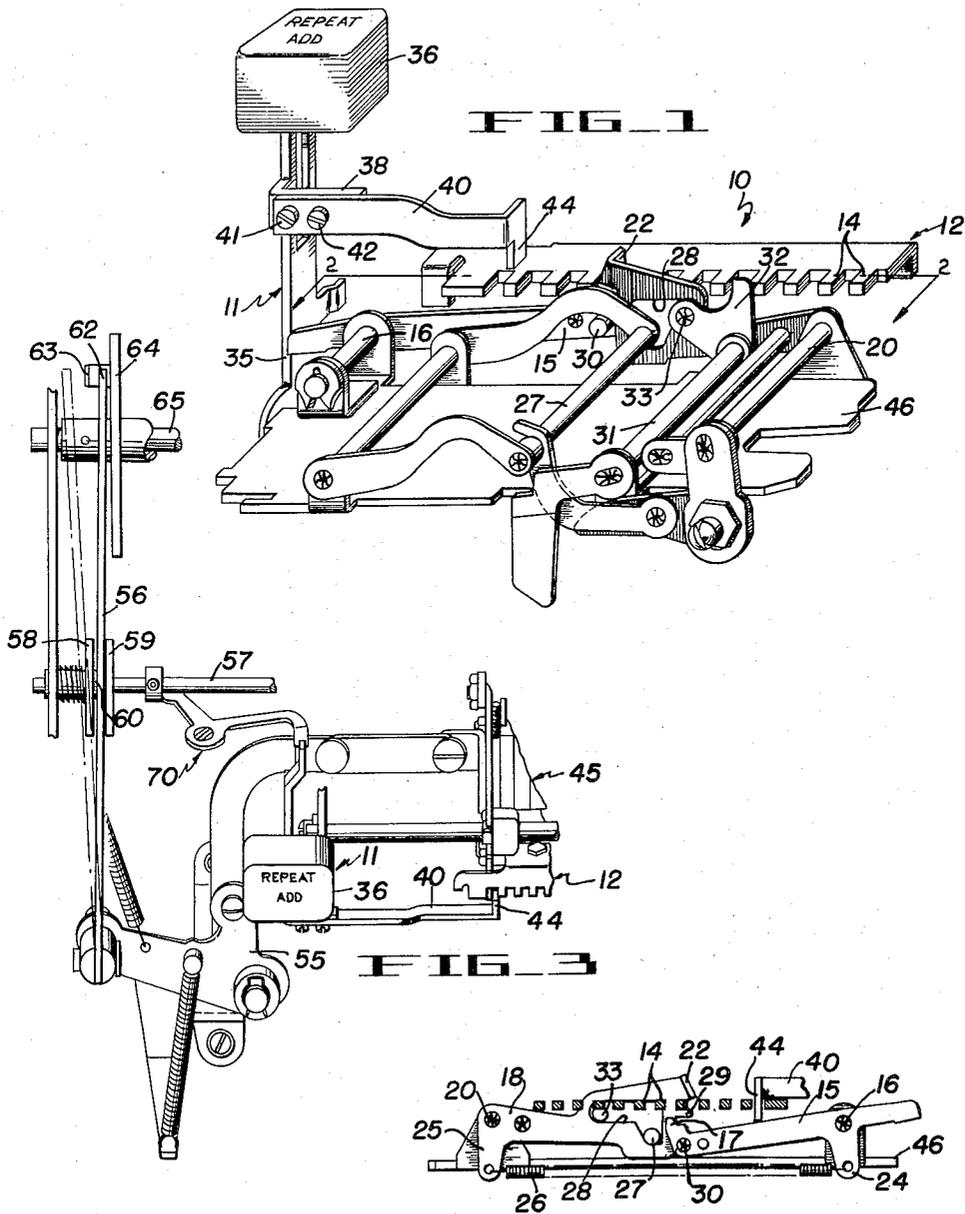


FIG. 2

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**REPEAT ADDITION MECHANISM FOR TEN KEY  
ADDING MACHINE**

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This invention relates to adding machines and more particularly to means for providing a multiplying operation in an adding machine having a repeat-addition key and a shiftable selection unit and is, in effect, an improvement on the adding machine disclosed in Patent No. 2,832,530, issued April 29, 1958, to Harold J. Chall.

It is among the objects of the present invention to provide a simple attachment for an adding machine of the character indicated, which will enable the adding machine to perform multiplication operations upon properly controlled operation of the repeat-addition control key of the machine; which can be applied to, and removed from, the machine as may be desired and requires no modification of the machine construction; which is effective to step the shiftable selection mechanism of the machine one step to the left each time the repeat-addition key is depressed and released so that a value can be multiplied by the digits of a multiplier successively from the lowest to the highest digit of the multiplier; and which renders an adding machine effective to accomplish functions ordinarily obtainable only with an expensive and complicated calculating machine.

Other objects and advantages will become apparent from a consideration of the following description and the appended claims in conjunction with the accompanying drawing wherein:

Fig. 1 is perspective view of the escapement mechanism and the repeat addition key;

Fig. 2 is a view showing the escapement mechanism released by the repeat addition key; and

Fig. 3 is a top plan view of the restore mechanism of the adding machine.

With continued reference to the drawing, the numeral 10 generally indicates an escapement mechanism constituting a component of an adding machine, such as the ten-key adding machine disclosed in Patent No. 2,832,530, referred to above, and is effective to step the shiftable selection unit of the machine one step to the left each time a digit value is entered into the selection mechanism, and the numeral 11 generally indicates the repeat-addition control key of such a machine.

The escapement mechanism comprises an escapement comb, or rack, 12 of right-angular cross-sectional shape having spaced-apart teeth 14 on the outer edge of one of its legs. This rack is rigidly secured to the shiftable selection mechanism 45 (Fig. 3) of the machine for stopping the shiftable selection mechanism at positions successively shifted one step to the left as the digits of an entry value are entered into the selection mechanism from the keyboard, not illustrated, of the machine.

The escapement mechanism also includes an escapement pawl 15, in the form of an elongated lever, pivotally mounted on an upstanding ear projecting from the bottom keyboard plate 46 by a pivot pin 16, and having at its other end, an upwardly extending detent formation 17 adapted to fit between adjacent teeth 14 of the rack 12 to hold the rack at successively stepped positions; and

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a detainer latch 18 in the form of a bellcrank lever pivotally mounted at its angle on an upstanding ear projecting from the bottom plate 46 by a pivot pin 20 spaced transversely of the machine from the pivot pin 16. The latch lever 18 has, on its free end, an inclined abutment formation 22 having a thickness materially less than the width of the spaces between adjacent teeth 14 of the rack 12. The pawl 15 has an extension 24 projecting downwardly from the pivot pin 16, and the latch 18 has an extension 25 projecting downwardly from the pivot pin 20. These extensions 24 and 25 are interconnected at their lower ends by a tension spring 26 which tends to raise the adjacent, free ends of both levers so that the detent formation 17 is positioned between two adjacent teeth 14 of the rack 12 and the abutment formation 22 of the latch lever 18 is positioned above the toothed portion of the rack.

A bar 27, extending under the keyboard of the machine, is received at one end in a notch 28 in the latch lever 18 near the free end of this latch lever. This bar is forced downwardly each time a keyboard digit key is depressed, thereby moving the free end of the latch lever 18 downwardly to insert the abutment formation 22 between two adjacent teeth 14 of the rack 12. When the free end of the latch lever 18 is forced downwardly, an extension 29, on the free end of this lever, engages a pin 30 projecting from the free end of the pawl 15 to simultaneously move the free end of the pawl downwardly and withdraw the abutment formation 17 from the interdental space of the rack in which this detent is engaged. When the detent 17 is withdrawn from the toothed portion of the rack 12, the abutment 22 having a thickness less than the width of the interdental spaces of the rack, as explained above, the rack will shift sufficiently to the left so that, when the pressure on the bar 27 is released and the spring 26 raises the free ends of the latch lever 18 and the pawl lever 15, the upper end of the detent formation 17 will first engage under a tooth 14 of the rack and, will subsequently engage in the next interdental space of the rack as the abutment formation 22 is raised out of the interdental space in which it is engaged, permitting the rack to take the remainder of the coincidental step to the left. Operation of the escapement mechanism is also accomplished, upon depression of the "0" key of the machine, by rocking movement of a shaft 31 and lever 32 secured on the end of the shaft 31 adjacent the escapement mechanism, the lever having a pin 33 which rides in the slot 28 of the latch lever 18 and forces the free end of this latch lever downwardly to operate the escapement mechanism in the manner described above whenever the "0" key is depressed.

The repeat-addition control key 11 has an elongated, flat stem 35 which carries the key top 36 at its upper end, by means of which finger pressure is applied to depress the key. This key is effective, when depressed, to cause the machine to cycle a desired number of times without change or restoration of the selection mechanism to thereby add a value set up in the selection mechanism into the accumulator of the machine and to repeatedly print such value the desired number of times, as is fully set forth in Patent No. 2,832,530, referred to above.

In order to repeat the addition cycle, it is also necessary to have the shiftable selector unit, at the end of each addition cycle, in the position to which it has been stepped by the escapement mechanism during the entry of the value therein. This requires that the shiftable unit return mechanism, including the bellcrank lever 55 (Fig. 3) and hook link 56, be disabled.

A guide shaft 57 (Fig. 3) is slidably mounted for longitudinal movement and a pair of guide disks 58 and 59 are mounted on this shaft 57. The hook 56 ex-

tends past the shaft 57 and is disposed above the shaft and between the guide disks 58 and 59. The link 56 rides on a sleeve 60, which surrounds the shaft 57 between the disks 58 and 59, and is provided rearwardly of the sleeve 60 with a downwardly projecting hoop formation 62 which is engaged by a pin 63 on a disk 64 pinned to the main drive shaft 65, so that when the pin 63 engages the hook 62, it will pull the hook link 56 rearwardly, thus returning the shiftable carriage 45 to its right-hand, or home, position.

When the repeat-addition key 11 is depressed, a bell-crank 70 is rocked to move the shaft 57 and guide disks 58 and 59 to the left. This moves the hook 62 of the link 56 to the left and out of the path of the pin 63, so that this pin will not engage the hook 62 to return the shiftable selector unit to its home position during the last half of the operating cycle.

In order to use the adding machine for multiplication, it is possible to set up, in the selection mechanism of the machine, a value representing the multiplicand; then, by depressing the repeat-addition control key for a number of machine cycles representing the lowest digit in the multiplier, to enter the multiplicand into the accumulator register the proper number of times; then releasing the repeat-addition control key and stepping the selection mechanism one step to the left, as by depressing the "0" key; again depressing the repeat-addition control key for the number of machine cycles corresponding to the next, or tens-order, digit of the multiplier; again releasing the repeat-addition key and depressing the "0" key to step the shiftable selection mechanism another step to the left; again depressing the repeat-addition control key and repeating this process for the number of digits in the third order of the multiplier; and similarly for as many such steps as there are digits in the multiplier. Thereafter, depression of the clearing key of the machine restores the selection mechanism to its "0," or full-cycle, position. Finally, upon depression of the total key, the result of the multiplication will be printed by the machine.

While a multiplying operation can be performed in the above-described manner, this method is time consuming and troublesome to the operator and also involves a hazard of the introduction of error by reason of the operator forgetting or failing to depress the "0" key after each digit repeat-addition operation of the machine. It has been found that the operation can be greatly facilitated and expedited by attaching to the repeat-addition key of the machine a simple attachment which will automatically operate the escapement mechanism to step the shiftable selection unit one step to the left each time the repeat-addition control key is depressed and subsequently released.

The repeat-addition control key stem 35 is provided below its key top 36 with a formed ear 38 projecting to the right. An arm 40 is secured to the ear 38 by screws 41 and 42 and projects toward the escapement mechanism. At its other end, the arm is provided with a perpendicularly offset and downwardly extending abutment formation 44, the lower end of which is positioned to enter the interdental spaces of the rack 12 in the next space to the left from the space below the abutment formation 22 of the latch lever 18. The abutment formation 44 has a thickness materially less than the width of the interdental spaces of the rack 12. When the repeat-addition control key 11 is manually depressed, the bottom edge of the abutment formation 44 moves through the interdental space positioned therebelow and engages the top edge of the pawl 15, as shown in Fig. 2, moving the free end of the pawl downwardly to disengage the detent formation 17 on the pawl from the teeth of the rack 12. As the abutment formation is now disposed in the interdental space of the rack, upon release of the detent formation 17 from the rack teeth, the rack will shift a slight distance to the left until it is stopped by

engagement of a tooth thereof with the abutment formation 44. Upon subsequent release of the repeat-addition control key, the abutment formation 44 is lifted out of the interdental space in which it is engaged, permitting the free end of the pawl 15 to rise. At first, the top end of the detent formation 17 will engage under a rack tooth 14 but, when the abutment formation 44 is fully disengaged from the rack teeth, the rack will advance the remainder of the step and the detent formation will rise into the next interdental space. Thus the rack and the associated shiftable selected unit will be advanced one step to the left and stopped each time the repeat-addition control key 11 is depressed and released.

It will thus be apparent, that with the arm 40 mounted on the repeat-addition control key and carrying the abutment formation 44 in position to operate the pawl 15, each time the repeat-addition control key is depressed and released, the selection unit will be stepped one step to the left. Thus, the repeat-addition key may be held depressed for a number of cycles corresponding to the lowest, or units, digit of the multiplier; may then be released and depressed, stepping the selection mechanism one step to the left, and held depressed for a number of cycles corresponding to the tens-order digit of the multiplier. This operation may be repeated for all of the multiplier digits; after which, the clearing key is depressed to return the selection mechanism to its home position and "0" condition. Thereafter, upon depression of the total key, the result of the multiplication will be printed by the machine.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is, therefore, to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are, therefore, intended to be embraced therein.

What is claimed is:

1. In an adding machine having a repeat-addition control key and an escapement mechanism including a toothed rack, a pivoted pawl having a detent formation and spring means urging said pawl in a direction to engage said detent formation in interdental spaces of said rack, an arm secured at one end to the stem of said repeat-addition control key and having at its other end an abutment formation overlying said pawl and the toothed portion of said rack when said repeat-addition control key is undepressed and effective when said repeat-addition control key is depressed to release said pawl from said rack and enter an interdental space in said rack to stop the rack in position and to hold said pawl released until said repeat-addition control key is released at which time said abutment formation is removed from the rack teeth and the rack moves sufficiently to engage the detent formation of said pawl in the next interdental space of said rack.

2. In an adding machine having a repeat-addition control key and an escapement mechanism including a toothed rack, a pivoted pawl having a detent formation, spring means urging said pawl in a direction to engage said detent formation in interdental spaces of said rack, and a pivoted lever moved into engagement with a tooth of said rack when said detent is displaced from said rack to temporarily hold said rack at an intermediate step position until said detent is returned to latching engagement with said rack, means actuated by said repeat-addition control key to release said detent from said rack without moving said pivoted lever and including an abutment formation overlying said pawl and the toothed portion of said rack when said repeat-addition control key is undepressed, said abutment formation being moved by depression of said repeat-addition control key into an interdental space of said rack and into engagement

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with said pawl to release said pawl from said rack, and stop said rack in position to maintain said pawl released while said repeat-addition control key is depressed and being moved to release said rack and said pawl when said repeat-addition control key is released thereby freeing said rack to move until the detent formation of said pawl engages in the next interdental space of the rack.

3. In an adding machine having a selection unit shiftable step-by-step from right to left as the digits of an entry value are entered therein, escapement mechanism controlling the step-by-step shifting of said selection unit and including a toothed escapement rack, a pivoted pawl having a detent movable into and out of engagement with the teeth of said rack and a pivoted lever having an abutment movable into engagement with the teeth of said

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rack when the pawl detent is moved out of engagement with said teeth, and a repeat addition key having a stem mounted for up-and-down movement, an escapement actuating lever moved by said key stem and having an abutment formation moved by downward movement of said key stem into engagement with said pawl to disengage said pawl detent from said rack teeth and into engagement with said rack teeth to limit the leftward movement of said selection unit when said pawl detent is disengaged from said rack teeth.

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