Dec. 3, 1935. E. RACZ 2,022,823

CALCULATING MACHINE

Filed July 15, 1933 4 Sheets-Sheet 1

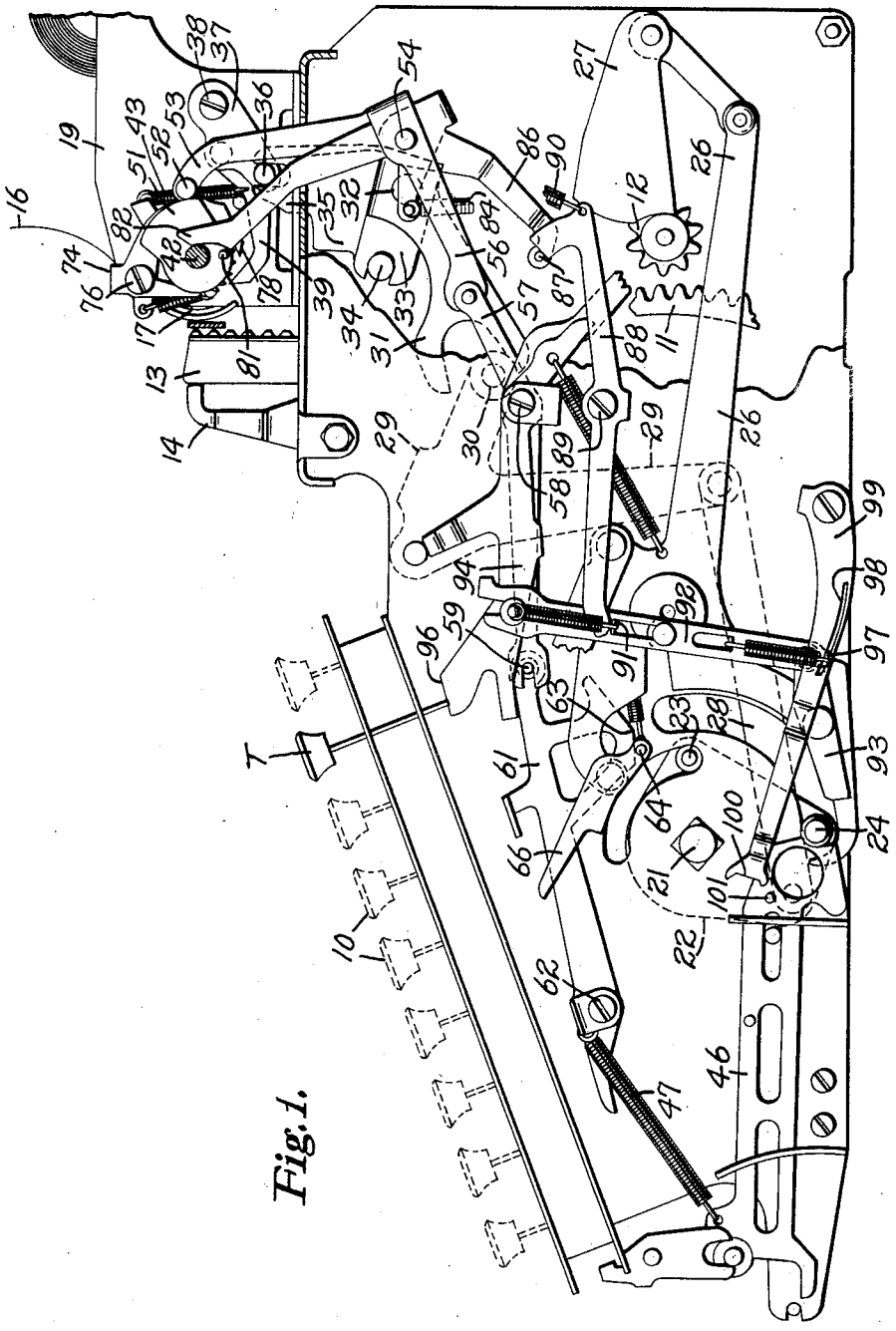


Fig. 1.

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CALCULATING MACHINE

Filed July 15, 1933 4 Sheets-Sheet 2

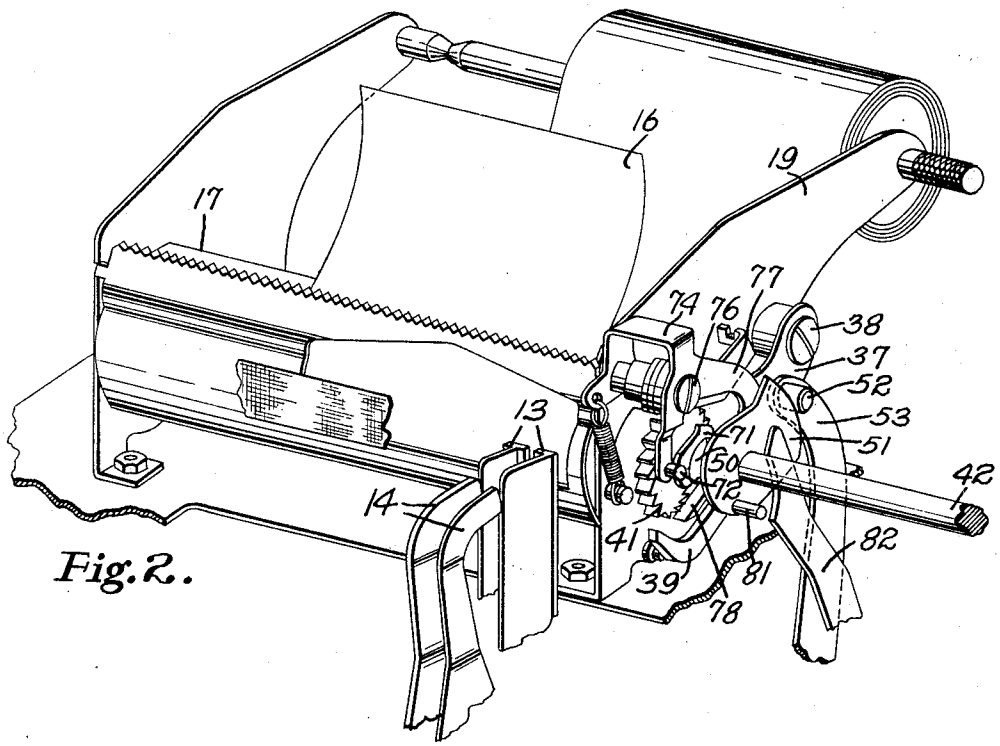


Fig. 2.

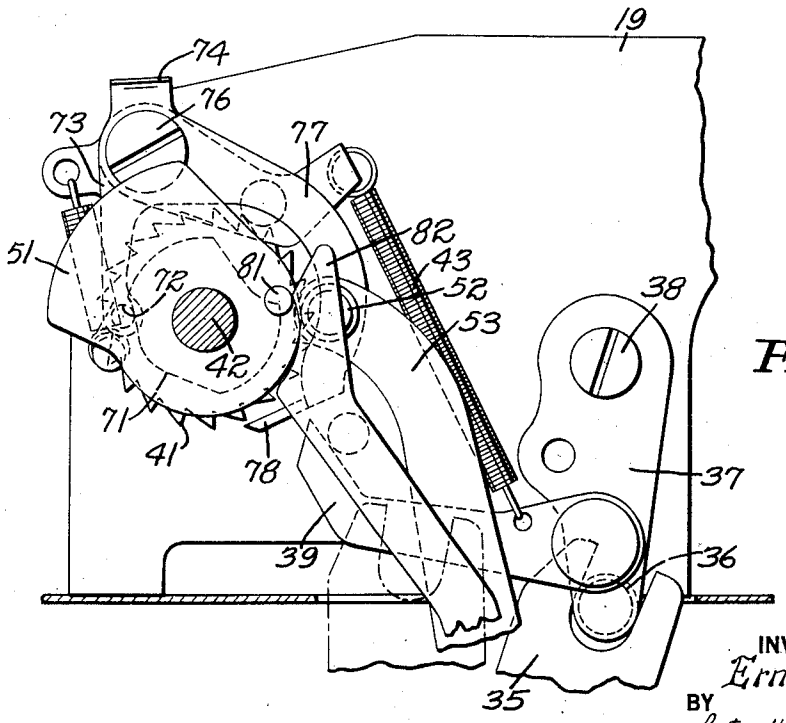


Fig. 3.

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CALCULATING MACHINE

Filed July 15, 1933 4 Sheets-Sheet 3

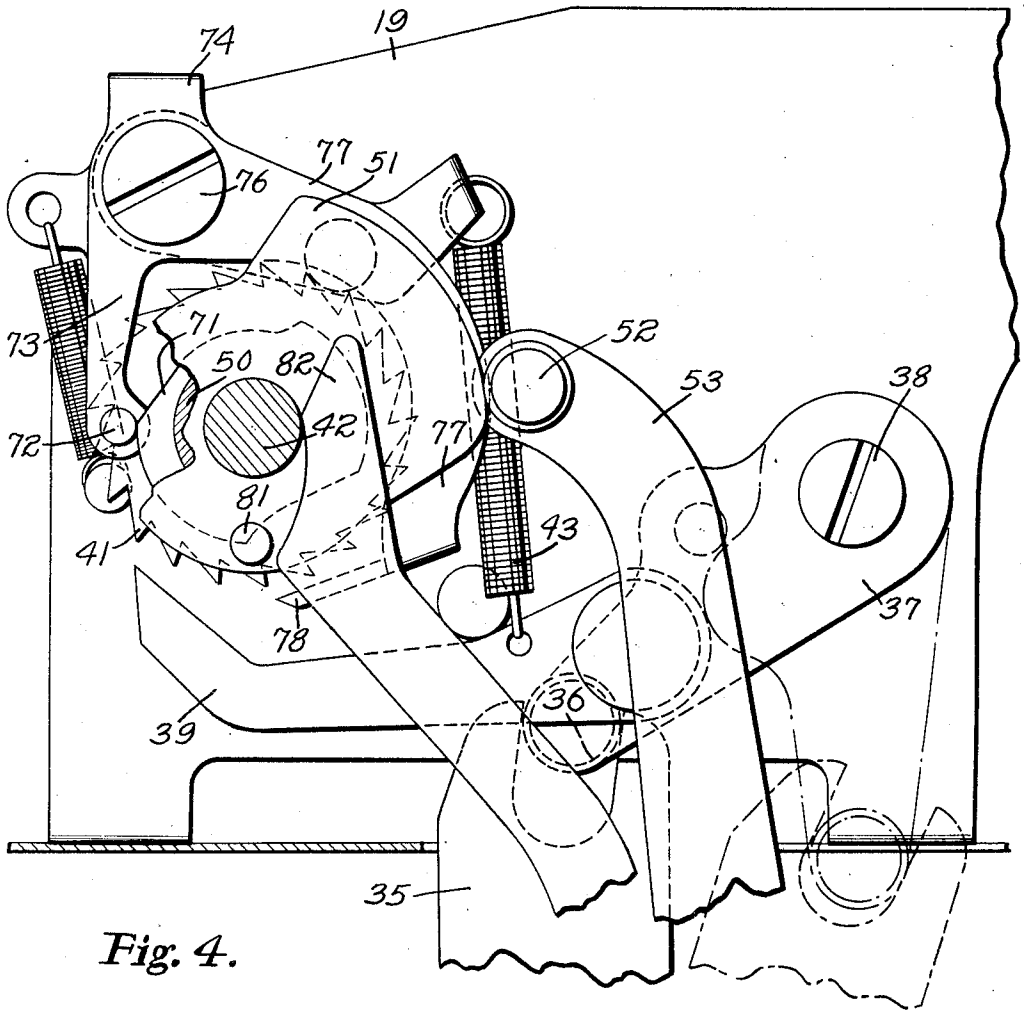


Fig. 4.

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CALCULATING MACHINE

Filed July 15, 1933 4 Sheets-Sheet 4

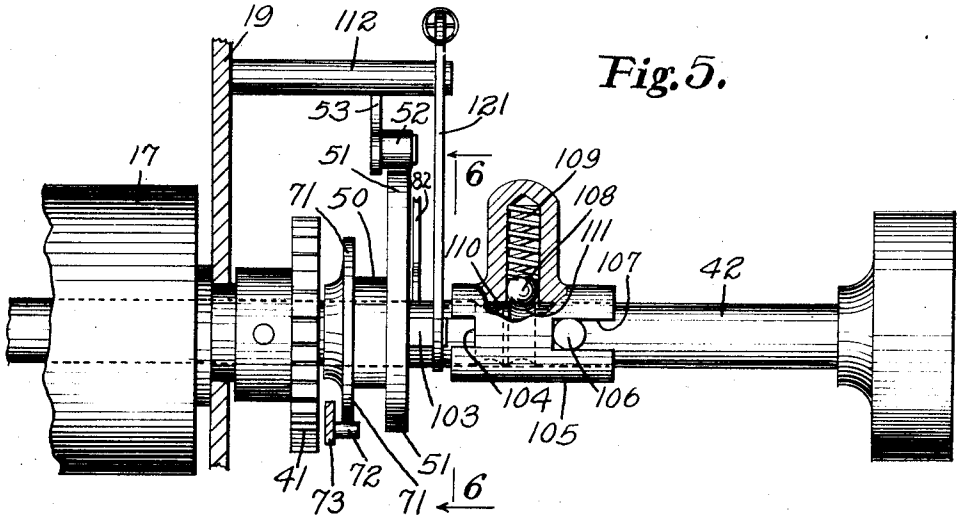


Fig. 5.

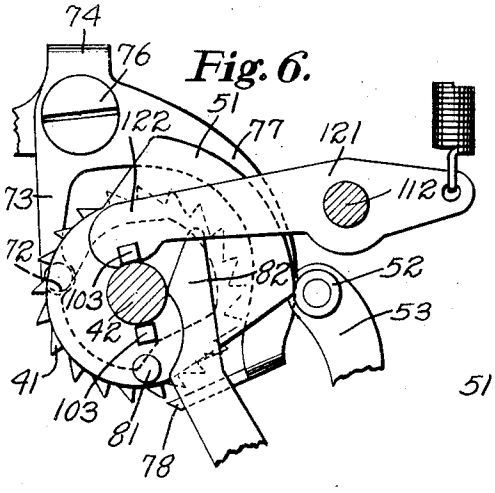


Fig. 6.

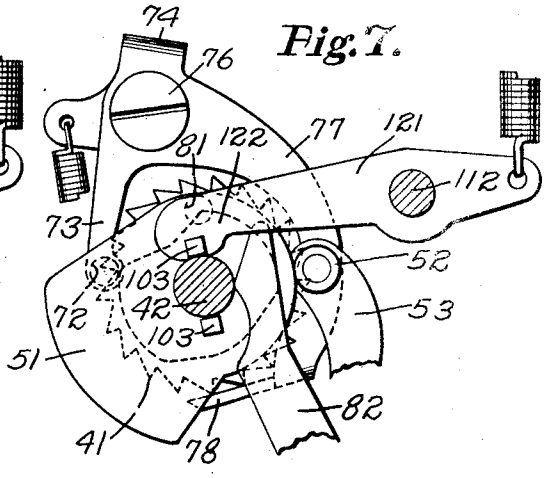


Fig. 7.

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Patented Dec. 3, 1935

2,022,823

UNITED STATES PATENT OFFICE

2,022,823

CALCULATING MACHINE

Ernest Racz, Detroit, Mich., assignor to Burroughs Adding Machine Company, Detroit, Mich., a corporation of Michigan

Application July 15, 1933, Serial No. 680,559

23 Claims. (Cl. 235—60)

This invention relates to a calculating machine and it is directed particularly to a novel means for automatically controlling the functions of a calculating machine.

In many lines of work, such as in recording collections from telephone pay stations and in making tax records and other similar records, it is desirable to have a series of entries listed one below the other in a vertical column, which entries sometimes should be spaced different distances from one another and some of which involve different calculating operations than the others. It is desirable, in order to promote speed and accuracy, to have the position, nature of these entries and calculating operation controlled automatically, and the present invention is directed to a machine for accomplishing these desired ends.

The broad object of the invention is to provide an improved calculating machine.

A more particular object is to provide an improved automatic control for the function of a calculating machine.

A still more particular object is to provide an automatic control for the functions of a machine which control is governed by the line space position of a work sheet in the machine.

Other objects and advantages of the invention will appear from the following specification and drawings:

Figure 1 is a right side elevation of a calculating machine embodying the controls of this invention and illustrating the machine at the initial position for performing a series or cycle of operations and with the right side frame broken away.

Fig. 2 is a perspective view of the paper carriage and associated mechanisms.

Fig. 3 is a partial right side elevation of the paper carriage in position for totaling operation and with the machine at the end of the forward stroke.

Fig. 4 is an enlarged end view illustrating the control cams and associated levers.

Fig. 5 is a plan view of the right end of the platen shaft and associated cams showing the normalizing elements.

Fig. 6 is a fragmentary sectional side elevation on the line 6—6 of Fig. 5 looking in the direction of the arrow.

Fig. 7 is a view similar to Fig. 6 with the detents holding the controlling cams in add condition.

This invention is shown as being applied to a "Burroughs" type portable calculating machine as shown in the Horton Patent No. 1,853,050, to which reference is made for details of construction of the calculating machine.

Calculating machine generally

The machine in general is controlled from a keyboard having depressible keys 10 which control the longitudinal position of sliding bars (not shown) which in turn differentially position racks 11 which cooperate with one or more registers 12 to accumulate the entries and position the printing mechanism. The printing mechanism includes type hammers 14 and type bars 13, which print upon a sheet of paper 16 on a platen 17, and associated mechanisms. The paper is supplied from the usual roll, the paper and the platen being supported by a carriage 19.

The machine is operated by either a motor or hand crank, as shown in the Horton Patent 1,853,050, attached to a main drive shaft 21 through a disconnectible connection (not shown) illustrated in the Horton patent. The drive shaft 21 carries a drive plate 22 to which is attached two roller studs 23 and 24 positioned to move a pitman 26 which in turn actuates the cam 27 for controlling the engagement and disengagement of registers 12. Driving plate 22 also rotates the platen step by step for line spacing through linkage 28 to 34, inclusive, which terminates in a crank 35 (Figs. 3 and 4) having a forked connection to a stud 36 carried by an arm 37 pivoted at 38 to the carriage. Arm 37 carries a pawl 39 which engages ratchet 41 carried by the platen shaft 42, the pawl being urged into engagement with the ratchet by spring 43. The throw of pawl 39 or the degree of rotation of the platen shaft by it is controlled by means to be later described. The foregoing mechanism for line spacing the platen is the usual construction found in machines of this type and is therefore not described in greater detail.

Stud 24 of the drive plate also engages a slide 46 urged rearwardly and upwardly by a spring 47 which slide controls a number of functions of the machine such as positioning the cipher stops, which, as described in the Horton patent, if prevented from moving, will prevent operation of the machine through the disconnectible driving connection.

Automatic control of calculating machine functions

In the embodiment of the invention illustrated one of the machine functions that is automatically controlled is the placing of the machine in add or non-add condition. Other functions are

also controlled but the automatic control of the add and non-add features will first be described.

Attached to the platen shaft is a cam 51 which moves with the platen as it is line spaced. Cam 51 is engaged by a roller 52 upon the outer end of a yoke shaped crank lever 53 pivoted at 54 to the frame of the machine. The other arm 56 of lever 53 is connected to one end of a lever 57 pivoted at 58 to the frame of the machine, the other end of which has a forked connection with a pin 59 on the rear end of a lever 61 pivoted at its forward end at 62 to the frame of the machine and urged counterclockwise by spring 47.

Lever 61 has a depending cam 63 adapted to engage a pin 64 carried by the tail of a dog 66 pivoted to pitman 26 and movable into position to be engaged by pin 23 for conditioning the machine for addition when the roller 52 is on the low part of the cam 51 and movable out of position for non-add condition by cam 63 when the roller 52 is on the high part of cam 51. Dog 66 is of the usual type employed in machines of this character and its action is therefore not described in more detail. It follows from the foregoing that when roller 52 rides upon the high point of cam 51, lever 53 is rocked clockwise thereby rotating lever 57 counterclockwise and depressing lever 61 which in turn rotates dog 66 clockwise to move it out of engaging position with pin 23 thereby conditioning the machine for a non-add operation.

While, in the prefered embodiment, the cam 51 is located on the platen shaft it is to be understood that the invention is not limited to this exact location.

Automatic control of line spacing

Another control that is provided is the automatic control of the number of spaces that the paper or sheet is moved during any given operation.

For this purpose a cam 71 is rigidly secured to the hub 50 of cam 51 and therefore rotates with the platen shaft. Cam 71 engages a roller 72 carried by one arm 73 of a bell crank 74 pivoted to the carriage at 76, the other arm 77 of which carries a finger 78 which is engaged by a pawl 39 and controls the number of teeth, i. e., line spaces effected, engaged by pawl 39 as it moves forward to space the platen. It follows, therefore, that as the cam 71 rotates, it will, due to its varying heights, vary the position of finger 78, and vary the number of teeth exposed to the pawl 39 to change the line spacing when the pawl 39 moves forward.

While the drawings here shown provide for double and triple spacing, provision can be made for exposing only one ratchet tooth 81 so that the platen will be advanced only one step at each operation of the machine.

With respect to the control of line spacing it is also to be understood that, while, in the preferred embodiment, the cam 71 is on the platen shaft, it is not intended that the invention shall be limited to this location.

Enforced totaling

Another function of the machine that is controlled automatically is the taking of a total. In the embodiment shown, the total taking means is not conditioned automatically but certain parts are set so that the machine cannot be operated unless the total taking means is conditioned for total taking. In other words, the taking of the total is "enforced" in the sense that the operator cannot manipulate the machine in any other way.

For this purpose cam 51 is provided with a laterally projecting pin 81 in position to engage the upper end of a cam lever 82 pivoted at 54 to the frame of the machine and urged counterclockwise by a spring 84. Lever 82 has a lower arm 86 carrying a laterally projecting pin 87 which engages a lever 88 pivoted at 89 to the frame of the machine and urged counterclockwise by a spring 90. The forward end of this latter lever engages a tongue 91 struck outwardly from the outer member of a two piece slide 92 for controlling the totaling operation (see Patent 1,853,050). The lower end of slide 92 is yieldingly connected to a pivoted dog 93 for rocking the squared end of said dog into position to be engaged by roller stud 24 on driving plate 22 to cause a totaling operation to take place in the usual manner. The upper end of slide 92 is slidably connected to a pivoted lever 94, the forward end of which has a flat upper edge 96 disposed in the path of the totaling key T whereby depression of key T will lower slide 92 and rock dog 93 in position to be engaged by a roller stud 24.

The lower end of the inner member of the slide 92 is also provided with an offset tongue 97 projecting into a slot 98 in a pivoted arm 99, the forward end 100 of which is movable into position to engage the pin 101 projecting laterally from slide 46 to prevent the latter from moving rearwardly.

Engagement of pin 81 with cam lever 82 at the total operation of the series or cycle of operations moves lever 82 clockwise, thus retracting pin 87 from lever 88 and permitting the latter to be rocked counterclockwise by the spring 90 to lower slide 92 to position the forward end 100 of arm 99 in the path of pin 101 which, as has been previously explained, will prevent the operation of the machine unless the total key is depressed to rotate arm 99 still further to lower its forward end below pin 101. This makes it necessary, therefore, to depress the total key in order to take the final and total operation of the machine; in other words, a totaling operation is enforced.

Control of sequence of operations

The illustrated application of this invention is so designed, and the cams are so shaped and the totalizing enforcing pin 81 so placed as to provide for a series of nine machine operations to one complete rotation of the platen. As illustrated in the following typical form of record sheet, the first three machine operations are made with the machine in non-add condition and with platen spacing arranged for double space; the fourth operation is a spacing one in "add" condition and taking three line spaces. The fifth, sixth and seventh operations are taken in "add" condition to add the amounts of the different species of currency, and with double line spacing. The eighth operation is with triple spacing and is an enforced total operation to print the total of the 5th, 6th and 7th items. The ninth operation is taken with triple spacing and in total condition to print the usual clear sign common to this type of machine, thereby indicating that when a new series of operations are started the machine is in clear condition.

From the above it will be evident that one complete rotation of the platen is equivalent to

twenty-one line spaces and that the top of every sheet will have the clear sign thereon.

After the ninth machine operation the paper will have been so spaced that when it is torn off on the tear-off blade, the clear sign, represented by an "asterisk" will be hidden behind the tear-off blade so that it will appear at the top of the incoming sheet and indicate that the machine was clear when the series of operations was started.

Number of operations and cam positions	Character of item entry	Machine operation	Platen line spacing
1	Code or telegraph number.	Non-add	Double spacing.
2	Date	Non-add	Double spacing.
3	Time	Non-add	Double spacing.
4	Spacing no entry	Add	Triple spacing.
5	Specie of currency (25¢).	Add	Double spacing.
6	Specie of currency (10¢).	Add	Double spacing.
7	Specie of currency (5¢).	Add	Double spacing.
8	Total (enforced)	Total	Triple spacing.
9	Clear signal	Total	Triple spacing.

It will be apparent that the cams may be varied as to the number of low and high points to cause add or non-add operations to take place at a desired operation in the sequence of operations and to provide for the desired platen spacing at each of the various operations in the sequence or cycle of operations. It will also be apparent that the number of pins, such as pin **81**, may be varied to cause or enforce a totaling operation to be taken after any desired number of items have been entered into the machine.

It will be understood that while the present or illustrated machine is limited to a sequence of nine operations to one revolution of the platen, the number of operations relatively to one revolution of the platen may be varied by suitable cams and arrangements thereof. For simplicity in design and operation, however, it is preferred that the number of operations be completed, that is, the number of operations in a single cycle be equivalent to one revolution of the platen. Of course, the platen and record form must be started at a predetermined starting point.

Normalizing

In order to convert the machine into a normal listing machine, for example, when it is desirable to add and print, or only to print a list of amounts, or numbers, as on the standard machine of this type, means are provided for disabling the automatic controls as follows:

The add and non-add controlling cam **51** and the line space controlling cam **71** are both fastened to the same hub **50** rotatably mounted on the platen shaft **42**. The cam **51** has a pair of lugs **103** (Figs. 5, 6 and 7) projecting from diametrically opposite sides thereof and so positioned as to engage correspondingly diametrically opposite slots **104** on one end of a sliding sleeve **105** non-rotatably secured to the platen shaft **42** by a pin **106** extending through the platen shaft and into diametrically opposite slots **107** in the other end of sleeves **105**. Slots **107** are of such a length that they will be engaged by pin **106** in either one of two positions of sleeve **105** on the platen shaft **42**. Sleeve **105** is retained in either of two axial positions by a ball detent **108** urged against the platen shaft **42** by a spring **109**. The platen shaft **42** is provided with two annular grooves **110** and **111** to assist the ball detent **108** in retaining the slide in either of its two positions. When the sleeve **105** is moved to the left on the platen shaft **42**, slots **104** will engage the lugs **103** and couple the cams **51** and **71** to the platen shaft **42**, consequently, when platen shaft **42** is rotated by the line spacing pawl **39** of Fig. 4, line spacing of the platen will be effected according to the position of the cam **71**, and the machine will be in add or non-add condition according to the position of the cam **51**.

To lock the cam unit **51**—**71** in a set position and against rotation when the sleeve **105** is disengaged from lugs **103**, a detent **121** mounted on a stud **112** projecting from the carriage side frame **19** is provided with a slotted forward end **122**, which, when the sleeve **105** engages the lugs **103** rides on the periphery of the sleeve **105** when the platen shaft **42** rotates under conditions other than normal. The slotted end **122** of the detent **121** is caused to engage over one of the lugs **103**, according to whether it is desired to operate the machine in add or non-add condition.

It will be evident from Fig. 6 that when the detent **121** engages one of the lugs **103**, as here shown, the machine will be operated in non-add condition because the stud **52** will be on the high part of the cam **51** and the line spacing will be triple spacing regulated by the shelf **78**. If the detent **121** is engaged with the opposite lug **103**, the rolier stud **52** will engage the low or "add" part of the cam **51** and the listing will be in add condition and the platen will be spaced two line spaces during every operation of the machine.

It will be seen from the foregoing that when sleeve **105** is moved to the left and ball **108** engages groove **110**, cams **51** and **71** will be connected to the platen shaft and will function, whereas when sleeve **105** is moved to the right and ball **108** engages groove **111**, sleeve **105** will be disengaged from cams **51** and **71** and the machine will be normalized, i. e., not automatically controlled to perform a predetermined series of operations with particular line spacing.

From the foregoing description it will be clear that there has been provided a machine which is automatically controlled as to function and line spacing in accordance with the latter and which is fully automatic to enter a sequence of operations upon a record sheet, adding those items desired and non-adding those which are not to be added, and in which an enforced total must be taken at some one point in the series of operations.

It will be apparent to those skilled in the art that various changes may be made in the details of construction and many variations may be made in the sequence of operations without departing from the spirit and scope of this invention as defined in the appended claims.

I claim:

1. In a calculating machine adapted to be conditioned to perform different calculating functions, a printing mechanism operable to print the result of calculating operations along a printing line, paper holding means for supporting a work sheet in printing position relative to said printing mechanism, means operable to line space said sheet relative to said printing line, and means operating automatically to condition said machine to perform different predetermined functions in accordance with the different line space positions of said paper holding means.

2. In a calculating machine adapted to be conditioned to perform different calculating functions, a printing mechanism operable to print

the result of calculating operations along a printing line, paper holding means for supporting a work sheet in printing position relative to said printing mechanism, means operable to line space said sheet relative to said printing line, and means operating automatically to condition said machine to perform a non-add entry in accordance with the different line space position of said paper holding means.

3. In a calculating machine adapted to be conditioned to perform different calculating functions, a printing mechanism operable to print the result of calculating operations along a printing line, paper holding means for supporting a work sheet in printing position relative to said printing mechanism, means operable to line space said sheet relative to said printing line, and means operating automatically to condition said machine to enforce a totaling calculation in accordance with the different line space positions of said paper holding means.

4. In a calculating machine adapted to be conditioned to perform different calculating functions, a printing mechanism adapted to print the results of said calculations along a printing line, paper holding means for supporting a work sheet in printing position relative to said printing mechanism, means for line spacing said work sheet, and means controlled automatically by said paper holding means in accordance with its line space position for conditioning said calculating machine to perform different functions.

5. In a calculating machine adapted to be conditioned to perform different calculating functions, a printing mechanism operable to print the results of calculations along a printing line, a rotatable platen for holding a work sheet relative to said printing mechanism, means for line spacing said platen, and means controlled by said platen in accordance with its line space positions for conditioning said machine to perform different functions.

6. In a calculating machine adapted to be conditioned to perform different calculating functions, a printing mechanism operable to print the results of calculations along a printing line, a rotatable platen for holding a work sheet relative to said printing mechanism, means for line spacing said platen, and means controlled by said platen in acordance with its line space positions for enforcing a totaling operation.

7. In a calculating machine adapted to be conditioned to perform different calculating functions, a printing mechanism operable to print the results of calculations along a printing line, a rotatable platen for holding a work sheet relative to said printing mechanism, means for line spacing said platen, and means controlled by said platen in accordance with its line space positions for conditioning said machine to perform a non-add listing operation.

8. In a calculating machine adapted to be conditioned to perform different calculating functions, a printing mechanism operable to print the results of calculations along a printing line, a rotatable platen for holding a work sheet relative to said printing mechanism, means for line spacing said platen, and means controlled by said platen for determining line spacing of said work sheet.

9. In a calculating machine adapted to be conditioned to perform different calculating functions, a printing mechanism operable to print the results of calculations along a printing line, paper holding means for supporting a work sheet in printing position relative to said printing mechanism, means for line spacing the work sheet relative to said printing line, and means acting automatically to condition said machine to perform different functions in a predetermined sequence in accordance with the line space position of said paper holding means.

10. In a calculating machine adapted to be given cycles of operation and to be conditioned to perform different calculating functions, a printing mechanism operable to print the results of calculations along a printing line, means for supporting a work sheet in printing position relative to said printing mechanism, means operating automatically to line space said work sheet during cycles of operation of said machine, and means operating automatically to condition said machine to perform different functions in a predetermined sequence in accordance with the line space positions of said work sheet supporting means as it is line spaced during a series of cycles of operation of said machine.

11. In a calculating machine adapted to be given cycles of operation and to be conditioned to perform different calculating functions, a platen, a printing mechanism operable to print results of calculations along a printing line on said platen, means automatically line spacing said platen during cycles of operation of said machine, and means controlled by said platen in accordance with the line space positions of said platen, acting to automatically condition said machine to perform different functions in a predetermined sequence during a series of cycles of operation of said machine.

12. In a calculating machine having a printing mechanism operable to print the results of calculations along a printing line, paper holding means for supporting a work sheet in printing position relative to said printing mechanism, means for line spacing said work sheet relative to said printing line, said line space means being operable to line space said sheet one or more line spaces for each operation of said line space means, and means automatically controlling the number of line spaces said work sheet is moved during any one operation of said line space means in accordance with the line space position of said paper holding means at the time said operation takes place.

13. In a calculating machine adapted to be given cycles of operation, a printing mechanism operable to print results of calculation along a printing line, paper holding means for supporting a work sheet in printing position relative to said printing mechanism, line spacing means operable during each cycle of operation of said machine to automatically line space said holding means, said line spacing means being operable to line space said holding means different distances during different operations of said line spacing means, and means controlled by said paper holding means acting automatically to vary the number of spaces said holding means is moved during predetermined operations of the machine.

14. In a calculating machine adapted to be given cycles of operation, a rotatable platen, a printing mechanism operable to print the results of calculations along a printing line on said platen, means for line spacing said platen automatically during cycles of operation of said machine, said line spacing means being operable to line space said platen different distances, and means controlled by said platen in accordance

with its line space position automatically controlling the number of spaces said platen will be moved during a given cycle of operation of said machine.

15. In a calculating machine adapted to be given cycles of operation, a printing mechanism operable to print the results of calculations along a printing line, paper holding means for supporting a work sheet in printing position relative to said printing mechanism, means automatically line spacing said paper holding means during cycles of operation of said machine, said line spacing means being operable to line space said paper holding means different distances, and means operating automatically to vary in a predetermined sequence the number of spaces said paper holding means is moved during a given series of cycles of operation of said machine.

16. In a calculating machine adapted to be given cycles of operation, a rotatable platen, a printing mechanism operable to print the results of calculations along a printing line on said platen, means for line spacing said platen during each cycle of operation of said machine, said line spacing means being operable to line space said platen different distances and means controlled by said platen for causing the number of spaces said platen is moved to vary automatically in a predetermined sequence during a given series of cycles of operations of said machine.

17. In a calculating machine provided with means for giving it a cycle of operation, a printing mechanism, conditioning means for conditioning the machine to perform predetermined functions, paper holding means for supporting a work sheet in printing position relative to said printing mechanism, means operable to line space said sheet relative to said printing mechanism, and means governed in accordance with the line space position of said paper holding means and by said conditioning means for preventing said operating means from operating said machine except when said platen and conditioning means are in predetermined positions.

18. In a calculating machine provided with means for giving it a cycle of operation, a platen, a printing mechanism, conditioning means for conditioning said machine to perform predetermined functions, means operable to line space said platen relative to said printing mechanism, and means controlled by said platen in accordance with its line space position and by said conditioning means for preventing said operating means from operating said machine unless said platen and conditioning means are in predetermined positions.

19. In a calculating machine provided with means for giving it a cycle of operation, a printing mechanism, paper holding means for supporting a work sheet in printing position relatively to said printing mechanism, conditioning means for conditioning the machine to perform predetermined functions, and means controlled by said paper holding means in accordance with its line space position and said conditioning means for preventing said operating means from operating said machine unless said paper holding means and said conditioning means are in predetermined position.

20. In a calculating machine provided with disconnectible means for giving it a cycle of operation, a printing mechanism, paper holding means for supporting a work sheet in printing position relatively to said printing mechanism, conditioning means for conditioning the machine to perform predetermined functions, and means controlled by said paper holding means in accordance with its line space position and said conditioning means for disconnecting said disconnectible operating means from said machine unless said paper holding means and said conditioning means are in predetermined positions.

21. In a calculating machine adapted to be conditioned to perform different calculating functions, a printing mechanism operable to print the result of calculating operations along a printing line, paper holding means for supporting a work sheet in printing position relative to said printing mechanism, means operable to line space said sheet relative to said printing line, means operating automatically to condition said machine to perform different predetermined functions in accordance with the different line space positions of said paper holding means, and means for disabling said conditioning means to render the machine normal in operation.

22. In a calculating machine adapted to be conditioned to perform different calculating functions, a printing mechanism operable to print the results of calculations along a printing line, a rotatable platen for holding a work sheet relative to said printing mechanism, means for line spacing said platen, a pair of cams on the platen shaft, means controlled by one of said cams for conditioning said machine to perform predetermined functions, and means controlled by the other of said cams for determining the line spacing for each machine operation.

23. In a calculating machine adapted to be conditioned to perform different calculating functions, a printing mechanism operable to print the results of calculations along a printing line, a rotatable platen for holding a work sheet relative to said printing mechanism, means for line spacing said platen, a pair of cams on the platen shaft, means controlled by one of said cams for conditioning said machine to perform predetermined functions, means controlled by the other of said cams for determining the line spacing for each machine operation, and means actuated by the platen shaft for enforcing a totaling operation.

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