

March 21, 1950

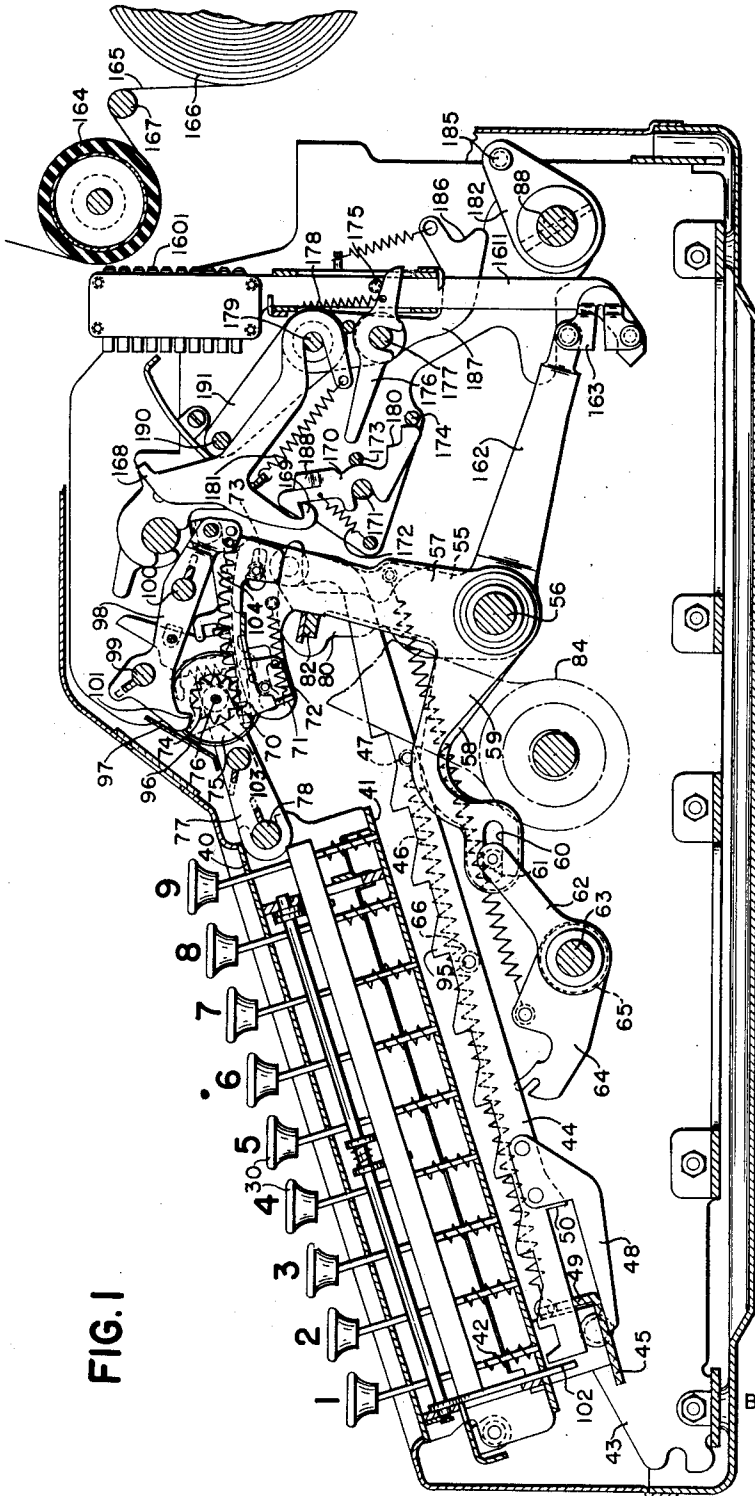
H. L. LAMBERT
CALCULATING MACHINE FRACTIONAL
KEYBOARD CONTROL MECHANISM

2,501,447

Filed April 3, 1945

4 Sheets-Sheet 1

FIG. 1



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By

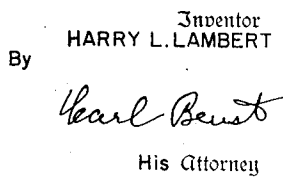
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His Attorney

Filed April 3, 1945

4 Sheets-Sheet 2

4 Sheets-Sheet 2



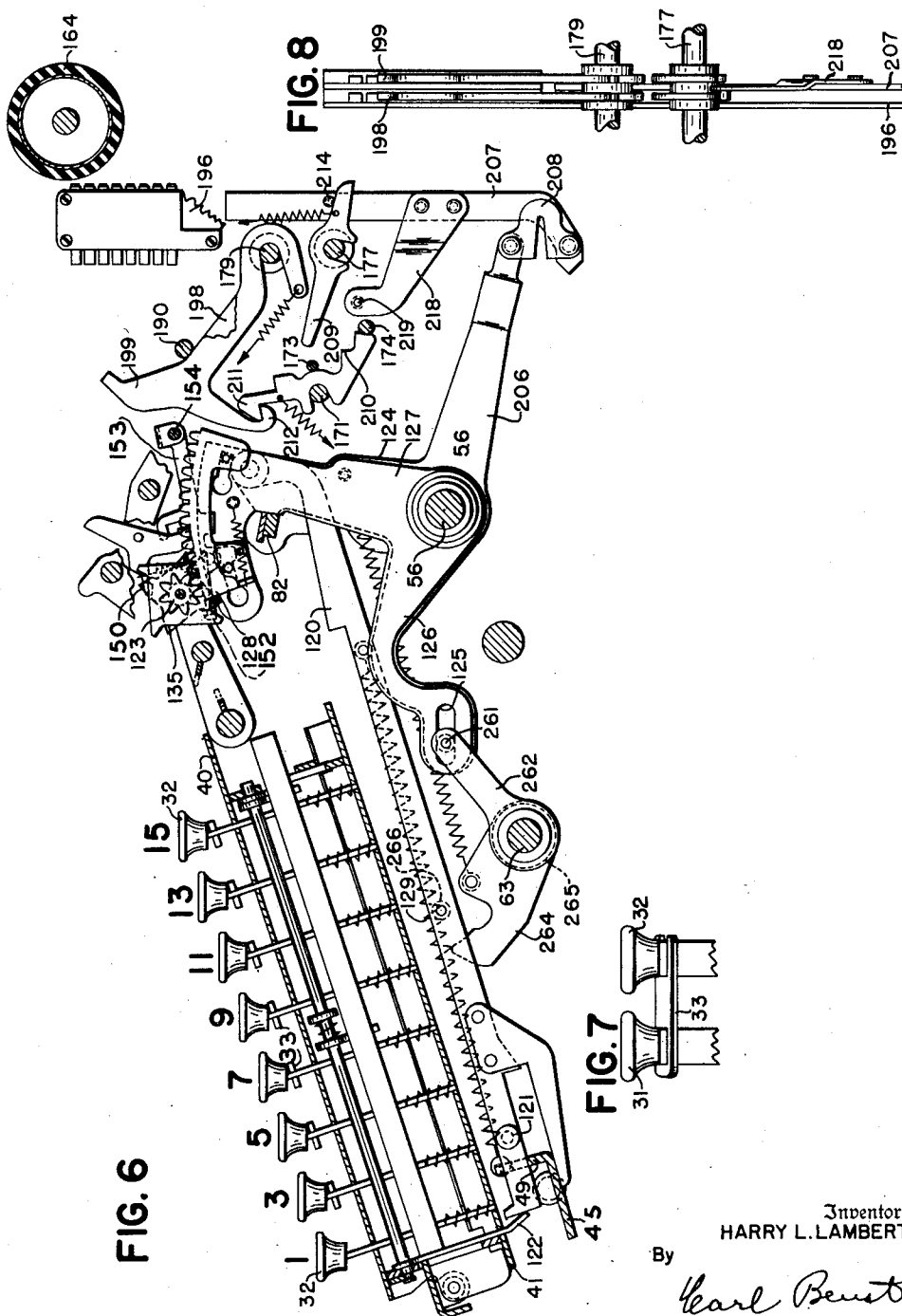
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4 Sheets-Sheet 3



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4 Sheets-Sheet 4

FIG. 9

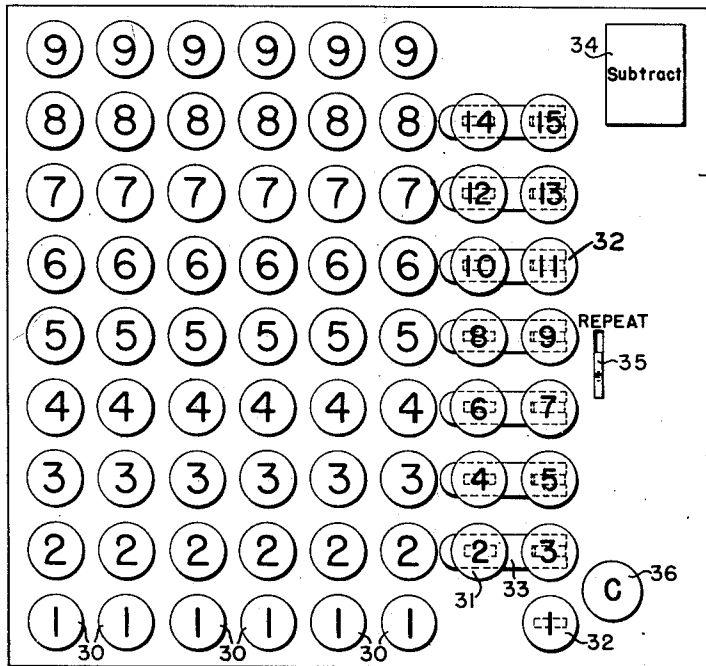


FIG. 10

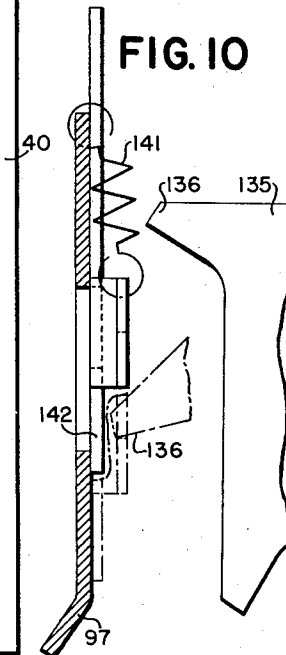


FIG. 11

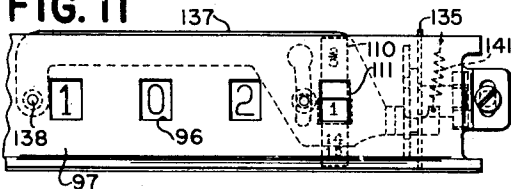


FIG. 12

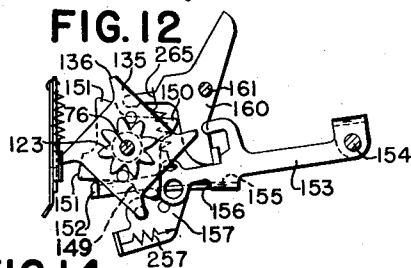


FIG. 13

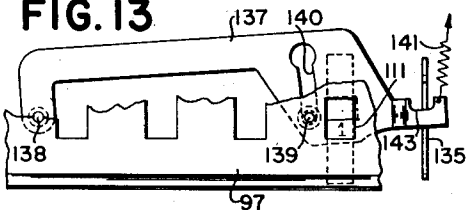


FIG. 14

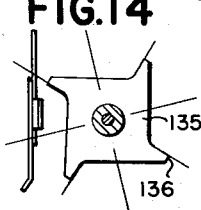


FIG. 17

2734.50	14
155.75	11
2.37	2
764.25	3
200.00	
75.69	15
3932.58	13 *

FIG. 15

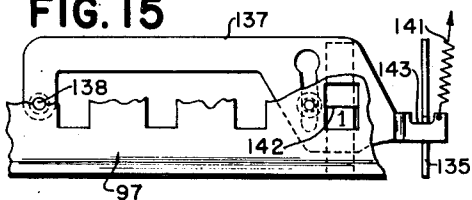
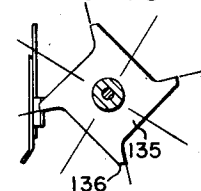


FIG. 16



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UNITED STATES PATENT OFFICE

2,501,447

CALCULATING MACHINE FRACTIONAL
KEYBOARD CONTROL MECHANISM

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by mesne assignments, to The National Cash
Register Company, Dayton, Ohio, a corporation
of Maryland

Application April 3, 1945, Serial No. 586,361

13 Claims. (Cl. 235—60)

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This invention relates to improvements in adding or calculating machines and particularly to the provision of mechanism for entering fractional amounts into a totalizer and for recording such amounts on record material.

One of the objects of the invention is to provide a totalizer capable of receiving fractional entries, either in a positive direction or in a subtractive direction, said entries being either in the decimal system or in the form of fractions.

Another object of the invention is the provision of a printing mechanism for entering fractional amounts on record material simultaneously with the entry of such fractional amounts into a totalizer.

A further object of the invention is to provide a single totalizer wheel controlled by two banks of keys, which totalizer wheel is capable of receiving and indicating fractional amounts.

Another object of the invention is to actuate a single totalizer wheel under control of two actuators, one of said actuators actuating the totalizing wheel through a transfer mechanism and the other of said actuators actuating the totalizer wheel directly.

A still further object of the invention is to provide a single totalizer wheel having two sets of numerals thereon for indicating fractional amounts and a shutter movable from one position to another position under control of one bank of keys to determine which one of a selected set of numerals on the totalizer wheel is to be exposed to view.

With these and incidental objects in view, the invention includes certain novel features of construction and combinations of parts, the essential elements of which are set forth in appended claims and a preferred form or embodiment of which is hereinafter described with reference to the drawings which accompany and form a part of this specification.

Fig. 1 is a sectional view of the machine, taken to the right of a whole number key bank and showing the actuators for entering amounts into the totalizer, together with the printing mechanism.

Fig. 2 is a sectional view showing the even-numbered numerator fractional amount bank, together with the fractional amount totalizer wheel and the printing mechanism for recording the even-numbered numerators.

Fig. 3 is a rear view of the fractional amount type carrier.

Fig. 4 is a detail view of a part of the hammer control mechanism.

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Fig. 5 is a diagrammatic view of the fractional number totalizer wheel and indicates the positions of the two series of numerals thereon.

Fig. 6 is a sectional view showing the odd-numbered numerator fractional amount bank, together with the mechanism for controlling the position of the totalizer shutter, and the mechanism for selecting a fractional amount printing hammer.

Fig. 7 is a detail view showing the means for connecting the odd-numbered and the even-numbered numerator keys together.

Fig. 8 is a front view of the hammer mechanisms for printing the fractional amounts.

Fig. 9 is a diagrammatic view showing the keyboard arrangement of the machine to which the invention is shown applied.

Fig. 10 is an enlarged scale detail view of the elements for shifting the fractional amount shutter mechanism.

Fig. 11 is a front view of the right-hand section of the totalizer and shows the mask and shutter in position.

Fig. 12 is an end view of the mechanism for operating the totalizer shutter, together with a transfer mechanism for readjusting the fractional amount totalizer wheel under control of the odd-numbered numerator keys.

Fig. 13 is a detail view of the shutter mechanism shown in Fig. 11 and shows the shutter in the upper position, in which the even-numbered numerators are displayed.

Fig. 14 is an end view of the mechanism shown in Fig. 13.

Fig. 15 is a detail view of the shutter mechanism of Fig. 11 and shows the shutter in the lower position, in which the odd-numbered numerators are displayed.

Fig. 16 is a detail end view of the mechanism shown in Fig. 15.

Fig. 17 is a facsimile of a portion of the tape printed by the machine.

GENERAL DESCRIPTION

The invention is shown as applied to an adding machine of the type described in United States Letters Patents to Peters, No. 1,386,021 and No. 1,386,022, and White, No. 1,854,875.

In this class of adding machines, there is provided a series of amount keys, or stops, against which a series of reciprocating members index. Actuated by the latter are the adding racks which impart movement to the totalizer wheels and the type carriers to position the type in the proper printing position.

In the machines illustrated in the above-mentioned Peters patents, each reciprocating member comprises a stop bar which indexes against the projecting key stem and is connected at its rear end with an L-shaped diverging pivoted lever, the latter carrying at its upper end an adding rack and at its rear end a type bar, and these associated elements move as a unit.

In the machine illustrated in the above-mentioned White patent, the adding rack is mounted on an independently pivoted lever adjacent to, and separate from, the L-shaped diverging lever, so that the rack and type bar need not move as a unit. As is well known, this construction is provided in machines of the Peters type when the subtracting feature is desired.

As illustrated in the present application, the invention is shown applied to the subtracting type of differential mechanism shown in the White patent. However, the invention is not limited to this type of differential construction, since a straight adding differential mechanism such as that shown in the Peters patent can be used therewith. The keyboard in the machine as described in the present application is provided with amount key banks similar to those disclosed in the above-mentioned White and Peters patents. In addition to the regular amount keys, which are arranged in decimal order, the present application illustrates two banks of fraction keys. These two banks of keys are illustrated in the present machine for adding sixteenths, and one bank of keys is provided for entering such fractions having odd-numbered numerators, and another bank of keys is provided for entering such fractions having even-numbered numerators. The fraction keys are so interconnected on the keyboard that the depression of any odd numerator key, except the "1" key, will also carry with it its adjoining even-numbered numerator key. The construction of the differential mechanisms associated with the fraction banks of keys is such that the index member associated with the odd-numbered numerator keys will move only one step when a key in this bank has been depressed, and the index member in the even-numbered numerator bank will move a number of steps equal to the value of the numerator on the key depressed. Thus, for example, if it is desired to enter $\frac{5}{16}$, the "5" key in the right-hand bank is depressed. This key carries with it the "4" key in the second bank. During the operation of the machine, the index member in the right-hand bank moves one step to adjust a four-pointed wheel, which actuates a shutter for the purpose described later. This one-step movement of the index member in the right-hand bank also actuates a four-point transfer element, so that, upon the entry of two successive odd-numbered numerators, one is transferred into the fraction dial wheel. The depression of the "4" key in the even-numbered numerator bank will cause the index member associated with this bank of keys to move two steps, thus advancing the fraction dial wheel two steps. If before this entry operation—that is, with the "5" key depressed—the fraction dial wheel were standing at zero, then, upon operation of the machine, the dial wheel will be moved to present the numerals 4 and 5 to the sight opening provided in the machine. At this time, the shutter operated under control of the odd numerator index member will be positioned so that the numeral 5 is in displaying position and the numeral 4 is concealed, thus indi-

cating $\frac{5}{16}$ as having been entered into the totalizer.

The index member of the even numerator differential positions two type carriers, to present two numerals, to the printing line. A separate printing hammer is provided to print from either one of the two type carriers that are presented to the printing line, and the differential mechanism in the odd numerator bank sets up a control member to select one of the two printing hammers to be released to take an impression from the proper one of the type carriers. Thus, when an odd-numbered numerator key is depressed and the machine is operated, the printing hammer for the odd-number type carrier is released to take an impression. If no odd-numbered numerator key is depressed, then the printing hammer for printing from the even-numbered type carrier will be released for operation.

The type characters provided on the type carriers for the fractional amounts show only the numerators with a horizontal line drawn beneath them. The denominator, "16," is not engraved on the type carrier, since it will be understood by the user of the machine that the characters printed in the first column on the record strip represent the fractions for which the machine is built, which, as illustrated in the present machine, are sixteenths.

DETAILED DESCRIPTION

Keyboard

The keyboard of the machine as illustrated in the present application is provided with six banks of keys **30** for entering amounts into the totalizer in the usual and well-known manner, as shown and described in the above-mentioned patent to White. Just to the right of the units bank of keys **30** is provided a bank of fraction keys **31**, which is used to enter all fractions having even numerators. To the right of the bank of keys **31** is provided a bank of keys **32** for entering all fractions having odd numerators. Each of the keys **31** is provided with a plate **33**, which is secured just beneath the head of the key and which projects to the right and under the head of the adjoining key **32**. The plate **33** is slotted at its right end so that the key **31** may be depressed without depressing the key **32**. However, upon depression of a key **32**, the plate **33** is carried therewith, thus depressing the adjoining key **31**. The plate **33** thus provides a means whereby, when any one of the odd-numbered numerator keys, except the key representing "1," is depressed, it will carry with it the adjoining even-numbered key having a value one-sixteenth lower than that of the odd-numbered key being depressed.

The usual subtract key **34**, repeat lever **35**, and correction key **36** shown and described in the above mentioned White patent, are provided on the keyboard of the instant machine. The constructions, functions and controls of these three control members are exactly like those illustrated in the above-mentioned White and Peters patents, and therefore no further description thereof is given herein.

The keyboard (Figs. 1, 2, 6, and 9) is provided with a top plate **40** and a bottom plate **41**, suitably supported by side frames **43** (one of which is shown in Fig. 1). The top plate **40** is provided with suitable slots through which the keys project and which provide supporting and guiding means for the keys, said keys being arranged to slide in

said slots substantially at right angles to the top and bottom plates.

Amount bank—Whole number keys

The construction of the whole number amount banks is like that disclosed in the above-named White and Peters patents. As shown in said patents, each key is provided with a shoulder, against which the upper end of a spring 42 presses to maintain the keys in their undepressed positions. Each bank of keys is also provided with a detent for maintaining a depressed key in its depressed position to maintain the lower end of the depressed key in the path of a shoulder on the associated index bar 44 (Fig. 1). A comb 45 acts as a guide for the forward end of the index bar 44. A spring 46, one end of which is attached to the upwardly-extending flange of the comb and the other end of which is attached to a stud 47 on the index bar 44, tends to draw the index bar forwardly. Secured to the side of the index bar 44 is a plate 48, formed to provide a fork which straddles the comb 45 to properly guide the index bar in its different movements. The face 49 of the comb 45 acts as the 9's stop for the index bar when the shoulder 50 on the index bar comes into contact with said face 49 during an operation in which the "9" key is depressed.

The rear end of the index bar 44 is pivoted, by means of a stud, to the upper end of a diverging lever 55, pivotally mounted on a shaft 56. A rack lever 57 is also pivoted on the shaft 56 adjacent the diverging lever 55. The construction of the diverging and rack levers is the same as that shown in the White patent. Each diverging lever 55 includes a forwardly-extending gooseneck arm 58 having at its extremity a slot which is radial with respect to the shaft 56. A similar gooseneck extension 59 on the rack lever 57, having a slot 60 in alignment with the slot in the diverging lever, is provided, and when the machine is conditioned for adding operations, a stud 61 projects through the slots in the gooseneck arms of the diverging lever and the rack lever to couple them together to move as a unit. The stud 61 is mounted on an arm 62 secured to a hub 65 rotatably mounted on a shaft 63. To this hub 65 is secured the usual complementary arm 64 adapted to cooperate with a stud 66 on the index bar 44 for the purposes of subtracting as fully shown and described in said White Patent.

When the machine is conditioned for subtracting operations, the shaft 63 and arms 62 and 64 are shifted endwise in the manner fully disclosed in the above-mentioned White patent to withdraw the stud 61 from the slot in the diverging lever to thereby uncouple the diverging lever from the rack lever for the purposes and functions described in said White patent.

Each rack lever 57 carries at its upper end the usual adding rack 70, stop piece 71, and carrying spring 72. The rack 70 is provided with two studs 73, which are free to slide in elongated slots in the rack lever 57. Each rack 70 may mesh with a pinion 74, secured to a registering dial or number wheel 75. The number wheels 75 are all rotatably mounted on a common shaft 76 and are provided with the customary tens transfer control mechanisms. A suitable carry-over mechanism is also provided between the fraction registering dial 110, referred to below, and the units whole number amount wheel 75. The shaft 76 is carried on a rocking frame 77 pivoted on a shaft 78, so that the pinion 74 may be rocked into and out of mesh with the rack 70 in the proper tim-

ing during the machine operation in a manner well known and described in the above-mentioned patents.

Two arms 80 (Fig. 1) and 81 (Fig. 2) are pinned to the shaft 56 at each end thereof, and support between them a cross bar 82. The cross bar 82 normally engages a flat surface 83 on the diverging and rack levers. The function of the cross bar 82 is to control the time of movement of the diverging and rack levers and their associated index bars. During the forward movement of the operating handle 84 (Fig. 1), the cross bar 82 is moved out of the path of movement of the diverging and rack levers to release them to the action of the springs 46, and the levers are restored to their normal positions by the return stroke of said cross bar and said handle.

The cross bar 82 is rocked by the operating handle when the latter is first pulled forwardly by a mechanism including a plate 85 (Fig. 2), to which the operating handle 84 is releasably clutched. The plate 85 has pivoted thereto a link 86, which is pivoted at its other end to an arm 87 secured to a shaft 88. Also secured to the shaft 88 is a cam 89, with which a roller 90 on a pitman 91 cooperates. The pitman 91 is pivotally connected to the above-mentioned arm 81 by a stud 92, and the rearward end of the pitman 91 is bifurcated to straddle a hub 79 of the arm 87. A spring 93, having one of its ends attached to a stud on the arm 81 and having its other end anchored on the hub 79, maintains the roller 90 in contact with the cam 89.

Forward and return rocking movement of the handle 84, through the plate 85, the link 86, the arm 87, and the shaft 88, rocks the cam 89 first counter-clockwise (Fig. 2) and then back in a clockwise direction to its normal position. Counter-clockwise movement of the cam 89 causes the roller 90, under tension of the spring 93, to follow the contour of the cam 89, thus pulling the pitman 91 rearwardly and rocking the arms 80 and 81 counter-clockwise (Fig. 2). Counter-clockwise movement of the cross bar 82 releases each pair of diverging and rack levers for movement by its spring 46. The levers continue to move until a shoulder 95 (Fig. 1) of the index bar strikes the end of a depressed key. The shoulders 95 are so arranged on the index bar 44 in relation to the keys 30 that the index bar and the rack lever will move an extent commensurate with the value of the depressed key.

After the rack levers are positioned under control of the depressed keys, the totalizer frame 77 is rocked to lower the totalizer pinions into engagement with the racks 70, whereupon the cam 89, acting against the roller 90, cams the pitman 91 and the arms 80 and 81, together with the cross bar 82, to rock the latter clockwise (Fig. 1) to restore the rack levers to their normal positions. During this return movement of each rack lever, the amount represented by the depressed key is entered into the totalizer pinion 74 and is indicated on the registering dials 75 through a sight opening 96 provided (see also Figs. 11, 13, and 15) in a plate 97, carried by the totalizer frame 77.

The forward end of a plate 98, adjacent each totalizer pinion 74 and supported by rods 99 and 100, has an alining tooth 101 formed thereon, with which the totalizer pinion engages when the totalizer is rocked out of engagement with the rack 70 to maintain the pinion and the registering dial in proper alinement while disengaged

from the adding rack. The rods 99 and 100 are supported by the side frames 43.

The usual zero stop pawl 102 (Fig. 1) is provided to arrest the index bar 44 and the rack lever in the zero position, when no amount key 30 is depressed. Depression of any key 30 in the amount bank moves the zero stop pawl out of the path of the end of the index bar 44 to release the index bar to the action of the spring 46 in the manner described in the above-mentioned patents.

Amount bank differential—Fraction banks

The construction of the banks of keys for entering the fractional amounts is similar in all respects to the construction of the amount banks described above for the whole number key banks. The present machine is constructed to enter fractions in steps of one-sixteenth, and two banks of keys are used to enter all of the fractional amounts. A registering dial 110 is differentially positioned under control of the keys 31 (Fig. 2) and is divided into eight sections, each section, except the first, having two numerals (see Fig. 5) which may be positioned opposite the sight opening 111 (Figs. 11, 13, and 15) in the plate 97. A shutter 137 is provided and assumes one of two positions in order to conceal one of the numerals positioned opposite the sight opening. The position of the shutter is under control of the odd-numbered numerator keys 32 in a manner to be described presently.

Fraction differential mechanism—even-number numerators

The differential mechanism for entering the even-number numerators into the registering dial 110 is shown in Fig. 2. Depression of a key 31 (Fig. 2) withdraws a zero stop pawl 112 from the path of an index bar 113 and presents the ends of the depressed key into the path of an appropriate shoulder 114 on the index bar 113. A spring 117 constantly urges the index bar 113 toward the front of the machine.

The index bar 113 is pivotally connected to a diverging lever 116, pivoted on the shaft 56. The diverging lever 116 is provided with a forwardly-extending arm having a radial slot in alinement with a radial slot 259 in a forwardly-extending arm 258 on a rack lever 115 pivoted on the shaft 56 adjacent the diverging lever 116. A stud 361 is carried by an arm 362, secured to a hub 365 rotatably mounted on the shaft 53. The hub 365 also has secured to it a complementary arm 364, similar to that disclosed in the above mentioned White patent, to cooperate with a stud 366 on the index bar 113 for subtract purposes. Since there are only seven keys in the key bank, the complementary system is based on eight, and therefore the arm 364 is located seven steps from the stud 366, instead of nine, as in the whole number banks, where the base is ten. The stud 361 enters said radial slots and couples the levers 115 and 116 together for addition and is disengaged from the lever 116 during subtraction operations in the manner fully shown and described in the above mentioned White patent. The rack lever 115 has slidably mounted, near its top, a rack 158, meshing with a pinion 159 on the shaft 76. The pinion 159 is secured to the side of the fraction registering dial 110.

A spring 257, one end of which is anchored to a flange on a plate 157 (see also Fig. 12), secured to the side of the rack 158, normally maintains a flange 156 on the rack 158 in contact

with a flange 155 of a transfer trip arm 153. When the flange 156 is in contact with the flange 155, the rack 158 is held in its normal position, and, when the flange 155 is withdrawn from the path of the flange 156, the spring 257 moves the rack 158 one step relatively to the rack lever 115, for a purpose described later.

Operation of the machine with a key 31 depressed and the consequent counter-clockwise movement of the bar 82 releases the rack lever 115 and the diverging lever 116, together with the index bar 113, to the action of the spring 117. When the index bar 113 is arrested by the depressed key, the rack lever 115 is in a position corresponding to the value of the depressed key. In this instance, each key progressively represents two-sixteenths, and therefore, even though the registering dial 110 moves only one step when actuated by the rack lever 115, the amount represented will be increased by two-sixteenths for each unit of movement of the index bar 113, as represented by the various keys 31.

In all other respects, the construction and operation of the differential mechanism controlled by the keys 31 are the same as described above for the differential mechanism operated under control of the keys 30.

Fraction differential mechanism—Odd-number numerators

The differential mechanism associated with the keys 32 (Fig. 6) differs from the above-described differential mechanisms in that the depressed keys do not arrest the movement of an index bar 120 associated therewith. The index bar 120 is provided with a stud 121, which projects to the right thereof, and, when the index bar is released by depression of any key 32 and the consequent removal of a zero stop member 122, the stud 121 engages the face 49 of the comb 45. The extent of movement given to the index bar 120 when moving from the position shown in Fig. 6 to the position in which the stud 121 engages the face 49 is equal to one step of movement, or, that is to say, an extent sufficient to rotate a registering pinion 123 (Figs. 6 and 12) one-eighth of a rotation. Thus it is clear that, no matter which key 32 is depressed, the registering pinion 123 will move only one-eighth of a rotation during adding operations. This step of movement is transmitted from the index bar 120 to the registering pinion 123 by means including a rack lever 127, which lever is pivoted on the shaft 56 adjacent to a diverging lever 124. The index bar 120 is pivoted to the diverging lever 124 which is provided with a radial slot into which a stud 261 on an arm 262 projects. This arm 262 is secured to a hub 268 rotatably mounted on the shaft 63 and has secured to it a complementary arm 264 to cooperate with a stud 265 on the index bar 120 for subtraction purposes. The complementary arm 264 is spaced from the stud 265 a distance sufficient to permit the arm to move two steps when the stud 265 remains in its normal position (shown in Fig. 6) during subtraction operations, the latter operations being accomplished in the manner shown and described in the White patent above referred to. In the White patent the complementary arm is located nine steps from the controlling studs since the complements are based on the decimal system of ten. In the present machine no more than two steps are needed, as will appear hereinafter. The stud 261 also projects into a radial slot 125 in an arm 126 of the rack lever 127 to couple the levers together for

addition. The rack lever 127 carries an actuating rack 128 similar in all respects to the actuating rack 70 described in connection with the differential mechanism shown in Fig. 1. The index bar 120 is actuated by a spring 129, when released by the cross bar 82, and, when moved until the stud 121 is arrested by the face 49 of the comb 45, carries the levers 124 and 127, together with the rack 128, forwardly. During this time, the pinion 123 is disengaged from the rack 128, and, after the rack is positioned, the pinion 123 is again moved into engagement with the rack 128. Thereafter, the cross bar 82 returns the levers 124 and 127 to their normal positions, and, in so moving, the rack 128 rotates the pinion 123 one-eighth of a rotation.

The registering pinion 123, instead of being secured to a registering dial like the dial 75 (Fig. 1), is secured to a four-point disk 135 (Figs. 6, 10, 11, 12, 13, 14, 15, and 16).

The four-point disk 135 is arranged to actuate, or position, the shutter 137, pivoted on a stud 138 carried by the plate 97. The shutter 137 is guided in its pivoting movement by a stud 139 in the plate 97 projecting through a guide slot 140 in the shutter 137. A spring 141 normally maintains the shutter 137 in the position shown in Fig. 13, wherein the lower end of the guide slot 140 contacts the stud 139 in the plate 97. When in this position, a sight opening 142 in the shutter 137 is so positioned that an even-numbered numerator on the registering dial 110 is exposed through the sight opening 111 in the plate 97. The free end of the shutter 137 is provided with a notch 143, with which the points 136 of the disk 135 engage. Assuming that the registering dial 110 is set at zero, then, when the disk 135 is moved one step under control of the index bar 120 upon operation of the machine with a key 32 depressed, the disk 135 is rotated from the Fig. 14 position to the Fig. 16 position. In so doing, one of the points 136 engages the notch 143 of the shutter and carries the shutter downwardly against the tension of the spring 141 until the sight opening 142 moves into a position wherein the lower numeral on the registering dial 110 is exposed to view through the sight opening 111.

Upon the next operation of the machine following the one in which the shutter 137 is positioned into the Fig. 15 position, and during which a key 32 is depressed, the index bar 120 controls the positioning of the actuator rack 128 to rotate the four-point disk 135 another step to cause the tooth engaging the notch 143 to pass out of or beyond the notch 143 and release the shutter to the action of the spring 141, whereupon the shutter is returned to the position shown in Fig. 13, in which the lower end of the guide slot 140 engages the stop stud 139. In this position, an upper or even-number numerator is again exposed to view through the sight opening 111.

From the above it is clear that, for each operation of the disk 135, the shutter moves from one position to the other. When moved by a point 136, the flash is moved into the Fig. 15 position, and when the point 135 is moved past the notch 143, the flash is moved to the Fig. 13 position by the spring 141.

The result of the positioning of the shutter 137 is such that, when the amount standing on the dial 110 is an odd number, the odd-number numeral will be exposed, and, when the amount standing on the dial 110 is an even number, the

even number will be exposed to the sight opening.

The operation and the coordination of the two differentials under control of the keys 31 and 32 may be best explained by assuming that the dial 110 is standing at zero. The subsequent operation of the machine with the "2" key 31 (Fig. 2) depressed will cause the dial 110 to move one step to bring that part of the registering dial having the "2" and the "3" (Fig. 5) exposed to the sight opening 111. Since the amount of the entry is a fraction having an even-numbered numerator, the flash 137 will remain in the position shown in Fig. 13, and the disk 135 will remain in the position shown in Fig. 14. If, for the next operation of the machine, the "1" key 32 (Fig. 6) is depressed and the machine is operated, the index bar 120 controls the rotation of the pinion 123 and the disk 135 to move one step, thus moving the disk 135 from the Fig. 14 position to the Fig. 16 position and in so doing lowers the flash to expose the "3" to the sight opening. Since the "1" key 32 (Fig. 6) was the only one depressed, the dial 110 was not rotated, and, since the dial was set with the numerals "2" and "3" opposite the opening 111, movement of the flash to the Fig. 15 position exposes the odd-number of this pair of numerals, which in the example is "3."

If, during the next operation of the machine, the "1" key 32 is again depressed, then, during the operation of the machine, a point 136 of the disk 135 will pass beyond the notch 143, thus releasing the shutter 137 to move under the action of the spring 141 and expose the even number standing opposite the sight opening 111, which in the example should be "4." Now, since during this operation no key 31 was depressed, the registering dial 110 is not moved under control of the index bar 113, and therefore the numeral "2" would be exposed to the sight opening, if some other means were not provided for advancing the registering dial 110 one step. The mechanism for accomplishing the necessary adjustment of the registering dial 110 under such conditions includes a four-point cam member 150 (Fig. 12) secured to the four-point disk 135. Each point on this cam member 150 acts to trip a mechanism similar to the usual tens transfer mechanism commonly used in the patents referred to above. The four points on the cam member 150 are so arranged that, when it becomes necessary to advance the dial 110 by reason of advancing the pinion 123 two steps, one of the camming points 151 engages a flange 152 on the transfer arm 153 to rock it on a pivot 154. Such rocking of the arm 153 lowers the flange 155 out of the path of the shoulder 156 of the plate 157, mounted on the actuator rack 158 in the differential mechanism shown in Fig. 2. The actuator rack 158 meshes with the pinion 159 of the registering dial 110. Lowering of the flange 155 out of the path of the shoulder 156 results in the actuator rack 158 moving one step in the adding direction to present the next pair of numerals "4-5" to the sight opening 111. Since the shutter is in its upper position in the example assumed, the numeral "4" will be exposed to view.

The usual transfer arm retaining pawl 160, pivoted on a stud 161, is provided to maintain the arm 153 in its proper positions. This pawl is restored to its normal position at the beginning of the next succeeding operation of the machine, when the totalizer frame is rocked

counter-clockwise (Figs. 1, 2 and 6) to disengage the pinions of the totalizer from the actuating racks in the usual and well-known manner. Such restoring movement of the pawl 160 results in the arm 153 being rocked clockwise by a spring 265 to position the flange 155 into the path of the flange 156 on the plate 157, where it remains until the arm 153 is again tripped by the next one of the four trip points 151 on the cam member 150, as is well known in the art.

Subtract operation

To clearly explain a subtract operation involving fractions, the example of $75\frac{14}{16}$ minus $3\frac{7}{16}$ will be explained.

As fully disclosed in the before mentioned White patent, the stud 63 (Fig. 1) in the whole number banks are located on the bars 44 in respect to the arm 64, to permit the arm 64 to move an extent equal to the complement of 9. For example, if the bar 44 in the units bank for the whole number is arrested by the 5 key, the stud 66 for this bank will be arrested in a position to stop the complementary arm in its 4 position.

The even-numbered numerator bank contains only seven keys, and therefore the distance between the stud 366 (Fig. 2) and the effective surface of the complemental arm 364 is complementary to 7. For example, if the 6 key 31 is depressed, the stud 366 moves forwardly three steps, since the 6 key occupies the third position in the key bank. The stud 366 when positioned under control of the 6 key controls the complemental arm 364 to advance four steps.

The odd-numbered numerator keys release the bar 113 to move only one step when a key 32 is depressed, and maintains the bar 113 in the position shown when no odd-numbered numerator key 32 is depressed the complementary arm 264 moves two steps. Therefore, in the example assumed, the complementary arm 264 moves two steps.

In the example assumed, the amount standing on the totalizer reads $75\frac{14}{16}$, and the fraction wheel is therefore setting with the section of the fraction wheel bearing the numeral 14-15 at the window, and the shutter 137 is in its lower position to cover the numeral 15, as illustrated in Fig. 14.

To subtract $3\frac{7}{16}$ from $75\frac{14}{16}$, the operator depresses the 3 key 30 in the units whole number key bank, and the 6 key 31 in the even numbered fraction bank. The subtract key 34 is depressed and the machine released for operation.

During the machine operation the bar 120 and the stud 266 in the odd-numbered fraction differential mechanism remains stationary and therefore the complemental arm 264 moves two steps to move the four-point disk 135 and the four-point cam 150 two steps. Moving the disk 135 two steps alternately lowers and releases the shutter 137 so that at the end of the machine operation the shutter is in the upper position, as shown in Fig. 13. Moving the four-point cam 150 two steps trips the transfer pawl 153 to cause a rack in the even-numbered fraction differential mechanism to advance one step beyond its movement under control of the complementary arm 364.

The depressed 6 key 31 in the even-numbered keybank arrests the bar 113 in the position where in the stud 366 arrests the complemental arm 364 after moving four steps. Therefore the dial 110 in the fraction order is advanced five steps, that is, four steps under control of the stud 366

and one step by the transfer mechanism tripped by the cam 150. This advances the dial to the position in which the digits 8-9 are opposite the window and since the shutter is in its upper position the digit 8 is exposed to indicate a fraction of $\frac{9}{16}$.

Passing of the dial through 14-15 to 0-1 causes one to be tripped into the units whole number dial 75. Also, depression of the 3 key 30 in the units order whole number bank causes the dial 75 to move six steps under control of the stud 66 and the complementary arm 64. This results in the units whole number dial advancing seven steps to expose the numeral 2 at the window.

Since no keys 30 are depressed in the orders above the units whole number bank, 9 is automatically added into each order higher than the units order, with the result that at the end of the operation the amount $72\frac{9}{16}$ is indicated.

A second example of $75\frac{14}{16}$ minus $3\frac{7}{16}$, is briefly described. This operation is the same as in the example above, except that depression of the "7" key in the odd-number fraction key bank causes the bar 120 and the stud 260 (Fig. 6) to advance one step, thus limiting the movement of the complemental arm 264 to one step of movement. Since the "7" key also depresses the "6" key in the even-number fraction bank, the control of the even-number differential is the same as in the first example. One step of movement of the complemental arm 264 shifts the shutter 137 to expose the odd-number numerator at the window, and such one step of movement of the complemental arm is not sufficient to move the cam 150 far enough to cause a transfer to carry into the fraction numeral dial 110. Therefore, the dial 110 is advanced four steps to bring the numerals 6-7 opposite the window. In this operation the shutter 137 is in the lower position, thus exposing the numeral 6 through the window. At the end of this operation the value $72\frac{9}{16}$ appears at the window.

In a problem where no fractions are included, such as, for example, 75 minus 3, the cam 150 moves through two steps to trip one into the dial 110, and the dial 110 is moved seven steps under control of the complemental arm 364, thus moving the dial 110 from 0 to 0, and tripping one into the units order whole number dial 75 to supply the unit known in the art as the "fugitive 1." The complemental arms 64 in the whole-number banks control the whole-number differential mechanisms to enter 9 complements into each whole number dials above the units order to obtain the correct remainder in the manner well known in the art, and as shown and described in detail in the above mentioned White patent.

PRINTING MECHANISM

Mechanism is provided for entering the various items on a record strip as they are entered into the totalizer. As far as the printing mechanism associated with the whole number banks is concerned, this mechanism is the same as that described in the above-mentioned Peters and White patents. The novel mechanism disclosed herein includes a control for printing the fractions as they are entered under control of the two fraction banks of keys 31 and 32. Described in general terms, the fraction printing mechanism consists of a type basket having two type carriers, one bearing even and the other odd characters, which is adjusted under control of the even-number numerator key bank 31. A control is

provided for selectively tripping one of a pair of hammers to print from the proper one of the two sets of type carriers. If no odd-numbered numerator key 32 is depressed, the even-number hammer will be tripped, whereas, if an odd-numbered numerator key is depressed, the odd-number hammer will be tripped. The control of the selection of the printing hammer is effected by the movement or non-movement of the index bar 120 (Fig. 6) in the odd-numerator key bank 32.

Printing whole-number digits

The whole number digits are represented by type carriers 1601 (Fig. 1) carried in a basket mounted on the upper end of a type bar 1611 connected to an arm 162 on the diverging lever 55 by a link 163. Differential movement of the index bar 44 under control of a depressed key 30 positions the arm 162 and the bar 1611 to present a type character commensurate with the value of the depressed key at the printing line opposite the platen 164. The record material 165 is fed from the roll 166 around a guide rod 167 and under the platen 164, and thence past the printing line and out of the machine.

A printing hammer 168 is provided to strike the selected type carrier to impinge the type against a ribbon (not shown), the record material, and the platen to make a printed record.

The hammer 168 is held in cocked position by a hook 169 formed thereon, which is engaged by a pawl 170 pivotally mounted on a shaft 171. A spring 172 normally maintains the pawl 170 in position to latch the printing hammer 168 in its cocked position. A rod 173 acts to hold the trip pawls 170 on the shaft 171, and a rod 174 limits the counter-clockwise movement of the pawl 170 under action of the spring 172. A stud 175 on the bar 1611 normally limits counter-clockwise rotation of a tripping arm 176 mounted on a shaft 177 under action of a spring 178. The arm 176 is rocked bodily around the shaft 179 during a machine operation, to engage its end with a shoulder 180 on the trip pawl 170 to rock the trip pawl clockwise to release the printing hammer. When the type bar 1611 is in the home position, the hammer will not be released, since the arm 176 is held in such a position that it will not engage the shoulder 180. However, when the type bar 1611 rises, during the machine operation and under control of a depressed key 30, into the "1" position, or higher, the forward end of the arm 176 is lowered into contact with the shoulder 180. If the arm 176 is positioned against the shoulder 180, then, on bodily movement of the arm, the pawl 170 is rocked on the shaft 171 to withdraw the hooked end from the hook 169 on the printing hammer, which is thereupon released to the action of a spring 181. The spring 181 thereupon swings the hammer 168 rapidly clockwise to strike the type carrier located at the printing line.

The arm 176 is rocked bodily around the shaft 179 by a pair of arms 182 (Fig. 1) and 183 (Fig. 4). Each of the arms 182 and 183 is provided with a stud 185. When the operating handle 84 is pulled forward and the shaft 88 is rocked counter-clockwise, as described above, the arms 182 and 183 move the studs 185 into contact with shoulders 186 on a pair of arms 187 mounted on the shaft 179. Mounted between the arms 187 is the shaft 177, on which the arm 176 is supported.

Therefore, upon operation of the machine and rocking of the shaft 88 counter-clockwise, the

pair of arms 187 carrying the shaft 177 and the arm 176 move forwardly of the machine, and, when the arm 176 is in contact with the shoulder 180, the arm trips the printing hammer 168 by rocking the pawl 170 clockwise until its hooked end is withdrawn from the hook 169 of the hammer.

The stud 175 is so located on the type bar 1611 that the arm 176 is not in position to release the pawl 170 when the type carrier is in either zero position or home position, and therefore zeros are normally not printed. The usual and well-known offset flanges 188 are provided on the pawls 170, which extend behind the next higher order pawls 170, so that zeros may be printed in lower denominational orders whenever the pawl 170 of a higher order denomination is released and no keys are depressed in said lower order denominations.

A rod 190, carried between two arms 191 secured to the shaft 179 (see also Fig. 4) is provided for restoring the tripped printing hammers 168 near the end of the machine operation. The right-hand arm 191, as viewed from the front of the machine, is provided with a depending arm 192 connected to a link 193 connected to the arm 183 on the shaft 88. At the beginning of the machine operation, when the shaft 88 is rocked counter-clockwise (Fig. 4), the arm 183, through the link 193, the arm 192, and the pair of arms 191, moves the rod 190 clockwise away from the printing hammers. This permits the operation of the printing hammers in the manner described above. Near the end of the machine operation, when the arm 183 is restored to its home position, the rod 190 is retored to the position shown, by the link 193, the arm 192, and the pair of arms 191. During this restoring movement, the rod 190 picks up all of the tripped hammers and restores them to their home positions, wherein they are again latched by the pawls 170.

Printing fractions

The type basket, differentially positioned under control of the keys 31, is provided with two sets of type carriers, as shown in Fig. 3. These type carriers are positioned under control of the depressed keys 31, through the diverging lever 116, which is provided with a rearwardly extending arm 195. The arm 195 is connected to a type bar 196 by the link 197.

During the machine operation, the depressed key 31 (Fig. 2) controls the setting of the type bar 196 to position two type characters at the printing line (see Fig. 3). For example, if the "4" key is depressed and the machine operated, both the "4" and the "5" type carriers are positioned at the printing line. Two separate printing hammers are provided, each operated independently of the other for printing from one or the other of the two type carriers. When an even-number numerator fraction key 31 alone is depressed, the printing hammer 198 (Fig. 2) is released to print from the type carrier containing the character representing the depressed key. However, if an odd-number numerator key 32 is depressed, as described above, which also depresses the adjoining even-number numerator key 31, the type carriers will be positioned just as before, under control of the even-number numerator key 31. However, depression of a key 32 effects a control over the release of the printing hammers so that the hammer 198 will not be released to print, and a hammer 199 (Fig. 6) will be released to take an impression from that one

of the left-hand type carriers, as viewed in Fig. 3, which is set at the printing line.

The release of the hammer 198 will be described first. This hammer is released in the same manner as the hammer 168, described above. The type bar 196 is provided with a stud 215, normally maintaining an arm 201 in ineffective position. Adjustment of the type bar 196, under control of a key 31, withdraws the stud 215 from contact with the arm 201 and permits the spring 200 to rock the arm 201 counter-clockwise. Such movement positions the end of the finger 201 behind a shoulder 202 on a pawl 203, normally engaging a hook 204 on the hammer 198. After the arm 201 is positioned behind the shoulder 202, the shaft 177 is rocked around the shaft 179 as a pivot point, thus causing the finger 201 to rock the pawl 203 to release it from the hook 204 of the impression hammer 198, and causing the spring 205 to swing the hammer 198 clockwise to strike the type carrier carrying the even-number numerator character to take an impression on the record strip. The hammer 199 for taking impressions from the odd-number type characters is released as follows. As explained above, the index bar 120 is released under control of the keys 32, but moves only one step under control of the stud 121 thereon. The index bar 120 thereby moves the diverging lever 124 one step counter-clockwise when a key 32 in the odd-number numerator bank is depressed, before the operation of the machine. The diverging lever 124 has an arm 206 connected to a bar 207 by a link 208.

The bar 207 does not have type carriers mounted at its top, like the similar bars 161 and 196, described above. However, this bar 207 is provided with a stud 214 for controlling an arm 209, and allowing, when the bar 207 moves up, the arm 209 to move behind a shoulder 210 on a pawl 211 normally latching behind a hook 212 on the printing hammer 199. The hammer 199 is aligned with the odd-numbered type characters in the basket shown in Figs. 2 and 3.

From this it is apparent that, in any machine operation in which the diverging lever 124 is moved one step, the printing hammer 199 will be released for operation to cause the hammer 199 to be released to print, from the odd-number type carrier set by the even-number keys 31, onto the record material.

In those operations of the machine in which the hammer 199 is released, it is necessary to prevent release of the hammer 198, so that printing of the even-number numerator is prevented when the odd-number numerator is printed. Such preventing means consists of a plate 218 secured to the side of the bar 207. The plate 218 is provided with a stud 219 (see also Fig. 2), which projects under the finger 201, and therefore, when the bar 207 is raised out of its normal position, the arm 201 is prevented from moving from behind the shoulder 202 even though said arm 201 has been released for movement into the path of said shoulder 202 by the raising of the stud 215.

From the above it becomes clear that only a single type basket is set, but the two banks of keys 31 and 32 control not only from which pair of type carriers the character is to be printed but also which type hammer is to be released to cause the proper printing. The control is such that the keys 31 set the type carriers and normally release the printing hammer for printing the even-number numerator characters. However, when an odd-number numerator key 32 is

depressed, this control is modified by the stud 219 raising the trip finger 201 from behind the shoulder 202, so that the hammer 198 is not released for operation, and at the same time the stud 214 positions the finger 209 behind the shoulder 210, so that the hammer 199 is released for operation and the odd-number numerator character is printed.

TOTAL-TAKING OPERATIONS

In the present machine, totals are taken in the same manner as in the previously mentioned patent to Peters; i. e., the totalizer wheels are moved into engagement with the actuator racks at the beginning of the machine operation and rotated in a reverse direction until the tens-transfer cams secured to the totalizer wheels strike against the tens-transfer pawls and stop the movement of the racks and type bars. The printing hammers are then fired to print the total on the record material, after which the actuator racks and type bars are returned to their home positions, with the totalizer wheels either engaged with or disengaged from the racks, depending on whether a total or sub-total is desired. Thus, in the present machine, the tens-transfer cam 103, secured to the pinion 74 and the dial 75 (Fig. 1) for the whole number units order, is rotated in a reverse or clockwise direction until a shoulder on the cam comes into contact with a flange (similar to flange 152) on a tens-transfer pawl or arm 104. The wheel is now in its zero position, and the amount standing thereon, prior to its return to this position, will be set up on the type slide 1611.

The 8-tooth pinion 159 and the dial 110 for the even numerator order (Fig. 2) will be returned to zero in a similar manner, the pinion and the dial being arrested in their zero position when a tens-transfer cam 105 secured thereto strikes against a flange (similar to flange 152) on a tens-transfer arm 106. The type slide 196 will now be positioned with one of its eight sets of type situated at the printing line ready to be driven by either the hammer 198 or 199 against the platen 164. Which of the two hammers will be released for operation will depend on the setting of the cam member 150 prior to total taking. If the cam member is in its zero or even position, as shown in Fig. 6, with the shoulder 149 (Fig. 12) of one of the points 151 located behind the flange 152 on the arm 153, then the odd numerator pinion 123 will be held against movement during total taking, and the slide bar 207 will likewise be prevented from moving upward. The finger 209 will thus be held in the position shown in Fig. 6, and the hammer 199 will not be released. The even numerator hammer 198 (Figure 2) will be released, however, since the finger 201 will be lowered into engagement with the shoulder 202 and the pawl 203 by reason of the upward movement of the slide 196. If the cam member 150 is in its odd position, as shown in Fig. 12, when a total is taken, the pinion 123 will move one step before the shoulder 149 of one of the points 151 strikes against the back face of the flange 152. This will allow the slide 207 to move up one step and cause the finger 209 to move behind the shoulder 210 on the pawl 211 so as to fire the hammer 199. At the same time, the hammer 198 is disabled by the stud 219, which holds the finger 201 out of engagement with the shoulder 202 on the pawl 203.

In this manner, the proper fractional amount will be printed on the record material, along with

a whole number total, as shown by the facsimile of the record tape in Fig. 17.

While the form of mechanism shown and described herein is admirably adapted to fulfill the objects primarily stated, it is to be understood that it is not intended to confine the invention to one form or embodiment disclosed herein, for it is susceptible of embodiment in various forms all coming within the scope of the claims which follow.

What is claimed is:

1. In a machine of the class described, the combination of a registering dial settable to display various values; a sight opening through which two of said values may be displayed at one time; a plurality of manipulative devices; differentially settable means settable under control of said manipulative devices; connections between the settable means and the registering dial to position two of said values opposite the sight opening at the same time; other manipulative devices; a normally latched means, released for operation by the manipulation of any one of said other manipulative devices; means to move the last-named means from the normal position into a moved position; a rack member connected for movement by said last-named means; an operating member engageable with and disengageable from the rack during each machine operation, said operating member movable one step during each machine operation following the manipulation of one of said other manipulative devices; a shutter having a normal position and a moved position and located in the sight opening to conceal one of said two displayed values in each of said positions of the shutter; a plurality of projections on the operating member arranged to alternately engage the shutter to move the shutter from normal position into moved position when moving one step, said projections so located on the operating member as to release the shutter when the operating member is moved another step during a subsequent operation of the machine; a carry mechanism, means connected to the operating member to trip the carrying mechanism when the operating member is moved said another step to thereby cause the registering dial to move to position another two values opposite the sight opening; and a means to restore the shutter into normal position when released during said subsequent operation.

2. In a machine of the class described, the combination of a registering dial settable to display various values; a sight opening through which said values may be displayed, the characters representing said values so arranged on the dial as to present two characters opposite the sight opening for each position of the dial; manipulative entry devices; a differentially operable means controlled by the manipulative entry devices to position the dial to present the two characters to the sight opening; a shutter normally in position at the sight opening to conceal one of the two characters opposite the sight opening; an actuating means to move the shutter from the normal position into a moved position wherein the other one of said two characters opposite the sight opening is concealed; and a plurality of manipulative devices having different values to release the actuating means for operation.

3. In a machine of the class described, the combination of a registering dial settable to display various values; a sight opening through which two of said values may be displayed at one time, the characters representing said values so ar-

ranged on the dial as to present two characters opposite the sight opening for each position of the dial; manipulative entry devices; a differentially operable means controlled by the manipulative entry devices to position the dial to present two of the characters to the sight opening at the same time; a shutter normally in position at the sight opening to conceal one of the characters displayed opposite the sight opening; an actuating means to move the shutter from the normal position into a moved position wherein the other one of said two characters opposite the sight opening is concealed, said actuating means operable during a subsequent machine operation to release the shutter; means to return the shutter to the normal position when released by the actuating means; transfer means to advance the dial one step to position two other values at the sight opening; connections between the actuating means and said transfer means whereby the transfer means is tripped during said subsequent operation; and manipulative devices to release the actuating means for operation.

4. In a machine of the class described, the combination of a registering dial settable to represent various values; a sight opening through which a pair of the various values are displayed at the same time, the characters for displaying the various values arranged on the dial in pairs consisting of an odd number and an even number, one of said pairs of characters being positioned at the sight opening for each position of the dial; even-number value manipulative devices; differentially movable mechanism controlled by the even-number value manipulative devices to control the positioning of the dials to select a pair of characters for display; a shutter located at the sight opening to conceal one character of the pair of characters at the sight opening; odd-number value manipulative devices; transfer means to advance the dial one step independently of the even-number manipulative devices; and an actuator operable under control of the odd-number value manipulative devices to control the transfer means and the shutter to move the latter from one concealing position to the other concealing position during a machine operation.

5. In a machine of the class described, the combination of a registering dial settable to represent various values; a sight opening through which a pair of the various values are displayed at the same time, the characters for displaying the various values arranged on the dial in pairs consisting of an odd number and an even number, one of said pairs of characters being positioned at the sight opening for each position of the dial; even-number value manipulative devices; differentially movable mechanism controlled by the even-number value manipulative devices to control the positioning of the dials to select a pair of characters for display at the same time; a shutter located at the sight opening to conceal one character of the pair of characters at the sight opening; odd-number value manipulative devices; transfer means to advance the dial one step independently of the even-number manipulative devices, and an actuator constructed to trip the transfer means and move the shutter from one concealing position into another concealing position during one machine operation and to release the shutter to move back into said one concealing position during a subsequent machine operation, said actuator being released under control of the odd-number value manipulative devices.

6. In a machine of the class described, the combination of a registering dial settable to represent various values; a sight opening through which the various values are displayed, the characters for displaying the various values arranged on the dial in pairs consisting of an odd number and an even number, one of said pairs of characters being positioned at the sight opening for each position of the dial; even-number value manipulative devices; differentially movable mechanism controlled by the even-number value manipulative devices to control the positioning of the dials to select a pair of characters for display; a shutter normally located at the sight opening to conceal the odd-number character of the pair of characters at the sight opening; odd-number value manipulative devices; an actuator released by the odd-number manipulative devices to move the shutter from the position in which the odd-number character is concealed into a position in which the even-number character is concealed, said actuator upon subsequent operation movable to release the shutter to again conceal the odd-number character of a pair of characters at the sight opening; means to move the shutter back to normal when released by the actuating means; and means controlled by the actuating means upon two successive operations thereof to advance the dial one step to thereby move another pair of characters into displaying position.

7. In a machine of the class described, the combination of a registering dial settable to represent various values; a sight opening through which the various values are displayed, the characters for displaying the various values arranged on the dial in pairs consisting of an odd number and an even number, one of said pairs of characters being positioned at the sight opening for each position of the dial; even-number value manipulative devices; differentially movable mechanism controlled by the even-number value manipulative devices to control the positioning of the dials to select a pair of characters for display; a shutter normally located at the sight opening to conceal the odd-number character of the pair of characters at the sight opening; odd-number value manipulative devices; an actuator released by the odd-number manipulative devices to move the shutter from the position in which the odd-number character is concealed into a position in which the even-number character is concealed, said actuator upon subsequent operation movable to release the shutter to again conceal the odd-number character of a pair of characters at the sight opening; means to move the shutter back to normal when released by the actuating means; a tripping member connected to the actuating means; and means tripped by the tripping member during every other step of movement of the actuating means under control of an odd-number value key to advance the dial one step to move another pair of characters into displaying position.

8. In a machine of the class described, the combination of a registering dial settable to represent various values; a sight opening through which the various values are displayed, the characters for displaying the various values arranged on the dial in pairs consisting of an odd number and an even number, one of said pairs of characters being positioned at the sight opening for each position of the dial; even-number value manipulative devices; differentially movable mechanism controlled by the even-number value manipu-

lative devices to control the positioning of the dials to select a pair of characters for display; a shutter normally located at the sight opening to conceal the odd-number character of the pair of characters at the sight opening; odd-number value manipulative devices; an actuator released by the odd-number manipulative devices to move the shutter from the position in which the odd-number character is concealed into a position in which the even-number character is concealed, said actuator upon subsequent operation movable to release the shutter to again conceal the odd-number characters of a pair of characters at the sight opening; means to move the shutter back to normal when released by the actuating means; a tripping member connected to the actuating means; and means tripped by the tripping member during every other step of movement of the actuating means to release an element of the differentially movable mechanism to move one step to move another pair of characters into displaying positions.

9. In a machine of the class described, the combination of totalizer having a plurality of registering elements representing whole numbers and one registering element representing fractions; two banks of fractional keys, one bank representing even number numerators and the other bank representing odd number numerators; means to connect the odd-number keys to the even-number keys of a value one less than the connected odd-numbered key whereby the connected even-number keys are operated by the operation of the odd-number keys; a differential mechanism controlled by each bank of keys, one of said differential mechanisms controlled by the even number bank of keys to enter even-number numerators of fractions commensurate with the value of the keys into said fraction registering element; and means connecting the other differential mechanism with the fraction registering element and operated by the said other differential mechanism to advance the fraction registering element one step upon every second operation of the said other differential mechanism, said other differential mechanism controlled by the odd-number fraction keys.

10. In a machine of the class described, the combination of a totalizer having whole number registering elements and a fraction registering element, a bank of keys representing even-number numerators of fractions, a bank of keys representing odd-number numerators of fractions, means to connect the odd number keys to the even number keys of a value one less than the connected odd number key whereby the connected even number keys are operated by the operation of the odd number keys, a differential mechanism controlled by the even-number numerator keys to advance the fraction registering element to simultaneously represent an even-number fraction and an odd-number fraction in each position of the fraction registering element, a shutter to conceal one of the numerators represented by the positioned fraction registering element, a second differential mechanism operated under control of the odd-number numerator keys to determine the position of the shutter to select the proper numerator represented by the positioned fraction registering element, and means actuated under control of the second differential mechanism to control the operation of an element of the first-named differential mechanism to advance the fraction registering ele-

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ment one step during every other operation of the second differential mechanism.

11. In a machine of the class described, the combination of a displaying member having a set of even number numerators and a set of odd-number numerators thereon, a group of even-number numerator keys, a group of odd-number numerator keys, differentially operable means positioned under control of the even-number numerator keys and connected to said displaying member whereby the displaying member is set to position an even-number and an odd-number numerator in displaying position, a shutter normally positioned to conceal the positioned odd number numerator, and means positioned under control of the odd number numerator keys to shift the shutter to conceal the even-number numerator and to expose the odd-number numerator.

12. In a machine of the class described, the combination of a displaying member having a set of even-number numerators and a set of odd-number numerators thereon, a group of even-number numerator keys, a group of odd-number numerator keys, differentially operable means positioned under control of the even-number numerator keys and connected to said displaying means whereby the displaying means is set to position an even-number numerator and an odd-number numerator in displaying position, a shutter settable to conceal one or the other of the numerators in said displaying position, and means controlled by a group of odd-number keys to determine the position of the shutter to select a numerator for display.

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13. In a machine of the class described, the combination of a displaying member having two sets of numerals thereon, a first group of keys, a second group of keys, means differentially operable under control of the first group of keys and connected to the displaying means whereby the displaying means is set to position a pair of numerals consisting of one numeral of each set of numerals into displaying position, a shutter settable to conceal one or the other of the numerals which are in displaying position and means controlled by the second group of keys to determine the position of the shutter.

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