Aug. 30, 1927. 1,641,126

I. S. DEMENT

COMPUTING MACHINE

Filed Jan. 9, 1904 23 Sheets-Sheet 1

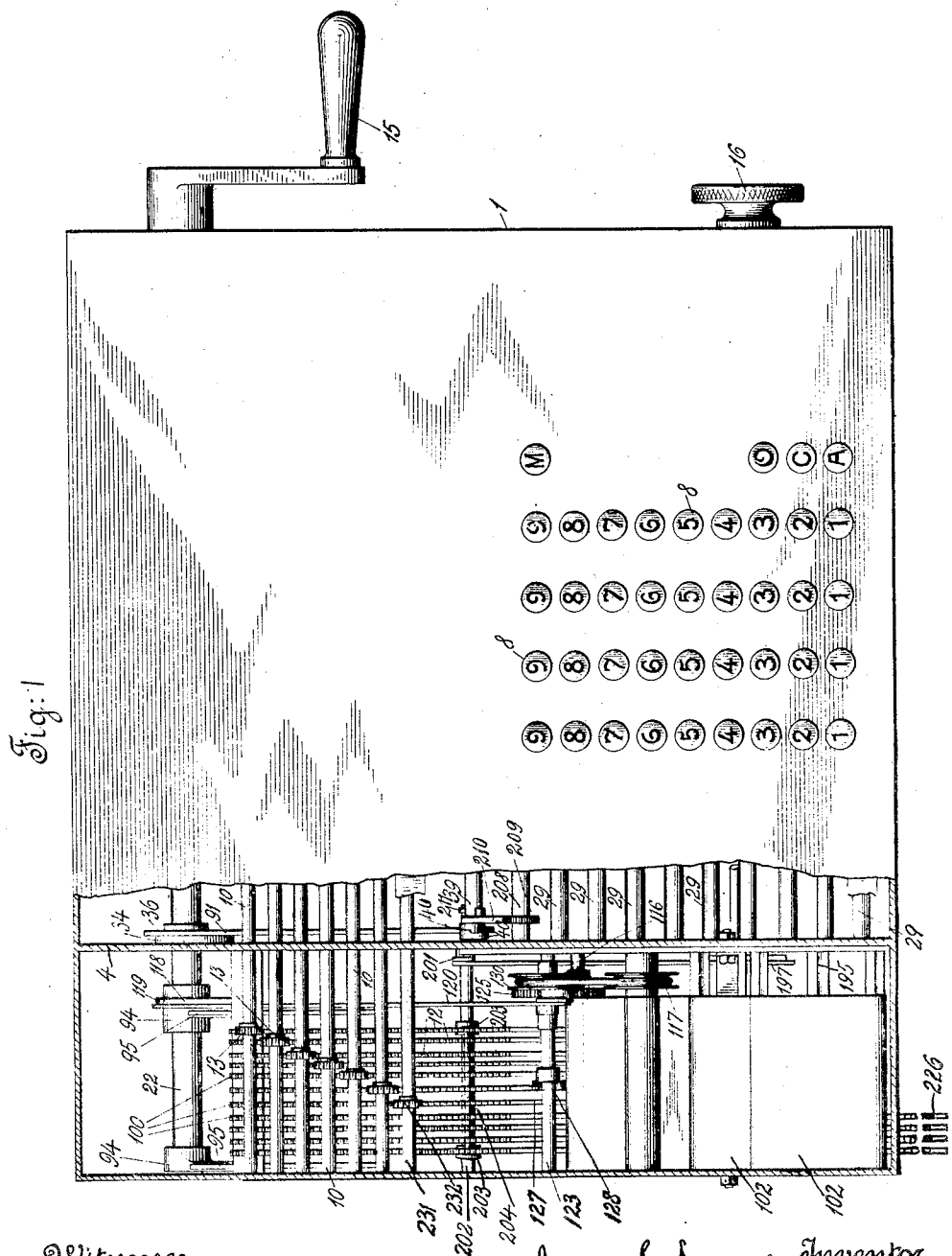


Fig: 1

Witnesses
F. N. Rochrich
John O Sampler

Isaac S. Dement Inventor
By his Attorneys
Kenyon & Kenyon

Aug. 30, 1927. 1,641,126

I. S. DEMENT

COMPUTING MACHINE

Filed Jan. 9, 1904 23 Sheets-Sheet 2

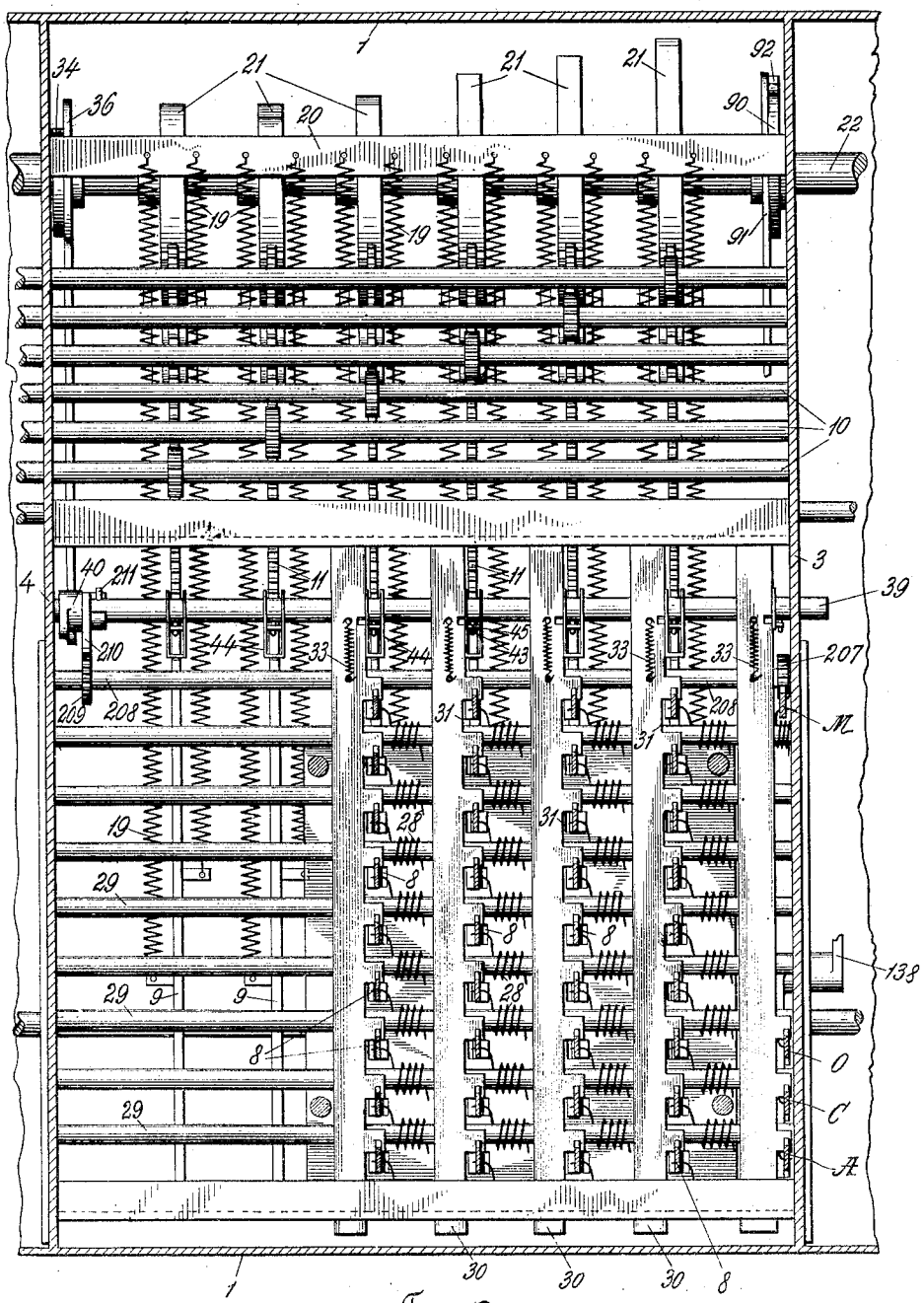


Fig: 2

WITNESSES:
F. N. Rochrich
John O. Gempler

INVENTOR
Isaac S. Dement
BY
Kenyon & Kenyon
his ATTORNEYS

Aug. 30, 1927. 1,641,126

I. S. DEMENT

COMPUTING MACHINE

Filed Jan. 9, 1904 23 Sheets-Sheet 3

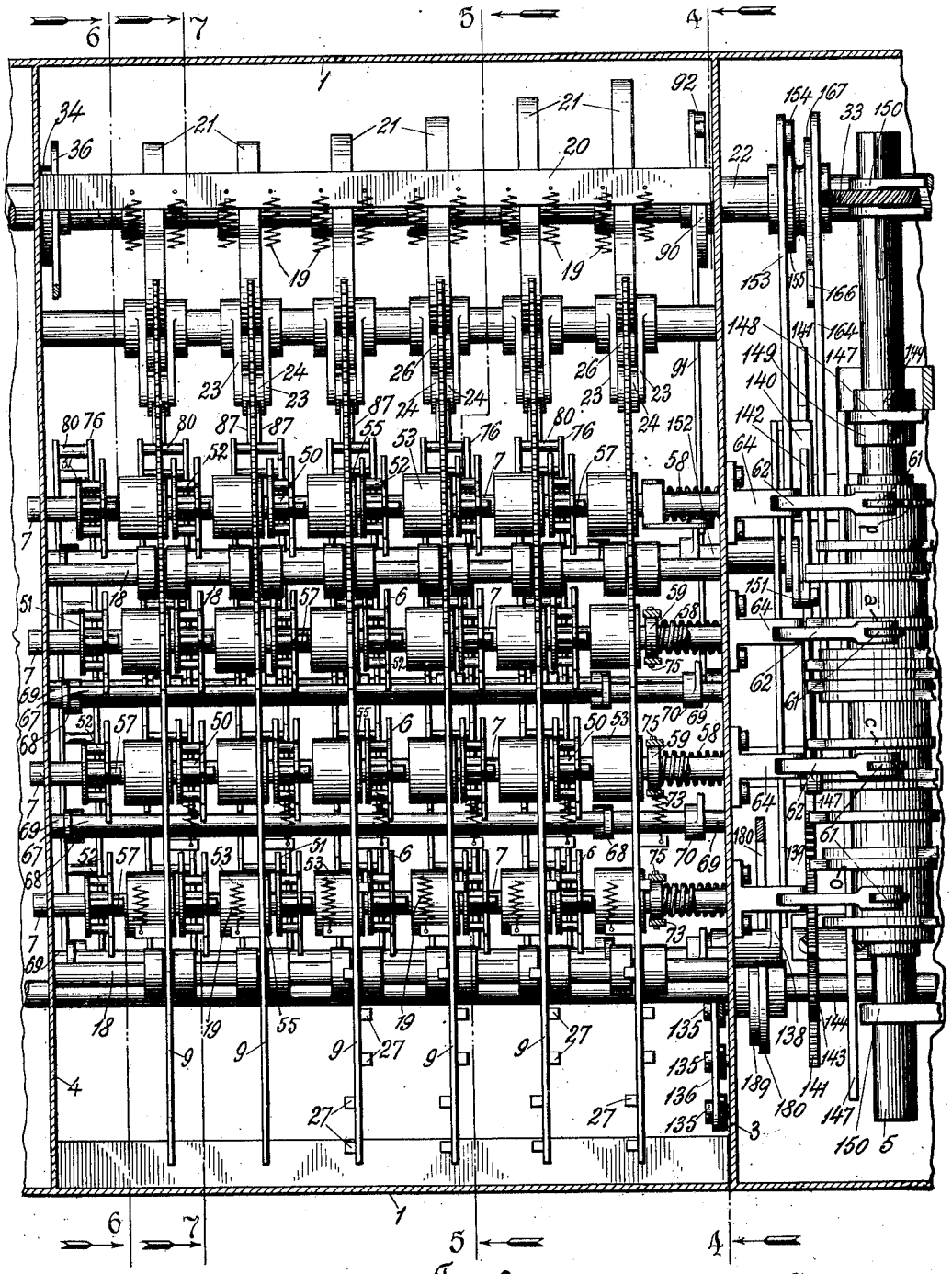


Fig. 3

Witnesses
F. N. Roehrich
John O. Gempler

Inventor
Isaac S. Dement
By his Attorneys
Kenyon & Kenyon

Aug. 30, 1927. 1,641,126

I. S. DEMENT

COMPUTING MACHINE

Filed Jan. 9, 1904 23 Sheets-Sheet 4

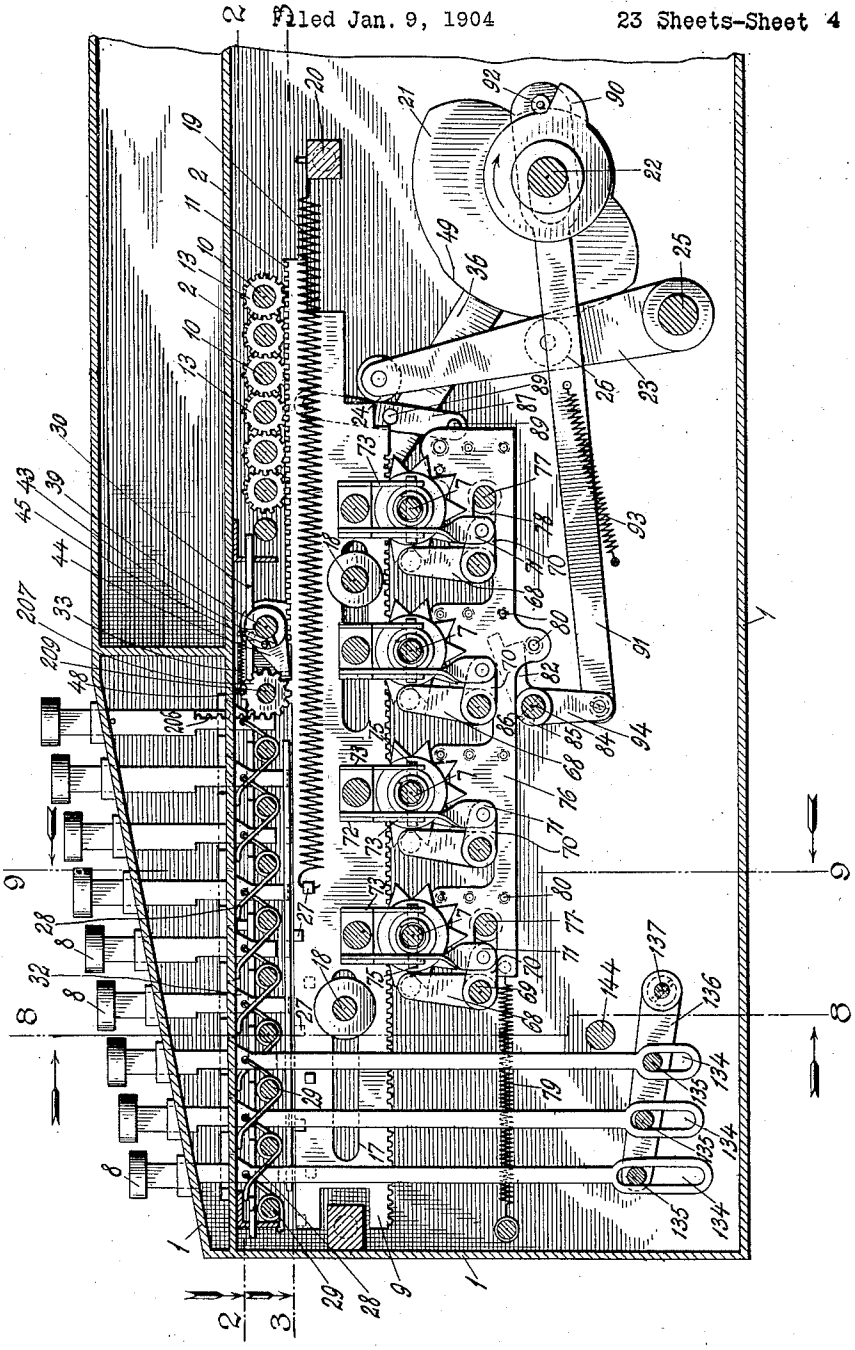


Fig. 4

WITNESSES:
F. J. Rochrich
John O. Kempler

INVENTOR
Isaac S. Dement
BY Kenyon & Kenyon
his ATTORNEYS

Aug. 30, 1927. 1,641,126

I. S. DEMENT

COMPUTING MACHINE

Filed Jan. 9, 1904 23 Sheets-Sheet 5

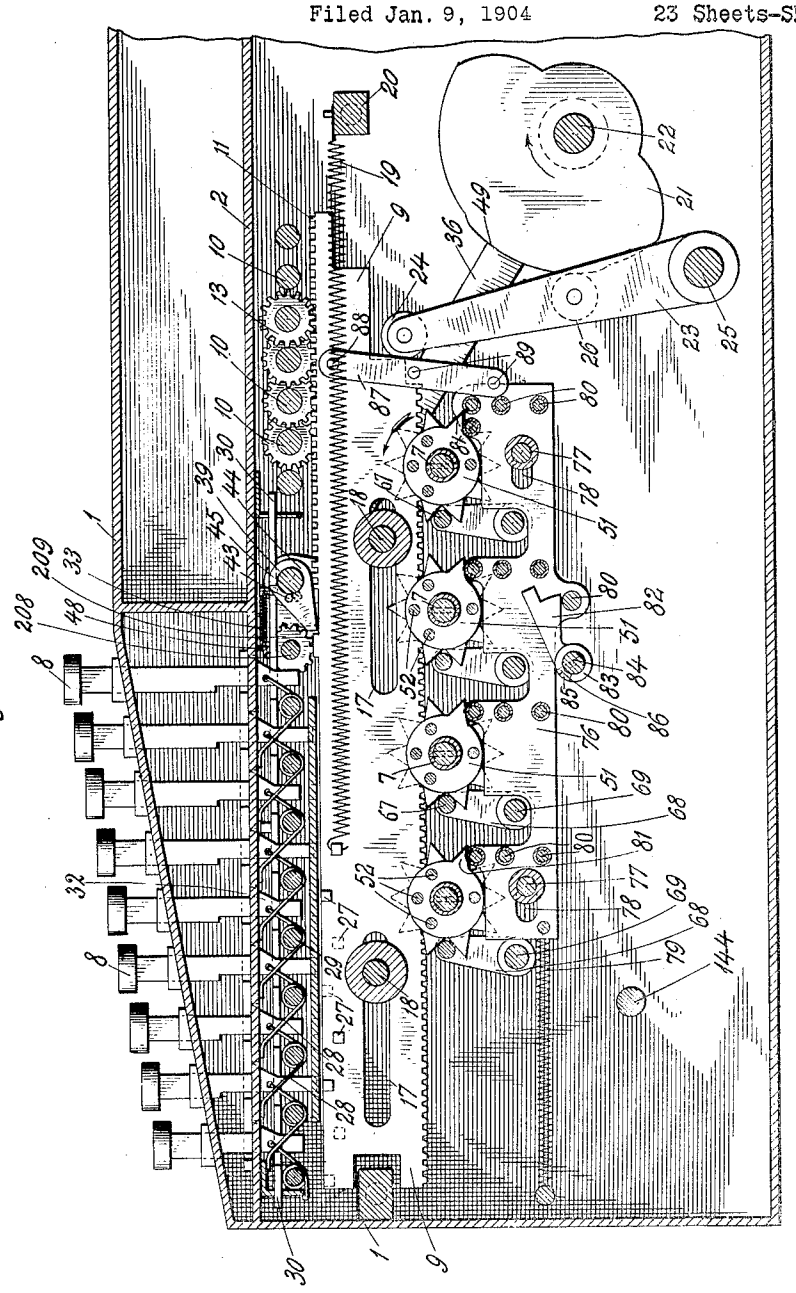


Fig: 5

Witnesses
F. N. Rochrich
John C. Gempler.

Isaac S. Dement Inventor
By his Attorneys
Kenyon & Kenyon

Aug. 30, 1927. 1,641,126

I. S. DEMENT

COMPUTING MACHINE

Filed Jan. 9, 1904 23 Sheets-Sheet 6

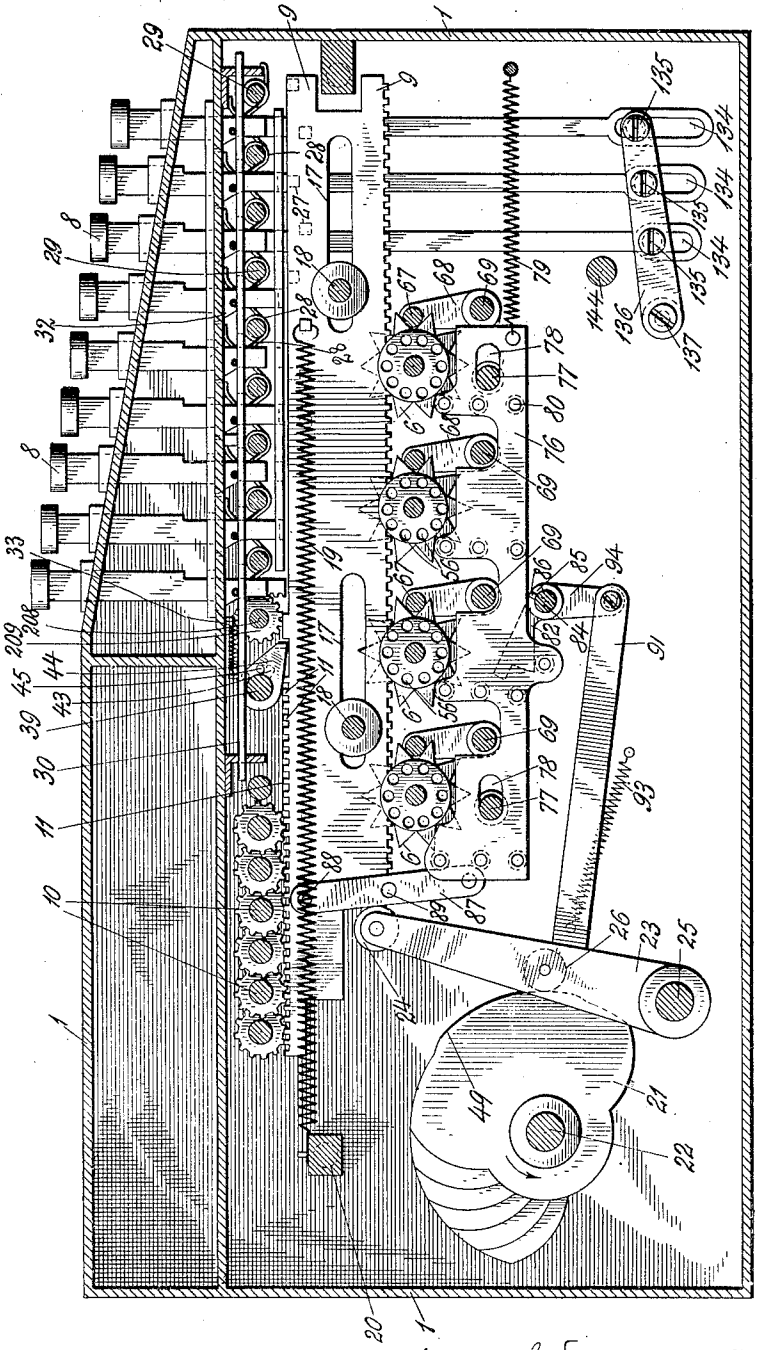


Fig: 6

Witnesses:
F. A. Rochrich
John O. Gempeler.

Isaac S. Dement Inventor
By his Attorneys
Kenyon & Kenyon

Aug. 30, 1927. 1,641,126

I. S. DEMENT

COMPUTING MACHINE

Filed Jan 9, 1904 23 Sheets-Sheet 7

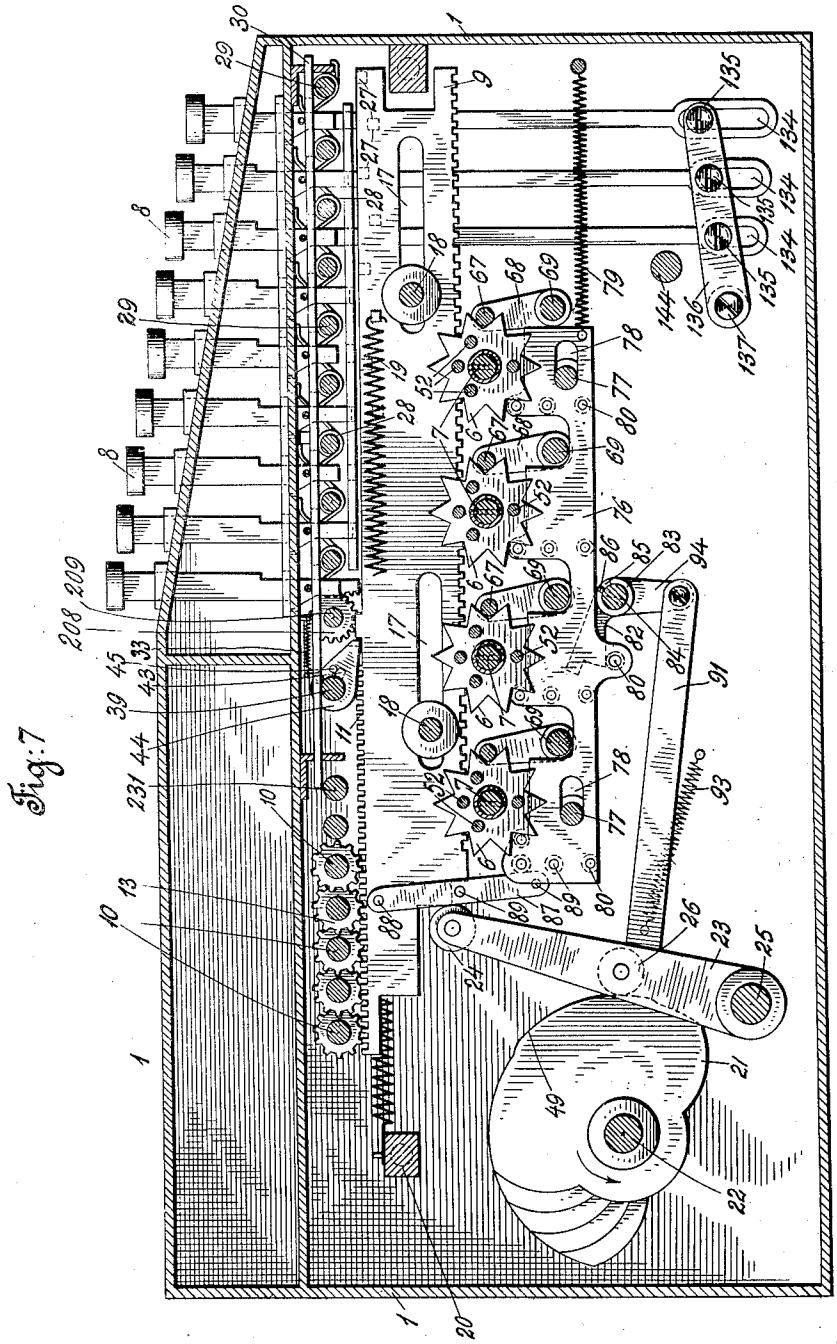


Fig: 7

Witnesses
F. N. Rochrich
John O Gempler.

Isaac S. Dement Inventor
By his Attorneys
Kenyon & Kenyon

Aug. 30, 1927. 1,641,126

I. S. DEMENT

COMPUTING MACHINE

Filed Jan. 9, 1904 23 Sheets-Sheet 8

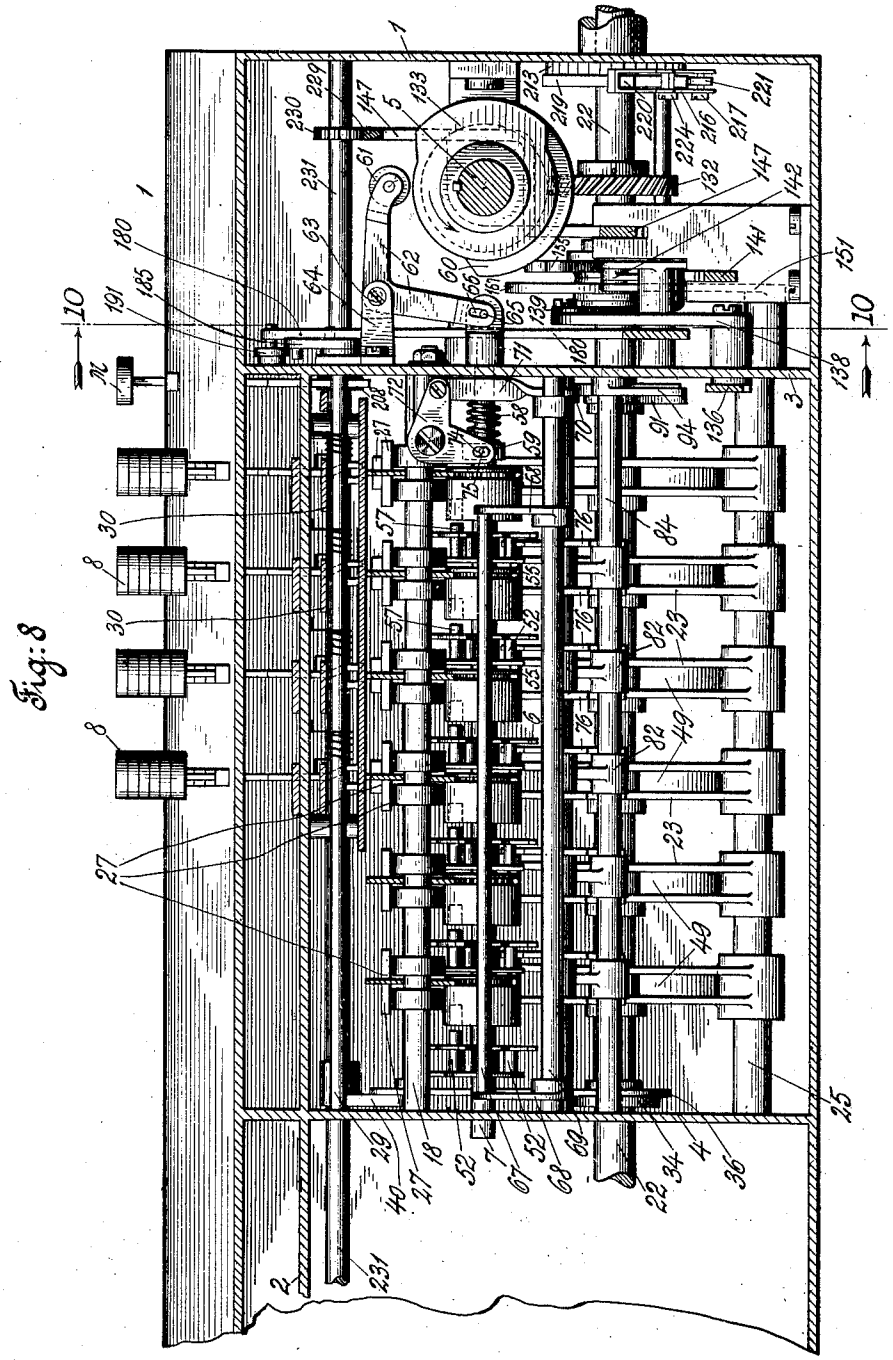


Fig. 8

Witnesses
F. N. Rochrich
John O. Gempeler.

Isaac S. Dement Inventor
By his Attorneys
Kenyon & Kenyon

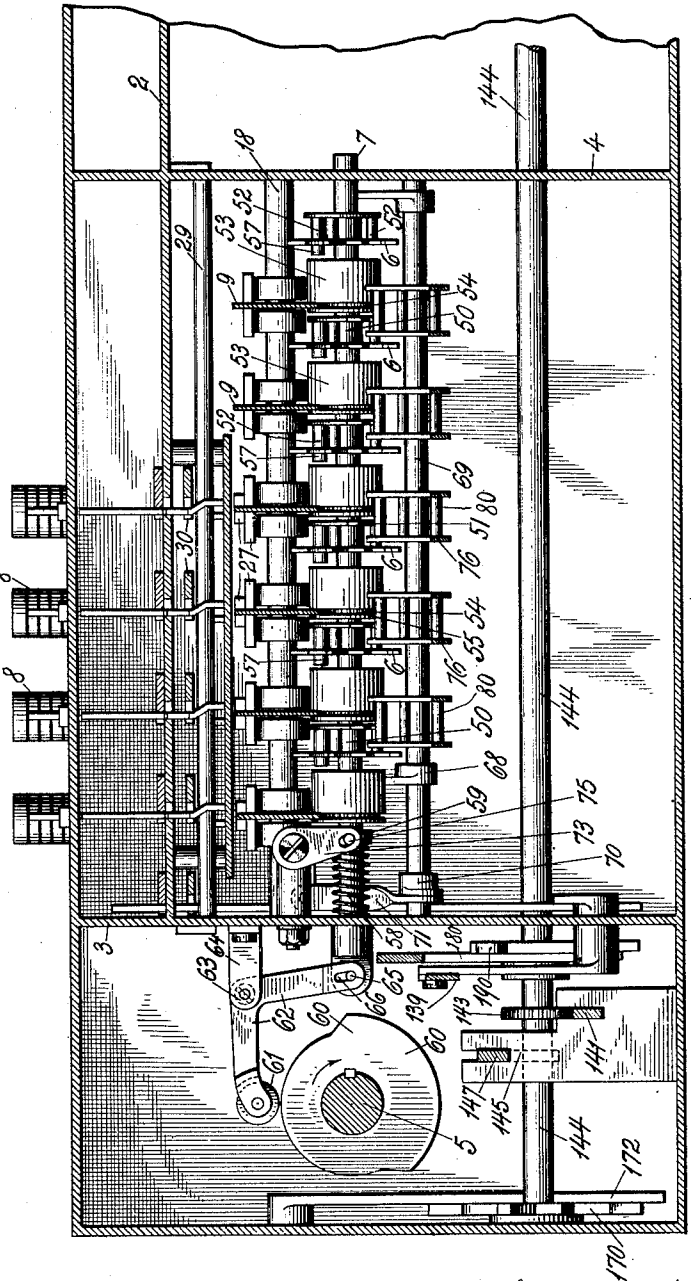
Aug. 30, 1927. 1,641,126

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Fig. 9.



Witnesses
F. N. Rochrich
John C. Gempler

Isaac S. Dement Inventor
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Kenyon & Kenyon

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COMPUTING MACHINE

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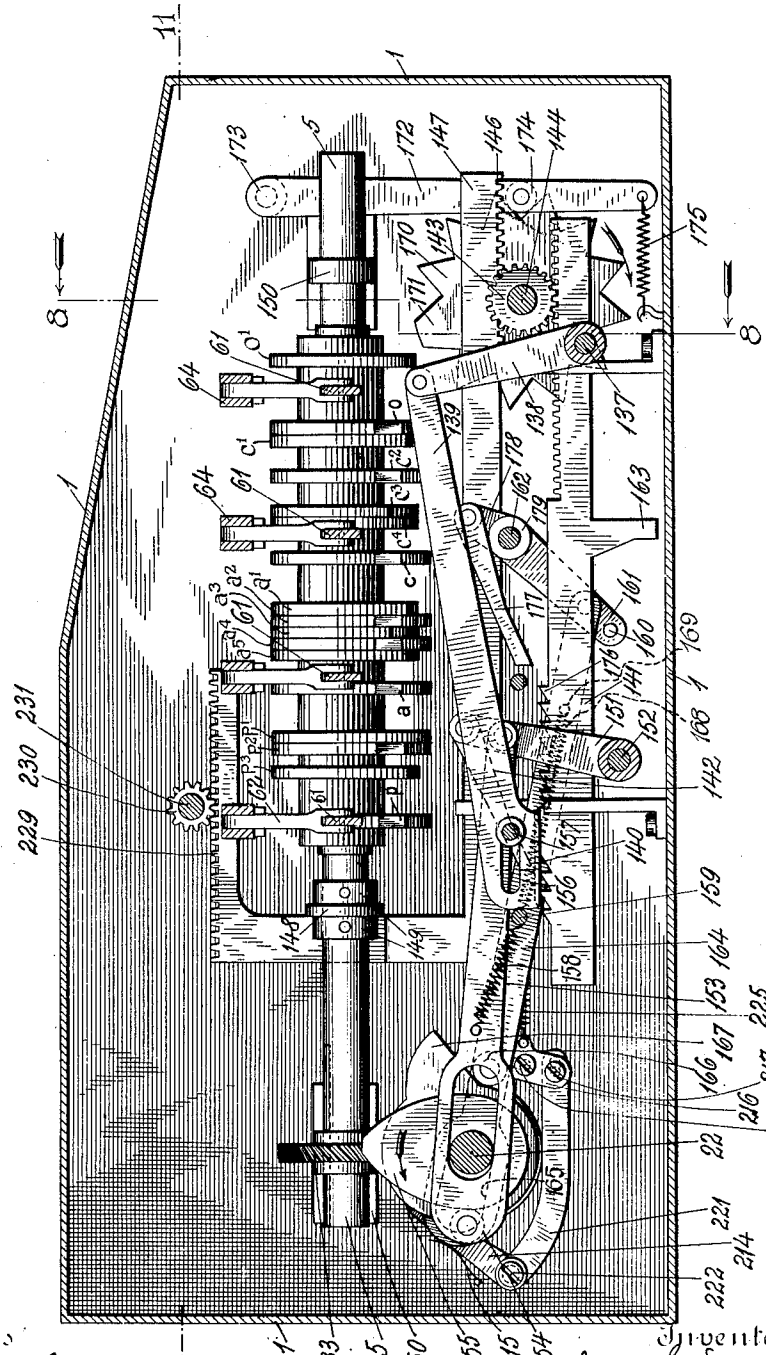


Fig: 10

Witnesses:
F. N. Rochrich
John A. Gempler.

Inventor
Isaac S. Dement
By his Attorneys
Kenyon & Kenyon

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I. S. DEMENT

COMPUTING MACHINE

Filed Jan. 9, 1904 23 Sheets-Sheet 11

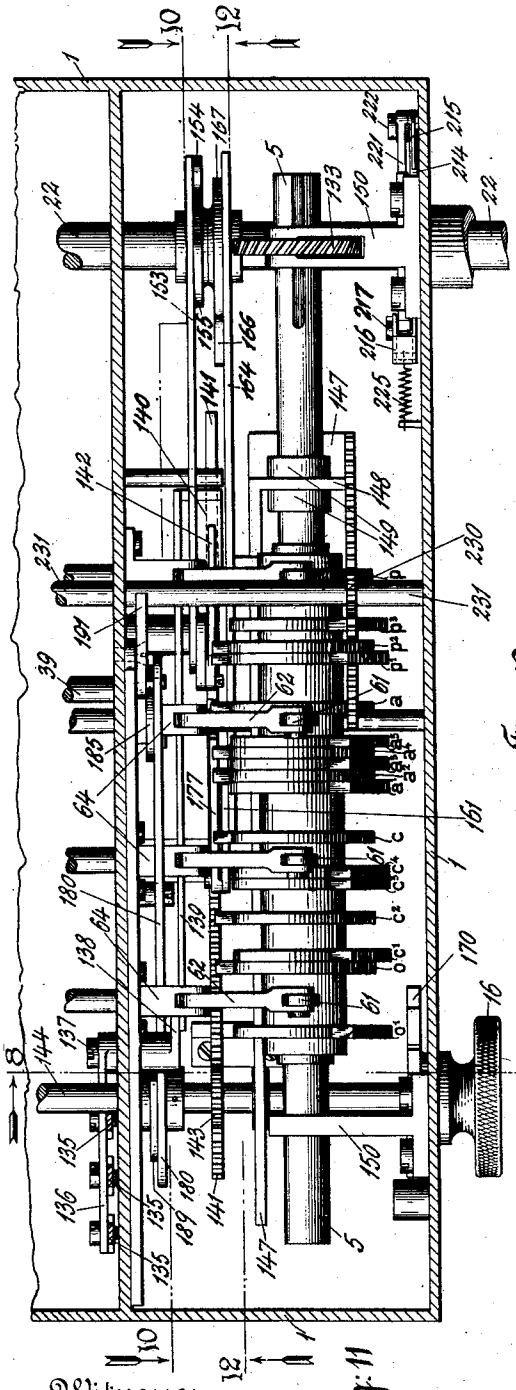


Fig: 11

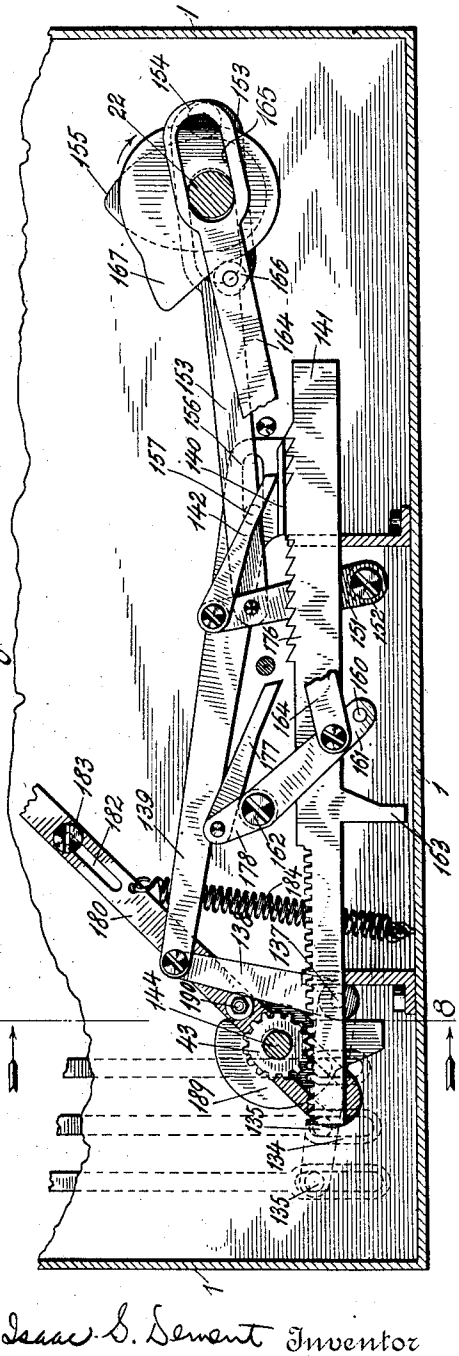


Fig: 12

Witnesses
F. N. Rochrich
John O. Gempler.

Isaac S. Dement Inventor
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Kenyon & Kenyon

Aug. 30, 1927. 1,641,126

I. S. DEMENT

COMPUTING MACHINE

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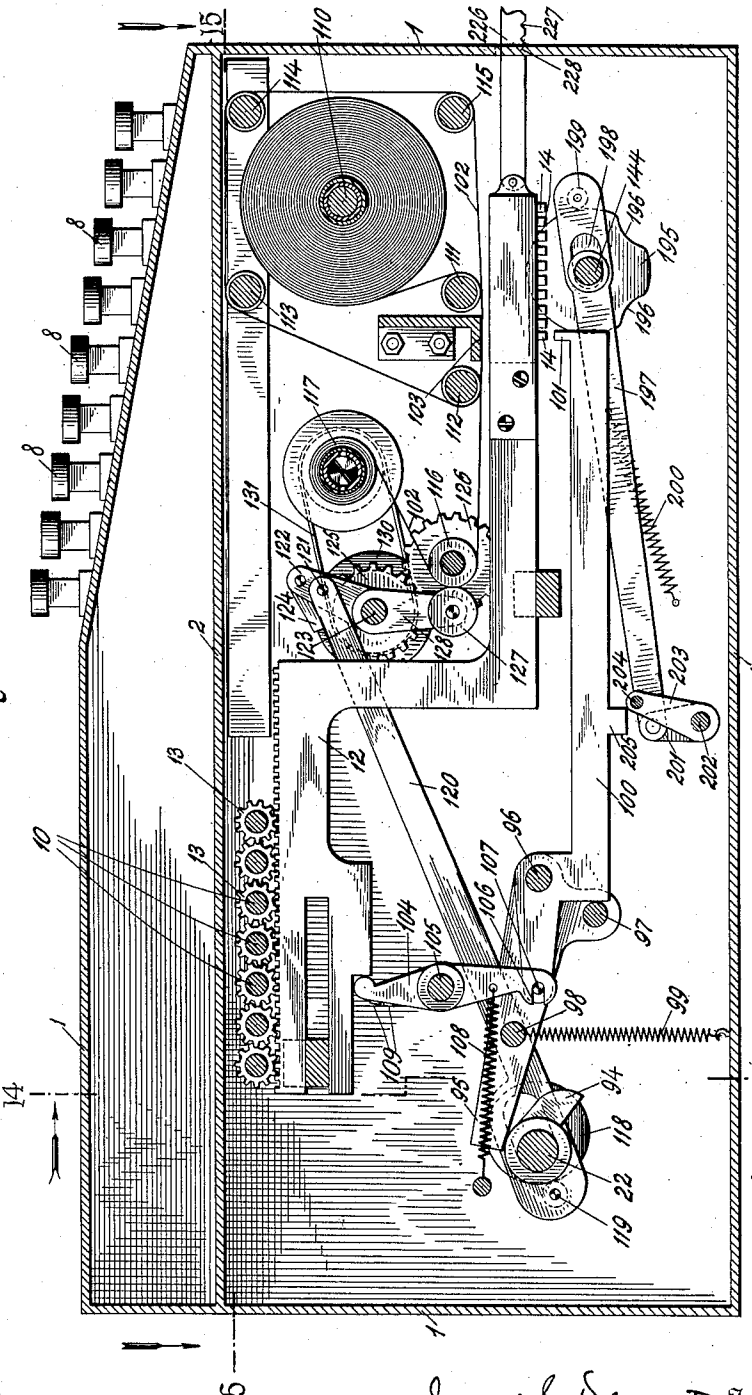


Fig. 13

Witnesses
F. N. Rochrich
John O. Gempler.

Isaac S. Dement Inventor
By his Attorneys
Kenyon & Kenyon

Aug. 30, 1927. 1,641,126

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COMPUTING MACHINE

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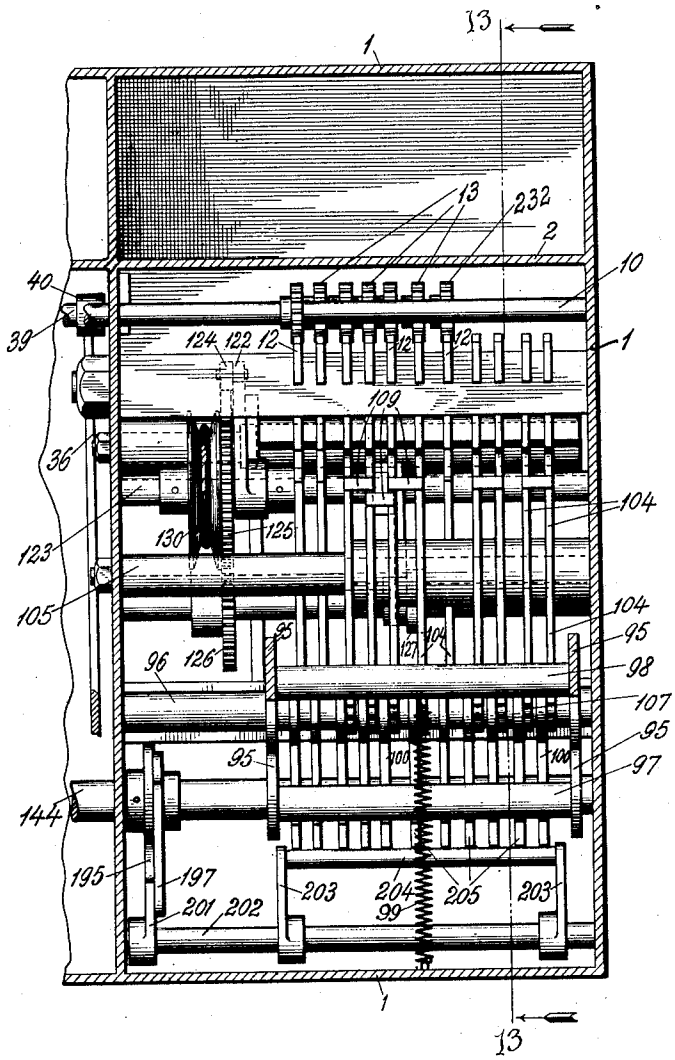


Fig: 14

Witnesses,
F. N. Rochrich
John O. Gempler.

Isaac S. Dement Inventor
By his Attorneys
Kenyon & Kenyon

Aug. 30, 1927. 1,641,126

I. S. DEMENT

COMPUTING MACHINE

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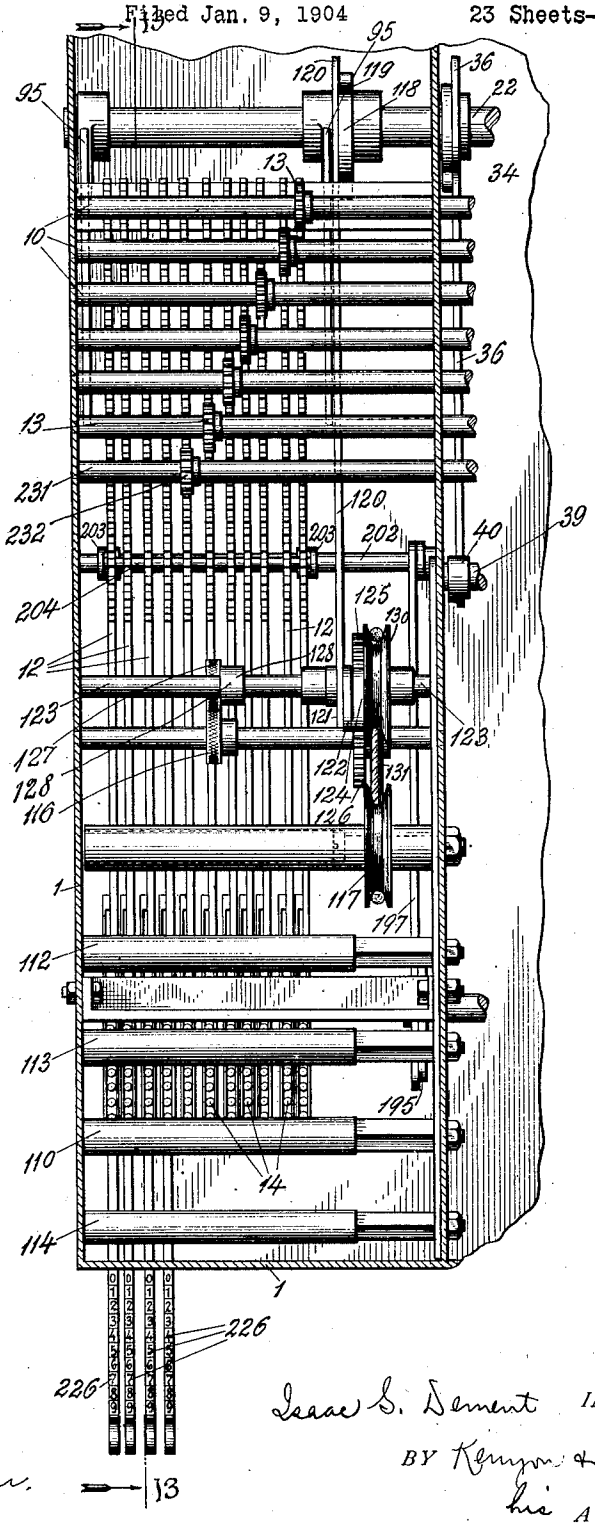


Fig: 15

WITNESSES:
F. N. Roehrich
John O. Gempler.

Isaac S. Dement INVENTOR.
BY Kenyon & Kenyon
his ATTORNEYS

Aug. 30, 1927. 1,641,126

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COMPUTING MACHINE

Filed Jan. 9, 1904 23 Sheets-Sheet 15

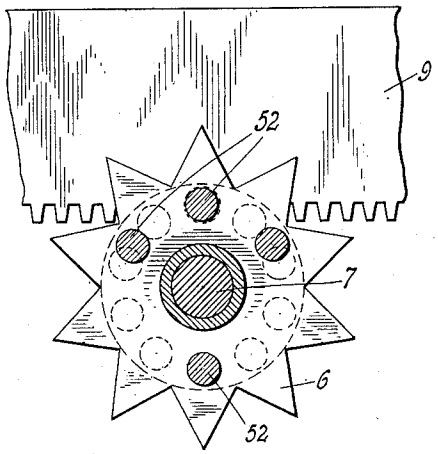


Fig: 16

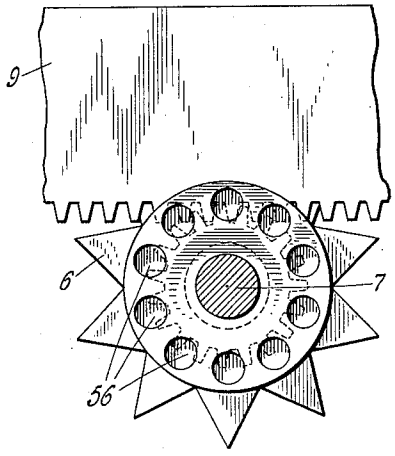


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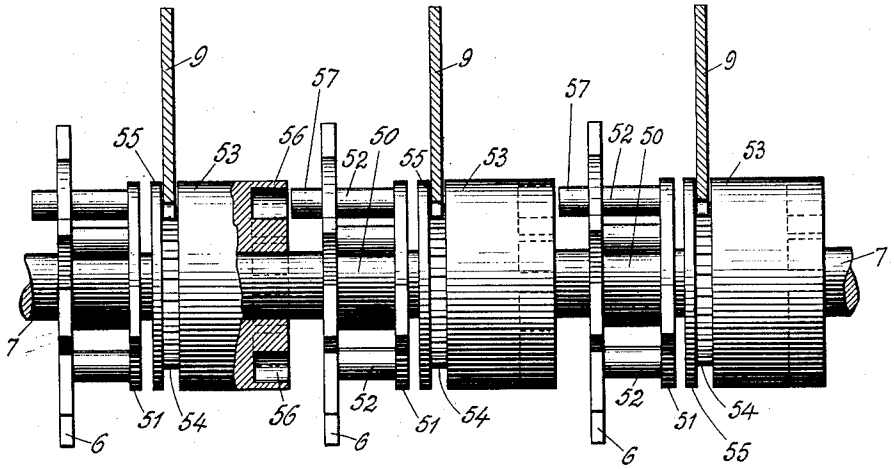


Fig: 18

Witnesses
F. N. Roehrich
John O. Gempler.

Isaac S. Dement Inventor
By his Attorneys
Kenyon & Kenyon

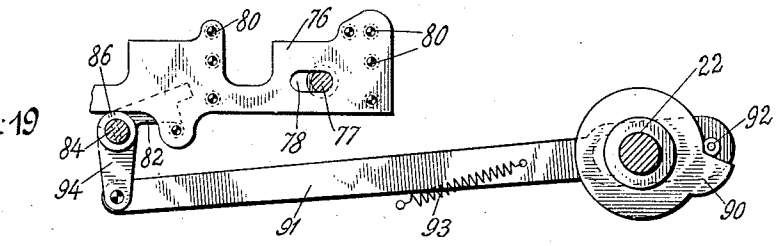
Aug. 30, 1927. 1,641,126

I. S. DEMENT

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Fig:19



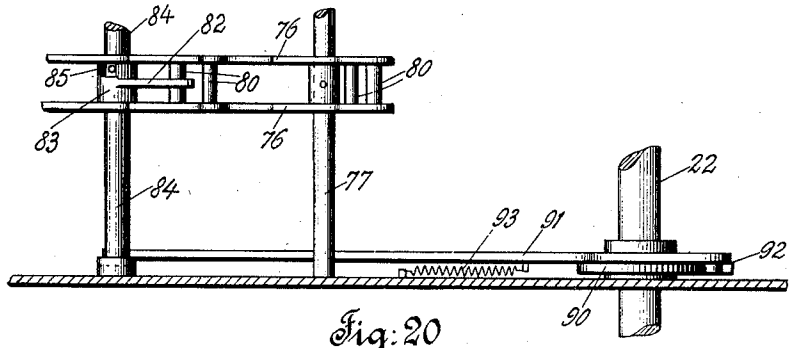


Fig:20

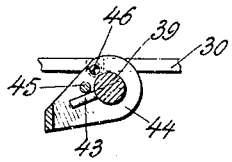


Fig:21

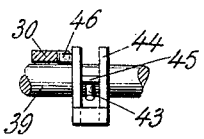


Fig:22

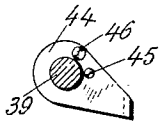


Fig:23

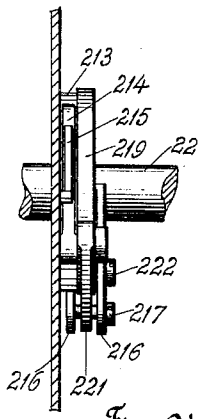


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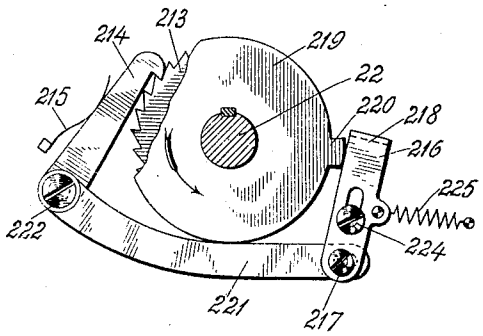


Fig:25

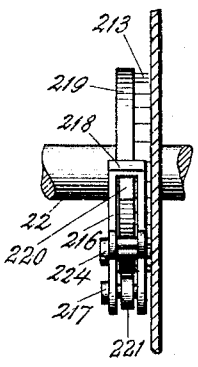


Fig:26

Witnesses
F. A. Roehrich
John C. Semple.

Isaac S. Dement Inventor
By his Attorneys
Kenyon & Kenyon

Aug. 30, 1927. 1,641,126

I. S. DEMENT

COMPUTING MACHINE

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Fig: 28

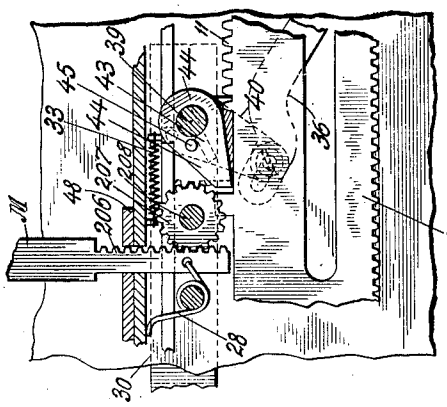


Fig: 30

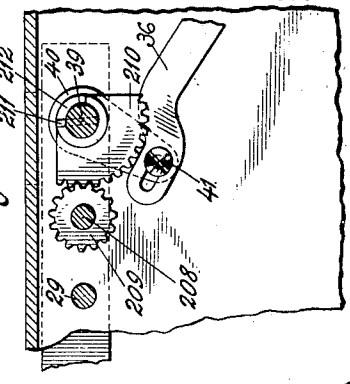
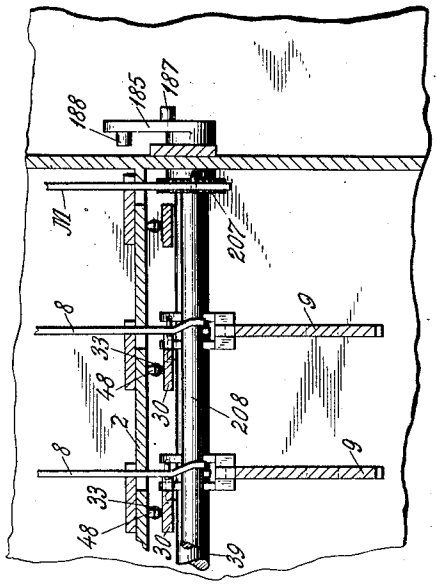


Fig: 27



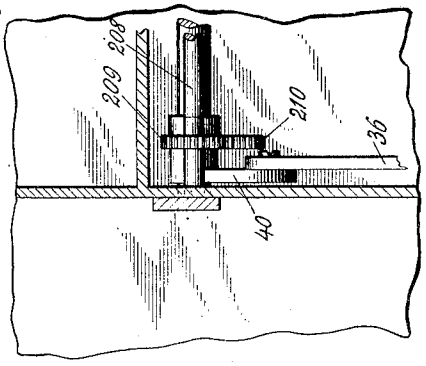
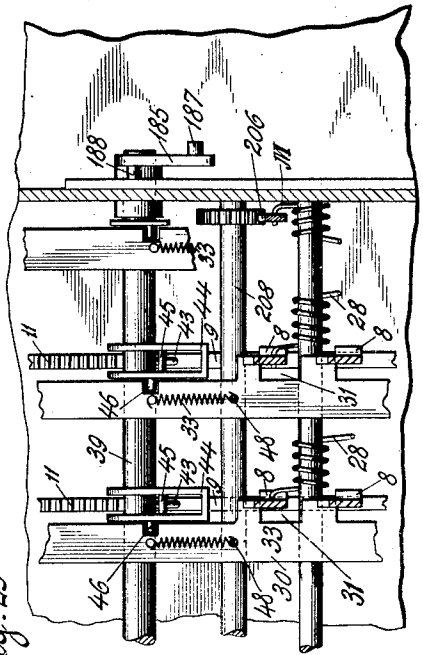
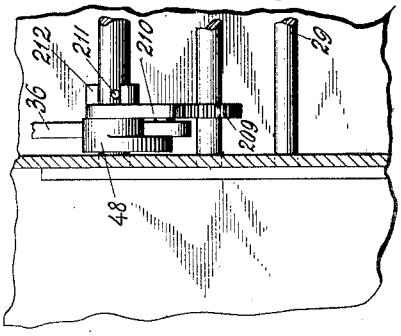


Fig: 29





Witnesses
F. N. Roehrich
John O. Gempesaw.

Isaac S. Dement Inventor
By his Attorney &
Kenyon & Kenyon

Aug. 30, 1927. I. S. DEMENT 1,641,126

COMPUTING MACHINE

Filed Jan. 9, 1904 23 Sheets-Sheet 18

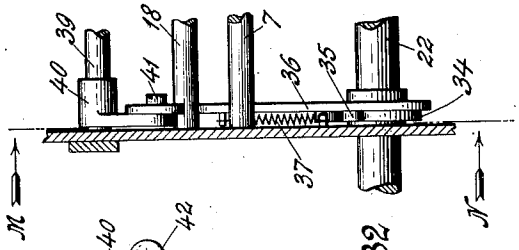


Fig:32

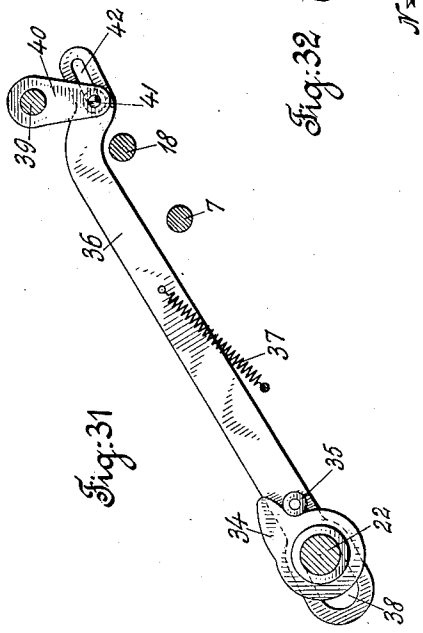


Fig:31

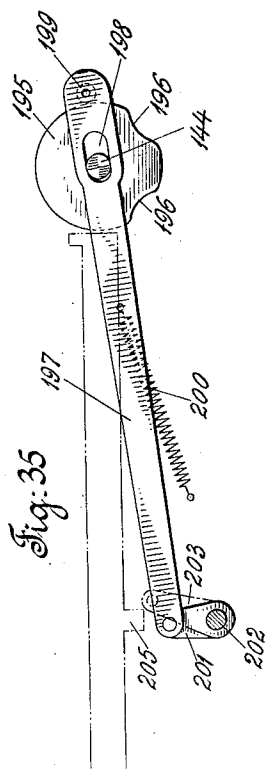


Fig:35

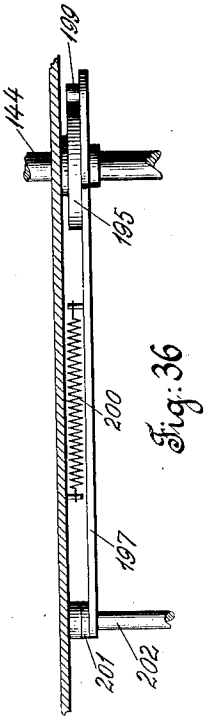


Fig:36

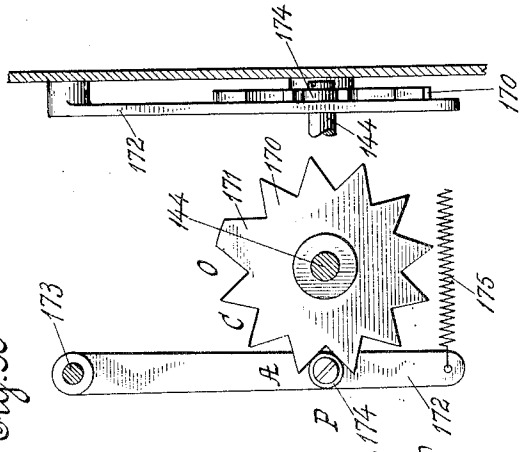


Fig:34

Fig:33

Witnesses:
F. A. Rochrich
John O. Gempler.

Isaac S. Dement Inventor
By his Attorneys
Kenyon & Kenyon

Aug. 30, 1927. 1,641,126

I. S. DEMENT

COMPUTING MACHINE

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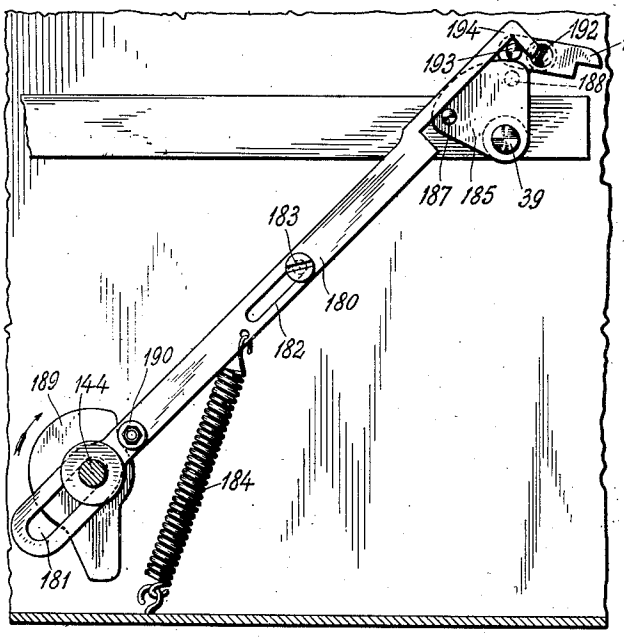


Fig:37

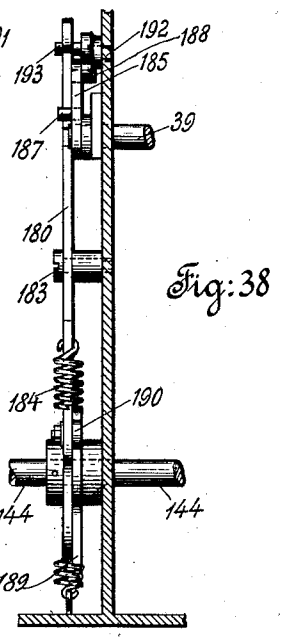


Fig:38

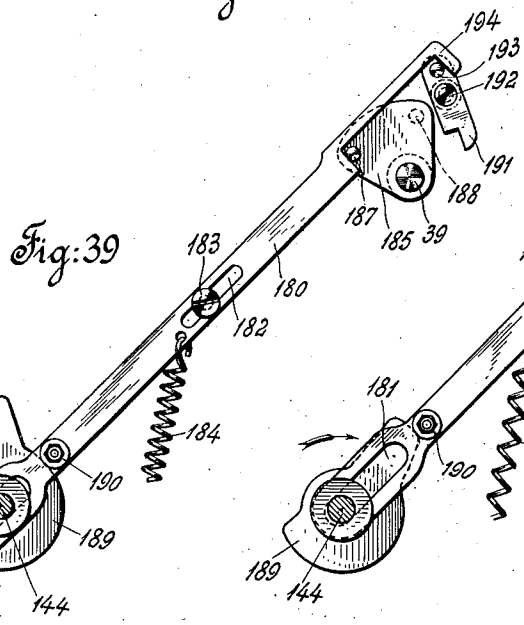


Fig:39

Fig:40

Witnesses
F. N. Rochrich
John O. Gempler

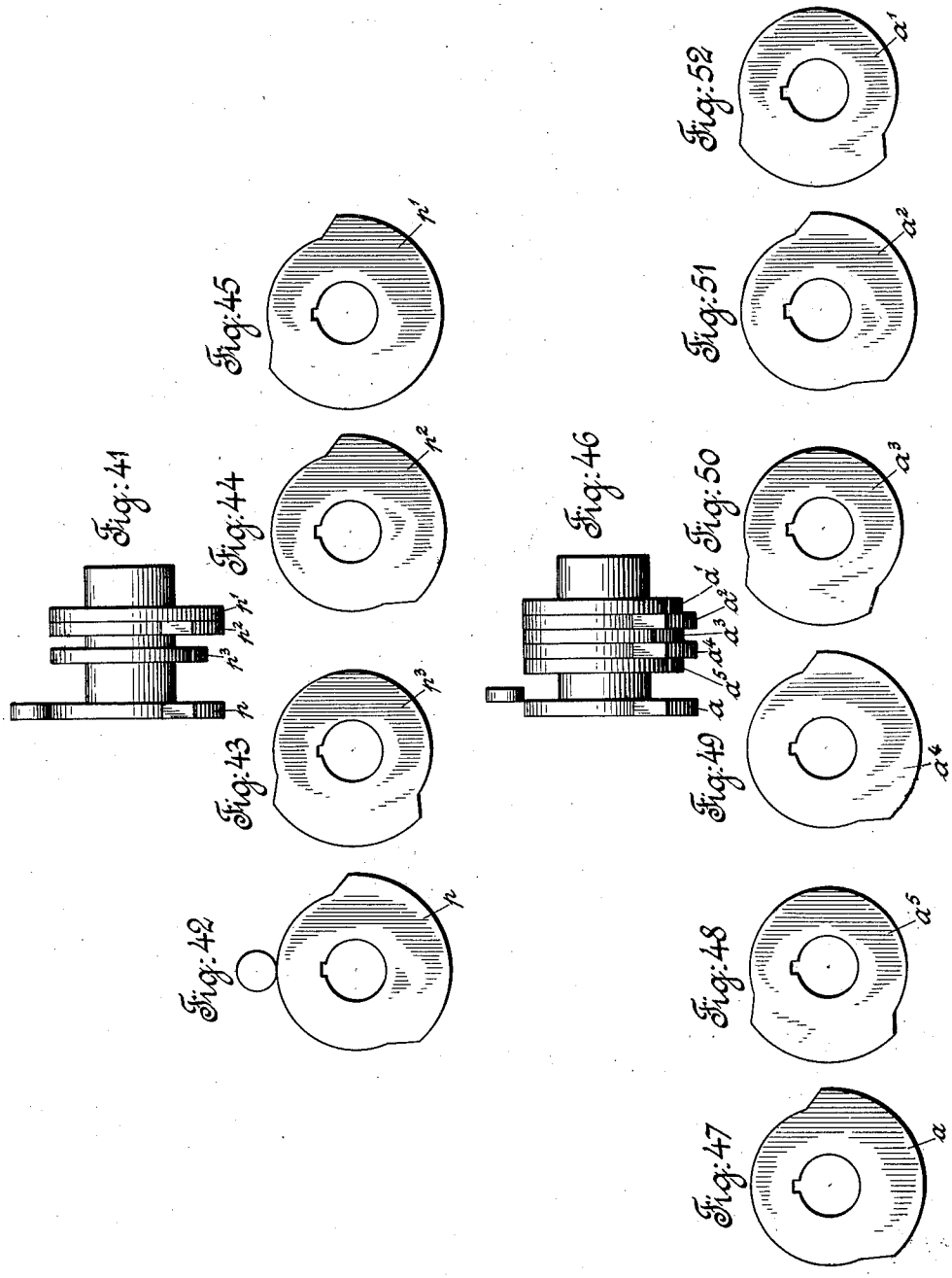
Isaac S. Dement Inventor
By his Attorneys
Kenyon & Kenyon

Aug. 30, 1927. 1,641,126

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COMPUTING MACHINE

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Witnesses
F. N. Roehrich.
John O. Gempler.

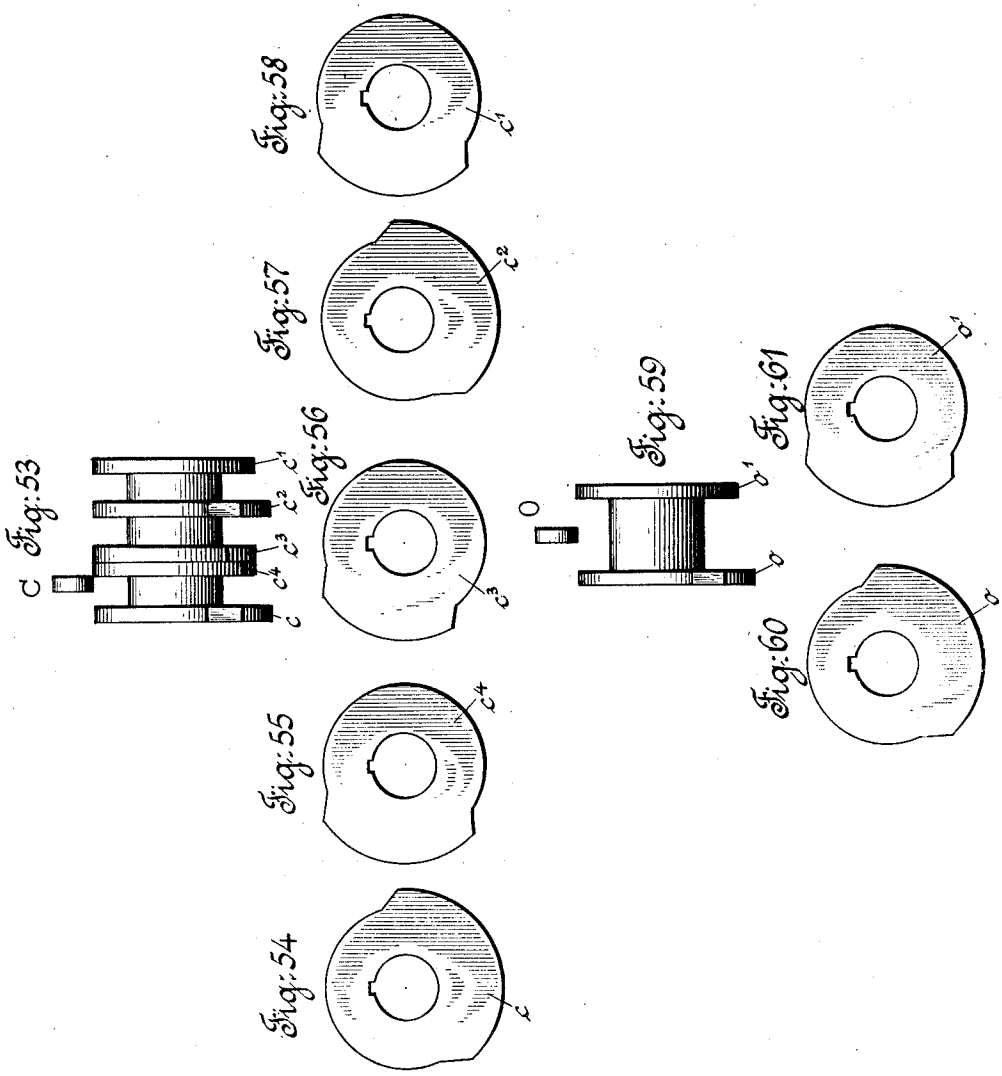
Isaac S. Dement Inventor
By his Attorneys
Kenyon & Kenyon

Aug. 30, 1927. 1,641,126

I. S. DEMENT

COMPUTING MACHINE

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Witnesses
F. N. Rochrich
John O. Gempler

Isaac S. Dement Inventor
By his Attorneys
Kenyon & Kenyon

Aug. 30, 1927. 1,641,126

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Fig. 70

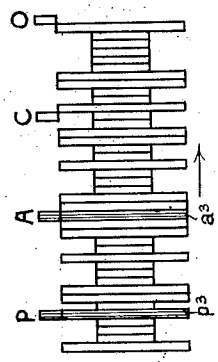


Fig. 71

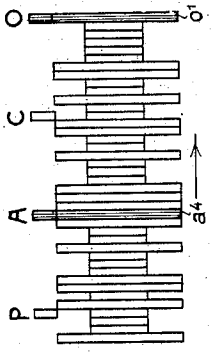


Fig. 72

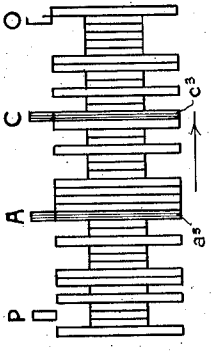


Fig. 73

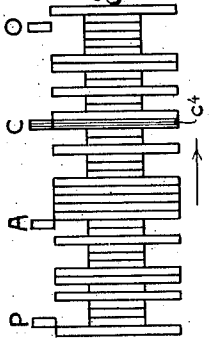


Fig. 66

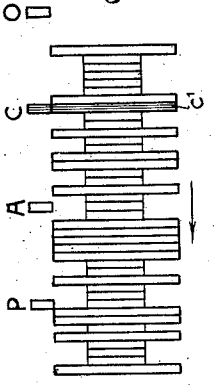


Fig. 67

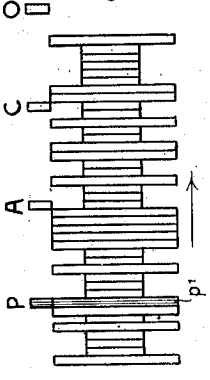


Fig. 68

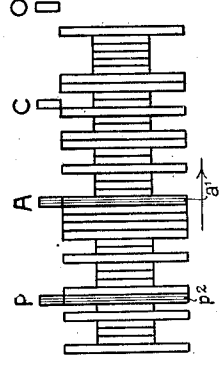


Fig. 69

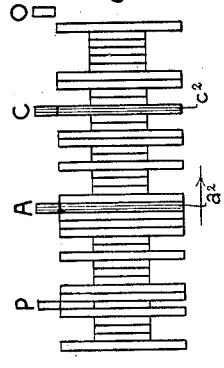


Fig. 62

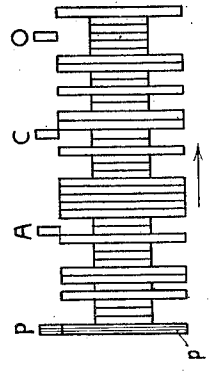


Fig. 63

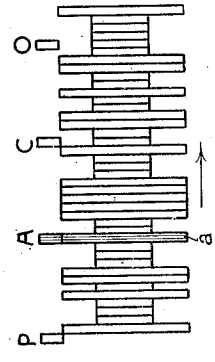


Fig. 64

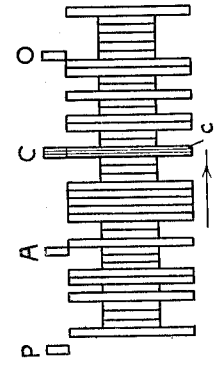
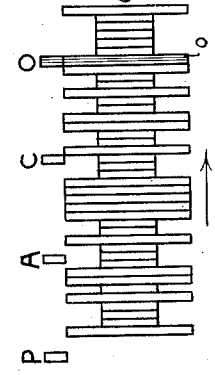


Fig. 65



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Aug. 30, 1927. 1,641,126

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COMPUTING MACHINE

Filed Jan. 9, 1904 23 Sheets-Sheet 23

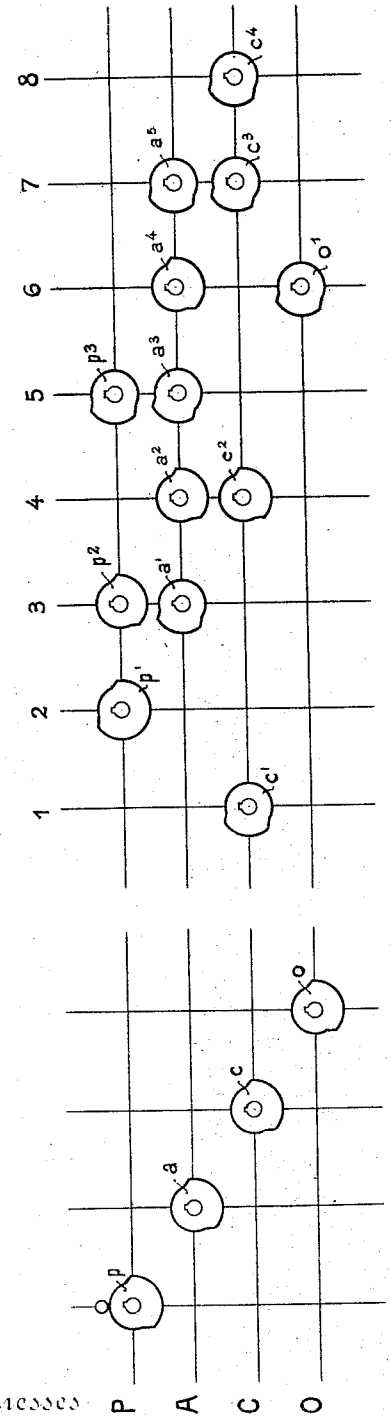
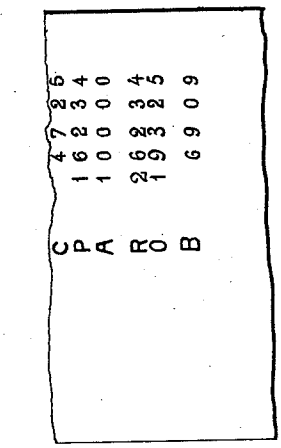


Fig: 74



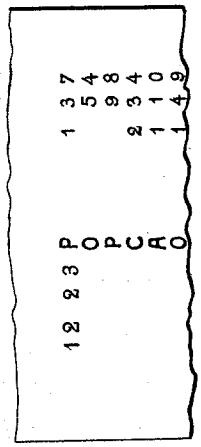


Fig: 75

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Patented Aug. 30, 1927. 1,641,126

UNITED STATES PATENT OFFICE.

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COMPUTING MACHINE.

Application filed January 9, 1904. Serial No. 188,389.

My invention relates to computing machines. It is especially useful and applicable, in its main features, to an adding machine in which there are a plurality of different series or sets of adding devices and it is in connection with such a machine that my invention is herein shown and described. It has for its object to provide means, in such a machine, for adding the total standing on one series or set of adding devices to another set of such devices or to the total standing on such set; also to provide means, in such a machine, for subtracting the total of one set from the total standing on another set; also to perform such subtraction without the use of any borrowing devices; also to provide means by which such addition or subtraction of totals or both addition and subtraction may be performed in a predetermined order or sequence; also to provide means by which such addition or subtraction or both may be performed automatically; also to provide means for taking the totals of the different sets of adding devices either alone or in connection with such addition or subtraction, or both, and for indicating such totals, or said sum or difference of totals; also to perform addition on any one or more of the separate sets of adding devices, to add totals or subtract totals by a common operating means adapted to be connected with any one or simultaneously with any two or more of the said sets and in such a manner as either to add on any set or sets or to move any set or sets to either extreme, or to add the total of one set to another, or subtract one total from another or to take totals and to perform all or any of such steps; also to provide means for controlling such operating means in a predetermined order, sequence and manner; also for controlling such operating means automatically; also to provide new and improved connecting means between the sets of adding devices and the operating means; also to provide improved means for locking the sets or any one of them in any position to which they may be moved, simple in construction and efficient in operation; also to improve generally the mechanism of computing machines, to simplify it, make it more durable, and to make it more positive in action and less dependent upon springs, and generally to improve the construction and operation of such a machine.

My invention consists in the novel devices and combinations herein shown and described.

My invention is an improvement upon the apparatus shown and described in my Patent No. 1,603,326 issued Oct. 19, 1926, for an improvement in computing machines. In the device therein shown there is a plurality of sets of adding devices upon either of which addition can be performed and from which the total can be taken as desired, and the total from either totalizer may be transferred to the other. In my present improvement not only may addition be performed upon any one of the different sets of adding devices and the total of such set be taken and indicated in any proper manner and the total standing upon one set of adding devices may be added to the total upon another set, but the total upon one set may be subtracted from that standing upon another set, or both the addition and subtraction of totals may be performed. Such addition and subtraction in my present improvement I preferably perform in a predetermined order and sequence and preferably automatically. In this way by a simple operation at the close of the day's business, or at any desired time, the machine may be made automatically to give and indicate in any proper manner all the totals required, to add certain totals together and to subtract other totals therefrom and to strike a balance. In my improved device, moreover, the subtracting may be done without the use of any borrowing mechanism, the subtracting being done in such a manner that the carrying devices are employed both for addition and for subtraction purposes.

While my invention in many of its features may be employed in many different kinds of computing machines, I have shown in the drawings accompanying this specification and forming a part thereof, the invention in its preferred form as embodied in an adding machine provided with a plural-

ity of sets of adding devices and in which totals may be added and subtracted and totals may be taken and indicated in any proper manner and in which, preferably, the taking of such totals, the adding and subtracting of totals, and the indicating thereof are done automatically in a predetermined order and sequence.

I will now proceed to describe said preferred form of my invention as disclosed in the drawing herein.

Referring to said drawings Fig. 1 is a plan of a machine embodying my invention in its preferred form, the cover being partly broken away to show parts of the printing devices and connections; Fig. 2 is a horizontal section taken on the lines 2—2 of Fig. 4, the printing devices, the cam shaft and the connections being omitted; Fig. 3 is a horizontal section on the lines 3—3 of Fig. 4, the printing devices being omitted; Fig. 4 is a vertical section on the lines 4—4 of Fig. 3; Fig. 5 is a vertical section on the lines 5—5 of Fig. 3; Fig. 6 is a vertical section on the lines 6—6 of Fig. 3; Fig. 7 is a vertical section on the lines 7—7 of Fig. 3; Fig. 8 is a vertical cross-section on the lines 8—8 of Fig. 4, and also Figs. 10, 11 and 12, the printing devices being omitted; Fig. 9 is a vertical cross-section on the lines 9—9 of Fig. 4, the printing devices being omitted; Fig. 10 is a vertical longitudinal section on the lines 10—10 of Figs. 8 and 11; Fig. 11 is a horizontal section on the lines 11—11 of Fig. 10; Fig. 12 is a vertical longitudinal section on the lines 12—12 of Fig. 11; Fig. 13 is a vertical longitudinal section on the lines 13—13 of Figs. 14 and 15, showing the printing devices; Fig. 14 is a vertical cross-section on the lines 14—14 of Fig. 13, the printing bars being omitted; Fig. 15 is a horizontal or plan section on the lines 15—15 of Fig. 13, the printing bars and also the paper and the main paper rolls being omitted; Figs. 16, 17 and 18 are details of the clutch mechanism, Figs. 16 and 17 being views taken from the opposite sides of Fig. 18; Figs. 19 and 20 are detail views of the carrying mechanism, Fig. 19 being a side view and Fig. 20 a plan view; Figs. 21, 22 and 23 show details of the locking devices of the adding bars; Figs. 24, 25 and 26 show details of the stopping devices with the crank to prevent more than a complete revolution at a time; Fig. 24 is a rear view looking toward the left side of Fig. 25; Fig. 25 is a side view, and Fig. 26 is a front view looking towards the right side of Fig. 25; Figs. 27, 28, 29 and 30 show details of the main shaft, the controlling shaft and the means for locking the key bars and for locking the keys, Fig. 27 being a vertical cross-section; Fig. 28 is a side view showing also the mistake key and its connections and Fig. 29 is a plan of Fig. 27; Figs. 31 and also 32 show details of the devices for unlocking the keys, Fig. 31 being a side view and Fig. 32 a rear view taken from the right of Fig. 31; Figs. 33 and 34 show details of the detent wheel of the controller shaft, Fig. 33 being a side and Fig. 34 an end view; Figs. 35 and 36 show details for locking the printing hammers in their inoperative position, Fig. 35 being a side view and Fig. 36 a plan of the parts shown in Fig. 35; Figs. 37, 38, 39 and 40, show details of the devices for unlocking and keeping unlocked the key bars during the totaling operation, Fig. 37 being a side view, Fig. 38 an end rear view taken from the right of Fig. 37, and Figs. 39 and 40 side views showing different positions assumed by the parts during the operation of the machine. Figs. 41 to 61, both inclusive, show details of the cams on the controller shaft. Figs. 62–73 are diagrams illustrating the different positions assumed by shaft 5 and its cams in the different operations of the machine. Fig. 74 is a diagram illustrating what cams are operated in the different operations of the machine and the relative shape and the relative location of each cam on the cam shaft. Fig. 75 represents a recording strip of a day's operations upon the machine, the middle part of the strip being broken away.

Before proceeding to describe in detail the mechanism of the different parts of the machine shown in the drawings I will briefly describe the salient features of the machine with a brief description of their operation and the results accomplished. 1 represents the casing of the machine. The main part of this casing, the part below the horizontal partition 2, Fig. 4, is divided horizontally into three compartments by means of vertical partitions 3 and 4 (see Figs. 8 and 1), the one to the right containing the cam or controlling shaft 5 and its connections, the central one between partitions 3 and 4 containing the sets of adding devices and the one to the left of partitions 4, see Fig. 1, containing the printing devices and their connections. The adding mechanism consists of a plurality of sets of adding devices. As shown these consist of four sets, although any desired number may be used. Each set consists of a series of adding wheels 6, see Figs. 3 and 18, loosely mounted on a shaft 7, supported in partitions 3 and 4. Each set contains an adding wheel for each denomination of value required and carrying devices, to be hereinafter described, are provided for carrying from a lower to a higher denomination in the usual manner. I provide any suitable number indicating devices for controlling the addition upon any of the sets of adding devices. As shown these consist of banks of keys 8 arranged in the usual way. Any suitable means may be employed for enabling the keys to control the addition

upon the sets of adding devices. I prefer to employ a common operating means adapted to be connected with any set of adding devices. As shown this consists of a set of operating bars 9 having a prescribed reciprocating movement, unless limited by the keys or other devices hereinafter to be described. As shown these bars are held in their forward position, that shown in Fig. 3 by positive stops which are withdrawing during the operation of the machine. The bars are then moved backward, preferably, by yielding means such as springs, to the limit of their backward movement, unless sooner stopped, and are then positively moved forward. The backward movement of any bar may be limited according to the key of its series that has been depressed, the backward movement of such bar representing the value of the key depressed. Any set of the adding devices may be operatively connected with the operating bars in either their backward or forward movement. The value of the keys depressed may thus be added to whatever set is in operative connection with the operating bars. This connection may be made either in the backward or forward movement but as shown the adding devices are connected herein for adding purposes only on the forward movement of the bars.

Any suitable means may be provided for connecting the bars 9 with any one of the sets of adding devices. As shown the set of adding devices 6 on the shaft 7 towards the top of Fig. 3 is normally connected in such a position that upon a revolution of crank handle 15, without any other adjustment, that set of adding devices will be operatively connected with operating bars on their forward or return movement thus adding to that set the value of the keys depressed. This set in the machine shown is shown for moneys paid in and I shall for the sake of brevity call this set the paid in set. The set immediately below in Fig. 3 is used to represent the moneys paid in on account, which set for short I will call the account set. In order to connect this set with the bars 9 I depress key marked A and then turn crank handle 15. The effect of depressing key A is to throw into operation a certain cam which will connect the account set with the operating bars on the forward or return movement of those bars thus adding the value of any keys depressed upon the account set. The next lower set in Fig. 3, is used to represent the amount of sales which are charged and which for short I will call the charge account. To add upon this set I depress key marked C and turn crank handle 15 one revolution. The lowest set of adding devices in Fig. 3 represents the amount of money paid out which for short I call the paid out account.

The total standing upon any set of adding devices may be taken and indicated in any suitable manner. As shown this is accomplished by connecting the operating bars 9, with any set of adding devices 6 on the backward movement of the operating bars. This movement of the operating bars is limited by stops for the adding devices which are adapted to stop such adding devices and their operating means when moving in the direction reverse to that of adding, as soon as the adding devices arrive at their zero position. These stops will be hereinafter described in detail. They permit the continued rotation of the adding wheels in the adding direction but stop those wheels when moving in the reverse direction, on arriving at the zero point. Accordingly when the operating bars are connected with any set of adding wheels on the backward movement of the bars, the adding wheels stop when reaching their zero position, thus limiting the backward movement of the bars in accordance with the value of the total represented by the condition of the set of adding devices before the movement began. By means of cross shafts 10 carrying pinions meshing with the racks 11 on the upper surface of operating bars 9, this movement is transmitted to type bars 12 in the printing compartment of the machine, the latter being provided on their upper surfaces with racks meshing with gear wheels 13 on cross shafts 10. The movement of type bars 12 bring upon the printing line type 14 (Fig. 13) corresponding with the backward movement of operating bars 9, thus setting up on the printing line the total represented on the set of adding devices before the operation began. This total may be indicated in any suitable way, as for example, by setting up numerals or type on a reading or printing line, or by printing such total as in the present case. These printing devices will be described in detail hereinafter.

By depressing any keys 8, and operating the machine, which is done by turning the crank handle 15 and by connecting the operating bars 9 with any set of adding devices, the numbers represented by the keys depressed may be added to any set of adding devices. By operating the machine without the keys and connecting any set of adding devices to the operating bars on their backward movement the total of any set of adding devices may be taken and indicated.

I also provide means for adding the total standing upon any set of adding devices to the total standing upon any other set and also provide means for subtracting any of these totals from any other total. This I accomplish by providing means for connecting any two or more of the sets of adding devices together and moving them so as to add the total of one upon the total

of the other, or to subtract the total of one from the total of another. While different means may be employed for thus connecting different sets of adding devices together, I preferably employ a common operating means for this purpose, adapted to be connected with any set or simultaneously with any two or more of the sets in the movement of the common operating means one way or the other; I also provide means for connecting any one or more of the sets with the operating means to move such set or sets either to the zero position or to the opposite of the zero position and provide locking means for holding the adding devices in any position to which they may be moved. In the machine shown I use the operating bars 9 as the common operating means for these purposes and I preferably provide such connections between the operating bars and the different sets of adding devices and so control them, that the operating means and the different sets of adding devices will be connected at such times and in such manner as to automatically add and subtract totals in a predetermined order or sequence and to indicate such additions and subtractions and the totals standing upon any of the sets of adding devices in a predetermined order and sequence. These connecting means and the order in which they operate will be described in detail later on. This automatic operation is obtained by turning button 16 on the outside of the casing a full revolution. Upon the turning of crank 15 the following operations will be performed upon the machine.

The adding devices of one set, for example, those representing the charge account or for sales made during the day which are charged, and which in the machine shown is represented by the adding devices on shaft 7 next to the bottom of Fig. 3, will be connected with the operating bars 9 on the backward movement and this will take the total standing on the charge account, the adding wheels being left at the zero point and locked in that position and the operating bars being returned to their forward position. This is accomplished by one revolution of crank handle 15, button 16 turning one step back from its original position.

The next operation will connect the upper set of the adding devices of Fig. 3 with the operating bars at the commencement of their backward movement continuing that connection during both the backward and forward movement of the operating bars, thus printing the total of this set of adding devices which represent, for example, the moneys paid in during the day or the paid in account, as I will term it. This operation returns this set of adding devices to their original position where they are locked and represent the total standing upon them before the operation. This operation has been performed by another revolution of crank handle 15 and button 16 has moved backward still another step. The result of the operation is to print the total of the paid in account upon the strip of paper below the total of the charge account.

In the next operation the second set of adding devices from the top in Fig. 3, representing, for example, moneys received on account, are connected with the operating bars on their backward movement, and are moved to zero where they are released from the operating bars and are locked in that position. This results in the printing of the total of the sums paid on account. The operating bars in this position are then connected to the paid in set and in their forward movement move over a distance in their adding direction equal to the movement of the account set in moving from their total to the zero position. The effect of this is to add upon the paid in account the total standing upon the series representing the sums paid on account. The operating bars and the paid in set are then released from each other and the paid in account locked in that position. The paid in set now represents the sum of the totals of that set and the account set. In this operation the total of the account set has been printed upon the paper underneath the total of the amount paid in. In this operation, as in all of the operations, crank handle 15 is rotated a full revolution and button 16 moves back one step.

In the next operation the bars 9 go to their full backward limit they being connected with neither set of the adding devices. On their forward movement they are connected with the charge set and with the account set moving the adding wheels of both sets to the position the reverse of their zero positions. In effect this will leave them in the position represented by the number 9. In this operation no printing is done.

In the next or fifth operation the bars 9 are connected during their backward movement with the paid in set and with one of the sets standing at the 9 position, as shown with the account set. This backward movement of the bars 9 is limited by the total position of the paid in set and the effect of this movement is to take the total standing upon the paid in set, or in other words, the sum of the totals standing originally upon the paid in set and the paid on account set. This is printed underneath the other totals already on the paper slip. The movement also subtractively transfers to the account set the sum of the totals of the account and paid in sets. At the end of the backward movement of the operating bars the paid in set is released and locked at zero, and the account set is released and locked in its set position representing the complement of the said sum of totals.

In the next and sixth operation the fourth or lowest set of adding devices of Fig. 3 representing, for example, the amounts of moneys paid out during the day or the paid out account, are connected with the operating bars 9 on their backward movement. This prints the total of the paid out account upon the paper slip. The paid out account set and the operating bars are then released from each other and the paid out account set left at zero. The operating bars in their backward position are then connected with the account set and on their return movement carry that set in the adding direction a distance equal to their forward movement, thus adding to the complementary sum of totals previously standing on the account set the total originally standing on the paid out account set. In this position of the account set the total represented by the condition of that set represents the reverse of the true difference between the sum of the totals of the paid in and the account set as a minuend and the total of the paid out set as a subtrahend. In the next operation this complement is reversed to obtain the true difference.

In the next or seventh operation this reversal is accomplished by connecting the operating bars with both the account set and another set in which the adding wheels stand at the nine position. As the charge set is now in this position the operating bars are connected with that set as well as with the account set and move both sets until stopped by the account set reaching its zero position. The account set is then released from the operating bars and locked at zero, and the condition of the charge set represents the true difference between the sum of the totals of the paid in and the account sets as a minuend and the total of the paid out set as a subtrahend. The operating bars are disconnected from the charge account and moved to their forward position leaving the charge set in the position to which they had been moved.

The eighth and last operation is for the purpose of taking and printing the total now standing on the charge set or the true difference or balance. This is accomplished by connecting the operating bars 9 with the charge set on the backward movement of the bars thus printing the said difference, which is the balance of the amounts received and the amounts paid out during the day. The operating bars are then disconnected from the charge set leaving it at zero and the operating bars are returned to their forward position. The parts are now all in their normal positions ready for the next day's operations. All of the totals of the different accounts are printed upon the slip of paper and the balance between receipts and disbursements is printed at the bottom. This has all been automatically accomplished and by means of a single turn of the thumb screw 16 and a few revolutions of the crank handle 15.

I will now proceed to describe in detail the different parts of the specific form of machine shown in the drawings.

The keys, operating bars and their connections.

These parts are shown more particularly in Figs. 2 to 8 inclusive and 28, 29 and 31.

One operating bar 9 is provided for each series of keys 8. I also provide two extra operating bars, shown in Fig. 3, for use in connection with the adding wheels of higher denominations, represented by the series of banks of keys. Of course as many of these adding wheels and operating bars may be used as desired. Each operating bar 9 is adapted, when free to move and not limited in its movement as hereinafter described, to have a reciprocating backward and forward movement of a prescribed or predetermined distance. Each bar 9 is provided with slots 17, encircling shafts 18, which run across the middle compartment of the machine, to permit such reciprocating movement. When released each operating bar is preferably pulled backward or to the rear of the machine by yielding means, as shown by springs 19, secured at one end to bar 20. Preferably two of the springs are provided for each operating bar, one on each side as shown in Figs. 2 and 3.

The operating bars are normally held in their forward position by two sets of locking devices, one under the control of the operator through the movement of the crank handle and the other under the control of the keys 8. The operating bars are also moved forward or to their original position preferably by positive means. The means for locking the bars against rearward movement are controlled by the operator through crank handle 15, and the means for positively moving the bars to their forward position are operated by a series of cams 21, on the main shaft 22. This shaft runs through the machine and is operated by means of crank handle 15 by means presently to be described. The locking means operated by cams 21 consist of a series of swinging arms 23, each composed of two portions connected on their upper end by a roller 24, and loosely mounted at their other end by a fixed shaft 25. 26 are antifriction rollers secured in arms 23 bearing against the cam surfaces 21. Roller 24 normally bears against the rear end of operating bar 9 and holds bars 9 normally in their forward position. As crank handle 15 makes a revolution, shaft 22 and cams 21 revolve with it permitting, during the first half of the revolution of the crank handle, the springs 19 to pull the operating bars 9 to their backward position, unless locked by the locking devices

referred to above as controlled by the keys. During the latter half of the revolution of the crank handle cams 21, arms 23 and roller 24 positively move operating bars 9 forward into their original position. The above operations are especially shown in Figs. 2, 3, 4 and 8.

Whenever a key 8 is depressed it throws the lower part of its stem into the path of the operating bar 9 belonging to its series. The lower part of the stem of the key when thus pushed downward is adapted to be struck by a projection 27 projecting from the side of operating bar 9 after the operating bar is moved the proper distance. These projections 27 are arranged so that the backward travel of any bar 9 will correspond to the value of the key operated. For convenience in arrangement the stems of contiguous keys of one series are made of different lengths thus all alternating keys being of the same length and the projections 27 are arranged in couples one on each side of its bar 9, the next couple on the reverse side and so on, and the projections 27 are arranged so that adjacent projections are at different heights on the side of bar 9, as clearly shown in Figs. 3, 4, 5, 6 and 7. 28 are springs for normally holding each key in its uppermost position. These springs are wound around rods 29 which run across the middle compartment of the machine and on one end each spring 28 is fastened to the stem of a key and on its other end bears against the under side of partition 2.

The keys when depressed preferably remove means which normally prevent operating bars 9 from moving backward, and such keys are preferably locked down and are released toward the close of the operation of the machine. The means shown for accomplishing these purposes are especially illustrated in Figs. 2, 4, 28, 29 and 31. The keys are locked down by means of a locking bar 30, supported in the frame work and adapted to slide horizontally backward and forward. The stem of each key projects through a notch 31 in the locking bar 30 and has a beveled rearward projecting portion 32, which normally lies just above locking bar 30. As the key is depressed this beveled surface forces bar 30 toward the rear against the tension of a spring 33, see Fig. 2, secured to the bar and the framework. As soon as the beveled edge 32 has passed below locking bar 30 spring 33 pulls locking bar 30 forward and locks the key in its down position. Towards the close of the operation of the crank handle the keys that are thus locked down are released by the following means. A cam 34, see Fig. 31, fast on main shaft 22 toward the close of the revolution of shaft 22 engages a roller 35 fast on an arm 36 moving the arm longitudinally against the tension of spring 37, a slot 38 in the arm encircling shaft 22 permitting this forward movement. 39 is a shaft loosely mounted in partitions 3 and 4 and carrying fast upon it at one end a crank arm 40. From the side of arm 40 a pin 41 projects into a slot 42 in the arm 36. The forward movement of arm 36 slightly rocks shaft 39 clockwise (Figs. 4, 28 and 29) moving the pin 43 fast on shaft 39 upwardly. This raises a lock 44 consisting of two arms with hubs loosely surrounding shaft 39, as the pin 43 engages with a cross pin 45 connecting the two parts of lock 44. From the side of lock 44 another pin 46 projects into an opening cut into the side of locking bar 30. As lock 44 is raised through shaft 39, as above described, pin 46 moves locking bar 30 to the rear releasing all of the keys that have been depressed. The keys that have been depressed immediately rise to their normal positions.

Locks 44 are normally in the position shown in Fig. 4 with the toe of the lock in line with the rear of an upwardly projecting part of operating bar 9. It is held in this position partly by its own weight and through a spring 33 secured at one end to bar 30 and on the other end by a pin 48 projecting downward from partitions 2. When the crank handle is turned all of the operating bars 9 are pulled backward and unless locks 44 have been removed from their locking position these locks will prevent operating bars 9 from moving but a very small distance towards the rear. These locks are removed from locking position through the action of the keys, any key of any series removing its corresponding lock 44. This is done by the slight movement to the rear of locking bar 30, engaging with pin 46 and raising lock 44 high enough so as to clear the top of the corresponding operating bar 9. When bar 30 returns to lock the key down it is prevented from moving forward far enough to permit lock 44 to drop into its locking position by reason of the fact that the stem of the key above the beveled surfaces 32 is made thicker or projects further to the rear than the part of the stem below. This extra width of the stem is made sufficient to hold lock 44 above the engaging point. As a result all the locks 44 that correspond with the series of keys in which the key is depressed are removed from their locking position and when the crank handle is turned those operating bars are permitted to make their full rearward movement. It will be understood that there is a locking bar 30 and a lock 44 with connecting parts for each series of keys. It will thus be seen that each operating bar is prevented from operating by two locks, one lock 44 controlled by the keys so that only those operating bars can be operated

which correspond with the series in which the key is depressed, and also by arm 23 and roller 24 controlled by the crank handle. Thus the keys regulate each operating bar used to operate and when the crank handle is turned later on those bars and those only are operated.

In order to avoid friction between the toe of lock 44 and the engaging part of bar 9 and to permit lock 44 to be raised out of locking position on the depression of the key without difficulty, the part 49 of cam 21 is slightly raised above the other portions of the cam, as shown in Fig. 4, thus holding operating bar 9 with its engaging surfaces slightly away from the toe of lock 44.

The adding devices and the clutch mechanism to connect them with the operating bars.

These are especially illustrated in Figs. 3, 4, 7, 8, 9, 16, 17 and 18.

I have shown four sets of adding devices each set consisting of adding wheels 6 loosely mounted on a shaft 7. It will be understood, of course, that any number of sets of such devices may be employed. The adding wheels are normally out of engagement with the operating bars and I provide clutch mechanism by means of which any set or sets may be thrown into operative connection with said bars, either on their backward or forward movement. In the machine shown the numbers represented by any keys depressed are added to whatever set of adding devices may be thrown into operative connection with the operating bars. For the purpose of this addition I have shown the adding wheels as connected with the operating bars on their forward or return movement although it is manifest that by suitable changes the addition could be performed on the backward movement of the operating bars. I will now proceed to describe the adding wheels and their connections by means of which this is accomplished. Each shaft 7 is movable longitudinally of its axis in partitions 3 and 4. Each adding wheel 6 is loosely mounted on the shaft. By means of a collar 50 fast on shaft 7 lying between adding wheel 6 and a stop wheel 51, also loose on shaft 7 and secured to the adding wheel 6 and rotating with it by means of studs 52 so that 6 and 51 form together a single rotating body, the adding wheel 6 and stop wheel 51 move longitudinally with the shaft 7. 53 are drums, one for each adding wheel. Each drum 53 is loose on shaft 7 so that it is free to rotate on its axis and so that shaft 7 is free to slip longitudinally through drum 53. Preferably 53 is provided with a gear wheel 54 meshing with a rack on the under side of operating bar 9 and is provided with a collar 55 between which and the body of the drum 53 the rack of bar 9 moves backward and forward. On account of this connection with operating bar 9 drum 53 is not movable longitudinally. Each drum 53 is provided near its periphery with a series of openings 56 into one of which a pin 57 projecting from the side of adding wheel 6 is adapted to enter whenever shaft 7 is moved longitudinally to the right, as shown in Fig. 3, or to the left as viewed in Fig. 18. When shaft 7 is thus moved longitudinally to bring pin 57 into one of the openings 56 adding wheel 6 is locked to drum 53 and in that position of the parts any movement of operating bar 9 backward or forward will also move the adding wheel.

Each shaft 7 is normally held towards the left as shown in Fig. 8 by means of a coil spring 58 encircling shaft 7 and lying between partition 3 and a collar 59 fast on the shaft. Shafts 7 are forced to the right, in the form shown, in the drawings, by means of cams 60 on controller shaft 5, the details of which will be explained later on. When it is desired to connect any set of adding devices with the operating bars, the cam 60 is caused, in the operation of the machine, to make engagement at the proper time. (which for adding purposes would be after the rearward movement of the operating bars and before their forward movement), with a roller 61 arranged on a bell-crank 62 pivoted at 63 in a bracket 64 secured to the framework. At the lower end of bell-crank 62 a pin 65 projecting from the side of an enlarged end of shaft 7 through a slot 66 communicates the movement to shaft 7 pulling it to the right, as shown in Fig. 8. This operatively connects the adding wheels of the set in question to operating bars 9, and the latter on their forward movement, for example, will add upon that set of adding wheels the value of the keys that have been depressed, it being understood, of course, that the forward movement of the operating bars is exactly equal to their backward movement and that the backward movement depends for its extent upon the value of the keys that have been depressed. When cam 60 passes by roller 61 spring 58 returns shaft 7 to its normal position disconnecting adding wheels 6 from the operating bars.

The adding wheels, when not in connection with the operating bars, are positively locked in position so that said adding wheels are always locked in any position to which they may be moved by the operating bars. The locking means are so arranged that, if the adding devices of any set are operatively connected with the bars 9, they will unlock the adding wheels of that set to permit their rotation on shaft 7. These locking means are also so arranged that they will not unlock the adding wheels until after the latter's engagement with the operating bars

and will lock them again before the operating bars are disconnected from the adding wheels. The locking means also hold the pins 57 in proper alignment to engage with one of the openings 56 in the drum and operating bars 9 always hold drums 53 so that one of the openings 56 will always be in proper alignment with its corresponding pin 57. Any suitable locking means may be employed, that shown consisting of the following devices. 67 (Figs. 7 and 8) is a locking bar, for locking the adding wheels of a set. A locking bar 67 and its connections is provided, of course, for each set of adding wheels. As shown locking bar 67 is carried by two arms 68, see Fig. 8, fast on rock shaft 69. At one end of this rock shaft is a crank arm 70 (Figs. 3, 4, 8 and 9) fast on the shaft and pivoted to a link 71, which link on its upper end is pivoted to one arm 72 of a bell-crank lever pivoted in the framework, said bell-crank lever having two lower arms 73, (Fig. 4) one on each side of shaft 7 and each having a slot 74 encircling a pin 75 projecting from both sides of shaft 7. This double arrangement of arms 73 is in order to stop the parts and to make the movement easy. Normally, locking bar 67 is held in locking position as shown in Fig. 8. Whenever shaft 7 is moved to the right, as viewed in Fig. 8, the locking bar is removed from locking position but the parts are so portioned that pins 57 engage with openings 56 before bar 67 clears the teeth of adding wheels 6. When shaft 7 returns to its normal position locking bar 67 engages with the teeth of the adding wheel 6 before the pins 57 leave openings 56. The adding wheels are thus always positively moved or positively locked in position.

Carrying mechanism.

Any suitable mechanism may be employed. That shown in the drawings is illustrated especially in Figs. 3, 4, 5, 8, 9, 18, 19 and 20. 76 is a sliding frame, one being provided for each denominational order except the highest and common to all four sets of adding wheels. Each frame 76 is adapted to have a slight backward and forward reciprocating movement on studs 77, which run across the middle compartment and are supported by partitions 3 and 4, the studs 77 passing through slots 78 in frames 76. A spring 79 tends to hold each frame in its forward position. Each frame 76 is composed of two side pieces secured together by a number of cross studs 80. One of these cross studs 80 is arranged so as to lie in the path of a tooth 81 of stop wheel 51. Stop wheel 51 is provided with a single tooth 81 as shown in Fig. 5. When the corresponding adding wheel 6 is moved in the adding direction shown by the arrow in Fig. 5, its full complement of ten points, tooth 81 strikes against said stud 80 and forces frame 76 to the rear a slight distance. To prevent the immediate return of the frame to its forward position I provide a lock 82 for each frame. The lock 82 has a sleeve 83 loosely surrounding shaft 84, the sleeve being provided with a short slot 85 into which projects a pin 86 fast to shaft 84. When a frame 76 is moved to the rear its lock 82 drops behind one of the studs 80 and holds frame 76 in its rearward position after tooth 81 has passed by the stud 80 with which it engaged. 87 is a swinging piece loosely pivoted at 88 to operating bar 9 of the next higher denomination. As shown piece 87 is composed of two side pieces secured together by studs 89, one of each of the sides being on each side of operating bar 9. The lower end of piece 87 (Figs. 3 and 5) rests against one of the studs 80 of frame 76 of the next lower denomination. When a frame 76 has been moved to the rear in the manner above described, piece 87 is swung slightly to the rear causing roller 24 to bear upon the rear side of piece 87. This rearward movement of piece 87 is just equal to the space traversed by operating bar 9 for moving an adding wheel one point. Whenever a piece 87 is thus moved to the rear its operating bar 9 on the forward movement is of course, moved one point farther forward than otherwise it would be moved, and this turns the adding wheel with which it is connected, one point more than is indicated by the corresponding key depressed. In other words, one unit is carried to said adding wheel. This occurs whenever the adding wheel of the next lower denomination is turned ten units. A carrying device is arranged, of course, for every denomination except the highest. It will be noted that the studs 80 with which the teeth 81 engage, move out of the way of the teeth when adding wheels 51 are moved in the adding direction. When, however, adding wheels are moved in the reverse direction, or the direction reverse to that of adding, the said studs 80 act as stops for the adding wheels when teeth 81 reach the position shown in Fig. 5, or the position in which the corresponding wheel stands at zero. The object of these stops 80 will be presently described. When the frames are in their normal position (Fig. 5) the upper studs 80 lie just below the teeth 81 of the adding wheels. If the wheels are rotated in the direction of the arrow, which is the additive direction, until the teeth 81 reach the under side of the studs 80, any continued rotation of the wheels in the same direction will cause the teeth to cam the studs 80, and consequently the frame 76 to the right (Fig. 5), this movement being permitted by the slots 78 in the frames 76. If, however, the

wheels are rotated reversely, as in total printing and clearing operations, they will move until the teeth strike on top of the studs 80 exerting merely a downward pressure, no camming of the studs 80 and frames 76 to the left of their normal positions being possible because the right-hand ends of the slots 78 (Fig. 5) rest against the supporting studs 77. While a frame 76 is not needed for the adding wheel of the highest denomination a stop 80 for the purpose above described is required and is shown in Fig. 3.

The above carrying operations takes place away at the end of the adding operation and in no way interferes with that operation. After the carrying operation has been completed, those frames 76 that have been moved are returned to their normal position by means of a cam 90 on main shaft 22 (see Fig. 19) slightly rocking shaft 84 counterclockwise as viewed in Fig. 5, causing pin 86 to move sleeve 83 and release lock 82 from engagement with stud 80 whereupon spring 79 returns frame 76 to its original position. Cam 90 rocks shaft 84 through a link 91 having a roller 92 with which cam 90 engages and a spring 93 secured to the framework at one end and link 91 at the other acts to hold roller 92 against cam 90 and also acts to return the link 91, arm 94 and shaft 84 to normal. Link 91 is pivoted at its other end to an arm 94 fast to shaft 84.

Printing devices and connections.

Any suitable method and means may be employed for indicating the amounts added on the different sets of adding devices or the totals, or sums of totals, or balance of totals taken at any time. I prefer, however, to indicate such means by printing them upon a paper strip. The devices shown for this purpose are especially illustrated in Figs. 1, 13, 14, and 15 and will be now described. Connected upon the main shaft 22 are two cams 94 which in the rotation of the shaft lift frame 95. The latter consists of two arms, one raised by each cam, pivoted on stud 96 which runs across the printing compartment. 97 and 98 are two tie rods connecting the two arms of frame 95. Spring 99 connected to tie rods 98 and the floor of the compartment holds frame 95 down against the cams. 100 are hammers loosely pivoted on stud 96 and having on their forward ends raised portions 101 adapted to strike whatever type 14 happen to be on the printing line at the time of the blow. Tie rod 97 lies normally against the hammers 100 as shown in Fig. 13. When this tie rod is moved backward through the action of cams 94 on frames 95, the hammers, since they rest against this rod, fall also by virture of their own weight, and when cams 94 pass off the arms 95 of the frame, the latter falls suddenly and the spring 99 through tie rod 97 throws the forward end of hammers 100 upward suddenly to give the printing blow. Raised portion 101 under the momentum of the movement rising and delivering a blow on type 14 forces the type upward against the paper strip 102, and the paper strip is by the blow forced against the support or platen portion 103, secured to the frame work thus causing the printing to be done upon the paper strip.

The above described movement is given only to those hammers 100 which at the time of the operation are unlocked. I prefer to always leave the cents and dimes hammer unlocked and also the letter hammer. All other hammers are normally locked and are so arranged as to be unlocked whenever the corresponding type bars are operated. As the zero type stands normally on the printing line the above arrangement always throws zero for the dimes and cents, unless the type bars of those denominations are moved to some other figure in which case the latter figure is printed, but nothing is printed down in other denominations or numbers except when the type bar corresponding to that denomination is operated. For each of said hammers a lock 104 is provided. This lock consists of a lever loosely pivoted on rod 105 which runs across the printing compartment, and has at its lower end a slot 106 which engages with a pin 107 projecting sideways from the end of the corresponding hammer 100. The upper end of lock 104 rests against a projection on the rear end of the corresponding type bar 12 and a spring 108 normally holds slot 106 in engagement with pin 107. In this position of the parts the corresponding hammer 100 will not fall when frame 95 is rocked and accordingly no printing blow will be given by said hammer. The lock is removed from operative position whenever a type bar is moved to the rear, its movement rocking lock 104 so that slot 106 no longer engages with pin 107 leaving the hammer free to deliver its blow. When the type bar returns to its forward position lock 104 returns to its locking position.

Preferably I arrange locks 104 so that the unlocking of any one unlocks all those of lower denominations. This is accomplished by the overlapping strips 109 in the usual manner.

I preferably provide another locking device to be used in the totaling operation as will be presently described.

Paper feed mechanism.

Any suitable recording strip may be used and any suitable device may be employed for feeding it. Those I prefer to use are shown in Figs. 13, 14 and 15. The recording strip 102 which I prefer to use is the well known composition strip having on one side paper

and on the other side a carbon surface. This paper is caused to pass the platen or printing point twice, each time with the carbon surface facing in the same direction, preferably downward, or with the upper surface of the lower layer at the printing point against the upper carbon surface and the printing will be effected upon the lower paper surface. This enables me to dispense with an additional carbon strip. This feature is not claimed in this application but forms the basis of Patent No. 833,029, dated Oct. 9, 1906.

As shown the recording strip 102 passes from the supply roll mounted on support 110 around idle roller 111 underneath platen 103 with the carbon side downward and then around idle rolls 112, 113, 114 and 115 and again under platen 103 with the paper surface upward and the carbon surface downward. Thence the recording strip passes around friction roller 116 and is wound up on roller 117.

The feeding devices are as follows: Cam 118 on shaft 22 through roller 119 fast on rod 120, gives that rod a reciprocating movement with each revolution of shaft 22. On its upper end rod 120 is pivoted at 121 to arm 122 mounted loosely on stud 123. Arm 122 carries a pawl 124 which engages the teeth of gear wheel 125 loose on stud 123, the latter engaging gear wheel 126 mounted on the same shaft as friction roll 116, both being fast on the shaft. 127 is another friction roll loosely mounted on the lower end of arm 128 loosely mounted on stud 123. A suitable spring (not shown) holds friction roll 127 against friction roll 116. 130 is a pulley loose on stud 123 secured to and rotating with gear 125. Motion is transmitted from this pulley to roller 117 by means of a belt 131 which passes over pulley 130 and a corresponding pulley on roller 117.

By means of the above arrangement a loose slip of paper can be at any time shoved in between the type and the lower carbon surface of the lower layer of the recording strip under platen 103 and the printing be taken off on said slip as well as upon the recording strip.

Means for controlling the connections between the different sets of adding devices and the operating bars.

When it is desired to add upon any of the sets of adding devices, it is necessary to connect such set with the operating bars at the proper time and in the proper manner. Likewise when it is desired to take the total of any of the sets of adding devices, it is necessary that such set shall be connected with the operating bars at the proper time and in the proper manner. Where it is desired to add the total of one set to the total of another set, or to subtract the total of one set from the total of another set, it is also necessary to make connection between the operating bars and the sets, either singly or two or more at the same time, and to make such connections in the proper order or sequence and manner. Any suitable means may be employed for controlling such connections. In the drawings I have shown the devices preferred by me for this purpose which I will now proceed to describe.

When a sum is to be added upon any set of adding devices the keys 8 representing the said sum are first depressed. If the said sum is to be added upon the paid in account all that is required on the part of the operator is to give the crank handle 15 a complete revolution. This rotates controller shaft 5 (Figs. 2 and 8 to 12) through a worm wheel 132 on shaft 22 meshing with a worm 133 on shaft 5. During the revolution of this shaft one of the cams 60 on the shaft, which is normally in alignment with shaft 7, upon which the paid in set of adding wheels is mounted, throws that shaft to the right, as viewed in Fig. 8, and as already described, operatively connects the adding wheels 6 of that set with the operating bars 9. The cam is so arranged upon shaft 5 that it will not thus operatively connect the adding wheels with the operating bars until the latter have completed their backward movement. This connection is made before these bars begin their forward movement. The bars will, of course, in moving forward move only the same distance they were permitted to move in their backward movement by the stops thrown into their path by the depressed keys. Accordingly the adding wheels of the paid in set will move in the adding direction the distance equal to that represented by the value of the keys depressed and the amount of that value will be added upon such set of adding devices. As a different cam is used for adding upon each of the different sets of adding devices and for each of the different operations hereinafter described in the taking of totals or the adding or subtracting of totals, I will distinguish the different cams 60 from each other by giving them also a different letter. The cam, which has been described, is used to add upon the paid in account I have designated *p*, see Figs. 3, 8, and 10. Cam *p* stands in alignment with the roller 61 of bell-crank 62 connected with the end of shaft 7 of the paid in adding wheels. This cam is also shown in Figs. 41 and 42. Fig. 41 represents that part of shaft 5 which carries cams effecting the paid in set of adding devices. Fig. 62 represents diagrammatically the relative position of the cams on shaft 5 as they stand in the normal position on that shaft. The parts marked P, A, C, and

O, in Figs. 62 to 73 represent, respectively, the rollers 61 connected with the shafts representing the paid in, the account, the charge and the paid out adding devices, and show the relative positions of the different cams on shaft 5 to the said several rollers 61 of these different shafts and the different operations to be described. Of these operations Fig. 62 represents the normal position of the various parts which normal position is the one in which the amounts represented by keys depressed is added to the paid in account set of adding wheels.

Fig. 42 represents the form of the cam *p* and its locations on shaft 5. The arrow (Figs. 8 and 9) represents the direction of rotation of shaft 5 as crank handle is revolved. This cam is shaped and located on said shaft so as to operatively connect the adding wheels with the operating bars after the latter have completed their backward movement and before they begin their forward movement.

If it is desired to add the value of any keys that are depressed, upon the account set of adding wheels, the operator before turning crank 15 depresses the key marked A in Fig. 1, if upon the charge account of adding wheels he depresses key marked C, or if upon the paid out adding wheels he depresses key marked O in Fig. 1. The effect of depressing any one of these keys is to move shaft 5 to the right (Fig. 10) one, two or three steps depending upon which of the keys A, C or O is depressed for the purpose of bringing a cam into alignment with the roller 61 of the shaft upon whose adding wheels it is desired to add. The effect of depressing key A is to cause shaft 5 at the proper time to move one step to the right from the position shown in Fig. 10, thus bringing the cam *a* into alignment with the roller 61 connecting with the account shaft. The effect of depressing key C is to cause shaft 5 to move two points to the right, as viewed in Figs. 10 and 62, bringing cam *c* into operative position with reference to the charge set of adding wheels, and the effect of depressing key O is to cause shaft 5 to move three steps to the right to bring cam *o* into operative connection with the paid out set.

The devices employed by me for this shifting of shaft 5 will now be described. The shaft of each key A, C, and O is provided at its lower end with a slot 134, see Figs. 4 and 7, taking over a pin 135 projecting from the side of a lever 136 fast upon shaft 137. Also fast on shaft 137, see Figs. 10 and 12, is arm 138, to the upper end of which is pivoted a link 139. This link has at its lower end a horizontal plate 140 extending sidewise from arm 139 and normally covering three teeth in a rod 141, as shown in Figs. 10 and 12. 142 is a pawl adapted to reciprocate when crank handle 15 is revolved in a manner presently to be described, and so arranged with reference to the three teeth of rod 141 and plate 140 as to slide on plate 140 when it is in its normal position, as shown in Figs. 10 and 12, without catching with the said teeth and therefore without affecting rod 141. But when plate 140 is withdrawn so as to expose any of the said teeth, pawl 142 engages with said teeth during its movement and imparts motion to rod 141 for a purpose presently to be described. The movement thus imparted to rod 141 is dependent for its extent upon the number of teeth exposed by plate 140. When key A is depressed plate 140 is moved to the right as shown in Fig. 10, and to the left, as shown in Fig. 12, to expose one tooth only. Key C exposes two teeth and key O three teeth. This difference in movement being the result of the relative arrangement of the upper part of slots 134 in reference to pins 135, as shown in Fig. 4. The result is that when key A is depressed and the tooth to the left, see Fig. 10, is exposed, pawl 142 moves rod 141 one point to the left, whereas when C is depressed it is moved two points and when O is depressed three points. The effect of this movement of rod 141 is to move shaft 5 to the right, as viewed in Fig. 10, one two or three steps. This is accomplished through a gear 143 on shaft 144 and meshing with a rack on the upper edge of rod 141 as viewed in Fig. 10, and gear 145 (Fig. 9) on the shaft 144 meshing with a rack 146 on the under edge and right-hand end, as viewed in Fig. 10, of a reciprocating frame 147. 148 is a ring encircling shaft 5 and secured to frame 147. It is placed between two collars 149 fast on shaft 5. Shaft 5 is mounted in bearings 150 in the framework and is free to move lengthwise of its axis. This motion is imparted to it by frame 147 through the devices above described. When key A is depressed and crank 15 is rotated from 147 with its shaft 5 is moved one step to the right, as shown in Fig. 10, moving cam *p* out of alignment with its roller 61 and moving cam *a* into alignment with its roller. When key C is depressed two teeth are uncovered and pawl 142 moves rod 141 two steps to the left, as shown in Fig. 10, moving frame 147 two steps to the right and bringing cam *c* under roller 61 connecting with the charge set of adding devices. Similarly key O when depressed causes cam *o* to be brought in alignment with the roller 61 of the paid out set.

In Fig. 74 I have represented at the left of the figure the above operations of adding. The horizontal lines representing the different sets of adding devices and the vertical lines the operative connection of the cams.

Thus the first vertical line to the left represents the operative connection of the cam *p* with the shaft of the paid in adding devices; the second vertical with the account adding devices; the third with the charge and the fourth with the paid out. These cams are all of the same shape as they all connect their respective adding devices to enable adding to be done upon the return movement of the operating bars.

Pawl 142 is mounted on arm 151 loosely mounted on stud 152 secured to the frame work. Pivoted to arm 151 is rod 153 provided with an elongated slot encircling main shaft 22 and provided with a roller 154 bearing upon the cam 155 fast on shaft 22. When crank handle 15 is turned shaft 22 rotates in the direction of the arrow as shown in Fig. 10, and cam 155 rocks pawl 142 a certain prescribed distance to the left. 156 is a slot in link 139 encircling stud 157 secured to the frame work to insure that plate 140 shall have a true horizontal reciprocating movement. Rod 153 is returned to its original position, as soon as cam 155 permits it by means of a spring 158 secured to it and to a pin 159 in the frame work.

Rod 141 is carried back to its original position after it has been moved to the left by pawl 142 by means of a pin 160 on the side of arm 161 loosely mounted on stud 162 striking a downward projection 163 from rod 141. Arm 161 is moved by means of a link 164 pivoted to it and having at its other end slot 165 encircling shaft 22. The roller 166 is carried by link 164 and is held against a cam 167 on shaft 22 by means of a spring 168 secured to pin 159 and pin 169 on link 164. Toward the close of the rotation of shaft 22 cam 167 causes pin 160 to strike projection 163 and move rod 141 back to its original position. In returning to that position it moves frame 147 back to its original position.

Upon shaft 144 is mounted a star-wheel 170 provided with a set of teeth and also one large tooth 171 to act as a stop. 172 (Figs. 10 and 33) is a depending rod pivoted on 173 and having a roller 174 adapted to engage between the teeth of star-wheel 170 and to act as a stop to prevent too rapid rotation of that wheel. A spring 175 holds roller 174 in engagement with wheel 170. Upon shaft 144 is mounted a knob 16 (Figs. 1 and 11), by means of which shaft 144 can be turned in either direction and shaft 5 be moved to any desired position manually. The normal position of the star-wheel in connection with roller 174 is shown in Fig. 10. On depressing key A, and turning crank handle 15 star-wheel 170 is moved in the direction of the arrow shown in Fig. 10, one point; on depressing key C it is moved in the same direction two points, and on depressing key O it is moved three points, bringing stop 171 against the upper side of roller 174. When rod 141 is returned to its original position it also returns star-wheel 170 to its original position, that shown in Fig. 10.

The means for taking totals, for adding totals of one set of adding wheels to that of another set, and for subtracting the total of one set from that of another.

I provide means for taking the total standing at any time upon any of the sets of adding wheels and of indicating such totals in a suitable manner. The total of any set of adding wheels is taken and indicated by operatively connecting the common operating means, through the operating bars 9, with such set of adding wheels during the backward movement of the operating bars. As already described the backward movement of the bars that are released will be limited by the condition of the various adding wheels of the set, this movement ceasing when teeth 81 (Fig. 5) of stop wheels 51 strike against studs 80, this arrangement of parts acting as a stop for such movement. The total thus taken will, through shafts 10 and connections, be indicated by the type on the printing line and by the printing on the paper strip as already described.

The total of any set of adding wheels is added to the total standing upon any other set of adding wheels by moving the adding wheels of the first set in the direction reverse to adding until they have been brought to the zero position, and then transmitting that movement, but in the adding direction, to the other set of adding wheels. The effect of this is to add the total of the first set upon the second set. Any suitable means may be employed for transmitting this movement of one set to another. In the device shown herein the means is employed for the purpose of connecting the operating bars 9 with the first set of adding devices on the backward movement of the operating bars. This backward movement of the operating bars is limited by the stops already described, when the adding wheels reach their zero position. The operating bars are then connected with the other set of adding devices on the forward or return movement of the operating bars and the same movement is transmitted in the adding direction to the second set thus adding upon them the total originally standing upon the first set.

In subtracting one total from another the set from which the subtraction is to be made, or the minuend set, and the set whose total is to be subtracted, or the subtrahend set, are so connected through the intervention of one or more sets and so moved that the total of the subtrahend set is subtracted from the total of the minuend set and the difference is correctly represented by the condition of

the other set or one of the other sets. The devices which I prefer to use for this purpose are so arranged and connected that no borrowing devices are required, the carrying devices of the adding wheels performing the function at the proper times of borrowing devices. This simplifies the construction and reduces the number of parts required in the machine. In the machine shown and described herein this subtraction of totals is accomplished by transferring to another set the total of the minuend set to obtain the complement thereof, then adding to such complementary total upon such set the total of the subtrahend set, giving the complement of the true difference between the totals of the minuend and subtrahend sets, and then transferring to another set the complement of the sum of such totals, this being the true difference between the said sets.

While the taking of any total or totals, the adding of totals or the subtracting of totals may be performed manually and at will, and in any order, or any one of said steps may be performed singly or in combination in any order or sequence desired, I prefer to perform all of the operations in a predetermined order and sequence and also automatically. In this way at the close of the day's business, or at any desired time, the totals of the different accounts that have been kept upon the different sets of adding devices may be taken in a certain prescribed or predetermined order, certain of the accounts can be added together, another or other accounts can be subtracted and the balance of the day's work be struck, and all these items will be indicated, as by printing upon a paper strip, in a predetermined order. Thus at the close of the day's business by a very simple operation my improved machine may be caused to print on a strip of paper, for example, the total of all the amounts paid in on different accounts, of credits, of amounts paid out, and the difference between amounts received and amounts disbursed. Thus a balance of the day's business can be struck off and printed immediately upon the close of the day's work.

I will now proceed to describe the devices by means of which such steps can be taken automatically in a predetermined order.

In my improved machine I have shown four different sets of adding wheels. It will be understood, of course, that any greater or less number may be employed, and that the order in which the totals are taken, the amounts that are to be added, and the order in which they are to be added and the accounts that are to be subtracted and the order in which they are to be subtracted may be varied as described.

In the machine shown the order in which these various steps are taken is as follows: The total is first taken of the charge account and is printed on the paper slip; then the total of the paid in account is taken and printed; the total of the received on account is added to the total of the paid in and the sum of the totals printed; the total of the paid out is then taken and printed and that total is then subtracted from the sum of the totals of the paid in and the received accounts and the balance is printed. To effect this eight separate and distinct operations are required and these operations will be taken up and described in their order.

When it is desired, as at the close of the day's business, to take the totals and strike a balance, the knob 16 is turned so as to move star-wheel 170 in the reverse direction to that of the arrow shown in Fig. 10, and until stop 171 comes underneath roller 174. The effect of this is to move frame 147 eight steps to the left, as viewed in Fig. 10, to move controller shaft 5 with its cams an equal distance in the same direction and also to move rod 141 eight steps to the right, as viewed in Fig. 10. This brings the right end of rod 141 in contact with the front wall of the casing and prevents further movement of the parts. The crank handle 15 is now turned for eight complete revolutions. The effect of each revolution of the crank handle is to move rod 141 one step to the left and consequently to move frame 147 and shaft 5 one step to the right. At the end of the eighth revolution of the crank handle the parts have reached their original positions. The effect of the above movements of shaft 5 is to bring successively into operative play a different cam or cams at each revolution of the crank handle and operatively connect different sets of adding devices, one or more at a time and to connect such set or sets with the operating bars 9 at different times so as to perform the various steps of taking totals and of adding or subtracting. After knob 16 has been moved the eight steps to the position indicated above, the action of the machine is automatic except in the single particular that power must be given to it by the turning of the crank handle. The various sets of adding devices are automatically connected with the operating bars at the proper times and in a predetermined order or sequence.

The means shown for moving rod 141, step by step, to the left, and frame 147 and shaft 5, step by step, to the right, as crank handle 15 makes its eight revolutions are as follows: This is accomplished by means of a set of eight teeth 176 on the upper side of rod 141 slightly to the right of the three teeth already mentioned, and by means of a pawl 177 mounted upon an arm 178, which is fast to the sleeve 179 on stud 162, to which arm 161 is secured. Whenever arm 161 is rocked upon the turning of the crank handle, pawl 177 is moved to the left, as shown in

Fig. 10, so as to engage with teeth 176, should they be in its path. During the addition, already described, upon any of the sets of adding wheels, rod 141 is either in the position shown in Fig. 10 or has been moved to the left so that none of the teeth 176 are within the range of movement of pawl 177. But when knob 16 has been moved the eight steps with the automatic operation, as above described, bar 141 is moved eight steps to the right bringing the teeth 176 at the left into the path of pawl 177 as it moves down and to the left. The result is that at each revolution of the crank handle pawl 177 feeds bar 141 one step to the left and shaft 5 one step to the right. This movement takes place toward the end of the revolution of the crank handle. Star-wheel 170 and knob 16 are, of course, moved back one step with rod 141.

The first of the eight operations is to take the total of the charge adding wheels and print that total. It also leaves the charge wheels at their zero position.

First operation.—Taking the total of the charge set and printing that total.

This is especially illustrated in Figs. 3, 10, 53–58, 66, 74 and 75.

When shaft 5 is moved eight steps to the left, as viewed in Fig. 10, through the turning of knob 16 eight points counter-clockwise, as viewed in Fig. 10, cam c^1 is brought into alignment with the roller 61 of the shaft of the charge set of adding wheels, see Figs. 53–58, 66 and 74. In Fig. 66, as also in any of the series of diagrams 66–73, the cam and the roller 61 that are in operative alignment with each other are cross-hatched and in these diagrams, I have marked the rollers 61 with the letters P, A, C and O, respectively, to indicate with what adding devices the shaft of the roller was connected, P standing for the paid in, A for the account or received on account, C for the charge and O for the paid out. In diagram 74 I have followed the same plan, the number representing the cam at a horizontal line indicating that the cam is in operative alignment with the set of adding devices represented by the letter at the left of the horizontal line. The eight vertical lines in the right-hand part of the figure represent the eight automatic operations which I am now describing. The cam c^1 on the first of these vertical lines indicates that cam c^1 is in this operation in operative alignment with the roller of the shaft of the charge adding wheels. The location and shape of the cam indicates the time of the operations of the operative connections between the cam and the roller of said shaft. The raised portion of the cam is shown at the left of the vertical line and this indicates that as shaft 5 rotates in the direction of the arrow, (Figs. 8 and 9) the cam comes into operative connections shortly after the commencement of the rotation of crank handle 15 and that the charge adding wheels are operatively connected with the bars 9 on their backward movement. This takes the total of the charge adding wheels and this total is indicated by being printed upon the paper strip. Fig. 75 is a view of the paper strip indicating the results of the different operations printed upon it. The first line at the right, "47.25" represents the total printed during this first operation of the adding wheels of the charge account.

The form of cam c^1, see Figs. 58, 74, indicates that at the close of the backward movement of bars 9 the bars and the charge adding wheels are disconnected from one another. As already described, before this disconnection takes place the locking bar 67 (Figs. 5 and 6) is thrown into locking position and the charge adding wheels are locked in their zero positions. The operating bars are then moved forward to their original position by the further rotation of main shaft 22, leaving the charge adding wheels at their zero position.

In the first operation it will be noted that the operating bars 9 are moved backward and forward without the depression of any key 8. It therefore, becomes necessary to throw out of operation locks 44 which normally hold the operating bars from backward movement until a key of the corresponding series is depressed. The means shown for throwing out these locks 44 (Figs. 5 and 28) during this first operation and the succeeding operations of totaling, adding and subtracting are as follows and are especially illustrated in Figs. 27, 30, 37 to 40 inclusive. 180, see Fig. 37, is a link provided at its lower end with a slot 181, encircling controller shaft 144, and a second slot 182 encircling stud 183 secured to the framework. Spring 184 normally holds link 180 in its downward position, as shown in Fig. 37. 185 is a rocking segment, fast on shaft 39, and having a pin 187 and a pin 188 projecting sidewise from it. 189 is a cam fast on shaft 144 and 190 a roller secured on link 180 and engaging the cam. 191 is a catch pivoted at one end at 192 in the framework and having a projecting pin 193.

Shaft 144 revolves in the direction of the arrow shown in Fig. 37, when the button 16 is manually turned to prepare the machine for the eight automatic operations. At the commencement of this movement catch 191 is released and drops into the position shown in the Fig. 39. Normally by means of projection 194 of link 180, engaging pin 193 of the catch, the catch is held in the position shown in Fig. 37. The further upward movement of link 180 is caused by the higher part of cam 189 tilting segment 185 through link 180 striking pin 187, whereupon catch

191 engages with pin 188 and locks the segment in its position. This position of the parts is illustrated in Fig. 40. The rotation of the segment and its shaft 39 causes pins 43, on shaft 39 to strike cross-pins 45 of locks 44 and lift the locks out of locking position. The operating bars 9 are now free to move to the rear on the rotation of the crank handle 15. Locks 44 are held in their inoperative position until the cam 189 reaches its normal position shown in Fig. 37 whereupon link 180 is pulled to its downward position and projection 194 strikes pin 193 and releases segment 185 from engagement with catch 191. Whereupon shaft 39 returns to its original position and allows locks 44 to again come into locking position. This, however, does not occur until the end of the 8th operation to be described, as shaft 144 turns in the direction reverse to that indicated by the arrow shown in Fig. 37, one step at each turn of the crank handle as already explained.

It will be understood from the above that during the totaling, adding and subtracting operations the operating bars 9 are locked until released by the crank handle and connections and on each turn of the crank handle revolution the operating bars 9 move backward and forward the entire distance of their travel.

Second operation.—Taking and printing the total of paid in adding wheels and restoring said wheels to their set position.

This is illustrated in Figs. 3, 10, 41, 45, 67, 74 and 75.

By the commencement of this operation shaft 5 has moved one step to the right from the position it occupied in the first operation. This position is illustrated in Fig. 67. The cam p^1 is now in operative engagement with the roller of the shaft of the paid in adding wheels. Cam p^1 becomes operative shortly after the commencement of the revolution of the crank handle and shaft 5, as clearly indicated by the form of the cam of the second of the automatic operations, as shown in Fig. 42. Accordingly the paid in adding wheels and the operating bars 9 are operatively connected on the backward movement of the bars. Thus taking and printing the total of the paid in adding wheels. This is represented by the amount "$162.34" on the second line at the right in Fig. 75.

As it is desired to keep this paid total on the paid in adding wheels in order to add to it the amount of the received on account adding wheels, the paid in adding wheels are not disconnected from the operating bars at the end of their backward movement but remain connected with those bars during their forward movement, as indicated by the form of cam p^1, see Figs. 45 and 74. When operating bars 9 have reached their forward position the paid in adding wheels have reached their set position that they occupied before the second operation was begun.

Third operation.—Taking and printing the account total and adding said total to the total on the paid in adding wheels and leaving the account adding wheels at zero.

These are especially illustrated in Figs. 3, 10, 41, 44, 46, 52, 68, 74 and 75.

In this position of the parts two cams are thrown into operative alignment with the rollers of two of the shafts, namely, cam p^2 in alignment with the paid in shaft and cam a^1 in alignment with the account shaft. The form of cams p^2 and a^1 and their location, see Figs. 44, 52, 68 and 74, causes the account adding wheels to be connected with the operating bars on their backward movement, thus taking and printing the total of the account adding wheels. This total is represented on the printing slip as $100.00, see Fig. 75. The account wheels are then disconnected and left at their zero position. Cam p^2 causes the paid in adding wheels to be connected with the operating bars 9 on their return or forward movement. This causes the total previously upon the account adding wheels to be added to the total on the paid in adding wheels. At the close of this operation the account wheels stand at zero and the condition of the paid in wheels represents the sum of the totals originally upon the paid in wheels and the account wheels.

The machine next automatically takes and prints the total now standing on the paid in wheels, representing the sum of the totals originally standing upon the paid in wheels and the account wheels, and subtracts from such sum the total standing on the paid out wheels, in the operation printing the total of the paid out wheels and the resulting difference or balance. In performing this work five separate and distinct operations are performed, from the fourth to the eighth, both inclusive, one of each operation being performed at each revolution of the crank handle. We will now consider these operations in their order.

Fourth operation.—In this operation the account wheels and the charge wheels, all of which now stand at zero, are moved to the position reverse to their zero position, or what is practically the "9" position. This step is merely one preparatory to the purpose of the subtraction to be hereinafter described. No printing takes place in this step.

The operation is illustrated in Figs. 3, 10, 46, 51, 53, 57, 69, 74 and 75.

In this operation two cams are in align-

ment with their respective shafts, namely, cam a^2 with the account shaft and cam c^2 with the charge shaft. Both of these cams are so located and proportioned, as shown in Fig. 74, as to operatively connect their adding wheels on the forward movement of the operating bars. As these wheels previously stood at their zero positions they will be moved by the operating bars to the reverse of that position, or to the position represented by 9. They are then disconnected from the operating bars and locked by their respective locking bars 67. This step is a mere preparatory one for what is to follow.

No printing whatever is done in this operation. The printing operation, which would otherwise ordinarily take place is prevented by means of the following described mechanisms which are illustrated especially in Figs. 13, 14, 15, 35 and 36. On shaft 144 is a cam 195 provided with two cutaway portions 196. 197 is a link provided with a slot 198 encircling shaft 144 and having a roller 199 bearing upon cam 195. Spring 200 secured to the link and the framework holds link 197 normally in its position to the left as shown in Fig. 13, except when forced to the right by the raised portions of cam 195. On its left end, as shown in that figure, link 197 is pivoted to an arm 201 fast on shaft 202, the latter being loosely mounted in the framework and free to rock. Upon shaft 202 are mounted two arms 203 fast to the shaft. 204 is a tie-rod connecting the upper end of these two arms 203. Normally cam 195 holds link 197 to the right, as shown in Fig. 13, holding tie-rod 204 to the right of a series of projections 205, projecting downward from hammers 100, one from each hammer. When, however, shaft 144 rotates so as to bring a cutaway portion 196 opposite roller 199, tie-rod 204 is moved underneath projections 205. In this position of the parts, which occurs, for example, during the fourth operation above described, the hammers 100 when released cannot fall, hence no printing blow is given and no printing is done.

The end of the fourth operation leaves the account and the charge adding wheels standing at "9" or the reverse of their zero position, with a single tooth 81 of stop wheels 51 standing underneath and against the studs 80. The normal or zero position is that shown in Fig. 5 with teeth 81 standing above and against studs 80.

Fifth operation.—Taking the total of and printing the sum of the totals of the paid in and the account sets, and subtractively transferring that sum to the account set to obtain the complement of said sum.

This is especially illustrated in Figs. 3, 10, 41, 43, 46, 50, 70, 74 and 75.

Cams p^3 and a^3 are now in operative alignment with the respective shafts of the paid in and the account sets. The cams operatively connect these sets with the operating bars on their backward movement. This clears the total then standing on the paid in wheels which represents the sum of the totals standing on the paid in wheels and the account wheels, and prints that total. This is represented in Fig. 75 by the figures "$262.34." Both sets of wheels are now disconnected from the operating bars, leaving the paid in set at zero and the account set at a position which represents the complement of the sum of the totals previously standing on the paid in wheels. That is to say, that sum, "$262.34," subtracted from "$999.99." In this particular instance, the condition of the account wheels would represent "$737.65." The account wheels are, of course, locked at that position. The operating bars are then returned to their forward or normal position which occurs, of course, on each revolution of the crank handle.

Any set of adding wheels could have been used in place of the account wheels provided they were first moved to their "9" position. Thus the charge set could have been used for this purpose equally as well as the account set.

Sixth operation.—Taking and printing the total of the paid out set, leaving that set at zero and adding the paid out total to the complementary total now standing on the account adding wheels.

This is especially illustrated in Figs. 3, 10, 46, 49, 59, 61, 71, 74 and 75.

In this operation cams a^4 and o^1 are brought into operative alignment with the account shaft and the paid out shaft, respectively. The paid out wheels are operatively connected with the operating bars during their backward movement, thus printing the paid out total on the printing line represented by the numbers "$193.25" in Fig. 75. The paid out wheels are then disconnected and left at zero. The account wheels are then connected and are moved during the forward movement by the operating bars, thus adding to the complementary total theretofore standing on them the total originally standing on the paid out wheels. The condition of the account wheels now represents the complement of the true difference or balance between the total originally standing on the paid out set and the sum of the totals originally standing on the paid in set and the account set. In effect the subtraction of the paid out from the sum of the other two has been effected although the account wheels represent the complement of the true difference or balance. This subtraction has been effected without any borrowing devices. This is be-

cause the operation has been reversed and the operation actually performed on the account wheels has been in the adding direction, thus the carrying devices used ordinarily in addition are utilized also for the purpose of subtraction without any different or further mechanism. It now becomes necessary to reverse this complementary difference or balance and the true difference or balance will be obtained. This is accomplished by the seventh operation.

Seventh operation.—Transferring the complement or complementary total on the account wheels, representing the complementary balance, to another set to obtain the true difference or balance and leaving the account wheel at zero.

This is especially illustrated in Figs. 46, 48, 53, 56, 72, and 74.

The only purpose of this operation is to transfer the complement of the total now standing on the account wheels to another set of wheels, such a complement constituting the true difference or balance between the sum of the paid in and the account on one side and the total of the paid out on the other. Any set of adding wheels or even a set of numeral wheels, without carrying mechanism, may be used for this purpose, but such wheels must, of course, be first moved to the "9" position, the reverse of the zero position. As the charge wheels stand in that position in virtue of the fourth operation those wheels are used in the seventh operation. The cams employed in this operation are a^5 and c^3. These cams are arranged so as to connect both the account adding wheels and the charge adding wheels with the operating bars on their backward movement. The charge wheels now stand at the complement of the total represented by the account wheels at the commencement of the operation, the same being the true balance above referred to. Both sets of wheels are now disconnected from the operating bars, leaving the account wheels at zero and the charge wheels in the set condition which represents the said true balance.

No printing is done in this operation. The second cutaway portion 196 of cam 195 standing in this operation opposite roller 199.

Eighth operation.—Printing the true balance now standing on the charge wheels.

This is especially illustrated in Figs. 53, 55, 73, 74 and 75.

Cam c^4 is the cam used in this operation. It connects the charge wheels with the operating bars during their backward movement, thus printing the total standing upon those wheels. This total is the true balance between the sum of the totals paid in and the account sets of the total of the paid out set and will be printed on the paper slip illustrated in Fig. 75 as "$69.09". The charge wheels are disconnected from the operating bars before their return movement and are then left at their zero position. It will be noted that all of the sets of adding wheels are now at their zero position ready for the next day's operation.

Fig. 75 reveals at a glance the results of the day's work.

The different forms of cams illustrated in the drawing, are thus variously made for the purpose of connecting the adding wheels with the operating bars at different times either on the backward movement of the latter or their forward movement or both. In the form of machine shown the cams making this connection during the forward movement of the operating bars are preferably made longer than those for making the connection during the backward movement because of the difference in means for moving the bars backward and forward. In the backward movement the bars are moved by springs, the cams merely permitting their movement. While in the forward movement, the bars are positively moved by the cams on the main driving shaft. Accordingly it is better for mechanical reasons to allow a longer time for this forward positive movement than for the spring backward movement.

In the fifth operation it will be noted that cam a^3 is slightly shorter than cam p^3. The effect of this is to cause cam a^3 to release the account wheels from connection with the operating bars slightly before p^3 releases the paid in wheels from said connection. The reason for releasing the account wheels from the connection with the operating bars slightly before the release of the paid in carrying wheels is to prevent any possibility of the operating bars moving the account wheels, after the stops of the paid in carrying wheels have been thrown out of operative position and before the account wheels are released and locked. The moment the carrying wheels are disconnected from the operating bars, these bars will shoot backward under the influence of their springs. If at the same moment the account wheels have not been disconnected, the operating bars will move them a greater or less distance. To avoid such a possibility I prefer to slightly shorten cam a^3 to disconnect the account wheels a moment before the paid in ones are disconnected.

The same is true in the seventh operation as between cams c^3 and a^5. Cam c^3 is slightly shorter than cam a^5 in order to disconnect the charge wheels slightly in advance of the account wheels for the reason already given.

Mistake key.

This is illustrated in Figs. 1, 4, 27–30.

The mistake key is marked M as shown in Fig. 1. The shank of the mistake key M is provided with a rack 206 (Figs. 27, 28 and 30) which meshes with a gear wheel 207 on shaft 208. This shaft is provided with another gear wheel 209 which meshes with the toothed segment 210, loosely pivoted on shaft 39. A pin 211 fast in shaft 39 moves in a slot 212 in the hub or sleeve of segment 210. The pin and slot are so arranged as to permit the normal operation of shaft 39 without affecting the mistake key. When, however, a wrong key has been depressed and it is desired to return the keys to their normal position without operating the machine, the mistake key M is depressed and through the key above described, shaft 39 is rocked so as to lift locks 44, and through pin 46 move locking bars 30 to release the keys that have been depressed.

Devices for preventing more than a complete revolution of the crank handle at a time and to prevent backward rotation of that handle.

These are especially illustrated in Figs. 24, 25 and 26. On main shaft 22 is mounted a ratchet-wheel 213. 214 is a pawl held by spring 215 in engagement with the ratchet-wheel to prevent backward rotation of shaft 22 and its crank handle 15.

216 is a link loosely pivoted on stud 217. The link is composed of two arms and a cross-piece 218 at the top. A disk 219 is fast on shaft 22 and provided with a projection 220. The shaft rotates in the direction of the arrow shown in Figs. 25. Stud 217 connects the two spring arms to frame 221 which is secured at 222 to a stud projecting from the framework. Toward the close of the revolution of shaft 22 projection 220 presses down spring arm 221. This pulls link 216 downward. A slot in the link 216 encircling a pin 224 secured to the framework, permits this downward movement. 225 is a spring secured to link 216 and the framework. When frame 216 is pulled downward the point where spring 225 is connected to the spring is now below pin 224 and the upper end of link will be pulled to the left or toward disk 219. Accordingly when projection 220 arrives at this point it will enter the space between the two arms of link 216 and will be caught on cross-piece 218. This will prevent more than a complete revolution of the shaft and crank handle.

The engagement of projection 220 with cross-piece 218 will pull link 216 to its upward position and on the slight rebound of projection 220 from 218, spring 225 which is now connected to link 216 above pin 224 will pull link 216 to the right or out of the path of projection 220 leaving the crank handle and its shaft free to be rotated again.

Letter and date type bars.

I preferably provide additional type bars carrying type to represent the date, and also a letter type bar carrying letters to represent the different sets of adding devices, respectively.

The date type bars, 12, are illustrated in Figs. 1, 13, 14, and 15, and as there shown are provided with projecting handles 226. The type bars are preferably operated by hand and bear conspicuously on the face of their projecting portions each a set of digits. In the machine shown two of the bars represent the months and two the days of the month. Each projecting handle is provided with a series of notches 227, adapted to fit over an upward projection 228 in the front wall of the casing of the machine as shown in Fig. 13. The operator can move the handles 226 to any position corresponding with the number of the month and the number of the day of the month. Thus on Fig. 75 the date is printed as 12—23, meaning December 23. Ordinarily the date need be printed but once upon the slip, namely, at the beginning of the day's record. The numbers on the face of the handles are to enable the operator to know when the proper type is on the printing line.

For each of the hammers of these date bars I also provide a lock 104 and connections, as already described, and these hammers are also locked in their inoperative position at the proper times by bar 204, as already described. In order, however, to permit the printing of the zero should 10, 20, or 30 be the number of the month or day of the month to be printed, I provide over-lapping strips 109 to cause the tens digit when operated to not only unlock its own hammer but the hammer of the unit's place. These are clearly shown in Fig. 14.

I also preferably provide a letter bar provided with letters corresponding to the different sets of adding wheels. Thus, for example, P for the paid in wheels, O for the paid out wheels, etc. This letter bar I preferably operate automatically and so connect it with the other mechanism that it will properly record the set of adding devices which are being used either for adding, or for taking totals or for striking a balance. The device and its operative means are especially illustrated in Figs. 1, 2, 8, 10, 14 and 15.

The letter bar is the one immediately to the right of the four date bars, as seen in Figs. 1 and 15, being the fifth type bar from the left in these two figures. It is moved backward and forward with frame 147 and controller shaft 5 so as to indicate

upon the recording strip at any time the particular set of adding wheels which is in operative connection with the operating bars. This is accomplished through a rack 229 in the upper part of frame 147, see Fig. 10, meshing with a gear 230 on a shaft 231, which shaft runs all across the machine, as shown in Fig. 8, and has a gear 232, like gears 13, meshing with a rack on the letter type bar. Accordingly whenever a number is added upon any set of adding wheels the recording strip will have printed thereon opposite the number thus added the letter designating the particular set of adding wheels upon which the addition was performed. Thus the upper part of the paper strip shown in Fig. 75, "P 1.37" means that $1.37 had been added upon the paid in adding wheels. The next line "O .54" means that $.54 had been added upon the paid out wheels, and so on. The slip will thus show all of the additions made during the day on the various accounts. Also part of the slip shows the total additions and subtractions automatically performed on the machine at the close of the day's work. Thus "C 47.25" means that the total taken at the close of the day by the sums added on the charge set of adding wheels is $47.25. The next line "P 162.34", indicates that the total paid in during the day is $162.34. The next line indicates that the total of the paid on account is $100. The next line "R 262.34", indicates the sum of the total paid in and the total paid on account during the day, or in other words, the total of the money received. The next line indicates the total paid out during the day and the last line "B 69.09", represents the balance between the sums received and the sums paid out.

It will of course be understood that as many of these extra type bars may be employed as are desired and that any letters, words or numbers may be represented in the type they carry that may be desired.

What I claim as new and desire to secure by Letters Patent is:

1. The combination of a set of number wheels and three sets of adding devices, means for automatically adding 9 to each of the number wheels and to each wheel of one of the sets of adding devices, means for subtractively transferring to said one set the total standing upon another of the sets to obtain the complement of said total, means for adding the said complementary total and the total standing upon a third set of adding devices, and means for obtaining the complement of the sum of such totals on said set of number wheels, whereby the difference may be taken between the totals standing upon two of such sets of adding devices.

2. The combination of three sets of adding devices, stops for said devices to stop them, when moving in the direction reverse to that of adding, on arriving at the zero position, means for automatically setting the wheels of one of said sets of adding devices to 9's, means for subtractively transferring to said set the total standing upon another of the sets to obtain the complement of said total, means for adding to said complementary total upon the first mentioned set the total standing upon the third set of adding devices, a set of number wheels, means for causing said wheels to be automatically set at 9's, and means for obtaining on said number wheels the complement of the sum of totals of the first set, whereby the difference may be taken between the totals standing upon two of such sets of adding devices.

3. The combination of three sets of adding devices, stops for said devices to stop them, when moving in the direction reverse to that of adding, on arriving at the zero position, means for automatically setting the wheels of one set to 9's, means for subtractively transferring to said set the total standing upon another of the sets to obtain the complement of said total, means for adding to such complementary total upon the first mentioned set the total standing upon the third set of adding devices adapted to be set at 9's by the above automatic setting means, a set of numeral devices and means for subtractively transferring to said set the complement of the sum of the totals standing on said first mentioned set of adding devices, whereby the condition of said set of numeral devices will represent the difference between the totals upon the second and third sets of adding devices.

4. The combination of a minuend set of adding devices, a subtrahend set of adding devices, and a third set of adding devices, means for automatically adding 9 to all wheels of the third set, a fourth set of devices, means for so controlling the fourth set that all of its wheels are automatically set at 9 by said automatic means, means for subtractively transferring to the third set the total of the minuend set to obtain the complement thereof, means for adding upon one of the sets the said complementary total upon the third set and the total of the subtrahend set, and means for transferring from such set to the fourth set the complement of the sum of such totals to obtain the difference between the minuend total and the subtrahend total.

5. The combination of four sets of adding devices, and means for automatically setting the wheels of two sets to 9's for subtractively transferring to one of the two sets the total of another of the sets to obtain the complement thereof, for adding to such complementary total the total of the third set, and for subtractively transferring the comple-

ment of the sum of such totals to the other of the first two sets, to obtain the difference between the totals of the second and third of said sets.

6. The combination of a minuend set of adding devices, a subtrahend set of adding devices, and two additional sets of adding devices, means for automatically and simultaneously setting both additional sets so that all the wheels of each set read 9, means for transferring to one of the additional sets the total of the minuend set to obtain the complement thereof, means for adding to such complementary total the total of the subtrahend set, and means for transferring from said additional set to the other additional set the complement of the sum of such totals to obtain the difference between the minuend total and the subtrahend total.

7. The combination of a minuend set of adding devices, a subtrahend set of adding devices, and two reversing sets of adding devices, stops for each set of adding devices, adapted to stop them, when moving in the direction reverse to that of adding, when such devices arrive at the zero point, operating means, means for connecting the operating means with both reversing sets to automatically move them in the adding direction to the point opposite to or the reverse of their zero position, means for then connecting the operating means also to the minuend set to move one of the reversing sets and the minuend set in the direction reverse to that of adding until the latter are stopped at their zero position, whereby the position of the adding devices of the reversing set will represent the complement of the minuend total, means for then connecting the operating means with the subtrahend set to move the latter in the direction reverse to that of adding until the latter are stopped at their zero position, means for then connecting the operating means with the same reversing set to move the reversing set in the adding direction to add the subtrahend total to the complementary total standing upon the reversing set, and means for connecting the operating means with said reversing set and also with the other reversing set while the latter is standing at the position opposite to or the reverse of the zero position, to move both of said sets in the reverse direction to that of adding until the first reversing set is stopped at its zero position, whereby the position of the second reversing set thus connected with the first reversing set will represent the difference between the totals originally standing upon the minuend and subtrahend sets.

8. The combination of a set of adding devices, stops for such devices to stop them, when moving in the direction reverse to that of adding, on arriving at the zero point, a set of numeral devices, means operated by the machine for automatically setting said numeral devices to a position opposite to or the reverse of zero, and common operating means adapted to connect the set of numeral devices, when in the position opposite to or the reverse of their zero position, with a set of adding devices, to move both sets in the direction reverse to that of adding until stopped by said stops, whereby the complement of the total of the set of adding devices will be represented upon the set of numeral devices.

9. The combination of a plurality of sets of adding devices exceeding two in number and means for mechanically connecting the sets for automatically transferring the totals from set to set in a predetermined order.

10. The combination of three sets of adding devices, a set of numeral wheels and actuators, automatically operated, and in a predetermined order for setting one set of adding devices and the set of numeral devices to a position in which all wheels thereof stand at 9, for subtracting from the said set of adding devices the total of another of the sets to obtain the complement of said total, for transferring to said complementary total the total of the third set, and for subtractively transferring from the first set to the set of numeral wheels the complement of the sum of such totals to obtain the difference between the totals of the second and third of said sets.

11. The combination of four sets of adding devices, operating means, and connections, adapted to be automatically operated, to connect the said operating means with one or more of the said sets automatically in such manner and predetermined order as to automatically move all wheels of one set to the 9 position to subtractively transfer to the 9's of said set the total standing upon another of said sets to obtain the complement thereof, to add to such complementary total upon the first mentioned set the total standing upon the third set of adding devices and then to obtain the complement of the sum of said totals upon another set, whereby the difference may be automatically taken between the totals standing upon two of said sets of adding devices.

12. The combination of a plurality of sets of adding devices exceeding two in number, stops for such devices to stop them when moving in the direction reverse to that of adding, on arriving at the zero point, operating means, connections, adapted to be automatically operated, to connect the said operating means with one or more of the said sets automatically in such manner and predetermined order as automatically to move one set to the position the reverse of their zero position and to move simultaneously said set and another set in the direction reverse to that of adding, until stopped by the stops

of the latter set, whereby the complement of the total of the second set will be set up in the first set; to move still another set in the direction reverse to that of adding until stopped by its stops and to move the first set an equal distance in the adding direction, whereby the total of the third set will be added to the complementary total on the first set; and to move another set to the position the reverse of their zero position, and to move simultaneously the said last mentioned set and the first set in the direction reverse to that of adding until stopped by the stops of the said first set, whereby, the complement of the sum of the totals on the first set will be transferred to the other set and will constitute the difference between the totals standing upon the second mentioned set and the third mentioned set.

13. The combination of a plurality of sets of adding devices exceeding two in number, stops for such devices to stop them, when moving in the direction reverse to that of adding, and arriving at the zero point, operating means, connections adapted to be automatically operated, to connect the said operating means with one or more of the said sets automatically in such manner and predetermined order as automatically to move one set to the position the reverse of their zero position and to move simultaneously said set and another set in the direction reverse to that of adding until stopped by the stops of the latter set, whereby the complement of the total of the second set will be set up in the first set; to move still another set in the direction reverse to that of adding until stopped by its stops and to move the first set an equal distance in the adding direction, whereby the total of the third set will be added to the complementary total on the first set; and to move another set to the position the reverse of their zero position and to move simultaneously the said last mentioned set and the first set in the direction reverse to that of adding until stopped by the said first set, whereby the complement of the sum of the totals on the first set will be transferred to the other set and will constitute the difference between the totals standing upon the second mentioned set and the third mentioned set.

14. The combination of a plurality of adding devices, means for taking the totals thereon, and controlling means for controlling the totaling means to take the totals in a predetermined order.

15. The combination of a plurality of adding devices, means for taking the totals thereon, means for adding the totals of different sets of the adding devices together and controlling means for controlling the total taking and total adding means, to cause the taking of the totals and the adding of the totals to be done in a predetermined order.

16. The combination of a plurality of sets of adding devices exceeding two in number, means for taking the totals thereon, means for subtracting the total of one set from the total of another set, and controlling means for controlling the total taking and the subtracting means, to cause the taking of totals, the subtracting and the taking of the total of the difference to be done in a prescribed order.

17. The combination of a plurality of sets of adding devices exceeding two in number, means for taking the totals thereon, means for adding the totals of different sets together, means for subtracting the total of one set from the total of another set, controlling means for controlling the total taking means, the adding of totals, the subtracting of totals and the taking of the totals of the resultant sum and difference, to cause such operations to be taken in a predetermined order.

18. The combination of a plurality of sets of adding devices exceeding two in number, means for taking the totals thereon, means for adding the totals of different sets together, means for subtracting the total of one set from the total of another set, controlling means for automatically controlling the total taking means, the adding of totals, the subtracting of totals and the taking of the totals of the resultant sum and difference, to cause such operations to be automatically taken in a predetermined order.

19. The combination of a set of numeral devices adapted to be held at the position the reverse of their zero position, means operated by the machine for automatically moving the numeral devices to said position, a set of adding devices, stops for said adding devices, to stop them, when moving in the direction the reverse of that of adding, on reaching their zero position, common operating means adapted to be connected simultaneously with the numeral devices and the adding devices, to move both sets until stopped by the stops of the adding devices and to be then disconnected from the numeral devices, and locking means for locking the numeral devices when thus released, whereby the total standing on the set of adding devices may be transferred to the numeral devices to obtain the complement thereof.

20. The combination of a plurality of sets of adding devices, common operating means, connections between said common operating means and each set of the adding devices adapted, when made operative, to connect the operating means with any one or more of the said sets to move them either way for

purposes of computation or indication, and a series of cams for controlling said connections.

21. The combination of a plurality of sets of adding devices, common operating means, connections between said common operating means and each set of the adding devices adapted, when made operative, to connect the operating means with any one or more of the said sets to move them either way for purposes of computation or indication, and a series of cams adapted to be automatically actuated, for making such connections operative in a predetermined order.

22. The combination of a set of numeral devices adapted to be set at the position opposite their zero position, a set of adding devices, stops to stop said adding devices, when moving in the direction reverse to that of adding, on reaching their zero position, operating means adapted to be connected with both the numeral devices and the adding devices to move the latter against their stops, means automatically operated for causing said operating means to set the numeral devices to the position opposite their zero positions, and means for controlling the connection between the operating means and the numeral and adding devices so that the numeral devices will be disconnected from the operating means in advance of the disconnection of the adding devices from such operating means.

23. The combination of a set of numeral devices, a set of adding devices, stops to stop said adding devices, when moving in the direction reverse to that of adding, on reaching their zero position, operating means adapted to be connected with the numeral devices to automatically move them to a position opposite their zero position, means for connecting said operating means with both the numeral devices and the adding devices to move the latter against their stops, and means automatically actuated for automatically controlling the connection between the operating means and the numeral and adding devices so that the numeral devices will be automatically disconnected from the operating means in advance of the disconnection of the adding devices with such operating means.

24. The combination of a set of numeral devices, a set of adding devices, stops to stop said adding devices, when moving in the direction reverse to that of adding, on reaching their zero position, operating means adapted to be connected with both the numeral devices and the adding devices to move the latter against their stops, and means for controlling the connection between the operating means and the numeral and adding devices so that the numeral devices will be disconnected from the operating means at a predetermined time in advance of the disconnection of the adding devices from such operating means.

25. In a machine of the class described, the combination with two accumulating devices, of means for setting one of said devices to a series of 9's, devices automatically operated for controlling said setting means, and means for subtractively transferring any total standing on the other of said devices to said first accumulating device.

26. In a machine of the class described, the combination of two accumulating devices, common operating devices therefor constructed to set one of said accumulating devices to a series of 9's, means for automatically controlling the common operating devices, devices for connecting said accumulating devices to said operating devices simultaneously, and connections whereby the extent of movement of said operating devices may be determined by the total standing on the other of said accumulating devices, thereby subtractively transferring said total to said one of the accumulating devices.

27. In a machine of the class described, the combination with a plurality of accumulating devices, and a main operating device therefor, of printing devices, and means for printing by said printing device the totals of all said accumulating devices separately solely by continued operations of said main operating device.

28. In a machine of the class described, the combination with a plurality of accumulating devices, and printing devices therefor, of a main operating device, a total controlling element manually settable, and means, controlled by said total controlling element but operated solely by continued operations of said main operating device, for causing the printing devices to print the totals of all said accumulating devices separately and in an automatic succession.

29. In combination, a plurality of registers having entries, a record, and means for automatically clearing said registers one after the other and for transferring their indications to said record.

30. In combination, a plurality of registers having entries, and mechanism for automatically bringing the registers into clearing relation and successively clearing the same.

31. In combination, a plurality of registers having entries, mechanism for automatically bringing the registers into clearing relation and successively clearing the same, and means for automatically recording the indications of said registers during decumulation.

32. In combination, a plurality of registers having entries and means for automati-

cally clearing the registers in a common record.

33. In combination, a plurality of registers and means for automatically clearing the registers in a common record.

34. In combination, a plurality of entry receiving devices, arranged to have numbers set up thereon and devices for automatically clearing the entry receiving devices in a common record.

35. The combination of a plurality of sets of adding devices exceeding three sets in number, stops for such devices to stop them and their operating means, when moving in the direction reverse to that of adding, on reaching their zero position, common operating means adapted to be connected with one or with two of said sets to move said set or sets either in the adding direction or in the reverse direction, and a differentially adjustable device for controlling said operating means whereby the difference may be automatically taken between the sum of the adding devices of one set and that represented by adding devices of another set.

36. The combination of a plurality of sets of adding devices, stops for such devices to stop them and their operating means when moving in the direction reverse to that of adding, on reaching their zero position, common operating means adapted to be connected with one or with two of said sets to move said set or sets either in the adding direction or in the reverse direction, yielding means for moving said common operating means a prescribed distance in one direction unless sooner stopped, means for positively returning said common operating means to their original position, and a differentially rotatably adjustable member for controlling said operating means whereby the difference may be taken between the sum represented by the adding devices of one set and that represented by the adding devices of another set.

37. The combination of a plurality of sets of adding devices, stops for such devices to stop them and their operating means, when moving in the direction reverse to that of adding, on reaching their zero position, common operating means adapted to be connected with one or with two of said sets to move said set or sets either in the adding direction or in the reverse direction, yielding means for moving said common operating means a prescribed distance in one direction unless sooner stopped, number-indicating devices adapted, when operated, to limit the movement of the corresponding yielding means in said direction, in accordance with the value of the number-indicating devices operated, means for positively returning said common operating means to their original position, whereby any sum may be added upon any set or sets of the adding devices, and a differentially adjustable member for controlling said operating means whereby the difference may be taken between the sum represented by the adding devices of one set and that represented by the adding devices of another set.

38. The combination of a plurality of sets of adding devices, stops for such devices to stop them and their operating means, when moving in the direction reverse to that of adding, on reaching their zero position, common operating means adapted to be connected with one or with two of said sets to move said set or sets either in the adding direction or in the reverse direction, number-indicating devices to control the movement of the adding devices in the adding direction, whereby any sum may be added upon any set or sets of the adding devices, and a manually and differentially adjustable member having a plurality of positions of adjustment for controlling said operating means whereby the difference may be taken between the sum represented by the adding devices of one set and that represented by the adding devices of another set.

39. In a calculating machine, the combination of a plurality of accumulators, means for controlling the amounts to be accumulated on said accumulators, means for controlling the taking of a total from said accumulators, means for locking the second said means in controlling position, and means operable for rendering the first said means ineffective when the second said means is locked in controlling position.

40. In combination, a plurality of sets of accumulating devices, means for operating the same, means for connecting any one of said sets of devices with said operating means, and mechanism for automatically controlling the sequence of connection of said sets of accumulating devices with the actuating means.

41. In combination, a plurality of registers, means for causing actuation of any register, and mechanism for automatically causing the actuation of said registers, in a predetermined sequence upon actuation of the first register in the sequence.

42. In a machine of the class described, a plurality of accounting devices, means for accumulating amounts thereon, a printing mechanism and means for automatically clearing said accounting devices and for transferring their indications to said printing mechanism in a definite order.

43. In a machine of the class described, a plurality of accounting devices, a printing mechanism, actuators for the accounting devices and printing mechanism, and means for automatically clearing said accounting devices and causing said actuators to transfer their indications to said printing mechanism in a predetermined manner.

44. In combination, a plurality of registers having entries, an operating mechanism, means actuated by said operating mechanism and a device operated as a preliminary to an operation of the machine and controlling said means whereby the means automatically brings the registers into clearing relation and successively clears the same.

45. In combination, a plurality of registers having entries, means operated as a preliminary to an operation of the machine, mechanism controlled by said means for automatically bringing the registers into clearing relation and successively clearing the same, and a printing mechanism for automatically recording indications of said registers during decumulation.

46. In a calculating machine, the combination of a plurality of number-keys, a printing device cooperative therewith for printing numbers, a plurality of shifting-keys, printing mechanism cooperative with said shifting-keys for printing identifying signs in conjunction with the numbers printed and a special key operatively connected with said shifting-keys and the printing mechanism thereof for printing a special sign in conjunction with the numbers printed by the said printing device for printing the said special sign in lieu of said identifying signs.

47. In a calculating machine, the combination of a plurality of number-keys, a printing device cooperative therewith for printing numbers, a plurality of shifting-keys, printing mechanism cooperative with said shifting-keys for printing identifying signs in conjunction with the numbers printed, and a special key operatively connected with said shifting-keys and the printing mechanism thereof for printing a special sign in conjunction with the numbers printed by the said printing device, for printing said special sign in lieu of the said identifying signs, and for rendering inoperative any of said shifting-keys which has been rendered operative.

48. In a calculating machine, the combination of a set of main accumulators, a set of auxiliary accumulators, means for actuating both of said sets and normally disengaged therefrom, camming means normally in a position whereby said main accumulators are moved into operative relation with the actuating means, means for shifting said camming means to a position wherein said auxiliary accumulators will be moved into operative relation with the actuating means, and means cooperating with the shifting means for printing an identifying sign when said shifting means has been operated.

49. In a calculating machine, the combination of a set of main accumulators, a set of auxiliary accumulators, means for actuating both of said sets and normally disengaged therefrom, manipulative means for controlling the movement of said actuating means whereby to control the entry of items in either of said sets of accumulators, printing means for printing on record material the items entered in said accumulators, camming means normally in a position to move said set of main accumulators into operative relation with the actuating means, means for shifting said camming means whereby to move the latter to a position into which said auxiliary accumulators will be moved into operative relation with the actuating means, and printing means cooperating with the shifting means for printing an identifying sign when said shifting means has been operated as an accompaniment to the printing of the items entered.

50. In a calculating machine, the combination of a main accumulator, an auxiliary accumulator, actuators therefor, means operating normally to place said actuators in operative relation to said main accumulator, means whereby said actuators may be operatively disassociated from said main accumulator and placed in operative relation to said auxiliary accumulator, means for automatically printing a record of the total on the auxiliary accumulator, and means operated as an incident to the production of the record for printing an identifying sign in connection with the record of said auxiliary accumulator.

51. In a calculating machine, the combination of a main accumulator, an auxiliary accumulator, an actuating device, means operating normally to place said actuating device in operative relation to said main accumulator, means whereby said actuating device may be operatively disassociated from said main accumulator and placed in operative relation to said auxiliary accumulator, means for automatically printing a record of the total on the auxiliary accumulator, means operated as an incident to the productions of the record for printing an identifying sign in connection with the record of said auxiliary accumulator, and means for automatically returning said accumulators to normal relationship with said actuating device.

52. In combination, a plurality of registers, mechanism for automatically bringing the registers into clearing relation in uninterrupted sequence and successively clearing the same, and means for automatically and in continuous succession recording the indications of said registers during clearing.

53. In combination, a plurality of entry receiving devices, manipulative means for controlling entries entered therein, means for selecting the registers for operation in any desired order, and devices operated in

a positive and uninterrupted sequence for automatically clearing the entry receiving devices in a common record.

54. In a machine of the class described, the combination of a plurality of accounting devices, a printing mechanism, actuators for the accounting devices and printing mechanism, means for automatically clearing the accounting devices, and means for operating the printing mechanism continuously and in a predetermined manner to print the amounts as they are cleared from the accounting devices.

In testimony whereof, I have signed my name to this specification.

ISAAC S. DEMENT.

CERTIFICATE OF CORRECTION.

Patent No. 1,641,126. Granted August 30, 1927, to

ISAAC S. DEMENT.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 11, line 112, for the word "from" read "frame"; page 13, line 62, for the word "described" read "desired"; page 19, lines 95, 96 and 97, strike out the words "adapted to be set at 9's by the above automatic setting means" and insert the same to follow after the word "devices" in line 97; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 18th day of October, A. D. 1927.

M. J. Moore,
Acting Commissioner of Patents.

Seal.