July 20, 1937. R. L. MULLER 2,087,542

ACCOUNTING MACHINE

Filed Dec. 28, 1925 16 Sheets-Sheet 1

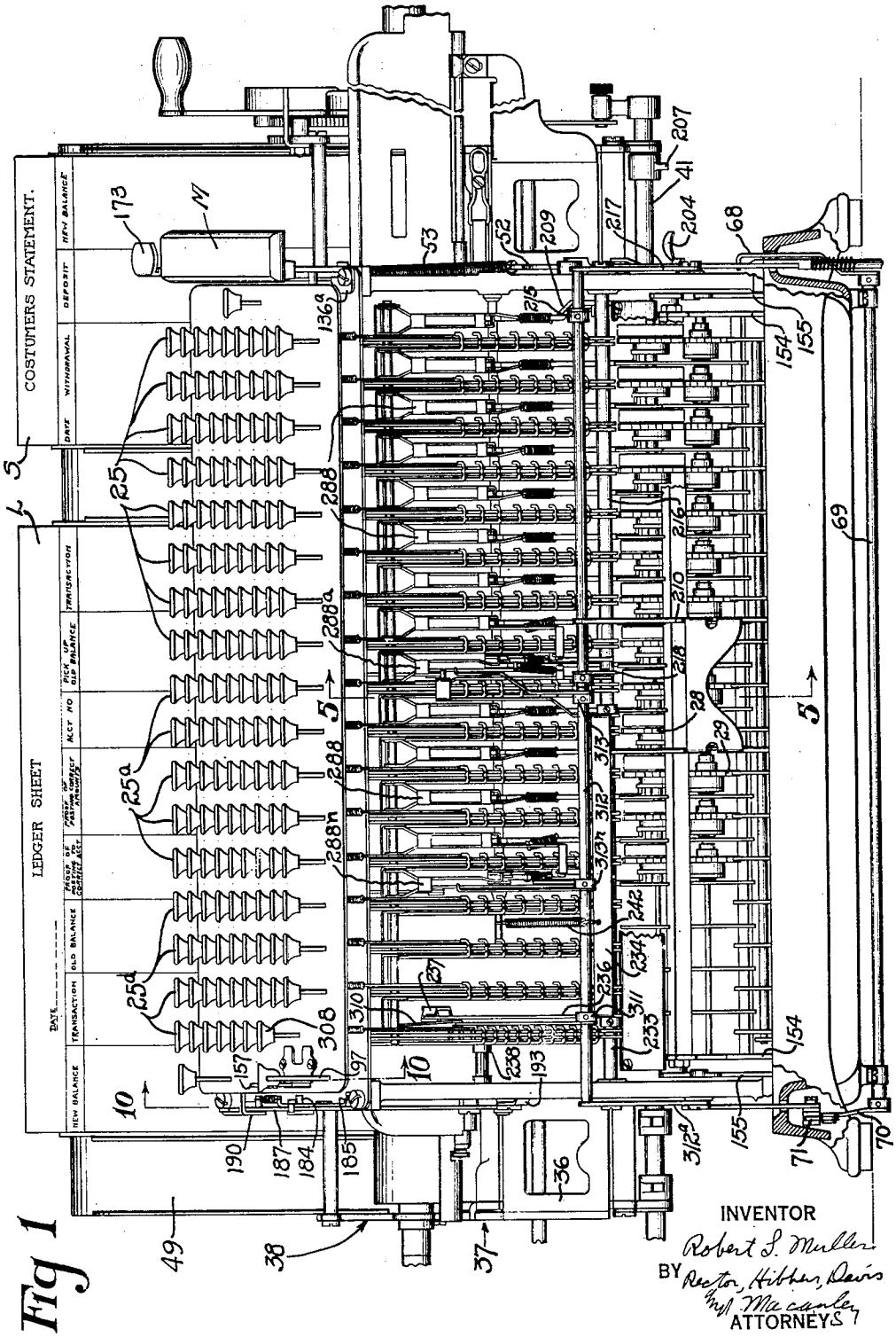


Fig 1

July 20, 1937. R. L. MULLER 2,087,542

ACCOUNTING MACHINE

Filed Dec. 28, 1925 16 Sheets-Sheet 2

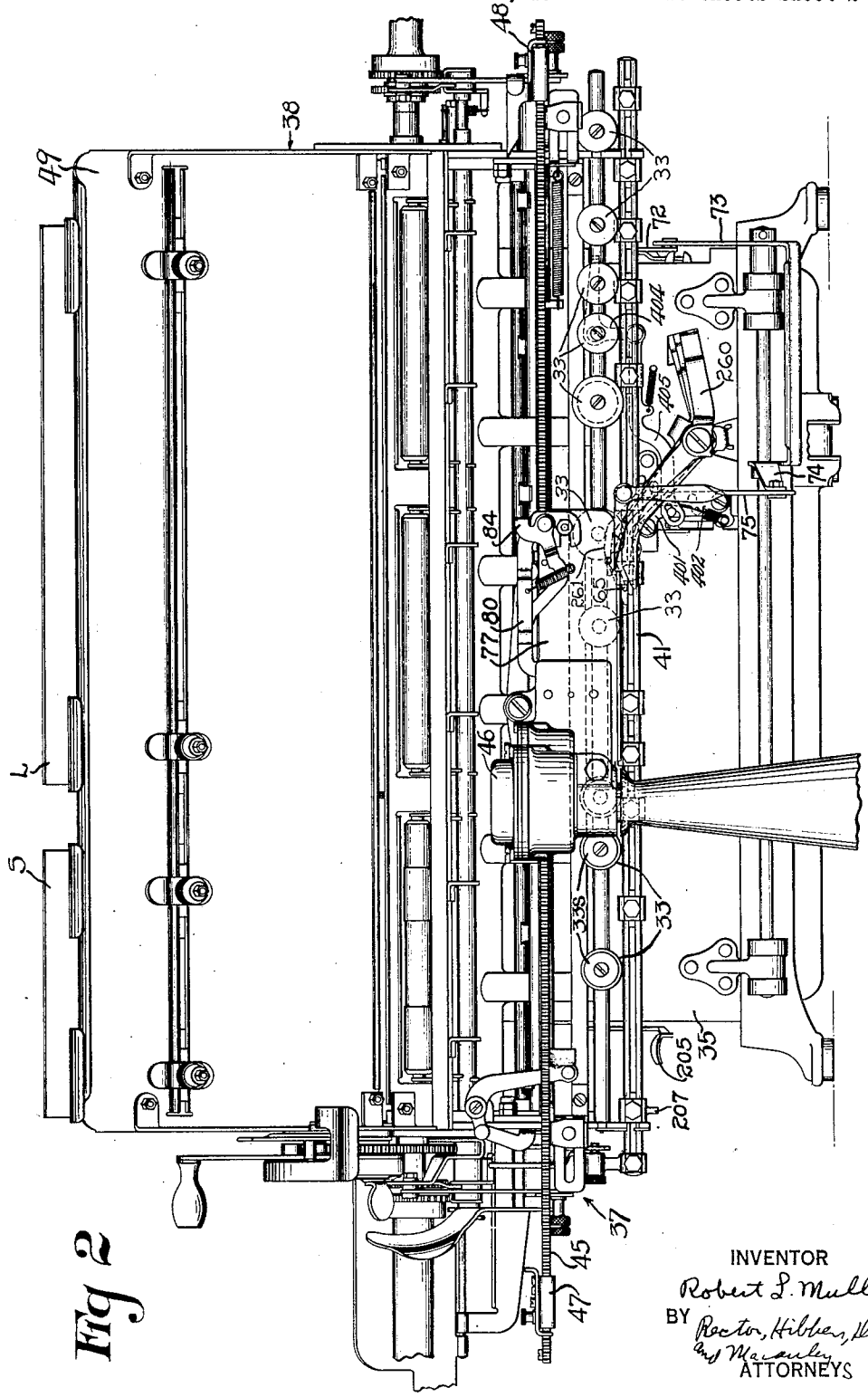


Fig 2

INVENTOR
Robert L. Muller
BY Rector, Hibben, Davis and Macauley
ATTORNEYS

July 20, 1937. R. L. MULLER 2,087,542

ACCOUNTING MACHINE

Filed Dec. 28, 1925 16 Sheets-Sheet 3

Fig 3

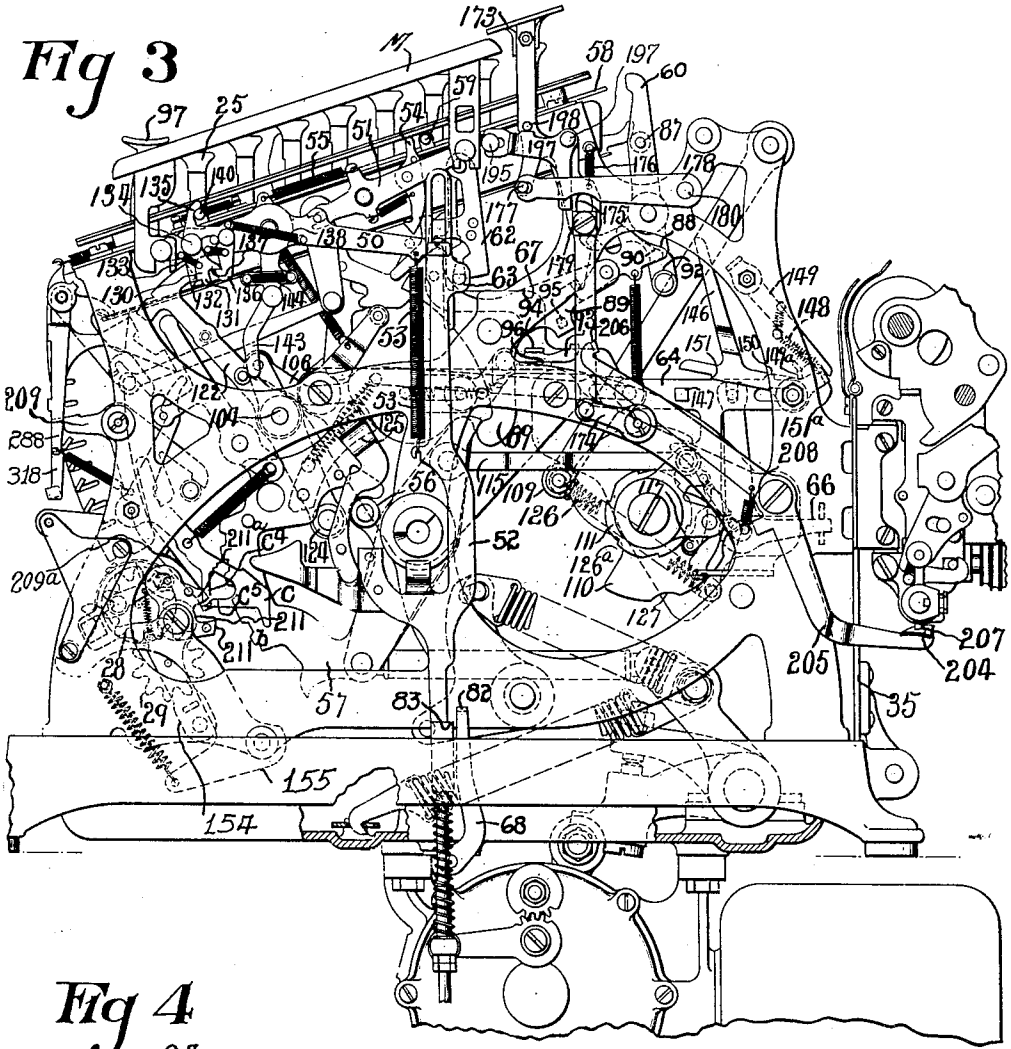
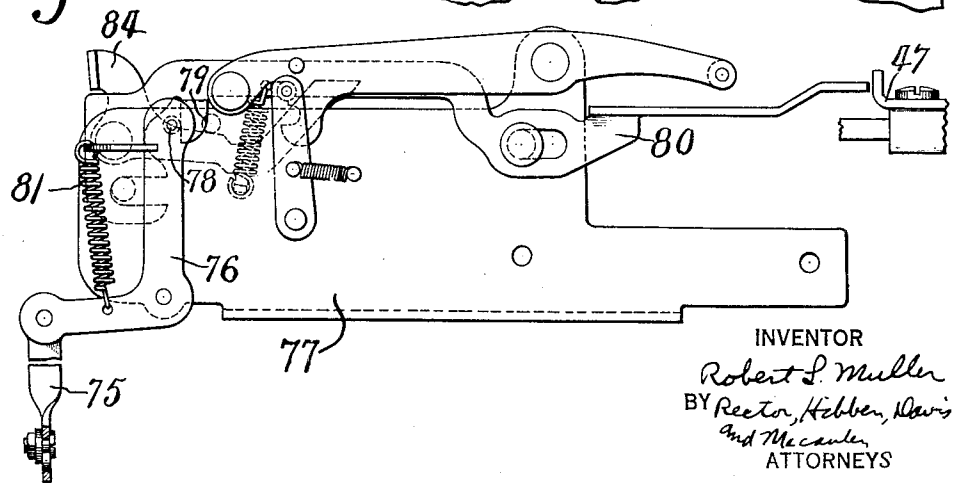


Fig 4



INVENTOR
Robert L. Muller
BY Reeter, Hibben, Davis and Mccauley
ATTORNEYS

July 20, 1937. R. L. MULLER 2,087,542

ACCOUNTING MACHINE

Filed Dec. 28, 1925 16 Sheets-Sheet 4

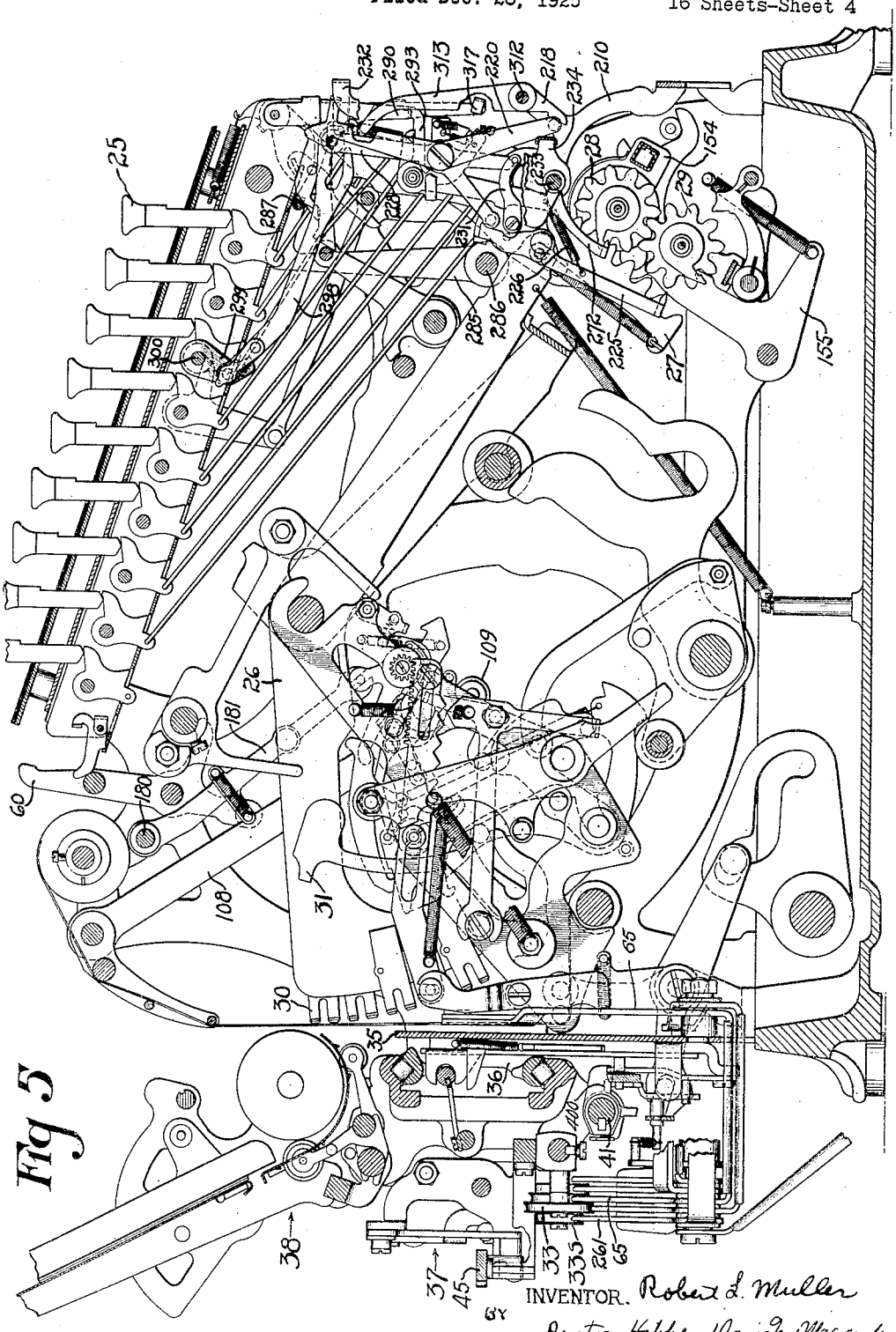


Fig 5

INVENTOR. Robert L. Muller

Rector, Hibben, Davis & Macauley

ATTORNEYS

July 20, 1937. R. L. MULLER 2,087,542

ACCOUNTING MACHINE

Filed Dec. 28, 1925 16 Sheets-Sheet 5

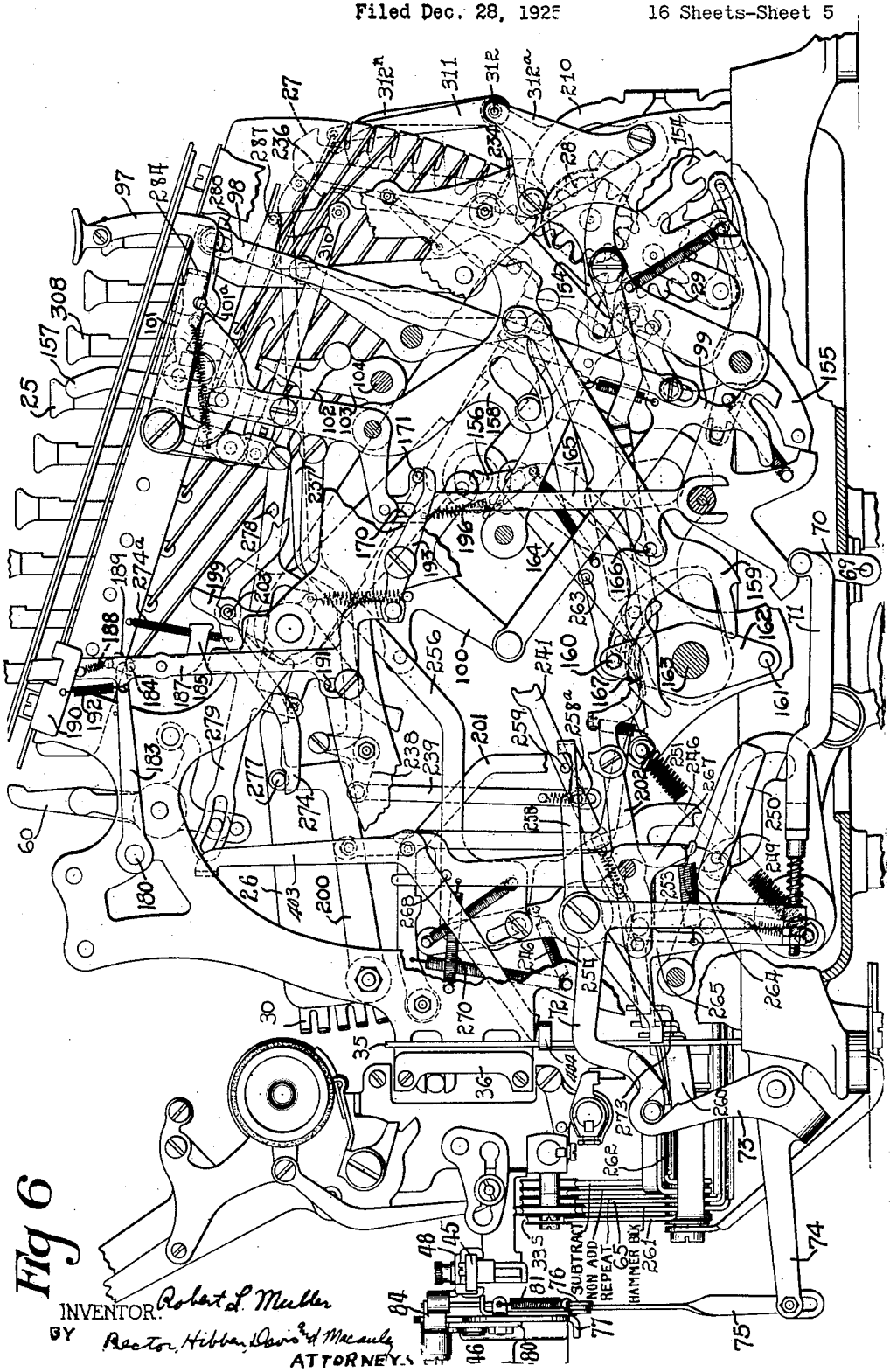


Fig 6

INVENTOR. Robert L. Muller

BY Rector, Hibben, Davis & Macauley

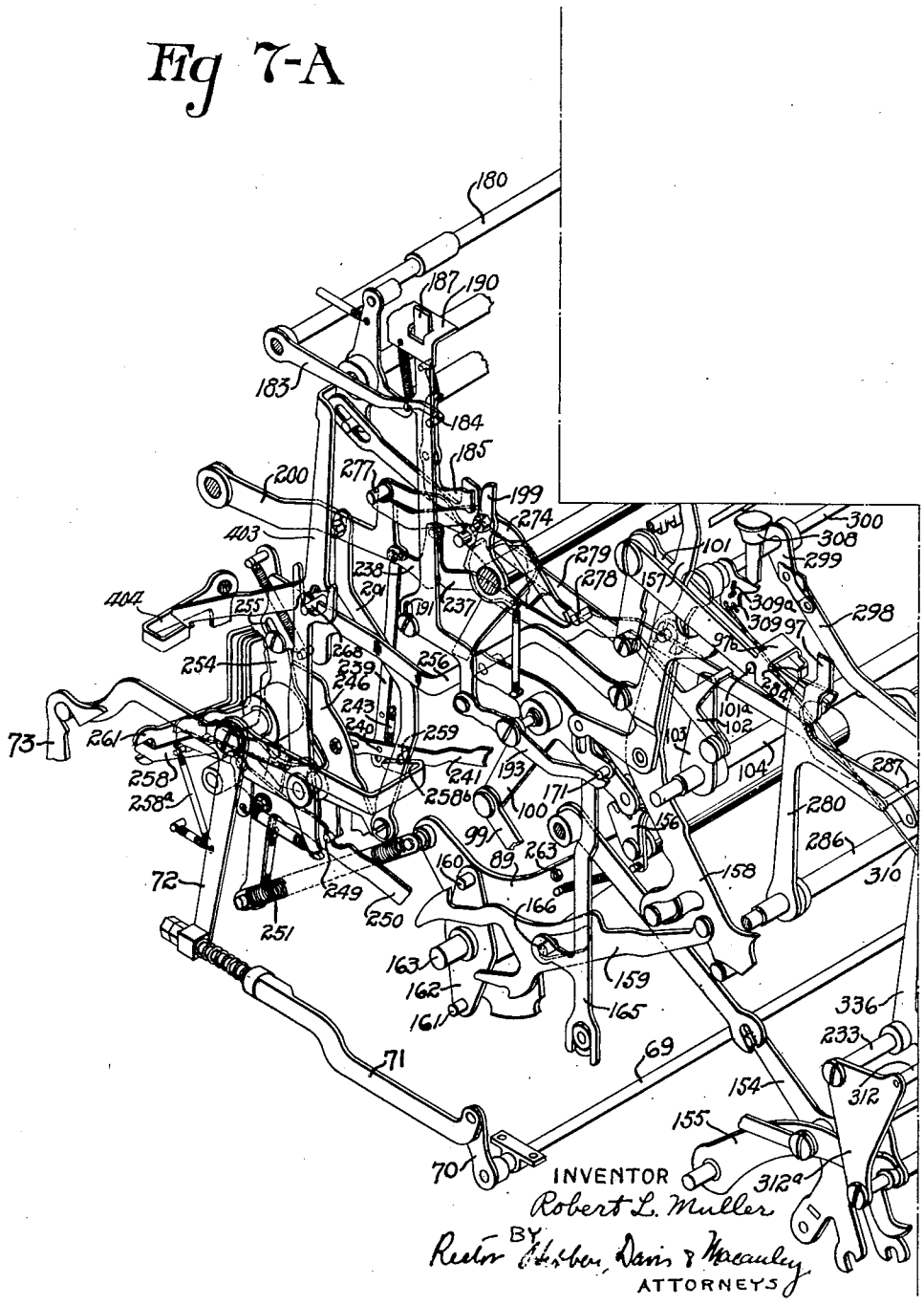
ATTORNEYS

July 20, 1937. R. L. MULLER 2,087,542

ACCOUNTING MACHINE

Filed Dec. 28, 1925 16 Sheets-Sheet 6

Fig 7-A



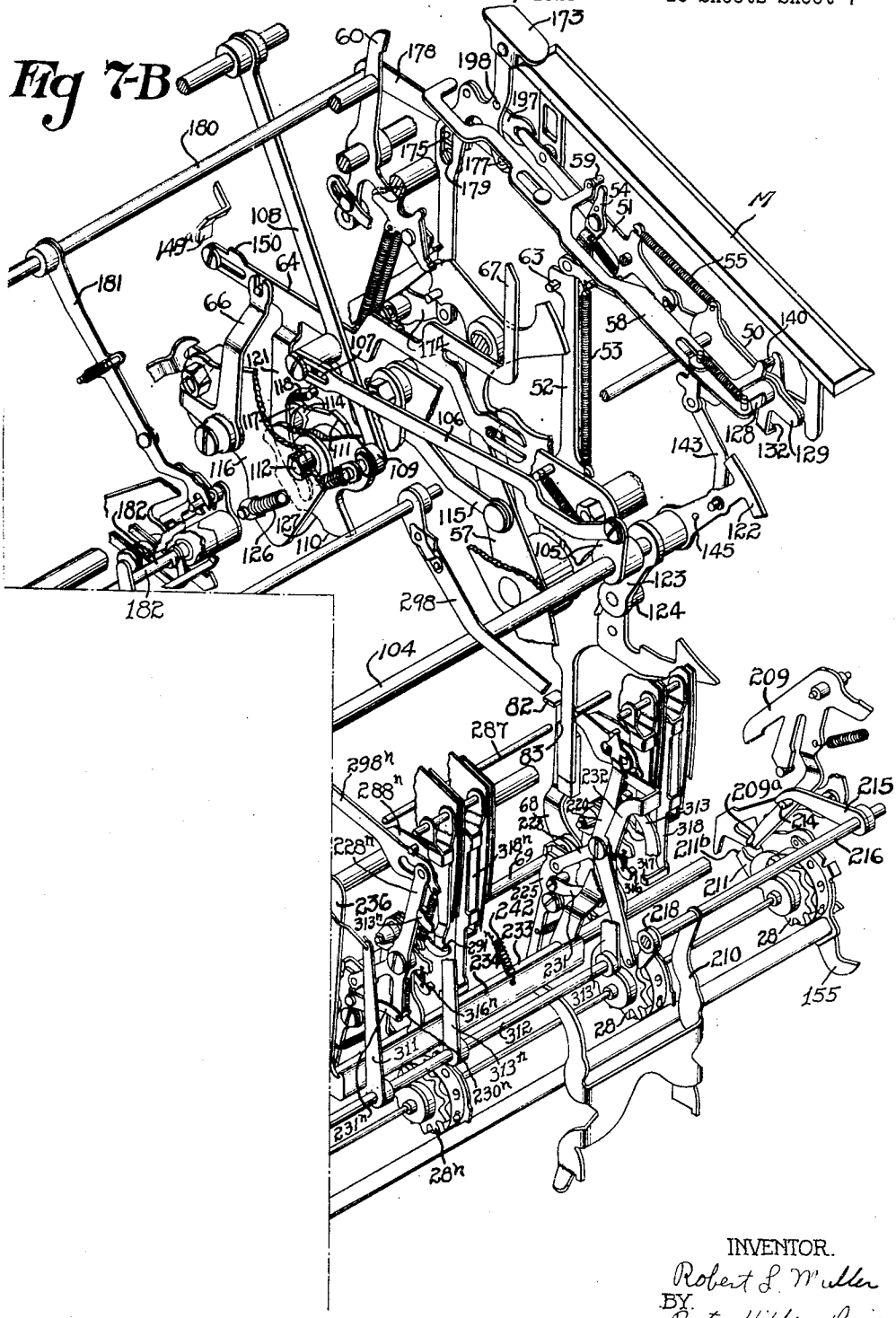
INVENTOR
Robert L. Muller
BY Rector, Hibben, Davis & Macauley
ATTORNEYS

July 20, 1937. R. L. MULLER 2,087,542

ACCOUNTING MACHINE

Filed Dec. 28, 1925 16 Sheets-Sheet 7

Fig 7-B



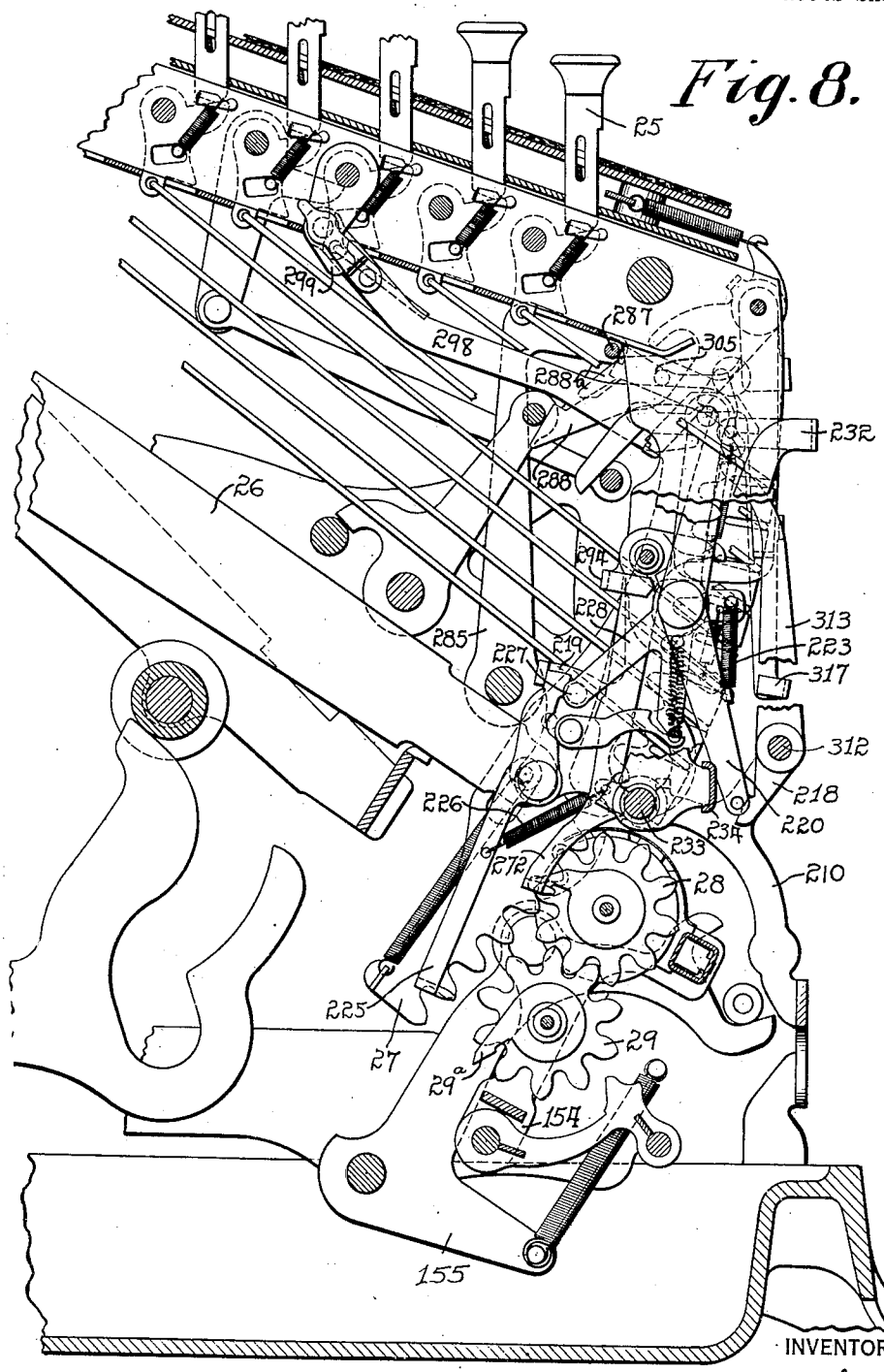
INVENTOR.
Robert L. Muller
BY
Dexter Hibben, Davis & McCauley
ATTORNEYS

July 20, 1937. R. L. MULLER 2,087,542

ACCOUNTING MACHINE

Filed Dec. 28, 1925 16 Sheets-Sheet 8

Fig. 8.



INVENTOR
Robert L. Muller
BY Rector, Hibben, Davis and Macauley
ATTORNEYS

July 20, 1937. R. L. MULLER 2,087,542

ACCOUNTING MACHINE

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Fig 9

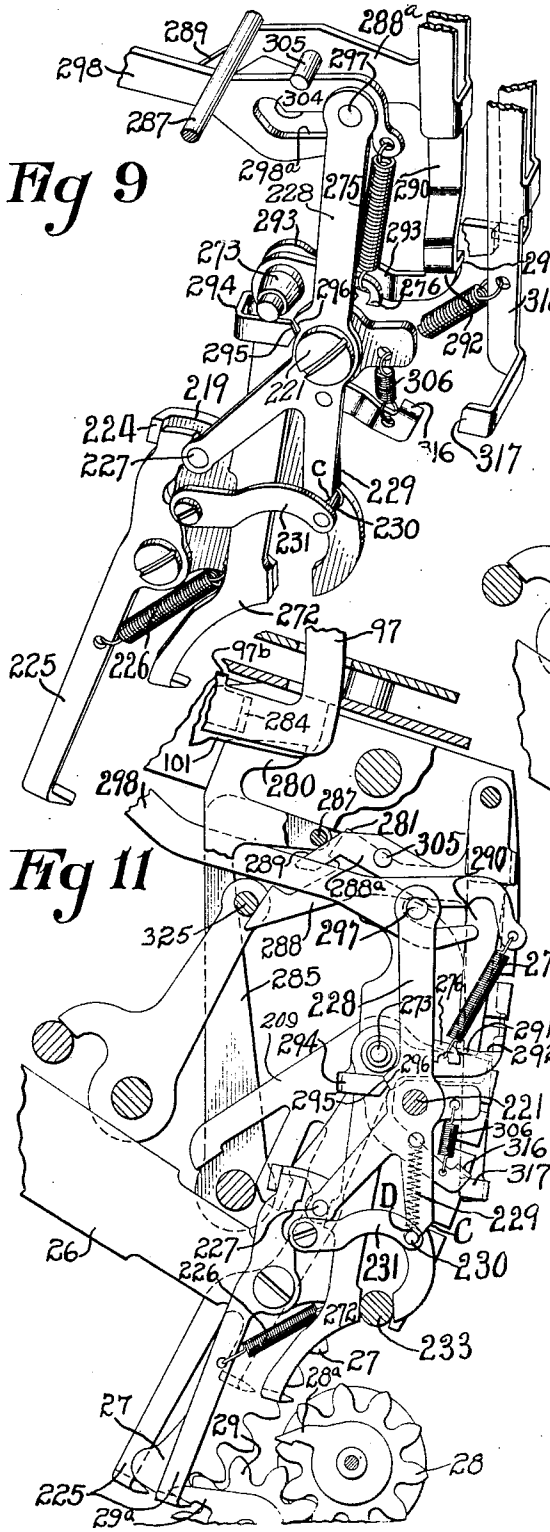


Fig 10

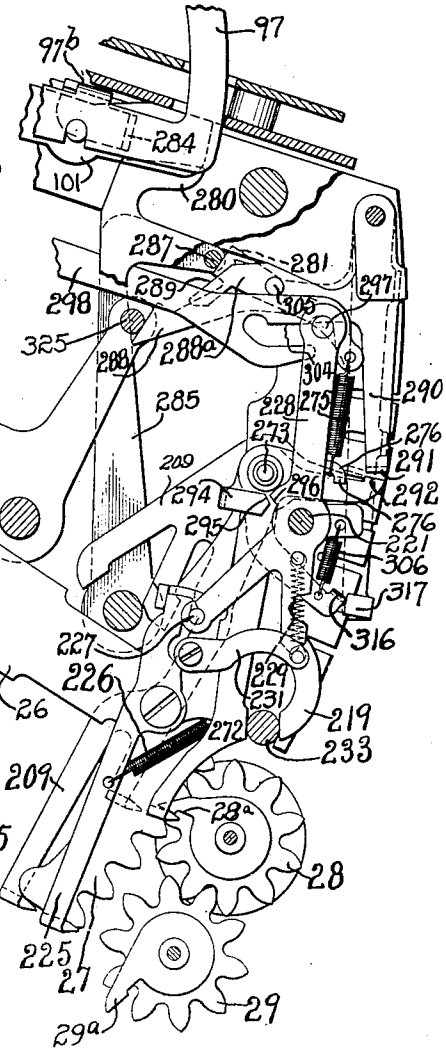


Fig 11

INVENTOR

Robert L. Muller

BY Rector, Hibben, Davis and Macauley

ATTORNEYS

July 20, 1937. R. L. MULLER 2,087,542

ACCOUNTING MACHINE

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Fig 12

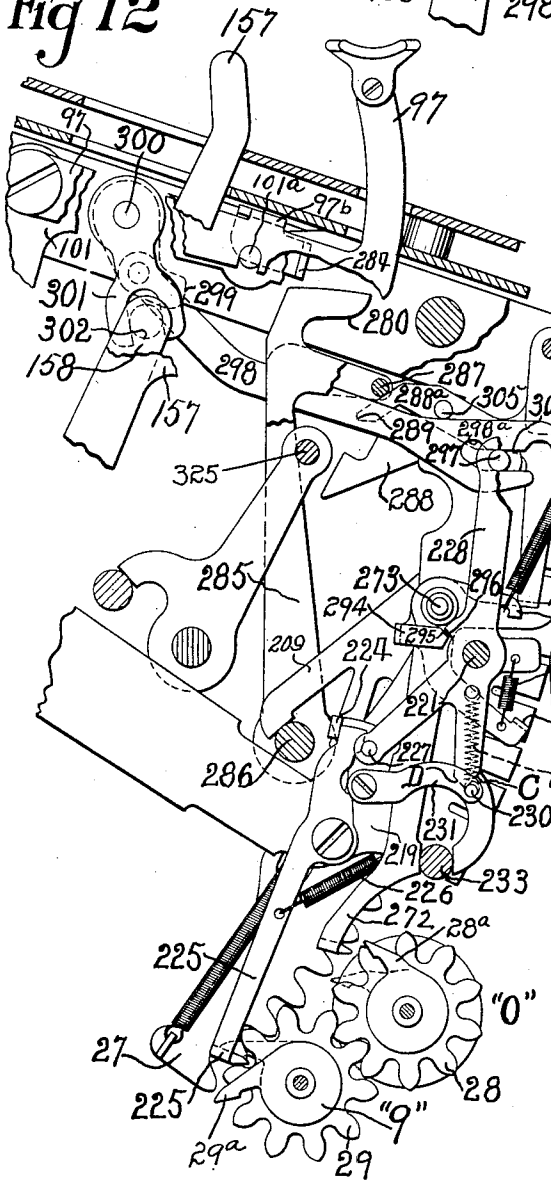


Fig 13

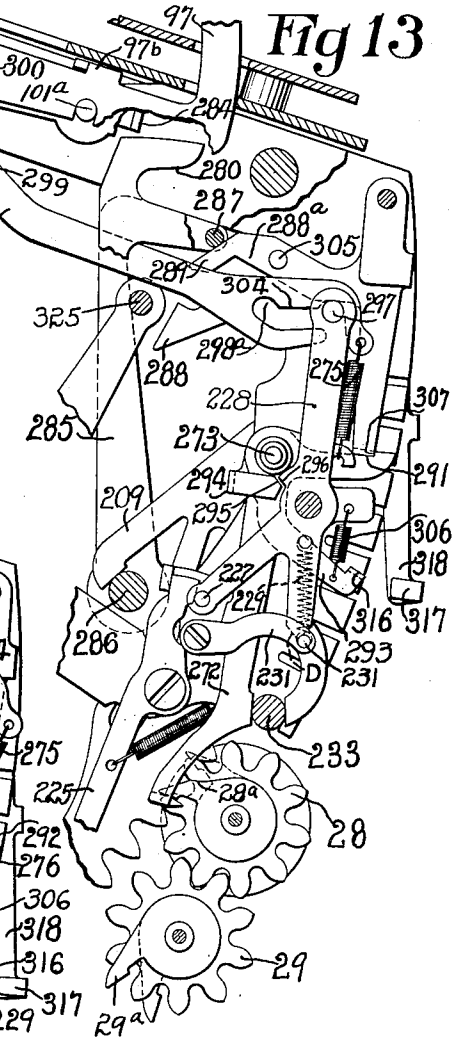
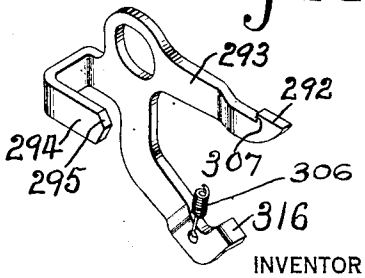


Fig 14



INVENTOR

Robert L. Muller

BY Rector, Hibben, Davis, and Macauley

ATTORNEYS

July 20, 1937. R. L. MULLER 2,087,542

ACCOUNTING MACHINE

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Fig 16

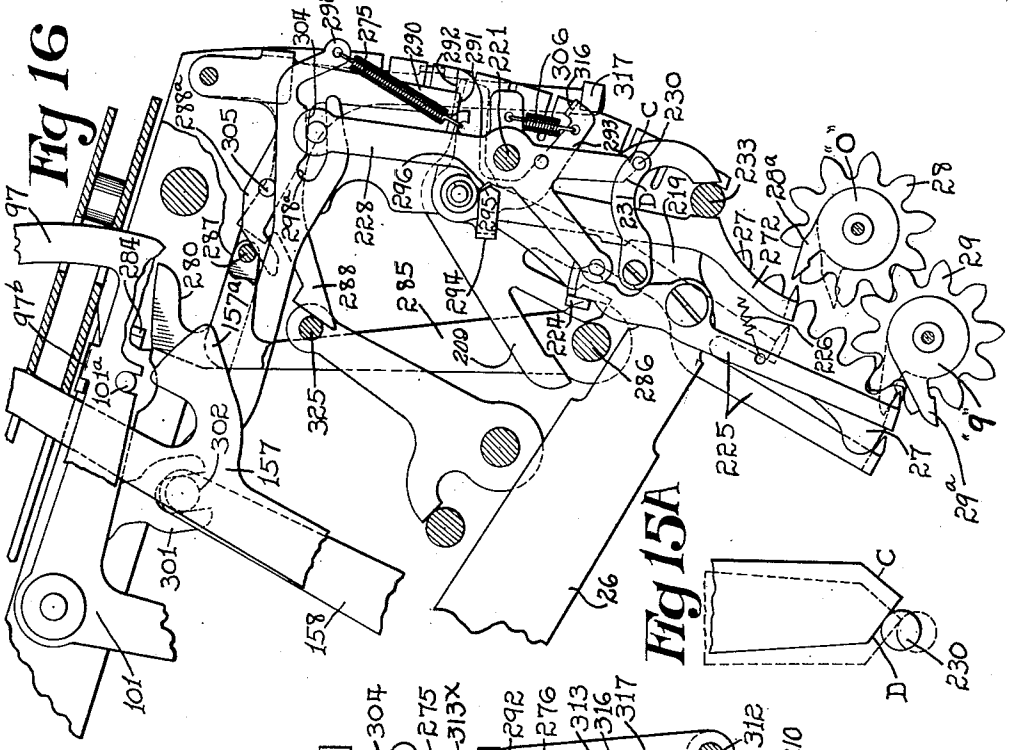
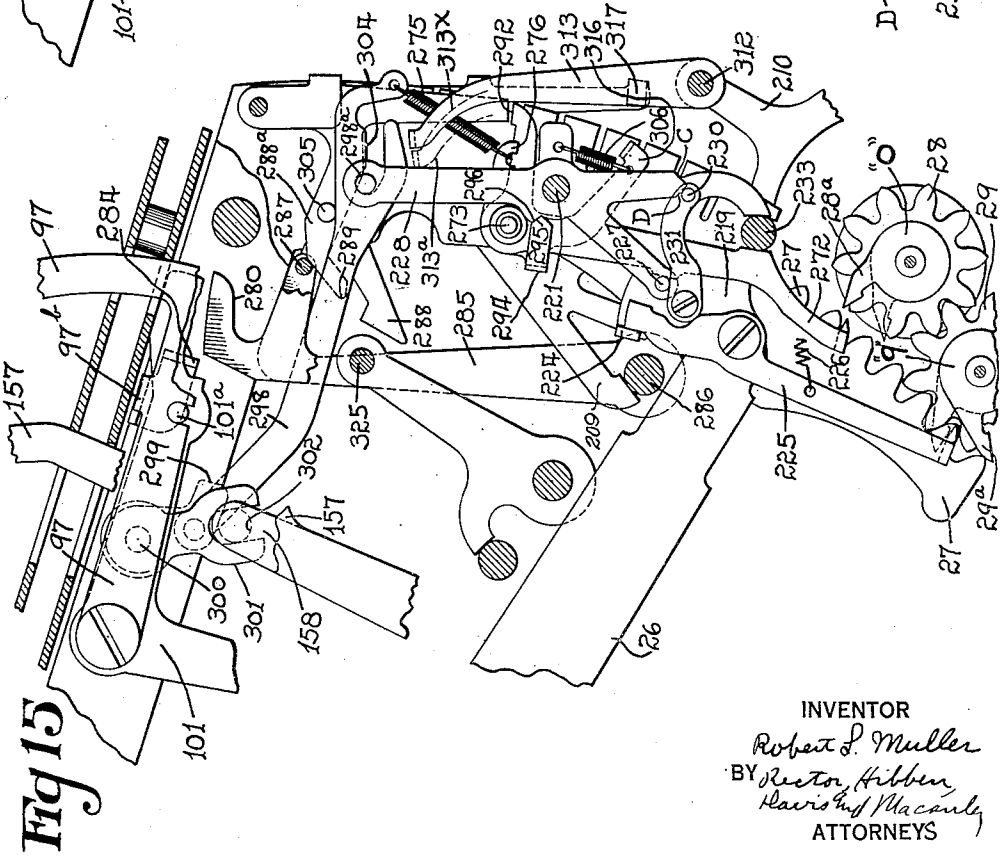


Fig 15A

Fig 15



INVENTOR
Robert L. Muller
BY Rector, Hibben, Davis & Macauley
ATTORNEYS

July 20, 1937. R. L. MULLER 2,087,542

ACCOUNTING MACHINE

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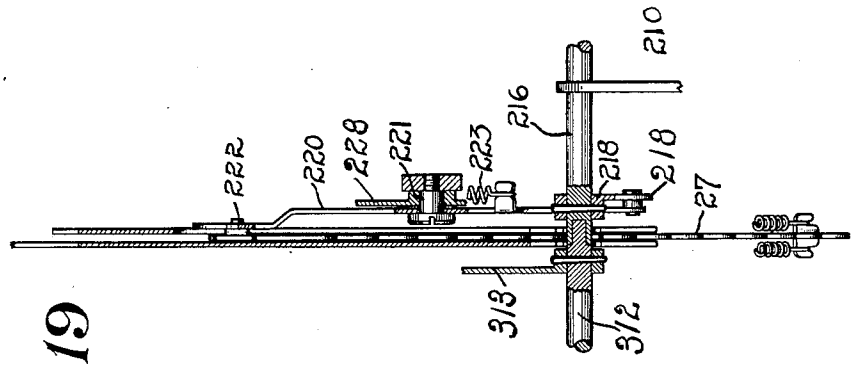


Fig 19

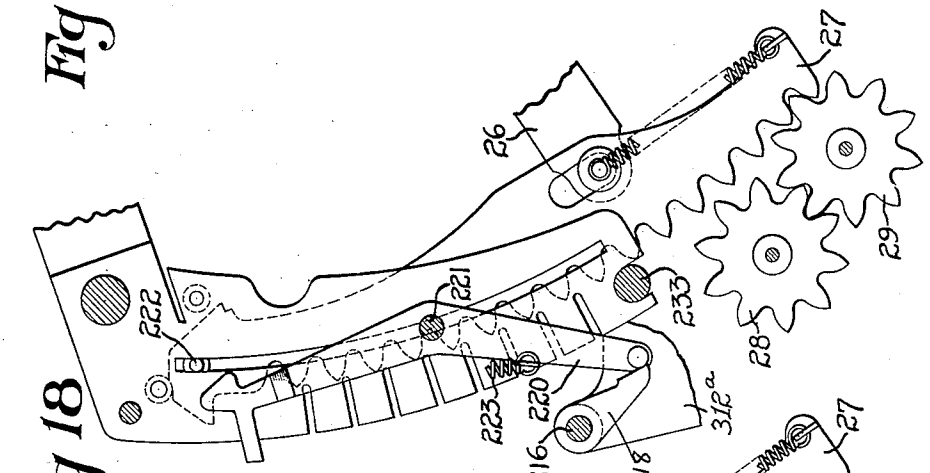


Fig 18

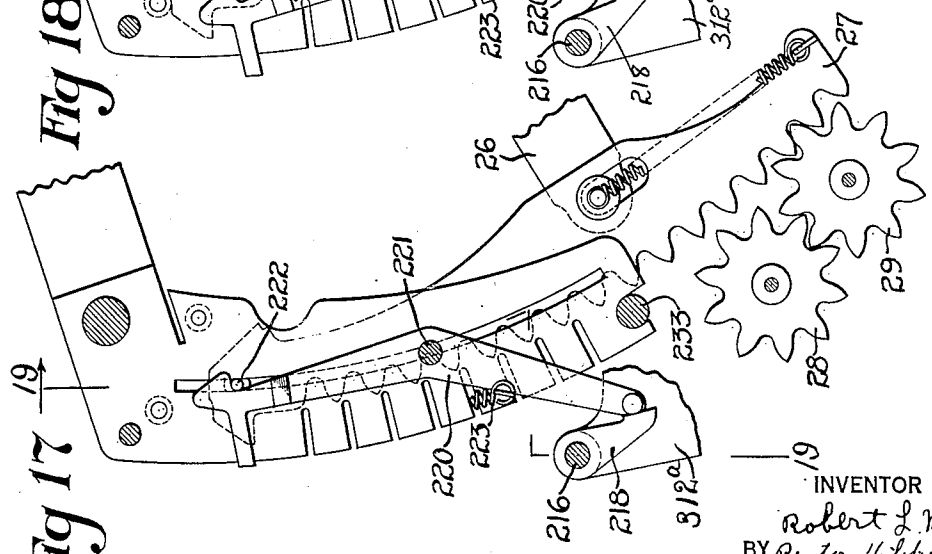


Fig 17

19

19

INVENTOR

Robert L. Muller

BY Rector, Hibben, Davis and Macaulay

ATTORNEYS

July 20, 1937. R. L. MULLER 2,087,542

ACCOUNTING MACHINE

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Fig. 20

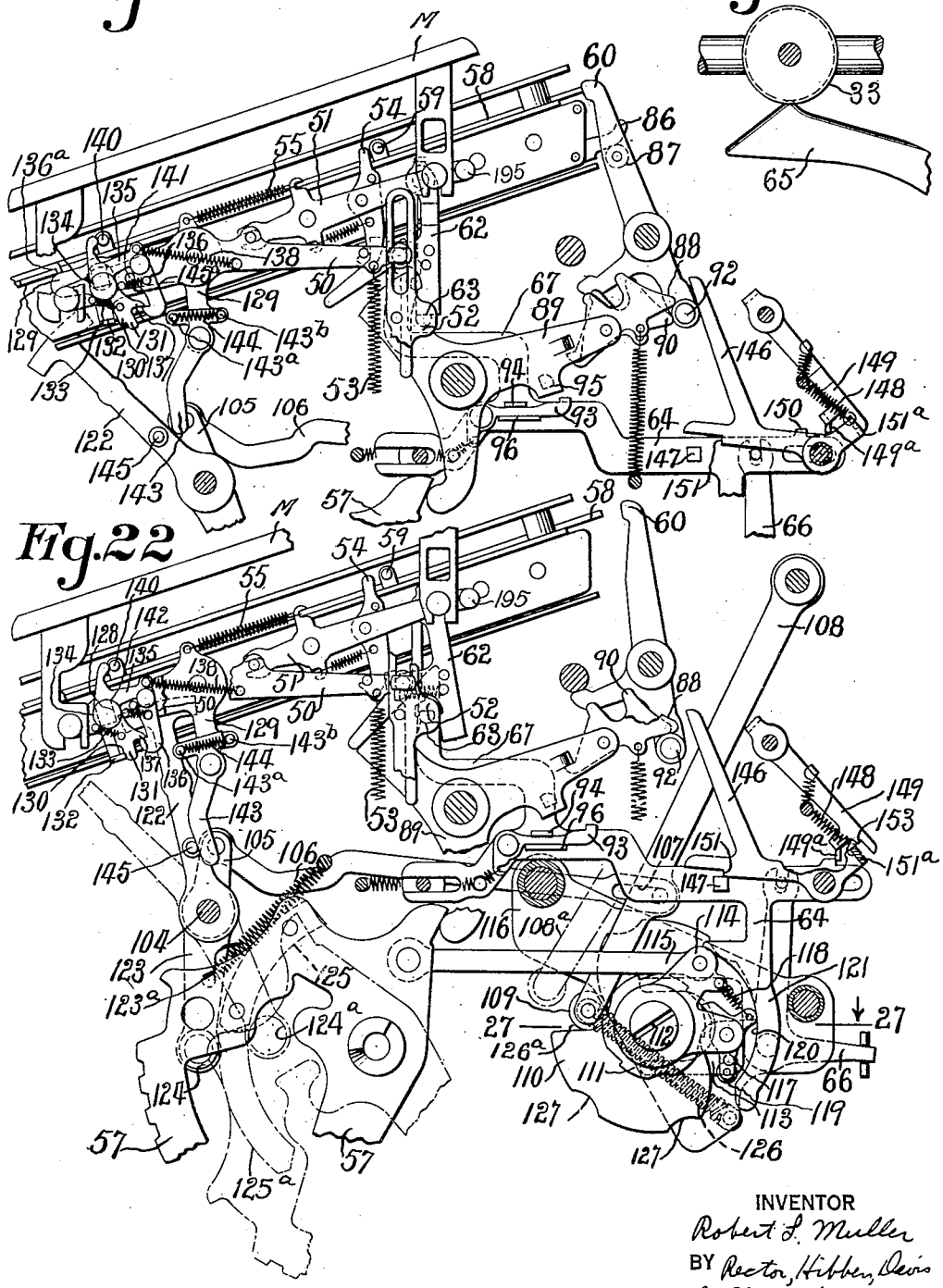


Fig. 21

Fig. 22

INVENTOR
Robert L. Muller
BY Rector, Hibben, Davis & McCauley
ATTORNEYS.

July 20, 1937. R. L. MULLER 2,087,542

ACCOUNTING MACHINE

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Fig 23

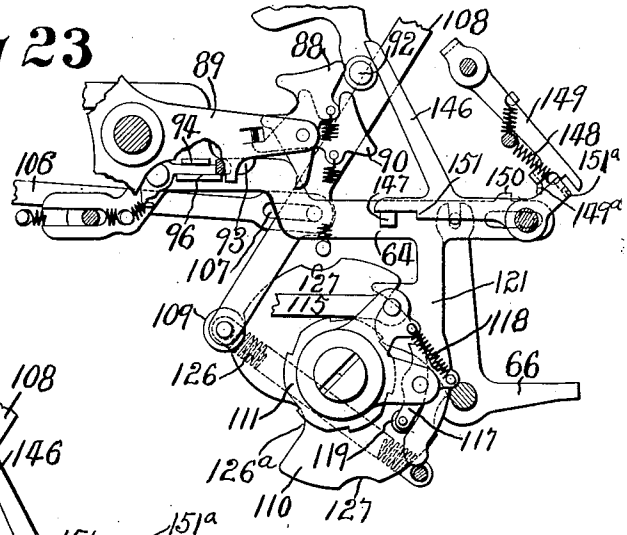


Fig 24

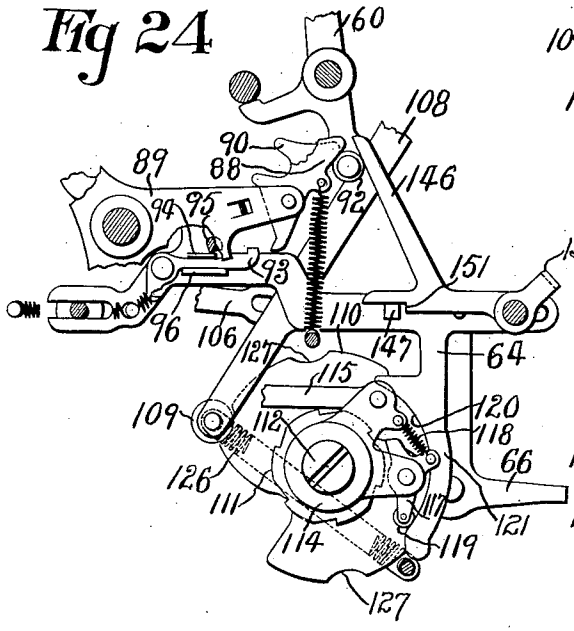


Fig 25

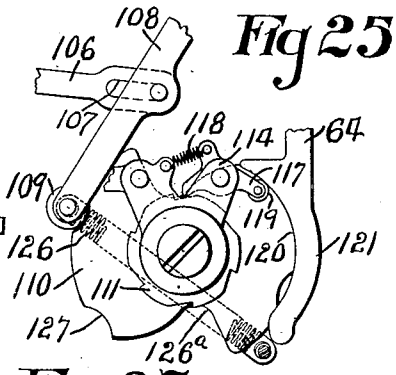


Fig 27

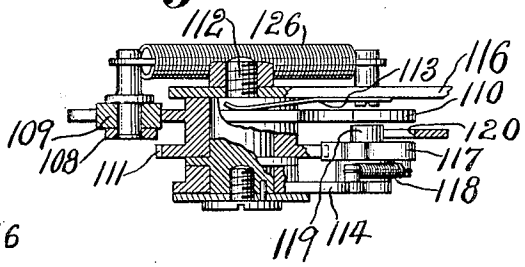
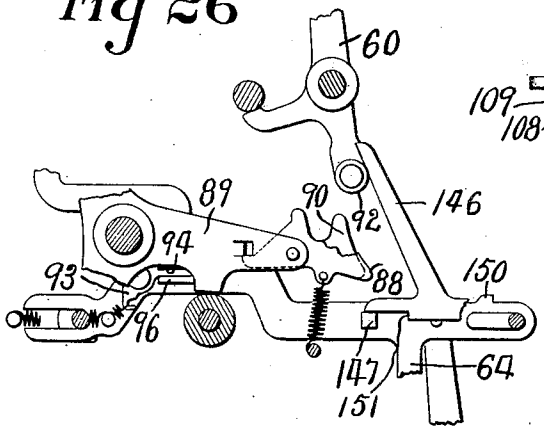


Fig 26



INVENTOR
Robert L. Muller
BY Rector, Hibben, Davis and Macauley
ATTORNEYS.

July 20, 1937. R. L. MULLER 2,087,542

ACCOUNTING MACHINE

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Fig 28

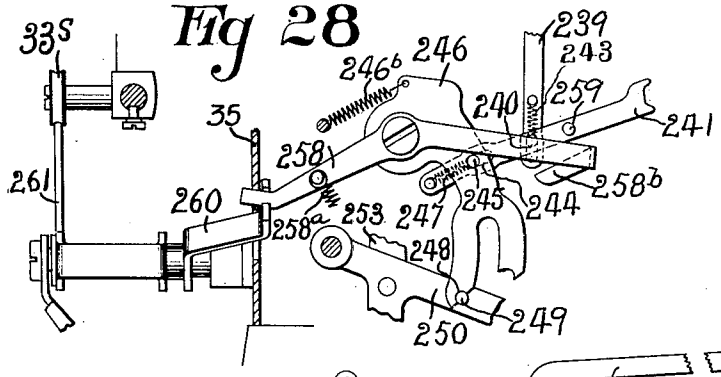


Fig 29

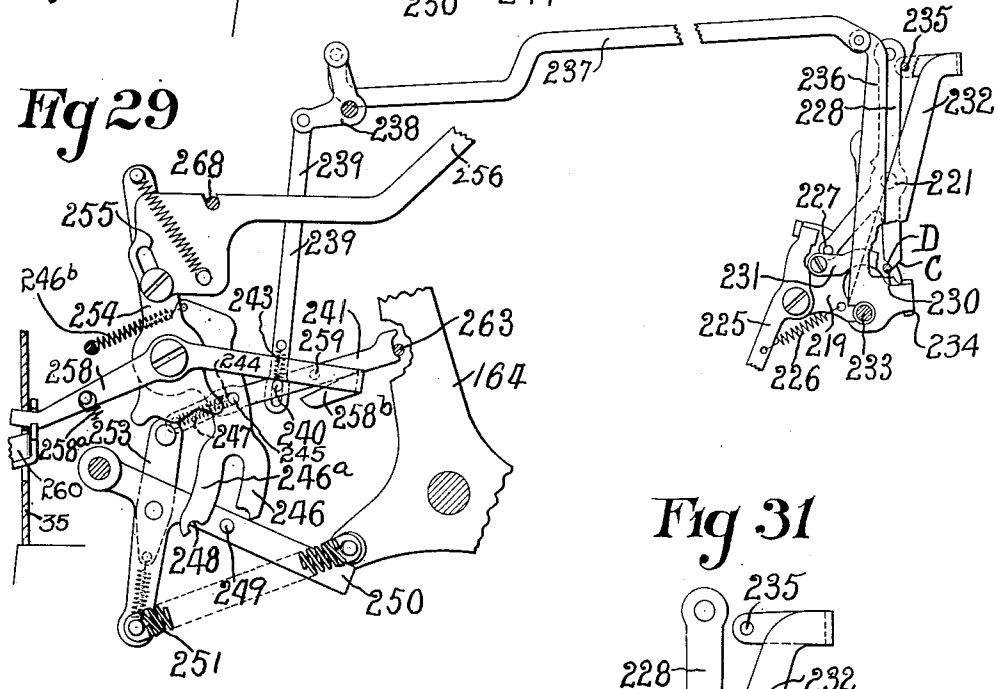


Fig 31

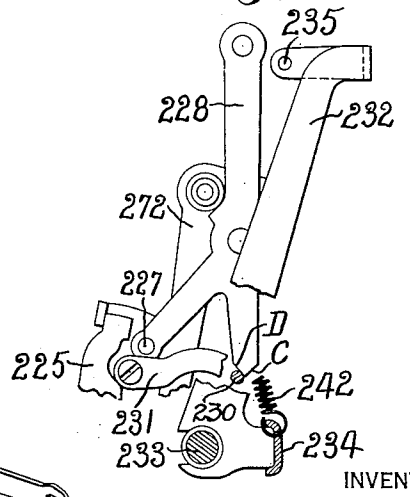
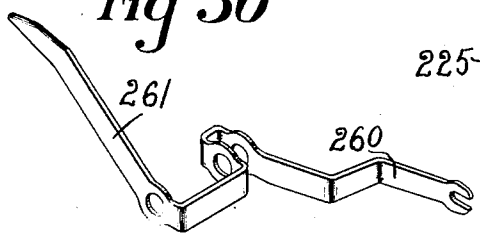


Fig 30



INVENTOR
Robert L. Muller
BY Rector, Hibben, Davis and Macauley
ATTORNEYS.

July 20, 1937. R. L. MULLER 2,087,542

ACCOUNTING MACHINE

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Fig 32

LEDGER SHEET

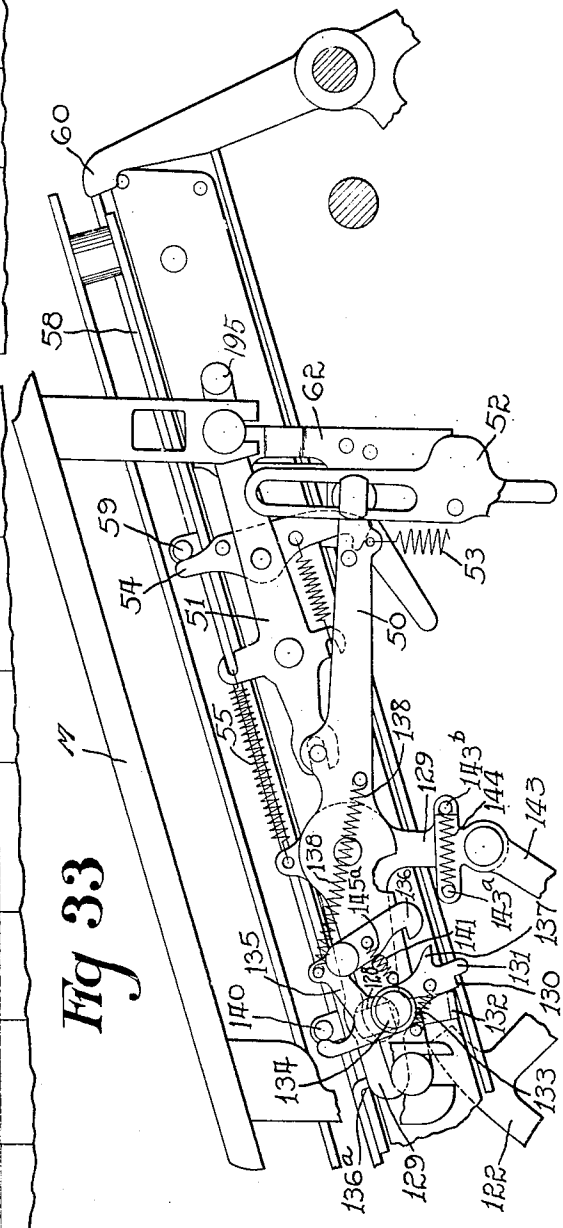
	NEW BALANCE	DATE 7th	TRANSACTION	8th OLD BALANCE	PROOF OF POSTING TO CORRECT ACCT.	9th PROOF OF POSTING CORRECT AMOUNTS	ACCT. NO.	1st PICK UP OLD BAL.	2nd TRANSACTION
1	900.00 BAL		400.00 –	500.00 –		.00 BAL	123	500.00	400.00
2	100.00 BAL		400.00	500.00 –		.00 BAL	123	500.00	400.00 –
3	100.00 CR		600.00	500.00 –		.00 BAL	123	500.00	600.00 –
4	900.00 BAL		400.00 –	500.00 –		999,640.00 CR	123	500.00	400.00
5	900.00 BAL		400.00 –	500.00 –		.00 BAL	123	500.00	400.00
6	100.00 BAL		400.00	500.00 –		360.00 CR	123	500.00	400.00 –
7	900.00 BAL		400.00 –	500.00 –	5	.00 CR	123	500.00	400.00

5

COSTUMERS STATEMENT.

DATE	3rd WITHDRAWAL	4th DEPOSIT.	5th NEW BALANCE.
DEC 14 '25		400.00	900.00 BAL
DEC 14 '25	400.00		100.00 BAL
DEC 14 '25	600.00		100.00 CR
DEC 14 '25		400.00	900.00 BAL
DEC 14 '25		400.00	900.00 BAL
DEC 14 '25	400.00		100.00 BAL
DEC 14 '25		400.00	900.00 BAL

Fig 33



INVENTOR
Robert L. Muller
BY Rector, Hibben, Davis and Macauley
ATTORNEYS

Patented July 20, 1937

2,087,542

UNITED STATES PATENT OFFICE

2,087,542

ACCOUNTING MACHINE

Robert L. Muller, Detroit, Mich., assignor to Burroughs Adding Machine Company, a corporation of Michigan

Application December 28, 1925, Serial No. 78,028

95 Claims. (Cl. 235—60)

This invention relates to improvements in accounting machines.

It relates particularly to improvements that will make an accounting machine more automatic and that will enable the work of an operator to be automatically proven. One of the main uses of the machine is in savings banks and while it may be used for a wide variety of other purposes, it will, for purposes of convenience, be described as it is used in a savings bank.

In posting bank ledgers, the customer's ledger sheet is placed in a machine and the old balance is entered and printed in the "old balance" column which is usually at the left hand side of the sheet. This old balance is obtained by the operator for entry by reading it from the ledger sheet, the old balance being the new balance of the previous entry. After the old balance is entered, the "transaction" items are entered, such items consisting of deposits or withdrawals. These items are read from deposit slips or checks or other memoranda. Generally speaking, the deposits are entered during one operation and the checks or withdrawals during another operation. After the entry of a "transaction", the machine is operated to take a new balance and print it on the ledger sheet, this balance being usually printed at the right hand side of the sheet.

The customer must also be provided with a statement and this statement should show the withdrawals and deposits as well as the customer's new balance. In the machine illustrated, this customer's statement is placed to the right of the ledger sheet and, provision is made so that, after the operator has entered the old balance and the transaction item, the machine continues to operate automatically to print the date of the entry on the customer's statement, to print the transaction item in its proper column on the statement, and to take a new balance and print it in the proper column on the statement. This completes the customer's statement but the machine continues to operate automatically to return the paper carriage across the machine to print the new balance on the left hand side of the ledger sheet so that there is a record of the new balance on the ledger sheet, and to move the paper carriage to the first proof column and automatically stop it there.

It will be readily appreciated that the customer's balance may not always be a positive balance. If it is a negative balance the registering mechanism must be in a different condition in order that the correct negative total may be printed. However, it is not desired that the work shall be slowed up by stopping the machine and requiring that the operator condition it for taking a negative total and, consequently, provision has been made for automatically conditioning the registering mechanism to take a total corresponding to the sign of the total actually in the register. In other words, the conditioning of the registering mechanism for the taking of a total is controlled automatically by the character of the total in the register.

Machines that will perform the posting work described are made very accurate and if an error occurs it is usually due to a mistake on the part of the operator. For example, an operator may read the old balance wrong which will result in a wrong number being entered in the machine. Or he may read the old balance correctly but depress the wrong key. Likewise, he may read the deposits or the withdrawals incorrectly or make a mistake in entering them.

In order to prove the work in the present machine the operator is required to enter the old balance and the transactions a second time, the second entry being a reverse entry, that is, if the transaction was a positive item such as a deposit, it is entered the second time as a negative item. In the operation of the machine the first reverse entry is the entry of a transaction and this is entered in the first proof column. After this reverse entry the carriage automatically tabulates to a new proof column where the old balance is entered a second time, but as of the opposite sign to the first entry. In making these entries the operator is required to read the items from the papers from which he first obtained them. It is rare that the same mistake is made twice and hence the second entry is an effective check on the accuracy of the work.

In posting ledgers the operator also enters the number of the customer's account in a different section of the machine and this number is printed on the ledger sheet. It is desirable to check the accuracy of this phase of the work as well as that in connection with the entering of items.

In order to prove the correctness of the account number of the customer the operator must enter it a second time in a reverse manner, such entry being made after the old balance is entered a second time.

The paper carriage then tabulates to a final proof position where the operator must depress the total key and give the machine a stroke of operation. If the entries have been correct the total key can be depressed and the printing

mechanism will print (.00 Bal.) thereby showing that the registering mechanism is clear. However, if a mistake has been made, the operator cannot depress the total key which immediately signals that an error has occurred. In order to clear the machine to correct the error a special key must be manipulated. When this is done and when the total key is depressed, the machine may be operated.

The general object of the invention is, therefore, to provide an improved automatic accounting machine.

Another object is to provide an improved means for automatically taking a total in a machine of the class described.

A further object is to provide a machine that will automatically condition itself for the taking of a positive or of a negative total, such conditioning depending upon the character of the total actually in the machine.

Another object is to provide an improved accounting machine in which the correctness of the work of an operator may be proven by locking certain parts of the machine against operation if an error has occurred.

A still further object is to provide certain mechanisms for insuring that the machine will be operated in the correct manner.

Other objects and advantages will appear from the following specification and drawings.

An embodiment of the invention is shown in the accompanying drawings in which;

Fig. 1 is the front elevation of an adding and listing machine of the well known Burroughs type, having applied thereto the improvements constituting the subject matter of my present invention; Fig. 2 is a rear elevation of the machine showing the tabulating equipment of the type exemplified in Rinsche Patent No. 1,580,534, April 13, 1926 and also showing control rollers and connections, such as those disclosed in my Patent No. 1,397,774, granted November 22, 1921 for controlling the performance of certain registering and recording functions of the machine; Fig. 3 is a right hand side elevation of the machine with the motor drive and paper carriage broken away; Fig. 4 is a detail front view of parts at the back of machine operated by devices on the carriage for controlling the motor release bar while the carriage is being returned to its extreme left hand columnar position; Fig. 5 is a transverse section through the machine as on the line 5—5 of Fig. 1; Fig. 6 is a left hand side elevation of the machine; Figs. 7A and 7B, taken together, form a perspective, skeletonized view of the various mechanisms having to do with the improvements embodying my invention; Fig. 8 is an enlarged sectional view through the forward part of the machine, being taken substantially on the same line as Fig. 5; Fig. 9 is a fragmentary perspective view of the mechanism controlled by the amount registering section to lock the total key against depression when this registering section is not clear; Figs. 10, 11, 12, 13, 15, and 16 are sectional views taken on different planes through the forward part of the machine, the section being mainly taken alongside of the mechanism shown in Fig. 9 and as on the line 5—5 of Fig. 1 while the upper part is a section taken on a plane through the left hand end of the keyboard as on the line 10—10 of Fig. 1, and these views show the various parts in the different positions which they assume, as will be described later; Fig. 14 is a perspective view of a latch forming one of the parts of the locking mechanism; Fig. 15A is a fragmentary view of a certain arm and pin illustrated in two positions; Figs. 17 and 18 are detail sectional views of the units rack and register wheels for the account number section of the machine and show the device for taking care of the "fugitive one", the parts being in normal position in Fig. 17 and in moved position in Fig. 18; Fig. 19 is a section taken on the line 19—19 of Fig. 17; Fig. 20 is a detail side view of the motor control mechanism and also is a partial section showing the repeat mechanism in the condition which it assumes near the end of the cycle of operation in which the number keys are released without disabling the motor repeat mechanism; Fig. 21 is a fragmentary rear view of the "repeat" roller and part of the arm coacting therewith; Fig. 22 is a view similar to Fig. 20 but shows certain cycling mechanism and the parts in normal condition; Figs. 23 and 24 are sectional views showing the cycling and repeat mechanisms in different conditions; Fig. 25 is another side view of the cycling mechanism and shows the parts in a still different condition; Fig. 26 is a sectional view showing the repeat mechanism in a condition different from those illustrated in Figs. 23 and 24; Fig. 27 is a horizontal section through the cycling mechanism, as on the line 27—27 of Fig. 22; Fig. 28 is a detail fragmentary view showing in normal condition part of the mechanism for controlling the rocking of the registering mechanism to subtracting condition when an overdraft is in the registering mechanism and the carriage is in a certain columnar position; Fig. 29 is a sectional view showing the same and additional parts in moved condition; Fig. 30 is a perspective view of the piece operated by the special roller shown in Fig. 28; Fig. 31 is an enlarged view of certain parts also shown in Fig. 29; Fig. 32 illustrates examples of work adapted to be performed by the machine, and Fig. 33 is a side view of the motor touch bar and connections.

The invention is shown applied to the well known Burroughs adding and listing machine, but it is to be understood that it is not necessarily limited in its application to said machine.

General machine features

Items are indexed in the machine by means of numeral or amount keys 25 and 25*a* (Fig. 1). They control the extents of movement of actuator levers 26 (Fig. 6) which carry at their forward ends the customary segmental actuator racks. Mounted for connection to the actuators are two sets of register pinions, one set 28 being called the add pinions, and the other set 29 being the subtract pinions. The pinions of the two sets mesh with one another so that items entered in one set are entered as complements in the other set. The two sets will be referred to, generally, as a registering mechanism. At their rear ends the actuator levers carry the segmental series of type 30 (Fig. 5) which are given percussive or printing blows by the usual hammers 31 which constitute a part of the printing mechanism of the machine as shown in Fig. 5. In the machine illustrated in Fig. 1, the first eight banks of keys 25 are the amount keys upon which the amounts are to be entered, the next five banks of keys 25*a* are the account number keys and are employed to set up the customers' account numbers, and the remaining four banks of keys 25*d* are employed for setting up the dates as is customary in this type of machine.

The registering mechanism is of that type more fully disclosed in Rinsche Patent No. 1,172,484 granted Feb. 22, 1916, and to which reference may be had for more detailed description. It will be noted, by referring to Fig. 1, that there are registering wheels **28** and **29** under the banks of account keys **25***a* and, as these wheels are controlled by these keys, for the sake of convenience I will refer to these wheels as the "account number" wheels or "folio registering mechanism", while I will refer to the registering wheels **28** and **29** controlled by the amount keys **25** as the "amount registering mechanism". As is well understood in the art, the items set up on the keys are positively entered in the registering mechanisms through the engagement of the adding wheels **28** with the racks **27** and are subtracted through the engagement of the subtraction wheels **29** with the racks. A positive total is printed under the control of the adding wheels **28** while an overdraft, that is, a negative total, is taken under the control of the subtracting wheels **29**.

Provision is made for printing in different columns on paper supported by the machine; and, for this purpose, a traveling paper carriage is provided which is normally moved from column to column across the machine as an incident to each cycle of machine operation, such movement being under the control of the usual tabulating mechanism of which parts are shown in Figs. 2 and 5, and which is described in Rinsche Patent No. 1,580,534, April 13, 1926. The carriage is also automatically returned across the machine by an automatic return mechanism described in said Rinsche patent and in Trew Patent No. 1,723,668, and shown generally in Fig. 2 of the drawings of this application.

The conditioning of the machine to perform various registering and recording functions is controlled automatically by the paper carriage as shown, for example, in Muller Patent No. 1,397,774. In the present application, only those parts of such mechanisms as are necessary for an understanding of the present invention will be described and illustrated.

The machine is provided with a means for operating it which is preferably a motor drive such as disclosed in Vincent Patent No. 866,750, a cycle of operation being initiated by depressing a motor bar M (Figs. 1 and 3). A hand crank of the familiar type may, of course, be used if desired—the same being attached to the main drive shaft which has a clutch-like end, shown in Fig. 2, for the receipt of such crank. The motor drives various cranks, shafts, and other parts, sometimes called the general operating means, which serve to operate the calculating, printing, and other mechanisms of the machine. For the purposes of this case, the "operating means" will be taken to be these general operating parts plus the device that actuates them, which, as illustrated, is the motor drive.

Examples of work

Before describing the invention in detail, a few typical examples of work will be explained so that the subsequent description of the mechanism may be more easily understood in relation to the functions that are to be performed.

Referring to Figs. 1 and 2, a ledger sheet L and a customer's statement S are shown in position in the paper carriage, which carriage is provided with guides and supports for accommodating these sheets, side by side. The machine illustrated has been set up to provide nine columnar positions for the paper carriage, the carriage being successively moved from one position to the other during a complete series of operations. For the sake of convenience, the nine positions have been indicated in proper sequence on ledger sheet and customer's statement shown in Fig. 32 where the columnar positions are indicated by numbers above the brackets.

First example

Referring to Fig. 32, assume that a ledger sheet and customer's statement are inserted in the machine and that the carriage is in its first columnar position. The customer's account number, which in this case is 123, is set up on the account number keys **25***a*, while the old balance, $500.00 is set up on the amount keys **25**. The machine is then given a cycle of operation by depressing a motor bar M whereupon it operates to print the account number in the column having the heading "Acct. No.", and the old balance is printed in the column entitled "Pick up Old Bal." During this cycle of operation, the old balance is entered in the add pinions **28** of the amount registering mechanism; and the account number is entered in the add pinions **28***a* of the account number registering mechanism. Near the end of the first cycle of machine operation, the carriage moves to its second columnar position so as to be ready for the entry of a deposit or withdrawal, as the case may be.

In the second column, a deposit of $400.00 is to be entered. The operator enters this amount on the keys and depresses the motor bar, whereupon the machine is given a cycle of operation during which the amount of $400.00 is printed on the ledger sheet and entered additively into the amount registering section. The keys in the account number section were released at the end of the machine operation in the first column; and since no account number keys were depressed in the second column, no printing and no calculations occur in the account number section. It is to be noted that, because of the release of the account number keys in the first column, no printing or calculations will occur in this section during subsequent operations until the account number keys are depressed.

After operating in the second column, the machine illustrated goes ahead automatically to operate and to condition itself in several succeeding columns, as will be presently explained, the operator having no function to perform from the time he depresses the motor bar in the second column until the carriage reaches its seventh columnar position and the machine stops. But it is first necessary to explain the purpose and nature of the succeeding operations.

After the entry of the old balance and the addition of a deposit, or the subtraction of a withdrawal or check, the net result, or "new balance", is the thing that is ordinarily desired. It should be explained at this point that, in the setting of the machine shown, deposits and withdrawals are not entered during the same lateral movement of the paper carriage across the machine. For example, if the old balance is entered and a deposit added, the machine goes ahead to get the new balance without waiting for the entry of a check. In the same manner, if the old balance is entered and a check withdrawn, the machine goes ahead to get a new balance without awaiting the entry of a deposit. It is possible to add deposits and sub-

tract checks during a single lateral travel of the carriage by adjusting the tabulating mechanism to get more columnar positions; but, for the purposes of the present disclosure, the machine has been illustrated for the operations above mentioned.

While a new balance is the thing desired, savings bank work, for which this machine is set up, requires that the deposit or the check, as the case may be, be printed on the customer's statement as well as upon the bank's ledger sheet. And it is desired that the deposits and withdrawals be printed in separate columns on the customer's statement. This means that the machine must be operated again to print the amount of the deposit or withdrawal, and it must be controlled to print these items in the correct columns.

Instead of attempting to have the carriage move automatically from the second to the fourth column, skipping the third column, in the case of deposits, or in the case of withdrawals to have the carriage move from the second to the third column and then to skip the fourth column and move to the fifth column, the machine is arranged so that it moves to both the third and fourth columns, but the printing and calculating mechanisms are controlled so as to get the desired result of printing in the correct column on the customer's statement. This requires two machine cycles between the second column and the new balance column which are primarily for the purpose of printing the deposit or withdrawal on the customer's statement.

In the first example of work, the carriage moves to the third, or "withdrawal", column where it goes through a cycle of operation automatically during which the printing mechanism is hammer-blocked so that no printing occurs. This control of the printing mechanism is necessary because the amount keys remain depressed in the third and fourth columns. The printing and hammer block mechanisms have not been described in detail, as they are the same as those fully shown and described in Muller Patent No. 1,397,774, Gascon Patent No. 1,395,991, and my co-pending application Serial No. 76,147, filed December 18, 1925, now Patent No. 1,843,648. Also, in this column, both the account number and the amount registering mechanisms are non-added, as described in Muller Patent No. 1,397,774. The date is printed in this column but is blocked out in all other columns.

The carriage then moves to the fourth column where it is given a cycle of operation automatically, during which the deposit is printed on the customer's statement. Both the account number and the amount registering mechanism are non-added. No printing occurs in the account number section because no keys are depressed, and also because the printing mechanism for this section is hammer-blocked. Near the end of the cycle of operation in the fourth column, the carriage tabulates to the fifth or "new balance" position.

In the fifth column, the machine continues to operate automatically where it goes through a totaling operation involving a spacing operation which, in this case, comprises two machine cycles, although one only is necessary under some conditions, and an actual total-printing operation. The carriage remains stationary in this column for the three cycles, but is released at the end of the third cycle. The first two cycles are preparatory or spacing cycles, and the third cycle is the cycle during which the new balance is actually taken and printed.

Savings bank work also makes it desirable to print the new balance a second time, the second printing being on the bank's ledger sheet. To effect this result, the total printed in the fifth column is left in the machine—that is, it is taken as a sub-total, after which the carriage is automatically returned across the machine and the total printed a second time.

The total in the first example of work, $900.00, is printed in the fifth column; and the carriage then automatically returns across the machine to its sixth columnar position where the machine again goes through a cycle of operation automatically to again print the new balance, $900.00. During the latter part of this cycle, the carriage shifts to its seventh position; but no automatic operation of the machine takes place, as the repeat mechanism is not conditioned to cause such operation. The machine is now in condition for the proving operations which are carried out in the following manner:

The operator enters the amount of the deposit, $400.00, which he reads from the deposit slip; but, in this instance, the $400.00 is subtracted instead of added. This may be done by moving the subtract lever to subtract position and giving the machine a cycle of operation. The machine is given a cycle of operation in this column, which subtracts the amount of the deposit from the registering mechanism; and the carriage moves to the eighth columnar position.

In the eighth position, the operator enters the old balance again by reading it from the customer's old balance and entering it on the keys. The old balance is entered negatively, which may be done by moving the subtract lever to subtract position and giving the machine a cycle of operation, or the carriage may be provided with a control roll to automatically condition it for subtraction. Also, in this column, the customer's account number is entered in the account section, but not printed, the printing mechanism being hammer-blocked and said account number is subtracted from the amount in the account registering mechanism. When the machine is given a cycle of operation in the eighth column, the old balance of $500.00 is subtracted from the amount registering section; and the account number 123 is subtracted from the account registering section. This should leave the machine clear, both in the amount and in the account number sections.

With the carriage in its ninth position, the machine is given two spacing cycles and the total key is depressed, whereupon the character ".00 Bal." is printed, which indicates that the amount registering mechanism is clear. No symbol is printed in the "Proof of posting to correct acct." column, zero printing being eliminated by means well known in Burroughs machines. The lack of a symbol in this column indicates that no error has been made in the entry of the account number. As will presently appear, if there had been an error in either the amount or the account number sections, the total key would be locked in the ninth column; and the operator would have to depress a special release key and operate the machine to clear it.

Second example

In the second example (Fig. 32), the same account number and the same old balance are

entered; but a check, or withdrawal, of $400.00 is subtracted which, while it reduces the balance, leaves it positive. Although the machine may be conditioned for subtraction by the subtract lever, a "withdrawal" key is used in this case, which operates to not only condition the machine for subtraction but also to cause a cycle of operation thereof; and, as before, the machine goes ahead automatically to operate in the third, fourth, fifth, and sixth columns. The "withdrawal" key also controls the hammer block mechanism previously mentioned, so that, when the carriage is in its third columnar position, the amount of the withdrawal will be printed; but, with the carriage in the fourth columnar position, said amount will not be printed. Both registering mechanisms are non-added in the third and fourth columns, as before; and no printing of the customer's account number occurs. When the carriage moves to its fifth columnar position, the machine goes through three cycles of operation automatically, and the new balance of $100.00 is printed under the control of the add pinions **28**. This balance is repeated with the carriage in the sixth columnar position—that is, the first column on the ledger sheet. With the carriage in the seventh column, the amount of the check, $400.00, is now added rather than subtracted, after which the carriage moves to its eighth columnar position where the old balance of $500.00 is subtracted, as distinguished from being added in the first entry. The customer's account number is also entered in the account section and subtracted. The carriage then moves to its ninth position, and, after giving the machine its spacing cycles, the total key is depressed, with the result that ".00 Bal." is printed to indicate that the items were correctly entered and that both registering mechanisms are clear.

Third example

In the third example (Fig. 32), the same account number and the same old balance are entered; but, this time, a check, or withdrawal, of $600.00 is subtracted in the second columnar position to cause an overdraft or negative total of $100.00. The "withdrawal" key is depressed in the second column, which conditions the machine for subtraction and causes a cycle of operation, after which the machine operates automatically through the third, fourth, fifth, and sixth positions, the control of non-adding and of hammer block being as before. The withdrawal of $600.00 is printed in the third columnar position; it is not printed in the fourth; and in the fifth column, the machine is given three cycles to take the total. Since the total in the register is negative, it is necessary that it be taken from the subtract pinions. Inasmuch as the machine operates automatically through the third, fourth, fifth, and sixth columns, there is no opportunity to condition it manually. It must be automatically conditioned in the fifth column to take a negative total. To this end, mechanism has been provided which, when a negative total or overdraft occurs in the second columnar position, causes the machine to be automatically conditioned in the fifth column to take the kind of total that exists in the register. This mechanism will be described in detail hereinafter. In the example being discussed, the credit balance or negative total of $100.00 is printed in the fifth and sixth columns, a symbol "CR" being printed to indicate an overdraft. The withdrawal is then entered in the seventh column, and the account number and old balance in the eighth column, each of said entries being of opposite sign to the first entries, after which the carriage moves to the ninth column where a clear sign is printed, as previously explained.

Fourth example

The fourth example (Fig. 32) is similar to the first; but it will be noted that, with the carriage in the seventh column, the amount of the transaction is incorrectly set up and printed as $40.00 instead of $400.00. Accordingly, after the old balance of $500.00 is subtracted in the eighth column, the positive amount of $360.00 remains in the registering mechanism. It is assumed that the account number, 123, is set up and subtracted in the eighth column. If the operator could now take a total in the ninth column by depressing the total key and releasing the machine as in the first example, the amount of $360.00 would be printed; but the operator would not be warned of his error and would not notice it unless he looked at the figures on the ledger sheet. In posting these transactions, it is very desirable that the operator catch the error at the time it is made; and to this end, means is provided for locking the total key against depression when there is a total in the registering mechanism in the ninth columnar position; and this locking takes place no matter whether the total is positive or negative. This notifies or signals the operator that an error has occurred. In order to release the total key, it is necessary to depress a special key and shift the control lever to add or subtract position, as the case may be, as will be explained later; and, then, upon operation of the machine, the complement of the total in the register will be printed because the total is taken with the machine in subtract condition for reasons which will appear in the description of the proving mechanism. The amount printed indicates to the operator the extent of the error.

Fifth example

The fifth example illustrated in Fig. 32 is the same as the first and need not be explained.

Sixth example

The sixth example (Fig. 32) is similar to the second except that, again, a mistake was made in setting up the withdrawal in the seventh column—that is, it is set up as $40.00 instead of $400.00. With the carriage in the ninth position, there is an overdraft of $360.00 in the registering mechanism. The total key is again locked against depression under the control of mechanism associated with the registering mechanism, and it is necessary to depress a special key and move the subtract lever to correct position to clear the register. Again the operator is warned of the error. In this case, the correct amount of the overdraft is printed because the total is taken with the machine in subtract condition for reasons appearing in connection with the description of the proving mechanism.

While the errors above explained have been described as occurring in the seventh column, it will be understood that the results would be the same if the errors had occurred in the eighth column, or if they occurred in the first or second columns while the entries in the seventh or eighth columns were correct. The proving action depends upon the entries in the seventh and eighth columns being the same as those in the first and second but of opposite sign.

Seventh example

In the seventh example (Fig. 32), the transaction is identical with the first except that the operator has set up the wrong folio or customer's account number with the carriage in the eighth column—that is, he has set up 128 instead of 123. When such an error is made either positively or negatively, the total key is locked in the same way as when there is a positive or negative total in the amount registering mechanism, with the result that the release key must be depressed in order to take a total with the carriage in its ninth position. When such a total is taken, a figure is printed in the "Proof of posting to correct acct.", such as the figure 5 in Example 7, which indicates the amount of the error and enables the operator to correct it.

With these examples having been explained in a general way, a detailed description of the mechanism will now be given.

Column printing control means

The back panel 35 (Figs. 2 and 5) of the supporting framework of the machine has secured to it the usual track 36 upon which the laterally shiftable carriage 37 runs. A rocking frame 38 which carries the rotatable platen, also carries the paper support or back 49 for holding upright the ledger sheets L and the customers' statements S.

Also mounted on the carriage is a rock shaft 41 carrying the usual column stops for determining the columnar positions of the carriage. As is well understood, upon each operation of the machine (except with the carriage in the fifth columnar position) the carriage is to be moved from right to left from one columnar position to the next by the usual carriage spring. As an incident to the last operation of the machine when the carriage is in its fifth columnar position, (this being the position in which the balance is printed on the customer's statement), the carriage is returned across the machine to the sixth columnar position, in which the new ledger balance is printed in the first column on the ledger sheet, by means of the electric motor through suitable connections partly shown in Fig. 2, but not disclosed in detail herein, as the same are not necessary to a complete understanding of my present invention and reference may be had, if desired, to said Rinsche and Trew patents for a complete disclosure of the same. Suffice it to say here, that the carriage supports a rack 45 which meshes with a gear (not shown) in a housing 46, in which is also mounted a second gear driven directly by the electric motor through suitable connections. When the carriage tabulates near the end of the last cycle of machine operations with the carriage in the fifth columnar position, that is, the last position to the right, as viewed in Fig. 2, a device 47 on the rack renders a clutch effective to connect the gears in the housing 46, whereupon the carriage is automatically moved toward the left, as viewed in Fig. 2, to bring the carriage to the sixth columnar position, the clutch being then automatically disabled by a suitable device 48 on the other end of the rack 45.

Motor control

The motor starting devices are now quite well known in the commercial art, and, in connection therewith, reference may be made to my aforesaid Patent No. 1,397,774. The reference letter M (Figs. 3, 20, and 22) designates a familiar touch or motor bar which is mounted upon spring-connected levers 50 and 51, the former having a pin-and-slot connection with a vertical bar 52. The lever 50 is also connected by a spring 53 to the bar 52. As in my Patent No. 1,397,774, a latch 54 is pivoted upon the lever 51 and is connected to it by a spring and the latch is adapted, upon depression of the touch bar, to engage with the stud upon the lever 50 and thus prevent restoration of the lever and touch bar to normal position. When the touch bar is depressed the vertical bar 52 is drawn upwards by the spring 53 so as to close the motor clutch and start the machine in operation. During the operation of the machine a roller stud 56 (Fig. 3) on the well-known full stroke sector 57 operates to depress said vertical bar 52 and open the clutch of the motor and if the latch 54 is released the lever 50 holds the bar 52 down so that there is no repeat operation. With the touch bar latched down, however, it is obvious that the spring 53 will remain active and the bar 52 will therefore be again elevated so that the second operation of the machine will automatically ensue.

As shown in my aforesaid patent, a slide bar 58 (Figs. 3, 20, and 22) arranged between the keyboard plates and drawn rearwardly by a spring, has a projection 59, adapted to act upon the upstanding tail of the latch 54. The rear end of this slide bar extends into the path of an upward extension of the familiar bail piece 60. When the carriage is in the first, seventh and eighth columnar positions, the motor clutch is closed to operate the machine and during each operation the bail piece 60 is rocked forwardly to the full extent to release the depressed amount keys 25 in the usual way (the depressed account keys also being released during the operations with the carriage in the first and eighth columnar positions). The stud 59 also trips the latch 54 and permits the bar 50 to move downward to normal position to hold the control bar 52 downward to maintain the motor connections broken. With the carriage in the other columnar positions, the motor clutch is closed automatically, the touch bar remaining depressed under the control of the "repeat" rollers 33 and connections which are quite similar to those disclosed in my Patent No. 1,397,774 and which will be briefly described here.

Repeat machine operations

I have referred to the fact that, with the touch bar M latched down by the latch 54, the vertical control bar 52 will be again elevated for clutch closing purposes, under the action of the spring 53. This action of the bar is, however, stayed pending arrival of the paper carriage in its new columnar position. For this purpose an abutment arm 62 is hung on the keyboard so that its lower end will stand in the path of a stud 63 on the bar 52 and block the rise of the latter, as illustrated in Fig. 20.

Slidably mounted in the machine is a repeat slide 64 which corresponds with the slide bar designated 115 in my Patent No. 1,397,774. This slide bar is controlled by the "repeat" rollers 33 which, in different positions of the carriage, depress the "repeat" arm 65 (Fig. 21) corresponding to the lever arm designated 6 in my said patent. This arm 65, which is part of a yoke member, is connected through suitable connections, as disclosed in my said former patent, to a lever 66 (Figs. 20 and 22) the upper end of the vertical arm of which is bifurcated to straddle a stud on the slide bar 64. There is a "repeat"

roller 33 for the second, third, fourth and fifth columnar positions and as each roller rides over the apex of the cam portion of the lever 65, as illustrated in Fig. 21, the arm 66 rocks rearwardly and, as a result, the slide bar 64 is slid rearwardly against the action of its spring. During this movement an upstanding finger 67 on the bar 64 strikes a stud on the abutment arm 62 and rocks the arm 62 rearwardly, thus permitting the control bar 52 to spring upwardly and close the motor clutch, which causes another operation of the machine automatically.

I have already alluded to the fact that, after a sub-total is printed in the last column on the customer's statement, with the carriage in the fifth columnar position, the carriage is automatically moved from its extreme left hand position to its extreme right hand position (as viewed from the front) by the motor connections to the rack 45 on the carriage (Fig. 2). During this movement of the carriage the "repeat" rollers 33 operate the arm 65 with the result that the slide bar 64 is reciprocated back and forth each time a roller passes over the arm 65. This movement throws back the abutment arm 62 and the motor control bar 52 would spring upwardly and release the motor clutch during the movement of this carriage if means were not provided for restraining this upward movement of the control bar at such time. In order to restrain such movement, I have provided an arm 68 (Figs. 1, 3, and 7B) and suitable connections, controlled by the carriage, for operating it, as will now be described.

The arm 68 is fast on a shaft 69 extending across the base of the machine and fast on the left hand end of the shaft is an arm 70 (Figs. 6 and 7A) connected by a link 71 to the downwardly extending arm of a bell crank lever 72, the rearwardly extending arm of which has a stud engaged by a cam slot in the upper end of an arm 73. This arm 73 forms part of a pivoted yoke piece (Fig. 6), the rearwardly extending arm 74 of which has a stud projecting into a slot formed in the lower end of a link 75 as best shown in Fig. 6. As shown in Fig. 4, the upper end of the link 75 is pivoted to the horizontal arm of a bell crank 76 which is pivoted on a plate 77 secured to the gear housing 46 (Fig. 2). The vertical arm of this bell crank lever carries a pin 78 (Fig. 4) engaged by a projection 79 on a control bar 80, which is slid by the device 47 to close the carriage return clutch in the housing 46 for the purpose of shifting the carriage from the fifth columnar position to the sixth columnar position, or in other words, from the extreme left to the extreme right, (as viewed in Fig. 4) as more fully explained in the aforesaid Trew Patent #1,726,668. When the bar 80 is so moved, its projection 79 through its engagement with the stud 78, rocks the lever 76 in opposition to its spring 81, and thus rocks the arm 68 from the position shown in Fig. 3 to the left (as viewed in said figure) through the link 75, yoke piece having arms 73 and 74, lever 72, link 71, arm 70 and shaft 69. This movement of the arm 68 carries its lateral lug 82 over a projection 83 on the control bar 52. The slide bar 80 is held in moved position until the carriage reaches the limit of its travel to the right and, thus, during the return movement of the carriage, and when the arm 62 is moved by the operation of the bar 64, the motor control bar 52 is restrained against upward movement by the engagement of the lug 82 on the arm 68 over the projection 83. As the carriage finally completes its travel to the right, the device 48 (Fig. 2) restores slide bar 80 to normal position by striking a projection on a pawl 84 as more fully explained in said Trew patent. When this happens, the spring 81 restores the bell crank lever 76 to normal position and, through the above described connections, rocks the arm 68 to normal position, thus permitting the control bar 52 to spring upwardly and hence close the motor clutch whereupon an automatic operation of the machine with the carriage in the sixth columnar position ensues.

Key release mechanism

When the carriage is in the first, seventh and eighth columnar positions and the machine operated, the depressed amount keys as well as the touch bar are automatically released and restored, and with the carriage in the fourth position, the depressed amount keys are released and the touch bar remains depressed, as the motor clutch is automatically closed to effect an automatic operation of the machine with the carriage in the fifth columnar position. The depressed account number keys are also released during operations with the carriage in the first and eighth columnar positions. With the carriage in the third and fourth columnar positions, the amount set up on the amount keys is to be selectively printed so that the depressed amount keys and the motor bar M are not to be released at the end of the operations of the machine with the carriage in the second and third columnar positions. To prevent release of the depressed keys during the operations last referred to, I employ the device shown and described in my Patent No. 1,397,774 for blocking the movement of the usual lever 89 to the position shown in Fig. 26. This device comprises the arm 93 (Figs. 20 and 22) on the slide bar 64, the arm having a projecting flange or shelf 94, which corresponds to the shelf numbered 121*a* in my Patent No. 1,397,774. During operations of the machine with the carriage in the second and third columnar positions, the repeat slide 64 is in its most rearward position so that the shelf 94 is in the path of a stud 95 on the lever 89 (as shown in Fig. 22 and Fig. 24) and, as the customary pawl 88 cannot pass under a roller 92 on the key releasing bail 60, the depressed keys and touch bar are not released.

In order to release the depressed amount keys without releasing the touch bar when the machine is operated with the carriage in the fourth columnar position, I provide a shorter pawl 90, pivoted beside the pawl 88, (Figs. 20, 22, and 23) and an extra shelf 96 on the arm 93. As the carriage moves to its fourth columnar position, the particular "repeat" roller 33 then depressing the arm 65, permits the slide bar 64 to move to the position shown in Figs. 20 and 23, so that the upper shelf 94 is carried out of the path of movement of the stud 95, while the lower shelf 96, which is longer, is in position to be engaged by the stud 95. By referring to Fig. 23, which illustrates the condition of the parts during the second half of the operation with the carriage in the fourth columnar position, it will be seen that with the shelf 96 in obstructing position, the lever 89 is arrested in an intermediate position and the pawl 90 passes the roller 92 while the longer pawl 88 does not. Upon return movement of the arm 89, the pawl 90 rocks the side bail piece 60, as shown in Fig. 20 a sufficient extent to release the depressed amount keys, but

not trip the latch 54, which is holding the touch bar in depressed condition.

Total key

To control the machine for printing a total, the total key 97 (Fig. 6) is depressed, which, through the link 98, lowers the pitman 99 so that when the latter is operated by the three armed lever 100 during the operation of the machine, the registering wheels are engaged with the racks 27 during the downward stroke of the latter, as is common in Burroughs machines. With the machine set up as illustrated, this key is manually depressed only in the ninth columnar position of the carriage, as will be presently explained.

When the carriage is in its fifth position, the total is taken as a sub-total, i. e., it is left in the machine because it is desired to print the total a second time after the carriage is returned across the machine. The cycles of machine operation in the fifth carriage position take place automatically under the control of the repeat mechanism. Provision is made for automatically moving the pitman 99 downward under the control of a "step-by-step mechanism" that is controlled by the paper carriage through the repeat slide, as will now be described.

Means for automatically conditioning the machine for total taking

The total key (Figs 6, 7A, 15, and 16) is formed in two parts, instead of one as is usual in this type of machine. The arm 97 with the finger button or piece comprises one part and a bell crank lever 101, pivoted on the same stud, forms the other part. A pin 101*a* on the forwardly extending arm of the lever 101 projects into a recess in the arm 97, so that, when the arm 97 of the total key is manually depressed, the lever 101 is rocked with it. This construction permits the bell crank 101 to be rocked clockwise to condition the total-taking means for total taking even though the total key, in the event of a negative total, may be locked by the negative total locking mechanism hereinafter described.

The downwardly extending arm of the lever 101 (Fig. 6) is connected by a link 102 to an arm 103 fast on a shaft 104 (known as the 1400 shaft on Burroughs machines) to which is also secured an arm 105 (Fig. 22). The forward end of a link 106 is connected to the arm 105 and the rear end of the link is provided with the slot 107 (Figs. 22, 23, and 25) through which a stud on an arm 108 projects. A spring 126 is connected to the lower end of the arm 108 and tends to draw it rearwardly. The upper end of the arm 108 is journaled loosely on a shaft and the lower end of the arm carries a roller 109 adapted to ride on the edge of a cam plate 110 which has a double formation, there being two like parts because the cam plate is given but one half of a rotation during a series of operations of the machine and the two parts are alternatively effective. The cam plate 110 is fastened to a ratchet wheel 111 and both are loose on a machine stud 112 projecting from a fixed plate 116. A spring 113 (Figs. 22 and 27), in the form of a leaf with prongs, is secured to the plate 116 and engages the cam plate 110 to frictionally prevent accidental rotation of the cam plate and ratchet. Also loose on the stud 112 is a lever 114, one arm of which is connected by a link 115 to the full stroke sector 57, while the other arm carries a three-armed pawl 117. One of the arms of the pawl is pointed and adapted to engage the ratchet teeth; a second arm is connected to a spring 118, and the third arm carries a roller 119. The "repeat" side 64, referred to above, carries a depending arm 121 having a curved forward edge 120, which, when the slide is in its forward and intermediate positions, illustrated in Figs. 23 and 24, respectively, engages the roller 119 and holds the pointed arm of the pawl 117 out of engagement with the ratchet wheel 111 in opposition to the spring 118. The slide is in its forward or intermediate position during each cycle of operation, except when the carriage is in its fifth columnar position and then it is in the rear position, illustrated in Fig. 22. When the slide 64 is in its rear position, the edge 120 of the projection 121 is out of engagement with the roller 119 so that the pawl 117 is adapted to coact with the teeth of the ratchet wheel 111.

With the pawl disengaged from the ratchet wheel, it will be evident that the lever 114 is rocked back and forth idly by the sector 57 without turning the ratchet wheel and cam plate 110. With the carriage in the fifth columnar position, the slide 64 is in its rear position and, during the first spacing cycle of operation in the machine, the pawl 117 is effective and the ratchet wheel and cam plate are moved from the position shown in Fig. 24 to that shown in Fig. 25, the cam plate being aligned in such positions by engagement of the roller 109 in notches 127 in the concentric edge portions of the plate. Fig. 25 shows the position of the parts at the end of the first half of the first spacing cycle with the carriage in the fifth columnar position, and while Fig. 24 shows the condition of the parts during operation of the machine with the carriage in the second and third columnar positions, yet it illustrates the position in which the cam plate 110 remains during all operations except with the carriage in the fifth columnar position. As usual there are two spacing cycles of machine operation before the subtotal is printed. During the second spacing cycle operation the cam plate 110 is moved from the position illustrated in Fig. 25 to that shown in Fig. 22.

An arm 123 (Fig. 22) on the rock shaft 104 carries the usual roller 124 cooperating with a flange 125 on the pull stroke sector 57. At the end of the first half of the second cycle of operation with the carriage in the fifth columnar position, the cam plate 110 is moved to the position shown in Fig. 22, but the roller 124 is back of the flange 125 (as shown by the dotted lines 124*a*) so that the arm 108 is held in the dotted line position 108*a* indicated in this figure, until at the end of the cycle when the roller 124 is permitted to pass under the end of the flange 125 whereupon the spring 126 draws the arm 108 rearwardly to the full position shown in Fig. 22, the roller 109 being seated in one of the deep recesses 126*a* in the cam plate. During this movement of the arm 108, its stud being in engagement with the rear end of the slot 107, draws the link 106 rearwardly thus depressing the lever 101 of the total key automatically through the arm 105, shaft 104, the arm 103 and link 102. The spring 126 is stronger than the customary spring 123*a* (Fig. 22) which is connected to the arm 123. Now during the third cycle of operation, the sub-total is taken from the registering mechanism and printed.

With this construction, a total, in the form of a sub-total, is automatically taken in the fifth columnar position of the carriage without requiring any attention on the part of the operator. The

paper carriage not only controls the cycles of machine operation for causing the total to be taken, but it also controls the conditioning of the cam mechanism that actually conditions the machine to take the total, and the carriage may thus constitute a "total-taking control means or part of it". This cam-operated mechanism including the parts 110, 111, 117, 118, etc., may, for purposes of convenience, be called a "step-by-step mechanism", or a "cycling mechanism", because it operates through a number of cycles, or steps, to condition the machine for total-taking. As already mentioned, the machine operates automatically through three cycles with the carriage stationary in the fifth columnar position. It goes through these three cycles because the repeat roller holds the repeat mechanism in position for such operations. The carriage remains stationary through these cycles because the carriage stop for the fifth column has a cut-out portion 400 shown in Fig. 5. When the carriage arrives in the fifth column, this cut-out portion permits a pawl 401 (Fig. 2) to move in a counterclockwise direction; and the lower extending arm of this pawl automatically disables the tabulating pawl 402; that is, it moves the tabulating pawl to such a position that the tabulating mechanism is not operated during the cycles of machine operation. Accordingly, the machine can be cycled any number of times without causing the carriage to move. However, when the bell crank 101 (Fig. 6) is rocked at the time the link 98 is pulled down during the latter part of the second cycle of machine operation in the fifth column, said bell crank moves a link 279 (Fig. 6) rearward; and the rear end of this link engages a lug on a bell crank 403 to rock the latter counterclockwise. The lower arm of bell crank 403 engages one arm of a crank 404 shown in Figs. 6 and 2. Referring to Fig. 2, this bell crank is connected to one end of a link 405 whose other end has a stud and slot connection with the pawl 401. The arrangement is such that when the total-taking bell crank 101 is rocked, the pawl 401 of Fig. 2 is rocked clockwise, thereby conditioning the tabulating pawl 402 for operation. Consequently, near the end of the third cycle of machine operation in the fifth column, the tabulating mechanism will be operated, whereupon the carriage will move slightly with the result that the automatic return mechanism will be set into operation to return the carriage across the machine.

Repeating the total

During the first half of the third cycle in the fifth column cycle the cam plate 110 is moved by the pawl 117 from the position shown in Fig. 22 to that shown in Fig. 24. The arm 108 is swung forwardly by this movement of the plate 110 and its stud moves forwardly in the slot 107 without affecting the position of the link 106 which, as will now be explained, is held in its rearward position until during the repeat sub-totaling printing operation with the carriage in the sixth columnar position.

As more fully described in the Kilpatrick Patent No. 928,931, granted July 27, 1909, when the touch bar is depressed and the total key is in normal position, a stud designated 14 in said patent and mounted on the lever, corresponding to my lever 50 (Figs. 3, 7B, 20, and 22), blocks the movement of an arm designated 14b in said patent and numbered 122 in said figures of my drawings, to prevent operation of the total key while the motor bar M is depressed. This stud is numbered 128 in my drawings (Figs. 7–13 and 22) and, instead of being on the lever 50, is mounted on the horizontal arm of a bell crank lever 129 pivoted on the stud on which the lever 50 is also pivoted. As shown in Fig. 3, normally, a shoulder 130 on a latch 131 (see Fig. 33), pivoted on a pin 134 on the lever 50, engages over a lug 132 on the lever 129, the latch being retained in such position by a spring 133. These parts are shown clearer in Figs. 20, 22, and 33, but in different moved positions. Also pivoted on the pin 134 is a small lever 135 on which is hung a pawl 136, the nose of which is normally positioned under a second shoulder 137 on the latch 131. A spring 145a (Fig. 33) connects the pawl 136 to a pin on the arm 50 and another spring 138 connects the rearwardly extending arm of the lever 135 to a stud on the arm 50. A stud 140 on the slide plate 58 projects behind the vertical arm of the lever 135. It will be recalled that, during the operation of the machine with the carriage in the fourth columnar position, the shorter wipe pawl 90 (Fig. 20) rocks the bail piece 60 and moves the slide plate 58 sufficiently to release the depressed amount keys but not the touch bar. During the forward movement of the plate 58, the stud 140 rocks the lever 135 counter clockwise to the position shown in Fig. 20, thereby lifting the pawl 136 and the latter is cammed rearwardly by a stud 141, coacting with the forward cam edge on the pawl. The shape of the nose and shoulder 137 is such that during this movement of the pawl 136 the latch 131 is swung rearwardly to carry its shoulder 130 out of engagement with the lug 132 on the lever 129. When this happens, the spring 55 connecting the lever 129 to the lever 51, rocks the lever 129 clockwise thereby raising the square stud 128 to permit the arm 122 to pass under it. Normally, the stud 140 is nearer the vertical tail of the lever 135 than is the stud 59 with respect to the upper end of the latch 54, so that, upon such forward movement of the plate 58, the latch 54 is not released and the touch bar remains in a depressed position.

Pivoted on the lower end of the downwardly extending arm of the lever 129 is an arm 143 and a spring 144 connects pins 143a and 143b on the arm 143 and the lever 129, respectively. The pin 143b also acts as a limit stud for the arm 143. As the arm 122 moves rearwardly at the end of the second spacing cycle of operation of the machine with the carriage in the fifth columnar position, as above explained, a roller stud 145 mounted on it engages the arm 143, thereby rocking it rearwardly against the action of the spring 144, the lever 129 being restrained from rocking during this movement of the arm 122 by the engagement of the square stud 128 with the upper edge of the arm 122. As the arm 122 passes from under stud 128, the lever 129 is rocked counter clockwise by the spring 144 to carry the square stud 128 in front of the arm 122, the spring 144 being stronger than the spring 55. The lug 132 on the lever 129 is thereby moved downwardly and the spring 133 then moves the latch 131 back to latching position, while the spring 145a at the same time restores the lever 135 and pawl 136 to normal.

It will now be seen that the stud 128 is moved in front of the segmental end of the arm 122 at the end of the second spacing cycle with the carriage in the fifth columnar position, and that during the third cycle of operation, the flange 125 is in back of the roller 124 on the arm 123. At the end of this third cycle, the stud on the

arm 108 is in the forward end of the slot 107 in the link 106 and the lower end of the flange 125 is higher than the roller 124, but the arm 122 and associated parts are held in total taking condition as the stud 128 then blocks return movement of the arm 122. Hence, during the next operation of the machine, that is, with the carriage in the sixth columnar position, the subtotal is again printed. At the end of this operation the motor bar is released, the latch 54 being released by the stud 59 on the slide 58 (Fig. 33), as explained above, and as the square stud 128 is then raised, the arm 122 and associated parts are moved by the customary spring 123*a* to normal position. Fig. 33 shows the parts in the positions which they assume just at the moment of release of the motor bar, at which time the nose on the pawl 136 is out of engagement with the shoulder 137 on the latch 131. Now, as the lever 50 moves to normal position, the latch 131 is raised and the springs 133 and 145*a* restore the latch 131 and pawl 136 to normal position. As shown in Fig. 22, the upper edge of the forwardly extending arm of the lever 129 is in engagement with a limit projection 136*a* on the lower keyboard plate.

Safety latch for repeat slide

I have provided a device for positively preventing the slide 64 from accidently moving too far rearwardly during the operation of the machine with the carriage in the second, third and fourth positions, in which positions the pawl 117 of the cycling mechanism (Figs. 23 and 24) is disabled. This means comprises a latch 146 pivoted on the rod which projects through the rear guide slot in the slide 64. When the slide is in its forward position (Fig. 26) and intermediate position (Fig. 24), a square stud 147 on the slide 64 is in front of a shoulder 151 on the latch 146 so that the slide bar 64 is blocked against accidental movement to its rearmost position. During the second half of the cycle of operation with the carriage in the fourth columnar position, the bail piece 60 is rocked by the wipe pawl 90 whereupon the roller 92, which is in engagement with the upstanding arm of the latch 146, rocks the latter clockwise, as shown in Fig. 20, in opposition to its spring 148. The rear part of the latch 146 is yoke-shaped and the tie-piece 151*a* of the yoke portion engages a latch 149 immediately above its shoulder 153. When the latch 146 is rocked to the position shown in Fig. 20, the spring for the latch 149 swings the latter to move the shoulder over the tie-piece and thus holds the latch 146 in disabled position when the roller 92 moves out of engagement with the upstanding arm of the latch 146, so that the slide bar 64 may be moved to its rearmost position as the carriage moves into its fifth columnar position. At the end of this movement of the slide bar 64 (as shown in Fig. 22) a shoulder 150 on the bar 64 strikes a foot 149*a* on the latch 149 thus disabling the latter, the latch 146 then moving to the position shown in Fig. 22. When the slide 64 moves forward the next time, the stud 147 is carried forward beyond the shoulder 151 on the latch and the latter rocks further counter clockwise to move the shoulder 151 behind the stud 147.

Registering mechanism

The registering mechanisms, that is, the account number and the amount registering mechanisms, are substantially identical with that of said Rinsche Patent No. 1,172,484. Both sets of pinions 28 and 29 are carried in a cradle 154 (Figs. 6 and 8) comprising the usual side members and connecting tie-pieces. This cradle is pivoted on and arranged between the side members of the well known main rocking frame 155. The rocking of the main register frame 155 to engage or disengage either the adding wheels 28 or subtracting wheels 29, as the case may be, with the racks 27 is done in a familiar way, the action being initiated by the operation of the wipe pawl 156 (Fig. 6) upon a stud on the three-armed lever 100.

Subtraction

An add-subtract lever 157, which corresponds with the one designated 68 in my aforesaid patent, projects through the keyboard and has a handle by which it may be thrown forward and back. This lever, as in my said patent, is separate from an arm 158 which does the work of rocking the cradle 154. A link 159 is coupled to the arm 158 and its rear end is bifurcated for the purpose of cooperating with the studs 160 and 161 carried on the cross arm 162 fast on the main power shaft 163. As in my said patent, the rearwardly extending arm of the lever 157 is connected to a depending link 165 carrying a stud 166 which occupies the slot in the link 159, but the upper end of the link 165 is somewhat different from the corresponding link designated 93 in my said patent, in that the upper end of the link 165 is provided with a slot 170 through which the stud on the lever 157 projects. The link 165 also has an ear carrying a stud 171.

When the lever 157 is thrown forward, that is, to subtraction position, the link 159 is elevated through the link 165 so that the hook 167 on the rear end of the link 159 is in line with the stud 160, with the effect that, during the operation of the machine, the cradle 154 is rocked to disengage the adding wheels 28 and engage the subtracting wheels 29. Because of the slot 170 in the link 165, the link may be raised without affecting the lever 157, as will be described later. The link 165 is raised in opposition to a spring 196 connected at its upper end to the link 165. The lever 157 is moved manually to a forward position when the machine is to be operated with the carriage in the seventh columnar position to subtract the deposited amount and is also moved to such position by a "subtract" roller 33, when the carriage is in the eighth columnar position so that the old balance will be subtracted.

Printing mechanism

The printing equipment, including the means for effecting the automatic elimination of imprints, is practically identical to that described in my Patent No. 1,843,648, and as its details are not essential to a complete understanding of my present invention, I will not describe it in detail, though it is shown in side elevation in Fig. 5. Suffice to say that, if the subtraction lever 157 were manually moved to subtracting position with the carriage in the second columnar position, the condition of the automatic elimination mechanism would be such that the amount of withdrawal would be printed in the "deposit" column and not in the "withdrawal" column on the customer's statement, if it were not for a withdrawal key.

Withdrawal key and connections

A "withdrawal" key 173 (Figs. 3 and 7B), which is designated 60 in my said patent, has the lower end of its stem pivoted to an arm 174, loosely

pivoted on a machine stud and the key is also provided with a slot 175 through which a machine stud 179 projects, the key being thus guided vertically. A spring 176 normally holds the "withdrawal" key in elevated position. A stud 177 on the "withdrawal" key projects into a recess in the forward end of an arm 178 fast on a shaft 180. Also secured to the shaft 180 is an arm 181 (Fig. 7B) which, when the "withdrawal" key is depressed, results in shifting a controlling arm shaft 182 which changes the hammer block setting so that the amount of withdrawal will be printed in the "withdrawal" column of the customer's statement but not in the "deposit" column, all of which is fully described in my Patent No. 1,843,648.

The "withdrawal" key, when depressed, also raises the link 159 (Figs. 6 and 7A) to subtraction position the same as if the subtraction lever 157 were drawn forwardly to subtracting position. On the left hand end of the shaft 180 is an arm 183, which, at its forward end, projects over a stud 184 extending laterally from a latch 185 pivoted on a vertical slide bar 187. The upper end of the bar 187 projects through a slot in a fixed plate 190 and, near its lower end, the bar 187 is provided with a slot 191 through which a machine stud extends, the bar being guided in this way in its vertical movement. A spring 192 normally retains the bar in its elevated position. The lower forwardly projecting end of the bar 187 is coupled to the rear end of a lever 193, the forward end of which projects under the aforementioned stud 171 on the link 165. It will now be obvious that, when the "withdrawal" key is depressed, the bar 187 is likewise moved downwardly in opposition to its spring 192, with the result that the link 165 and link 159 are elevated so that, during operation of the machine, the arm 158 rocks the cradle 154 to move the subtracting wheels 29 into position to be engaged with the racks 27.

The amount of the withdrawal is subtracted and printed with the carriage in the second columnar position and is also printed in the "withdrawal" column on the customer's statement while the carriage is in the third columnar position, but, during this latter operation, the registering mechanism is thrown out of operation. During both of the operations of the machine with the carriage in the third and fourth columnar positions, the hammer eliminating mechanism must be left under the control of the "withdrawal" key while the registering mechanism must be freed so that it can be controlled by the "non-add" rollers 33 on the carriage and so that the cradle 154 can be rocked to adding condition and, therefore, I have provided means for releasing the bar 187 (Fig. 6) as the carriage shifts to its third columnar position and means for latching the "withdrawal" key in depressed condition and I will first describe this latching means.

As shown in Fig. 3, a bell crank lever 197 is pivoted on the "withdrawal" key stem and the outer end of its forward extending arm is bifurcated to straddle a stud 195 on the rear end of the lever 51. When the motor or touch bar M alone is operated, the lever 197 is rocked counterclockwise to carry the lower end of its downwardly extending arm over the squared head of the machine stud 179, thus locking the withdrawal key against depression. A stud 198 on the key projects over the horizontal arm of lever 197 so that when the "withdrawal" key is depressed, it carries the lever 197 with it and the vertical arm of this lever moves down in front of the stud 179. As the horizontal arm of the lever 197 is coupled to the lever 51 the latter is rocked, as when the motor bar M is manually operated, to release the motor clutch. The latch 54 then retains the lever 51 in its lower position and this lever, through the lever 197 and stud 179, holds the "withdrawal" key depressed. This condition prevails until the lever 51 is released during operation of the machine to print the new balance in the first column on the ledger sheet, the carriage then being in its sixth columnar position. When the lever and motor bar are then restored the spring 176 aids in restoring the "withdrawal" key.

The means for releasing the bar 187 (Fig. 6) to free the registering mechanism from the control of the "withdrawal key" as the carriage moves to its third columnar position will now be described. As the carriage shifts to this position, one of "non-add" rollers 33 on the carriage rocks a three-armed lever 199 (which corresponds to the lever designated 107 in my Patent No. 1,397,774), this being accomplished through an arm 200, link 201, lever 202 and a yoke member carrying the "non-add" arm cooperating with the "non-add" rollers 33. When the lever 199 is rocked counterclockwise, as viewed in Fig. 6, a roller stud 203 on the upwardly extending arm of the lever strikes the forwardly projecting lower end of the latch 185, thus rocking the latch clockwise in opposition to its spring 188 to carry its pin 184 from under the arm 183, whereupon the spring 192 elevates the bar 187 to normal position. Now, during operation of the machine with carriage in the third and fourth columnar positions, "non-add" rollers 33 are effective to cause the registering mechanism to be inactive and, during the first of these operations, the cradle carrying the registering wheels is rocked into normal add position. When the "withdrawal" key is subsequently raised to normal position, the outer end of the arm 183 wipes past the pin 184, the upper edge of the end of the arm being curved for this purpose.

In order to lock the "withdrawal" key against depression except when the paper carriage is in the second columnar position, I provide a lever 205 (Fig. 3) centrally pivoted on a machine stud and having at its forward upward end a lug adapted to engage in a notch 206 in the stem of the key. The lower rear end of the lever 205 is provided with a cam plate 204 adapted to be engaged by a lug 207 carried by the tabulation bar mounted on the carriage. When the carriage tabulates to the second columnar position, the lug 207 engages the cam plate 204 thereby rocking the lever 205 in opposition to its spring 208 to release the "withdrawal" key.

Fugitive 1

Inasmuch as the present machine has a subtracting equipment of the character disclosed in the before-mentioned Rinsche Patent No. 1,172,484, which enables the registering mechanism to go negative the so-called "fugitive one" must be taken into account and this is done substantially as shown in said Rinsche patent. As described in that patent, when the cradle 154, carrying the registering wheels, is rocked from adding position to subtracting position and the subtracting wheels 29 are moved into mesh with the actuating racks 27, the needed unit of movement of the units wheel to take care of the "fugitive one" automatically results. This necessarily effects

both sets of pinions so that when the cradle 154 is rocked the other way and the adding wheels 28 are moved into engagement with the racks, the unit which was added to the negative total is subtracted therefrom and restored on the upper units wheel. As in said Rinsche patent, I provide one of the customary transfer pawls 209 (Figs. 3 and 7B) for the units rack. These pawls are designated 413 in said Rinsche patent. The units rack 27 is slotted like the other racks to provide for one step of movement relative to its actuating lever. Pivoted on the right hand side arm of the main registering frame 155 is a tappet-piece 211, (Fig. 3) which is shaped somewhat similarly to and performs the same function as the tappet-piece lettered "A" in said Rinsche patent. The transfer pawl 209 for the units bank, in place of having two feet as in the Rinsche patent, has but one foot 209*a*, with which the fingers 211*a* and 211*b* on the tappet-piece 211 are adapted to coact. As explained in said Rinsche patent, when the registering cradle 154 is rocked from adding condition to subtracting condition, the tappet-piece 211 is moved so that the lower finger 211*b* is brought into line with the foot 209*a* and, when the lower wheels 29 are moved into mesh with the racks 27, the units pawl 209 is displaced and, at the end of the cycle of operation, the units rack will be permitted to partake of the one step movement beyond its own normal position so that the correct negative total will be registered on the lower wheels 29, in case an overdraft has occurred. Whenever the machine is changed back to adding condition, the unit which was entered on the lower wheels 29 as the result of previous operation in subtracting condition, will be taken from the lower pinions and added on the upper pinions, because, when the cradle is rocked from a subtracting to an adding position, the tappet-piece is moved to carry its finger 211*a* in line with the foot 209*a* on a units pawl 209 and when the adding wheels 28 are moved into mesh with the racks, this pawl is displaced permitting the units rack to move upward one step beyond its normal position.

Also as described in said Rinsche patent, the tappet-piece 211 is moved to a neutral position in the same operation in which the units pawl 209 is displaced so that in further operations of the machine in the same condition there will be no further displacement of the pawl 209. In the Rinsche patent, the lever designated C therein, is employed to move the tappet-piece to neutral position and in my present machine I use a corresponding lever, also lettered "C", but of a slightly altered shape as its arms *c*4 and *c*5 form a V shaped projection and their opposite edges engage pins on the tappet-piece to move it to neutral position, whereas in the Rinsche patent the outer ends of the corresponding arms coact with the pins.

"Fugitive 1" for account registering mechanism

I have already stated that the account number, set up on the keyboard with the carriage in the first columnar position, is entered in the account number registering section, which comprises, in the machine illustrated, the registering wheels under the banks of account keys. With the carriage in the eighth columnar position, the account number is again set up on the account number keyboard section and subtracted from the account registering section. Each time the registering mechanism is changed from an adding condition to a subtracting condition, and vice versa, the "fugitive one" is added on the lower wheels or retaken on the upper wheels (as the case may be) of the account registering section the same as in the amount registering section, and this is accomplished through the following described device under the control of the tappet-piece 211.

The transfer pawl 209 carries a pin 214 (Fig. 7B) projecting under the rear curved end of an arm 215 fast on a shaft 216 suitably supported by a fixed plate 217 and arm 210 (Fig. 1). Fast on the shaft 216 near its left hand end is an arm 218 (Figs. 7B, 17, 18, and 19) engaging a stud on the lower end of a lever 220 loose on a fixed stud 221 and adjacent the rack 27 of lowest order for the account number section. A shoulder on the upper end of this lever normally engages over a stud 222 on a units rack 27. It will be obvious that every time the units pawl 209 for the units amount rack is displaced, the pin 214, because of the curvature of the arm 215, rocks the latter, shaft 216 and arm 218, the latter moving the lever 220 from the position shown in Fig. 17 to that shown in Fig. 18, thus carrying its shoulder away from the stud 222 so that the units rack for the account number section may be given its additional step of movement to take care of the "fugitive one". The lever is given this movement in opposition to its spring 223. When the pawl 209 is moved back to normal position during the next cycle of operation of the machine, the spring 223 rocks the lever 220 to normal position and then, as the units rack of the account number section moves down, the pin 222 wipes past the nose forming the shoulder on the lever 220 and when the pin is in line with the shoulder, the spring 223 again rocks the lever 220 back to normal position to carry the shoulder over the pin 222.

Automatic conditioning for positive or negative totals in accordance with the sign of the total in the registering mechanism

The manner in which the machine is automatically conditioned for total taking and automatically caused to take the total has already been described. However, the total in the registering mechanism may be positive or negative, which requires that the machine be conditioned to take the kind of a total that exists. When the total is positive, it is taken from the add pinions. When it is negative, it is taken from the subtract pinions. The present machine is conditioned automatically for negative or positive total taking under the control of the registering mechanism. There is also a control governed by the means that conditions the machine for total taking.

The Burroughs machine is one that is normally maintained in add condition. When an item is subtracted by depression of the "withdrawal" key, the machine is changed to subtract condition. As previously explained, a withdrawal item is entered in the second column, after which the machine goes through a series of operations automatically, during which the "withdrawal" key remains latched down. However, the control of the registering mechanism is taken away from the "withdrawal" key when the carriage moves to the third columnar position, as previously described. This means that, unless otherwise controlled, the registering mechanism will go back to add condition during the cycle of machine operation in the third column, even though the registering mechanism is non-added. This applies to

both the account number and the amount registering mechanisms.

If the item subtracted in the second column leaves the registering mechanism in positive condition, said mechanism need not be changed for total taking because it is already in correct, or add, condition for the taking of a positive total; but it must be controlled to prevent a change to subtract condition.

If the item subtracted in the second column should result in an overdraft in the registering mechanism, it is necessary to change the latter to subtract condition for the taking of a negative total from the subtract pinions. The manner in which this is done will now be described.

The amount registering mechanism rocks or "sets" a lever or "setting member" **228** (Figures 10 and 29) under the control of the add and subtract pinions of highest order of said registering mechanism. Said highest order pinions have the usual zero projections **28***a* and **29***a*, as shown in Figure 10. The zero projection **28***a* on the add pinion **28** cooperates with the foot of a lever **272**, while the projection **29***a* of the subtract pinion cooperates with the foot of a lever **225**. The mechanism will be described more particularly with relation to an overdraft.

Referring to Figure 15, the subtract pinion of highest order is shown with its zero projection **29***a* in "9" position. When an overdraft occurs, the zero projection passes in a clockwise direction from its "9" to or through its "0" position, the "0" position being shown in dotted lines in Figure 15. When this occurs, the lever **225** is locked clockwise to set the member **228**, as will be presently explained. The reason why the pinion **29** of highest order moves from its "9" to or through its "0" position may be explained by referring to the third example of work illustrated in Figure 32, although this action of a highest order pinion is understood in the art. In said example, when $500.00 is added, it goes into the add pinions **28** in the first columnar position, whereupon the subtract pinions **29** turn reversely; and at the end of the operation, the latter stand at 99,949,999. The next operation is to subtract $600.00, which is done by adding this amount into the subtract pinions. The "6" will be added to the "4" in the hundreds of dollars order, which will cause a tens-transfer carry to the next higher order to cause said higher order pinion to move from its "9" to its "0" position. Said tens-transfer will be carried through the remaining higher order pinions so that the highest order pinion will also move from its "9" to its "0" position. This would leave the subtract pinions at 00,009,999. However, a "fugitive 1" is added into the subtract pinion of lowest order, which moves that pinion from its "9" to its "0" position and causes a tens-transfer to the next higher orders, which carries through until the unit is put into the hundreds of dollars order, whereupon the subtract pinions stand at 00,010,000. As a matter of fact, the "fugitive 1" is inserted first, but the explanation has been made as above because it is easier to comprehend. The result is the same, namely, that the register pinion of highest order moves from its "9" to or through its "0" position.

The upper end of the lever **225** (Fig. 12) is adapted to engage a pin **227** on one arm of the setting member **228** which is in the form of a three-armed lever pivoted on the stud **221**. The stud **221** and the pivot stud for the lever **225** are supported by a fixed plate **219** which is best illustrated in Figure 9. A spring **226** (Fig. 9) urges the lever **225** to a position with its upper end in engagement with a limit lug **224** on the plate **219**. When the lever **225** is rocked clockwise, as above explained, its upper end engages the pin **227** and moves the member **228** from its normal or add position, shown in Figure 9, to a subtract or negative position illustrated in Figures 15, 29, and 31. The lower end of the downwardly extending forward arm of the three-armed lever **228** is pointed, the side edges D and C of the point acting as cam surfaces with which cooperates a pin **230** on the end of a detent arm **231** pivoted at its rear end to the plate **219**. The free end of the arm is urged upwardly by a spring **229**. In the normal or add condition of the parts, the spring **229** holds the pin **230** in engagement with the cam edge C. But when the lever **228** is rocked counterclockwise at the time an overdraft occurs in the registering mechanism, the pointed end of member **228** wipes past the pin **230**, after which the latter engages the edge D and holds the member **228** in its set position, as illustrated in Figure 15.

If the registering mechanism should be changed from negative to positive condition, such action occurs when an item is added. At that time, the add pinions **28** are in active position; and when the change occurs, the zero projection **28***a* on the add pinion of highest order moves from its "9" to or through its "0" position. When that occurs, a lever **272** (Fig. 11) is rocked clockwise; said lever is pivoted on plate **219** and urged counterclockwise by a spring **275**, and it has an abutment edge adapted to engage the pin **227** on the member **228** to move said member from negative to positive position.

The lever or setting member **228** controls certain other parts as follows: Journaled loosely on a rod **233** is a yoke-shaped member **234** (Figures 1, 7B, 29, and 31) having a vertical arm **232**. The upper end of this arm is bent laterally and then rearwardly, and a pin **235** is carried on the rearwardly projecting portion, said pin engaging the forward edge of the upstanding arm of the three-armed lever or setting member **228**. A spring **242** (Figure 31) urges the yoke **234** counterclockwise so as to maintain the pin **235** in engagement with the setting member **228**. The yoke **234** has another vertical arm **236** (Figures 7A, 7B, and 29) which is connected by a link **237** to the vertical arm of a bell crank lever **238** pivoted on a machine stud. The other arm of this bell crank is connected to a downwardly extending link **239** which has a slot on its lower end through which a stud **240** on an abutment arm **241** projects. A spring **243** (Figures 28 and 29) is connected to the stud **240** and to a pin on the link **239** to normally retain the stud **240** in engagement with the upper end of the slot at the lower end of the link **239**. This type of connection is made to enable the abutment arm **241** to move, as presently described, without subjecting the parts to undue strain.

The abutment arm **241** has a slot **244** through which a pin **245** projects, said pin extending laterally from an arm **246** pivoted on the usual ribbon shaft of the machine. A spring **247** is connected to a pin on the rear end of the arm **241** and to the pin **245** so as to normally urge the abutment arm to the right, as viewed in Figure 28.

The right-hand end of the abutment arm **241** is normally above the path of a stud **263** (Figs. 6 and 29) on an arm **164** that is oscillated during

each machine cycle. Said arm is rocked counterclockwise from the position of Figure 6 to that of Figure 29 and then returned clockwise to normal. If the abutment arm is lowered into the path of stud 263, said arm is moved to the left to engage the stud 245 as shown in Figure 29, whereas, if the abutment arm is not lowered, no leftward movement of it occurs.

From the description thus far given, it will be clear that the abutment arm 241 is controlled by the registering mechanism through the setting member 228. When the registering mechanism is in add condition, the abutment arm is above the path of the stud 263. But when the registering mechanism changes to subtract condition, said abutment arm, except for other controls hereinafter described, is lowered into the path of said stud 263 so that, when the arm 164 is rocked counterclockwise, the abutment arm 241 is thrust to the left. This movement of the abutment arm controls the subtract conditioning of the machine through mechanism as follows:

The stud 245 which is engaged by the abutment arm 241 is carried by an arm 246 pivoted on the usual ribbon shaft of the machine, said arm being urged counterclockwise, as viewed in Figure 29, by a spring 246b. The lower end of this arm is bifurcated, and one portion of it, 246a, has a recess 248 which is normally engaged by a stud 249 on one arm of the lever 250 pivoted as shown in Figure 29. The downwardly extending arm of this lever is connected by a spring 251 to the lever 164. Pivoted upon the lever 250 is a thrust piece 253, the upper end of which carries a roller stud adapted to act upon a rock plate 254 pivoted on the ribbon shaft. This rock plate is an old part of Burroughs machines, heretofore used for alternately rocking one of two registers to active position as shown in Kilpatrick Patent No. 1,152,715. It is employed because available although it is not used in exactly the same manner as in said Kilpatrick patent, as will be presently explained. The plate 254 carries a stud projecting through a slot 255 in the rear end of the link 256 connected at its forward end to the subtract lever 157 (Fig. 6), the subtract lever connections being like those described in Muller Patent No. 1,397,774.

When the stud 263 on arm 164 engages abutment arm 241 during the forward stroke of the machine, the member 246 is rocked from the position of Figure 28 to that of Figure 29 so that the stud 249 on lever 250 registers with the slot in the member 246. The lever 250 does not move upwardly immediately because it is engaged by the stud on arm 164, to which the spring 250 is attached. But, during the return stroke, when the arm 164 rocks clockwise, the lever 250 moves upwardly, whereupon the thrust piece 253 rocks the plate 254 clockwise to thrust the link 256 to the right to thereby move the subtract lever to subtract position. Movement of the subtract lever to subtract position raises the link 159 (Figure 6) so that during the next cycle of operation of the machine, the registering mechanism will be tumbled from add to subtract position.

To review again the operation of the mechanism so far described, the registering mechanism can go negative during one cycle of machine operation, whereupon the abutment arm 241 will be set. During the next machine cycle, the stud 263 moves abutment arm 241, and the parts operate to cause the subtract lever to be moved to subtract position. During the third cycle, the registering mechanism is changed from add to subtract position. If the registering mechanism contains a negative amount as a result of which the abutment arm 241 is set, and if said registering mechanism then changes from negative to positive condition, the abutment arm 241 is raised, which means that the registering mechanism will be tumbled to add position during the next machine cycle. Thus, the registering mechanism sets certain parts so that if the machine is given the necessary cycles, the registering mechanism will be adjusted relative to the actuators.

The cycling of the machine above-mentioned can be performed manually through the usual hand crank or by means of a motor drive which is set into operation for each cycle by the depression of a motor bar; and the total can be taken by depressing the total key in the new balance column. To operate the machine by hand the repeat mechanism is disabled either by removing the repeat rollers or by using a normalizing key such as described in Muller 1,397,774. However the present machine provides additional automatic controls, in that, the cycles that condition the machine for total taking, and which cause the taking of a total, are caused to take place automatically; and thus the control of whether or not the registering mechanism shall be adjusted relative to the actuators for the purpose of taking a negative total is governed not only by the registering mechanism itself, but also by the paper carriage which controls whether the automatic cycles shall occur to cause the adjustment. This paper carriage controls the total taking by controlling both the cycles that cause the totaling and the conditioning of the machine for the total.

A direct carriage control for the abutment arm 241 is also provided, the same being in the form of a lever 258 pivoted on the ribbon shaft. The right-hand end of this member is bent laterally and provided with a projecting end 258b adapted to engage a stud 259 on the abutment arm 241. The lever is urged counterclockwise, as viewed in Figures 28 and 29, by a spring 258a so that said lever 258 tends to hold the abutment arm 241 out of the path of the stud 263. The rear end of lever 258 engages in a slot in the end of one arm 260 of a yoke-shaped member best illustrated in Figure 30. This yoke member is pivoted on the support that holds the other carriage control yoke members. The yoke is provided with another arm 261 adapted to be engaged by special rollers 33S on the carriage (Figures 2 and 28). A roller 33S is active in both the fourth and fifth columnar positions of the carriage, the arrangement being that, in these carriage positions, the lever 258 is rocked clockwise to release abutment arm 241 so that the latter is freely responsive to the control by the registering mechanism.

From the above, it will be clear that whether the registering mechanism is tumbled or adjusted relative to the actuator racks for the purpose of taking a negative or positive total depends upon a mechanism controlled by the register in accordance with the sign of the total. This control determines whether the registering mechanism shall remain in add condition or be changed from add to subtract condition. The actual changing of the condition of the register or the adjustment of it relative to the actuators depends, however, upon whether the machine receives additional cycles of operation to effect such change; and the control of these cycles is by the paper carriage as heretofore described, which paper carriage also controls the conditioning of the

machine for total taking. In addition to controlling whether cycles of operation take place, the machine is also provided with the direct carriage control lever **258** which insures that the abutment arm **241** will be moved only in the columns where movement is desired. In order that the operation may be entirely clear, a series of cycles will be followed through.

Assume that the machine is to be operated to make the necessary entries when the amount withdrawn is larger than the old balance. With the carriage in the second columnar position, the lever **228** is rocked to the position shown in Figs. 29 and 31 when the overdraft occurs and the lever is held in such position by the engagement of the pin **230** with the edge D of the point of the lever **228**. At this time the projection **258***b* on the lever **258** is in engagement with the pin **259** on the arm **241** (as shown in Fig. 7A) and prevents the arm **241** from rocking downwardly and through the link **239**, lever **238** and link **237** prevents the yoke-member **234** from being rocked rearwardly by the spring **242** connected to the yoke member **234** when the upstanding arm of the lever **228** is moved out of engagement with the pin **235** on the arm **232** of the yoke-member **234**, as illustrated in Fig. 31. The spring **258***a* (Figs. 7A, 28, and 29), connected to the rear end of the lever **258**, is stronger than the spring **242** and hence holds the lever **258** in normal position in opposition to the spring **242** at this time and until the carriage shifts to its fourth columnar position. As the carriage tabulates to its fourth columnar position one of the special rollers **33S** engages the arm **261**, as shown in Fig. 28, thus rocking the lever **258** to lower its projection **258***b*, whereupon the spring **242** rocks the yoke-member **234** rearwardly to the position shown in Fig. 29 and through the link **237**, lever **238** and link **239** lowers the arm **241**. This movement of the arm **241** carries its forward end in line with a pin **263** on the lever **164**. At such time, the pin **249** is in engagement with the recess **248** in the arm **246**, as shown in Fig. 28. Near the end of the first half of the operation of the machine with the carriage in the fourth columnar position, the pin **263** engages the forward end of the arm **241**, thereby shifting the arm **241** rearwardly and rocking the arm **246**, to carry the recess **248** away from the pin **249**, as illustrated in Fig. 29, in which the parts are shown in the positions which they assume at such time. The slot in the lower end of the link **239** is provided to permit this movement of the arm **241**, without subjecting the parts connected with the link **239** to any strain. Now, during the second half of the operation of the machine with the carriage in the fourth columnar position, the lever **164** rocks back to normal position, whereupon the spring **251** raises the lever **250** and the roller stud on the thrust piece **253** rocks the cam plate **254** clockwise thus moving the link **256** forwardly to move the subtracting lever **157** to subtracting condition.

As the carriage shifts out of its fourth columnar position, the first roller **33S** moves out of engagement with the arm **261** and the spring **258***a* moves the lever **258**, link **239** and connected parts to normal position, but as the carriage moves into its fifth columnar position the second roller **33S** rocks the arm **261** and thus moves the lever **258**, link **239**, etc. back to the position shown in Figs. 28 and 29. Near the end of the first half of each of the cycles of operation with the carriage in the fifth columnar position, the pin **263** engages the forward end of the arm **241** and thus holds the arm **246** rearward so that its spring **246***b* is prevented from rocking the arm **246** forwardly and reengaging the recess **248** with the pin **249** as the latter is lowered in line with the recess. Thus the lever **250** is raised by its spring **251** and the subtraction lever remains in subtracting position, during each cycle with the carriage in the fifth columnar position. In retaining the subtract lever in subtract position during each cycle, the roller stud on the end of the thrust piece **253** engages the left-hand notch in the rocker plate **254** each time, the parts being suitably arranged for this purpose. In fact, a rocker plate with two notches is not necessary, but such a plate has been employed because it is a standard part and its use avoids the construction of a new part.

Thus it will be seen that, with an overdraft in the register, the lower wheels **29** are meshed with the racks **27** during the sub-total taking operation with the carriage in the fifth columnar position to print the correct negative total, i. e. amount of the overdraft. If no overdraft has taken place, the arm **228** is held in normal position, thus blocking movement of the pin **235** so that the arm **241** is held in normal elevated position when the carriage is in the fourth and fifth columnar positions, and the pin **263** on the lever **164** moves idly under the forward end of the arm **241**. Therefore the arm **246** is not displaced and as it prevents movement of the lever **250**, the link **256** is not moved and the registering mechanism remains in adding condition.

As the carriage moves out of its fifth columnar position, the second special roller **33S** is carried out of contact with the arm **261**, whereupon the spring **258***a* (Fig. 29) connected to the lever **258** and stronger than the spring **242**, restores the lever **258**, link **239**, arm **241**, lever **238**, link **237** and yoke-member **234** to normal position.

The carriage now shifts to the sixth columnar position and the sub-total is again printed. It will be recalled that the lever **101** of the total key is latched in moved position during the second sub-total taking operation by the engagement of the arm **122** behind the stud **128**. To latch the subtracting lever **157** in its moved subtracting position during this operation, the stud **101***a* on the lever **101** of the total key engages behind a projection **157***a* (Fig. 16) on the subtraction lever **157**, when the total key is automatically operated after the subtraction lever has been automatically moved to subtracting position when the carriage was in the fifth columnar position. At the end of the first half of the operation with the carriage in the sixth columnar position, the spring **246***b*, (Fig. 28) connected to the arm **246**, moves the latter to normal position as the pin **249** moves out of engagement with the forward edge of the arm **246***a* and presents itself to the recess **248**, the lever **250** then being latched down by the arm **246**.

With the carriage in the sixth columnar position, there is no "subtraction" roller **33** on the carriage engaging the "subtract" arm (Fig. 6) which, as more fully described in my aforesaid Patent No. 1,397,774, is connected by a yoke-member **262** (of which the "subtract" arm is a part), a lever **265** and a spring **264** to a lever **267**, having a pin **268** (Figs. 6 and 29) engaging in a recess in the link **256**. The same mechanism is shown in Fig. 17 of my Patent No. 1,397,774. As no roller engages the "subtract" arm with the carriage in the sixth columnar position, a spring **270**, (Fig. 6), connected to the upper end of the

lever 267, rocks the lever 267 rearwardly, thereby shifting the link 256 to move the subtraction lever 157 to adding condition when the latter is released from the pin 191a upon movement of the total key lever 101 to normal position, as explained above. The subtraction lever remains in adding condition as the carriage moves into the seventh columnar position, there being no "subtract" roller 33 for that position.

The lever 228 is restored to normal condition, shown in Fig. 9, during the operation of the machine with the carriage in the seventh columnar position. With the carriage in this columnar position, the withdrawn amount (which was subtracted with the carriage in the second columnar position) is now added and as the upper wheels 28 are in mesh with the racks, the wheels of higher orders pass to "0" position. With the example to which I have last referred (i. e. the third example—Fig. 32), at the end of the operation of the machine with the carriage in the sixth columnar position there is an overdraft of $100.00 in the registering mechanism and the upper wheels 28 stand at "999899.99". Now when $600.00 is added on the upper wheels with the carriage in the seventh columnar position, the upper wheels are moved to represent "00049999" and then when the "fugitive one" is added the amount registered in the upper wheels is $500.00. It will be seen that transfers have been successively made from the wheel 28 of 5th order to the wheels of higher orders thus turning the wheel 28 of highest order from "9" to "0". As this wheel passes to "0" its zero projection engages the foot on the lower end of an arm 272 (Fig. 10) and rocks it rearwardly. This arm is pivoted on a stud 273, projecting from the plate 219, and a spring 275, which is connected to a forwardly extending finger 276 on the upper end of the arm 272 normally retains the arm in engagement with the rod 233. As the pinion of highest order moves past "0" and rocks the arm 272 rearwardly, the latter engages the stud 227 on the lever 228 to restore the lever 228 to the normal position in which position its cam edge C engages the stud 230.

While it is preferable to use the carriage control lever 258 to hold the abutment arm 241 out of active position until it is needed, such lever is not necessary, as will be apparent by following through the operation of the machine with the lever 258 omitted.

First, take an example where a positive old balance is entered, to which is added a deposit. In such case, the machine remains in add condition through the various columnar positions of the carriage, the abutment arm 241 is inactive, and the machine is in proper condition in the new balance column to take a total.

Next, take a positive old balance, from which a check is subtracted that leaves the balance positive. During the machine cycle in the second column, the machine is in subtract condition and a "fugitive 1" is entered in a subtract direction; but, since the register does not go negative, the abutment arm 241 remains inactive. At the end of the cycle and as the carriage moves into its third columnar position, the control of the register is taken away from the withdrawal key, whereupon the add-subtract controls move to add position under the urge of their spring. The result is that the machine changes to add condition at the beginning of the cycle in the third column but no "fugitive 1" is entered in add direction because the register is non-added. In the Burroughs machine, the "fugitive 1" is added as the register is rocked into engagement with the racks after said register has been tumbled. The machine remains in add condition in the fourth column, and no "fugitive 1" is entered in this column. The machine also remains in add condition in the fifth column, with the result that a "fugitive 1" is entered during the first cycle, the tens-transfer mechanism, if tripped, is restored during the second cycle, and the total is taken during the third cycle.

Next, take a positive old balance, from which a check is subtracted that is large enough to cause an overdraft. During the machine cycle in the second column, the machine is in subtract condition, a "fugitive 1" is entered in subtract direction, and, when the register goes negative, the abutment arm 241 is moved down to active position. At the end of the cycle, and when the carriage moves to the third column, the control of the register is taken away from the withdrawal key, whereupon the add-subtract controls go to add condition under the urge of their spring. At the beginning of the cycle in the third column, the machine is changed to add condition, in which it remains during said cycle, but no "fugitive 1" is entered because the register is non-added. During the first half of said cycle, the abutment arm 241 moves the mechanism controlled by it, so that during the latter half of the cycle, the thrust plate 253 tends to move the add-subtract controls to subtract condition. Said controls are not moved immediately because they are locked during the machine operation, but, at the end of the cycle, the add-subtract controls are automatically moved to subtract position. At the beginning of the cycle in the fourth column, the add-subtract controls are in subtract position, and the abutment arm 241 remains active. The machine changes to subtract condition during the cycle, but no "fugitive 1" is entered because the register is non-added. While the add-subtract controls are released for return to add position at the end of the cycle, they cannot return because the mechanism controlled by the abutment arm 241 has again moved so as to hold the add-subtract controls in subtract position. At the beginning of the cycle in the fifth column, the add-subtract controls are in subtract position, and the abutment arm 241 remains active. The machine remains in subtract condition during the first cycle. Although the register is engaged with the racks, no "fugitive 1" is entered because the "fugitive 1" mechanism is already in subtract position from the entry in the second column. The non-add operations in the third and fourth columns did not affect it. While the add-subtract controls are released at the end of the first cycle for movement to add position, they cannot move to such position because the mechanism controlled by the abutment arm 241 is again moved to hold said controls in subtract position. During the second cycle in the fifth column, the same thing occurs, that is, the machine remains in subtract condition throughout the cycle and is maintained in such condition at the end of the cycle. Furthermore, it is locked in such condition at the end of the cycle because the total-taking lever is pulled down automatically and there is an interlock that holds the subtract lever in subtract condition. Accordingly, during the third cycle in the fifth column, the machine remains in subtract condition which is the correct condition for the taking of a negative total.

The machine also remains in subtract condition in the sixth column, since the total-taking mechanism is not released until after the operation in that column.

Assume, next, a negative old balance, from which a check is subtracted. During the cycle in the first column, the machine is in subtract condition, a "fugitive 1" is entered in subtract direction, and since the register goes negative, the abutment arm 241 is moved to active position. At the end of the cycle, the add-subtract controls are released for movement to add position. At the beginning of the cycle in the second column, the withdrawal key moves the controls to subtract condition, and the machine remains in subtract condition during the cycle. During this cycle, the abutment arm 241 acts on the mechanism controlled by it to move the parts so as to tend to move the add-subtract controls to subtract condition. However, these controls are already in that condition. At the end of the cycle in the second column, and when the carriage moves to the third column, the control of the register is taken away from the withdrawal key, which releases the add-subtract controls for movement to add condition, but they cannot move to such position because the mechanism controlled by the abutment arm 241 prevents it. Accordingly, during the cycle in the third column, the machine remains in subtract condition, and the abutment arm 241 remains active, with the result that, while the add-subtract controls are released at the end of the cycle, they cannot move to add position. In the same manner, the machine is kept in subtract condition through the fourth column and through the several cycles in the fifth column, so that it is properly conditioned for the taking of a negative total.

Next, assume a negative old balance to which a small deposit is added that leaves the balance negative. The machine is in subtract condition during the cycle in the first column, a "fugitive 1" is entered in subtract direction, and, since the register goes negative, the abutment arm 241 is moved to active position. At the beginning of the cycle in the second column, the add-subtract controls are in add position, and they remain in this position during the cycle. During this cycle, a "fugitive 1" is entered in add direction, and the abutment arm 241 moves the mechanism controlled by it, which tends to move the add-subtract controls to subtract position, but they cannot move because they are locked during the cycle. However, at the end of the cycle, said controls are moved to subtract position where they remain for the beginning of the machine cycle in the third column. From this point on, the operations are just the same as those above described—that is, the machine is maintained in subtract condition through the fourth column and through the several cycles in the fifth column, with the result that the machine is properly conditioned for the taking of a negative total. The "fugitive 1" is not entered in subtract direction until the first cycle in the fifth column.

Assume, next, a negative old balance to which a deposit is added that changes the balance to a positive one. The machine is in subtract condition during the cycle in the first column, a "fugitive 1" is entered in subtract direction, and, since the register goes negative, the abutment arm 241 is moved to active position. At the end of the cycle, the add-subtract controls move to add position where they remain for the beginning of the cycle in the second column. The machine remains in add condition during the cycle in the second column, and while the abutment arm 241 causes the mechanism controlled by it to tend to move the add-subtract controls to subtract position, they cannot move to such position because they are locked during the cycle. During this cycle, a "fugitive 1" is entered in add direction, and the register goes positive, which releases the abutment arm 241. But, since this release does not occur until the latter part of the cycle, said abutment arm is not returned to normal until the end of the cycle. At the end of the cycle, the add-subtract controls are automatically moved to subtract position where they remain for the cycle in the third column. During the cycle in the third column, the machine is in subtract condition but no "fugitive 1" is entered because the register is non-added. Since the abutment arm 241 was restored to normal and is not active during this cycle, the result is that, at the end of the cycle in the third column, the add-subtract controls are released, whereupon they automatically return to add position. The machine then remains in add condition during the cycle in the fourth and the three cycles in the fifth column, with the result that it is properly conditioned for the taking of a positive total in the fifth column. No "fugitive 1" is entered in the fifth column because it was entered in the second column and the operations in the third and fourth columns did not disturb the condition of the register.

From all the above, it will be apparent that the mechanism disclosed will automatically condition the machine for the taking of a positive or negative total, without the use of the carriage control lever 258. It is to be further noted that, while the cycles above mentioned have been followed through as though caused automatically by the repeat mechanism disclosed, and while the taking of the total has been considered as having been caused by the automatic cycling mechanism that pulls the total-taking devices to total-taking position, nevertheless, the machine will operate when the cycles are initiated manually and when the total key is depressed for total-taking in the fifth column. Assume, for example, that the automatic repeat mechanism is disabled. It is then possible to cycle the machine by depressing the motor bar in the third, fourth, and fifth columns. The machine will operate as above described because the manner in which it is cycled is immaterial. In the fifth column, instead of having the cycling mechanism operate to condition the machine for total-taking, the operator depresses the total key, whereupon he will get the total in the same manner as if the machine had been automatically condition.

Automatic conditioning for sub-totaling in the fifth and sixth columnar positions

As previously mentioned, the total taken in the new balance column is taken as a sub-total, that is, it is taken as a total but the total is left in the machine so that it may be again printed in the sixth column. Likewise, the total taken in the sixth column is left in the machine because it is desired to have this total in the registering mechanism, in connection with the proving operations. The controls that enable the total to be taken and still left in the machine are as follows:

A total is taken by moving the registering

mechanism into engagement with the actuators before the latter descend. The registering mechanism is moved by means of the member 100 shown in Figure 6 that operates through the pitman 99. The member 100 is rocked by a pass-by pawl 156 on the end of arm 164, these parts being quite well known in Burroughs machines. In total taking, the pass-by pawl 156 engages the right-hand stud on the member 100 at the beginning of the cycle to move the registering mechanism into engagement with the racks. If the register is to be cleared after the total is printed, the pass-by pawl is arranged to engage the left-hand stud on member 100 at the beginning of the second half of the machine cycle to thereby move the registering mechanism out of engagement with the racks. When it is desired to allow the total to remain in the machine, the action of the pass-by pawl 156 on the left-hand stud on member 100 is disabled so that the registering mechanism remains in engagement with the actuators during the second half of a machine cycle.

The disablement of the pawl 156 is automatically accomplished through the non-add controls. As previously explained, the non-add yoke "non-add" (Fig. 6), when moved by the carriage, rocks a lever 202 connected by a link 201 to an arm 200. The latter has a forward extension overlying a stud on a lever 199 whose lower end can be positioned so as to disable the pawl 156 when the latter reaches the vicinity of said lever. It will be recalled that the machine is given three cycles of operation in the new balance column. It is not desired to disable the pawl 156 during the first two cycles, but it should be disabled for the third cycle. In order to accomplish this result, the carriage is provided with a "sub-total" roller that is slightly smaller than the regular non-add rollers 33. As the carriage moves into the fifth column, this roller moves the sub-total yoke, and the lever 202 is rocked to pull down the link 201 and rock the lever 200 downward. But the movement of lever 200 is not enough to move pawl 199 to a position to disable pawl 156. However, the arm 200 is provided with the stud 277 overlying one end of the lever 274 pivoted at 203. The forward end of this lever is notched and adapted to engage a stud 278 on the link 279, although it is normally out of the path of said stud, as shown in Figure 6. When the arm 200 is rocked downward in the new balance column, as above explained, the lever 274 is rocked so that its notched end is in front of stud 278. No movement of the link 279 occurs during the first cycle in the new balance column, but, during the latter half of the second cycle, the total-taking bell crank lever 101 is rocked, which thrusts the link 279 rearward. The stud 278 then engages the end of the lever 274, which, in turn, rocks the lever 199 to position to disable the pawl 156. The result is that, during the third cycle, the pawl 156 is disabled and the total that is taken will be taken as a sub-total.

Inasmuch as the total key lever 101 is not released until the end of the cycle of machine operation with the carriage in its sixth columnar position, it follows that the lever 199 is held in position to disable the pawl 156 during the cycle of operation in the sixth column, with the result that the total taking in this column is taken as a sub-total also.

Automatic proving mechanism

If an error has been made in setting up one of the items on the keyboard, the machine will be automatically locked in its ninth columnar position, which notifies the operator that an error has been made and requires that he manipulate certain levers or keys in order to unlock the machine after which it may be operated and the amount of the error will be printed.

The locking device that acts to lock the total key includes the usual Burroughs locking arm 280, illustrated in Figs. 10 to 15, inclusive. This arm, together with a companion arm 285 is mounted on a shaft 286 (Fig. 13) and the two arms carry a tie bar or cross bail 287 that lies immediately back of the rearwardly projecting fingers 281 (Fig. 10) on the latches 288 cooperating with the transfer pawls 209. Whenever an amount key is depressed a slide is moved rearward to move the bail 287 rearward which moves the locking arm 280 to locking position. This will be clear by reference to Fig. 5 and to the patent to Vincent No. 1,028,161. Whenever one of the transfer pawls is tripped, as when a carry takes place, the corresponding latch 288 moves to a position such that its finger 281 prevents the bail 287 from returning to its unlocked position until the transfer pawls have been restored. If a carry takes place when the bail is not in locking position, the bail 287 is cammed rearwardly by the tripped latch 288 and this moves the end of the arm 280 under a projection or lug 284 carried by laterally extending arm 97b of the arm 97 of the total key. Accordingly, whenever any of the transfer pawls are tripped, the total key is locked against depression. This manner of locking of the total key against depression is usual in Burroughs machines and the present invention concerns a further control of the locking member 280 so that unless the register is clear in the ninth columnar position the total key cannot be depressed.

As previously explained, the machine is adapted to prove the numbers of the accounts as well as the account items and it is, therefore, necessary to employ two devices for controlling the total key lock, one controlled by the item section and the other by the account number section. Inasmuch as these two control devices are of similar construction it is not considered necessary to describe both of them in detail. The controlling device for the item section will be described and it will be understood that a similar construction is used in connection with the account number section. In the drawings the same reference characters have been used to designate like parts of these controlling sections and the suffix N is added to the numbers applied to the control devices of the account number section.

In order to understand the operation of the automatic proving means, it is necessary to keep in mind the manner in which the machine arrives at a condition for taking a total in the ninth columnar position. The total that is to be taken in the ninth columnar position is taken with the machine in addition condition and, in most cases the machine is in subtraction condition in the 8th columnar position. Accordingly, after the machine moves from the eighth to the ninth columnar position, it is necessary to give it two spacing cycles of operation. The first cycle rocks the registering mechanisms or registers from subtraction to addition condition, restores the tripped transfer pawls, and automati-

cally adds the "fugitive one" to the upper register. The second cycle restores any transfer pawls that may have been tripped by the adding of the "fugitive one". The rocking of the registers from subtraction to addition condition during the first spacing cycle automatically positions the lock **280** to prevent depression of the total key while the counter is being rocked, as described in Rinsche Patent No. 1,172,484. The lock is also maintained in locking condition during the second cycle by the transfer pawls that are tripped. After the machine has been given two cycles in the ninth columnar position, the registers will have been rocked to addition position and the transfer segments will all have been restored so that the lock will normally be released if no error has been made.

The automatic control of the locking arm **280**, to cause it to lock the total key against depression in the ninth columnar position when the register is not clear, is effected through the lever **228** already described.

The upper arm of the three-armed lever **228** carries a stud **297** operating in a cam slot **298***a* of a link **298**. This link is normally urged downwardly by the same spring **275** which urges the lever **272** in a counter-clockwise direction. The upper surface of the link **298** engages a stud **305** on the locking latch **288***a* that serves to move the bail **287** and the lock **280** to locking position. The ends of the slot **298***a* are recessed for the reception of the stud **297**, which provides a raised portion **304** between the recesses. When this raised portion rides over the stud **297**, the link **298** is raised which raises the latch **288***a* and cams the bail **287** to move the lock **280** to locking position.

The link **298** is moved forward from its Fig. 10 to its Fig. 12 position when the machine is operated after being changed from addition to subtraction condition and in a reverse direction when the machine is changed from subtraction to addition condition. The rear end of the link **298** is connected to one end of an arm **299** fixed to a shaft **300** which extends across the machine as illustrated in Fig. 7A. The left-hand end of this shaft has an arm **301** fixed to it and this arm has a bifurcated end that straddles a stud **302** on the upper end of the lever **158** that is rocked back and forth when the machine is conditioned for subtraction and addition and vice versa. When the machine is conditioned for subtraction, either automatically or by hand, and operated, link **298** is moved forward to the position of Fig. 12 and when the machine is conditioned for addition and operated, the link occupies its rear position illustrated in Fig. 13.

The normal position of the parts is illustrated in Figs. 8 and 9. The lever **228** is in what may be termed its "positive" position and the link **298** is in addition position. The stud **297** occupies the recess in the front end of the slot **298***a* and the link **298** is in its lowered position and the total key is unlocked. If, with the parts in this position, the machine is changed to subtraction condition, the link **298** is moved forward to its Fig. 12 position or "negative" position. This causes the link to be carried upwardly by the surface **304** engaging the stud **297** and the lock **280** is moved to locking position. Accordingly, when the lever **228** is in positive position and the link **298** is moved to subtraction position, the total key is locked.

Assume now that the machine has been changed to subtraction condition as illustrated in Fig. 12. This moves the counter pinions **29** to a position such that the projection **29***a* may engage the foot of arm **225** when the pinion of highest order is rotated from "9" to "0". Assume also that a negative total results from the operation of the machine while in subtraction condition. This would move the counter pinion **29** of highest order from its 9 to or beyond its zero position. In so moving, the projection **29***a* cams the arm **225** clockwise and the upper end of the arm, which engages the stud **227**, moves the three armed lever **228** to "negative" position as illustrated in Fig. 15. When this occurs the upper end of lever **228** carrying the stud **297** moves rearwardly to position the stud **297** in the rear recess of slot **298***a* as shown in Fig. 15. Accordingly, and except for other controls hereinafter described, the machine is unlocked when the lever **228** is in "negative" position at the same time that the link **298** is in subtraction position.

It will now be clear that if no negative total had occurred when the machine was in subtraction condition, the lever **228** would have remained in "positive" position and the total key would have remained locked against the taking of a total. In other words, as long as the total in the machine is positive, a total cannot be taken with the machine in subtraction condition.

It will also be understood that if, with the lever **228** in "negative" position due to a negative total, the link **298** is moved back to addition position, the machine is locked. Such operation would move the link **298** rearward from the position of Fig. 15 and the surface **304** would rest on stud **297**. In other words, with a negative total in the machine, a total cannot be taken with the machine in addition condition.

The above description will make clear that the machine cannot be operated to take a total unless it is conditioned in accordance with the sign of the total in the machine. This does not explain the locking of the machine against the taking of a total when the registers are not clear, but an understanding of the above described mechanism is necessary in order to comprehend the operation of the additional controls which will now be described.

In order to secure the proper result, it is desirable to lock the latch **288***a* in its upper or locking position under certain circumstances. For this purpose a latch **293** is provided, shown in detail in Fig. 14. This latch is pivoted at **273** and is urged counter-clockwise by a spring **306** one end of which is connected to the lower arm of the latch and the other end to an extension of the support **219** as illustrated most clearly in Fig. 9. The forwardly extending arm of the latch has a projection **292** which normally abuts the under-side of a lateral lug **291** on the arm **290** of the latch **288***a* which thus positions the latch. The projection **292** forms a shoulder **307** that may engage behind the lug **291** as illustrated in Fig. 11 to hold the latch **290** in locking position. The latch **293** also has an offset portion **294** provided with a pointed end **295** that engages an inclined surface **296** on the three-armed lever **228**. There is a clearance between the surfaces **295** and **296** when the lever **228** is in "positive" position shown in Fig. 10 which permits the latch **293** to move to its uppermost latching position. When the lever **228** is in its "negative" position, shown in Fig. 15, the surfaces **295** and **296** are in contact and the latch **293** cannot move counter-clockwise to latching

position, and it is also held in a slightly lower position as shown in Fig. 15 than if the lug 292 abutted the under-side of the lug 291 as it would under normal conditions. Also, if the latch 293 is in latching position when the lever 228 is moved from positive to negative position during operation of the machine while in subtraction condition, the surface 296 engages the surface 295 and moves the latch to unlatched position.

The latch 293 also has a downwardly extending arm having a lateral offset lug 316 with which cooperates a lateral projection 317 (Fig. 9) carried by an arm 318 which is an extension of one of the conventional Burroughs latches 411 shown in Rinsche #1,179,564. The arm 318 is released by the transfer pawl for the pinions of the next to highest order in the same manner as the latches 411 are released in said Rinsche Patent #1,179,564. Whenever a carry takes place in either the upper or lower pinion of next to highest order, which, in this machine, is the seventh pinion of the eight bank machine, the arm 318 is released for rearward movement in which case the lug 317 strikes the front of lug 316 to move the latch 293 to release position if the lever 228 is in "negative" position, which position of lever 228 holds the latch 293 in its most downward position and with its lug 316 in the path of lug 317. The lug 317 moves under the lug 316 to prevent the latch 293 from being released if the lever 228 is in "positive" position, which position of the lever 228 permits the latch 293 to occupy its normal released or upper position. The operation of the parts will be most easily understood by following through several examples.

The locking mechanism operates under three sets of conditions namely; (*a*) under normal conditions when the counters are clear in the ninth columnar position at which time the total key is unlocked; (*b*) under a condition when there is a positive total in the machine in the ninth columnar position in which case the machine is locked against the taking of a total; (*c*) under a condition when there is a negative total in the machine in the ninth columnar position in which case the machine is locked against the taking of a total. These conditions will be described in order.

(*a*) *Normal condition, registers clear, machine unlocked*

The first example of Fig. 32 will be followed through to show the operation under normal conditions.

In the first columnar position $500.00 is entered in the machine and the upper register pinions stand at 000500.00 while the lower pinions register 999499.99. In the second columnar position $400.00 is added which turns the upper pinions to 000900.00 and the lower ones to 999099.99. In this example, there are no withdrawals and the machine goes through the fourth, fifth and sixth positions which leave the registers in the same condition as in column 2. In the seventh columnar position the machine is changed to subtraction condition and 400.00 is subtracted. The change to subtraction condition locks the machine because the link 298 is moved forward to subtraction position while the lever 228 remains in "positive" position. The result is that the latch 293*a* is moved to locking position and it is latched in this position by the latch 293 which snaps up to the position of Fig. 12. When 400.00 is subtracted, and taking into account the "fugitive one" which is automatically borrowed from the upper and added to the lower register during the change to subtraction condition, the upper pinions register 000499.00 and the lower 999500.00. The machine is then moved to its 8th columnar position where 500.00 is subtracted. This moves the upper pinions to 999999.99 and the lower ones to 000000.00. It will be observed that, during this operation, a carry has taken place from each of the last four lower pinions which means that the arm 318 is released by the 7th pinion and the arm 225 is operated by the projection on the 8th or highest order pinion. The arm 318 is released first. At the instant it is released the lever 228 is in "positive" position and the latch 293 is in its upper position where it latches the arm 290 in locked position. Under these circumstances the lug 317 moves under the lug 316, as shown in Fig. 11, and, instead of moving the latch 293 to release position, acts to hold the latch 293 from moving to released position. Immediately thereafter the arm 225 is moved clockwise by the projection 29*a* on the 8th pinion 29 and the lever 228 is moved counter-clockwise to "negative" position. The movement of the lever 228 toward "negative" position tends to move the latch 293 toward unlatched position owing to the contact of surface 296 with surface 295, but the latch 293 is held against movement by the lug 317 on arm 318. This has the effect of limiting the counter-clockwise movement of the lever 228 so that it then assumes the dotted line position of Fig. 15A with the angular face D in a partway position on stud 230.

When the machine is moved to its ninth columnar position, it is changed to addition condition and given two spacing strokes. The first spacing cycle changes the machine to addition condition and moves the link 298 rearward. At this time the lever 228 is in "negative" position, and this movement of link 298 would act to lock the total key if it were unlocked but, since the lock has already been latched in locked position by the latch 293, such action is unnecessary. Immediately thereafter, the released latches 288 are restored to their normal or locked position. Included with these is the arm 318 which is thus moved to disengage the lug 317 from under the lug 316 on latch 293 thus permitting the lever 228 to move to the full line position of Fig. 15A under tension of spring 229. This moves the latch 293 to released position. The locking latch 288*a* cannot move to unlocked position because the link 298 is in addition position while the lever 228 is in "negative" position. At the completion of the forward portion of the first spacing cycle the upper register is moved into engagement with the racks 227 and at the end of the stroke the "fugitive one" is restored to the upper register which then registers 000000.00 while the lower register moves to 999999.99. This movement of the upper register pinions causes a continuous carry which again releases the arm 318. When the arm 318 is released the lever 228 is in "negative" position. This lever 228 holds the latch 293 downward sufficiently so that the lug 317 strikes the lug 316 and holds the latch 293 in released position to prevent its movement when the lever 228 is moved to "positive" position. Immediately after the arm 318 is released the projection 28*a* of the pinion of highest order moves the arm 272 to move the lever 228 to "positive" position. Since the link 298 has been moved to addition position the parts are in position to be unlocked. Such unlocking does not occur until the machine is given a sec-

ond spacing cycle to restore the transfer pawls that were tripped by the insertion of the "fugitive one", but at the end of the second cycle the machine is free to be operated to take a total.

(b) *Total key locked by positive total*

The fourth example of Fig. 32 will be used to describe the condition of the machine when an error has occurred resulting in a positive total remaining in the machine.

In this example $500.00 and $400.00 are put in the machine in the first and second columnar positions respectively and machine is in the same condition in the sixth columnar position as in the first example, that is, the upper register pinions stand at 000900.00 and the lower ones at 999099.99.

In the seventh columnar position $40.00 is subtracted instead of $400.00 which leaves the upper pinions at 000859.99 and the lower ones at 999140.00. During this operation, the link **298** is moved forward while the lever **228** remains in addition position with the result that the latch **288***a* is moved to locking position and is held there by the latch **293** which moves up behind the arm **290**.

In the 8th columnar position $500.00 is subtracted which moves the upper pinions to 000359.99 and the lower ones to 999640.00. Nothing happens to the locking mechanism during this operation as no carry takes place in the last two pinions to the left. This is in contrast to the first example where the machine cleared and a carry took place in the last two pinions to the left.

In the 9th columnar position, the machine is changed to addition condition and given two spacing cycles. The change from subtraction to addition moves the link **298** rearward and since the lever **228** has remained in addition position, this would tend to place the parts in unlocked condition, but the latch **288***a* is held in its locking position by the latch **293**. The spacing cycle restores any tripped carry pawls and inserts the "fugitive one" which causes the upper pinions to register 000360.00 and the lower pinions to stand at 999639.99. Here again the movement of the pinions does not change the condition of the locking mechanism. The second cycle restores any tripped transfer pawls, but does not release the lock because the latch **288***a* remains held in locking position by the latch **293**.

Before the total key can be depressed, the latch **293** must be disabled, and in order to accomplish this, a releasing mechanism has been provided.

A release key **308** positioned near the subtraction lever (Figs. 1 and 7A) is provided which has a stem resting on one arm of a pivoted bell crank **309** whose other arm is connected by a wire **310** to the upper end of an arm **311** fixed to a shaft **312** (Fig. 7B) extending across the front of the machine in axial alignment with the shaft **216**. The shaft **312** is journaled at its left-hand end in a plate **312***a* (Fig. 7A) and its right-hand end is reduced and journaled in the end of shaft **216** (Fig. 19). Fixed to the shaft **312** is an arm **313** (Figs. 1 and 15) having a lug at its upper end projecting laterally in front of the upper end of the lever **228**. A spring **309***a* (Fig. 7A) connected to the bell crank lever **309** normally holds the arm **313** in its forward position shown in full lines in Fig. 15.

When the key **308** is depressed, the arm **313** is moved rearwardly to the dotted line position of Fig. 15 which rocks the lever **228** counterclockwise to its subtraction position. As the lever **228** is moved to this position its surface **296** engages the surface **295** on latch **293** and moves the latch to its released position. This does not immediately release the lock **280** because the link **298** is in addition position while the lever **228** is in "negative" position. In order to release the lock, the subtraction lever **157** must be moved to subtraction position which causes operation of the machine to move the link **298** to subtraction position and allows it to drop to release the latch **288***a*. When the machine is operated in this condition, it prints the complement of the positive total in the machine, that is 999640.00 because the machine will have changed to subtraction condition, the "fugitive one" has been added to the lower pinions, and the total is printed from the lower pinions.

(c) *Total key locked by negative total*

The sixth example of Fig. 32 will be used to explain the operation of the parts when an error has occurred leaving a negative total in the machine in the ninth columnar position.

In this example $500.00 is entered in the first position which moves the upper counter pinions to 000500.00 and the lower ones to 999499.99. In the next position $400.00 is subtracted leaving the upper pinions at 000099.99 and the lower ones at 999900.00. During this operation the link **298** is moved to subtraction position while the lever **228** remains in "positive" position which results in moving the latch **288***a* to locking position where it is held by the latch **293**. The parts remain in this condition in the sixth columnar position.

In the seventh columnar position $40.00 is added. This moves the upper pinions to 000140.00 and the lower pinions to 999859.99. The change to addition condition moves the link **298** to position to unlock the latch **288***a*, but it is not unlocked because it is held by the latch **293**.

In the eighth columnar position $500.00 is subtracted. This moves the upper pinions to 999639.99 and the lower ones to 000360.00. The change to subtraction condition does not alter the condition of the locking mechanism except to move the link **298** to subtraction position, but it will be noted that the lower pinions have moved through zero causing a carry in the last three orders. This releases the arm **318** and its lug **317** dives under the lug **316** to prevent release of the latch **293**. The arm **225** is then moved by the projection **29***a* on the pinion **29** of highest order which moves the lever **228** to "negative" position. Since the latch **293** is held against movement by the lug **317** the lever **228** does not move to its full line position of Fig. 15A but only to the dotted line position of said figure.

In the ninth columnar position the machine is changed to addition condition and given two spacing strokes. The change to addition moves the link **298** rearward to addition position while lever **228** is in "negative" position and this would lock the total key, if such were necessary, but the same is already locked owing to the position of latch **293**. The spacing cycle restores the tripped transfer pawls including the arm **318** which thus releases the latch **293** and permits lever **293** to move to its full line "negative" position of Fig. 15A under the tension of spring **229**. This also carries the latch **293** to unlatched position. The "fugitive one" is added which moves the upper pinions to 999640.00 and the lower ones to 000359.99, but this has no effect on the locking mechanism. The second spacing cycle restores

any tripped transfer pawls, but the total key remains locked even though the latch 293 has been released, because the lever 228 is in "negative" position while the link 298 is in addition condition.

In order to release the machine, the subtraction lever 157 must be moved to subtraction position and the machine given two spacing cycles. When the machine is then operated, it will print the true negative total in the machine, to-wit, 000360.00 because the total is printed from the lower pinions and the change to subtraction has added the "fugitive one" to said pinions.

Special conditions

A special condition can arise when the machine is being used at its full capacity which illustrates the importance of the double function of the arm 318.

Assume for example that the register contains the positive amount 900000.00 after the operation in the seventh columnar position. The lower pinions would then stand at 0999999.99. Now assume that 800,000.00 is subtracted in the 8th columnar position. This would leave a positive total of 100,000.00 in the machine and it should be locked in the ninth columnar position. When the machine is changed to subtraction in the 8th position, the link 298 moves to subtraction position while the lever 228 remains in "positive" position with the result that the latch 288*a* is moved to locking position and held there by the latch 293. When the 800000.00 is subtracted the upper pinions move to 099999.99 while the lower ones move to 900000.00. It will be noted that a carry occurs from the 7th to the 8th pinion, but that the 8th pinion, that is, the one of highest order has not moved through from its "9" to its "0" position. This means that the arm 318 is released, but the arm 225 is not operated. Now, if the arm 318 with its lug 317 operated every time to strike the lug 316 and move the latch 293 to released position, it would release the latch 293 under the above circumstances while the lever 228 would remain in "positive" position. Consequently, the machine would be unlocked when returned to addition condition in the ninth columnar position. This would occur even though an error had been made leaving a positive total of 100,000.00 in the machine.

However, by having the arm 318 perform the function of holding the latch 293 in latching position under certain conditions, this error is avoided. The actual operation is as follows,

When the arm 318 is released the lever 228 is in "positive" position and the latch 293 in latching position. The latch 293 is then in such a position that the lug 317 does not strike the lug 316 but dives under it.

In the ninth columnar position, the machine is changed to addition condition. The first spacing cycle tumbles the register to add position and, during the return stroke of this cycle, the upper pinions are engaged with the racks and the "fugitive 1" is entered. The addition of the "fugitive one" changes the upper pinions to 100000.00 and the lower ones to 899999.99. This causes a carry from the 7th to the 8th upper pinion and again trips the arm 318 which again dives under the lug 316 to hold the latch 293. The change in the position of the link 298 would tend to release the lock because the lever 228 is in "positive" position, but the latch 293 holds the latch 288*a* in locking position. The first spacing cycle restores the tripped transfer pawls including the arm 318, but this does not return the latch 293 to releasing position. The second spacing cycle restores any tripped transfer pawls, but does not restore the latch 293 to released condition. Accordingly, the total key is locked and can only be released by depression of the release key 308 and movement of lever 157 to subtraction position.

As previously explained, there are two mechanisms of the kind described, one for the account number section and another for the item section. It will also be recalled that when the lever 228 is in "positive" position and the link 298 in subtraction position or vice versa the total key is locked. A condition might exist where the lever 228 for one of the mechanisms was in "positive" position and the other lever 228 in "negative" position. Then, no matter whether the subtraction lever be moved to addition or subtraction position, the total key would remain locked because the link 298 would always be in the opposite position to one of the levers 228. Such a permanent locking of the machine is prevented by the fact that the release key 308 moves both of the levers 228 into one position, that is, there are two levers 313 and 313*n* on the shaft 312 so that when the key 308 is depressed, both levers 228 are moved to "negative" position. Then when the machine is conditioned for subtraction, the total key is released.

It will be understood that the construction shown is for purposes of illustration and that variations may be made in it without departing from the spirit and scope of the invention as defined by the claims.

I claim:

1. In a machine of the class described, the combination of a registering mechanism comprising adding and subtracting wheels having zero projections and adapted to perform addition and subtraction, actuators for said wheels, means for conditioning said registering mechanism for addition or subtraction, means for causing the registering mechanism to control the extents of movement of the actuators, and mechanism under the control of the zero projections of the wheels of highest order for automatically controlling said conditioning means.

2. In a machine of the class described, the combination of a registering mechanism adapted to perform addition and subtraction, actuators therefor, a paper carriage shiftable to different columnar positions, means for causing the registering mechanism to control the extents of movement of the actuators when taking a total, mechanism for conditioning the registering mechanism for addition or the taking of a positive total or for subtraction or the taking of a negative total, and mechanism under the joint control of the registering mechanism and carriage for automatically controlling said conditioning mechanism to condition the registering mechanism for total taking in accordance with the sign of the total therein.

3. In a machine of the class described, the combination of a registering mechanism comprising a set of adding wheels and a set of subtracting wheels, actuators therefor, means for engaging the adding wheels and actuators for addition and the taking of a positive total and the subtracting wheels and actuators for subtraction and the taking of a negative total, a paper carriage shiftable to different columnar positions, and means under the joint control of the registering mechanism and carriage for auto-

matically selecting the wheels to be engaged with the racks during a total taking operation.

4. The combination in an accounting machine of registering mechanism, actuating means therefor, total taking means, means for conditioning the machine for addition or subtraction, and mechanism under the combined control of the register mechanism and the means for conditioning the machine for addition or subtraction for automatically locking the total taking means against operation when the registering mechanism is not clear after a predetermined series of operations.

5. The combination in an accounting machine of a registering mechanism including adding and subtracting wheels having transfer projections, actuating means therefor, a total taking means, and mechanism under the control of the transfer projections of the wheels of highest order for warning the operator that the registering mechanism is not clear when an attempt is made to take a total when said registering mechanism is not clear after a predetermined series of operations.

6. In combination, in an accounting machine, an operating means, a registering mechanism adapted to be conditioned for addition or subtraction and for the taking of a true negative total directly when the registering mechanism is in subtraction condition, and means automatically conditioned by said registering mechanism when an overdraft occurs therein for causing operation of the operating means to automatically place said registering mechanism in subtraction condition.

7. In combination, in an accounting machine, a registering mechanism including two sets of register pinions which may be moved to one position for addition and to another position for subtraction, and means governed by said registering mechanism when an overdraft occurs therein for conditioning the machine to cause operation of it to automatically move the subtraction pinion to subtraction position to enable a negative total to be taken from them.

8. In combination, in an accounting machine, a registering mechanism adapted to be conditioned for addition or subtraction, a traveling paper carriage, and means conditioned by said registering mechanism when an overdraft occurs therein and governed by said paper carriage for causing the registering mechanism to be automatically conditioned for taking a true negative total in a predetermined columnar position of the carriage.

9. In combination, in an accounting machine, a registering mechanism adapted to be conditioned for addition or subtraction, a traveling paper carriage, means conditioned by the registering mechanism when an overdraft occurs therein for causing operation of the machine to automatically condition the registering mechanism for the taking of a negative total therefrom, and means governed by the paper carriage for preventing said conditioning means from becoming operative except in a predetermined columnar position of the carriage.

10. In combination, in an accounting machine, a registering mechanism, a traveling paper carriage, means controlled by said paper carriage for automatically conditioning the machine to take the total from the registering mechanism in a predetermined columnar position of the carriage, and means governed by said registering mechanism for causing said mechanism to be automatically conditioned for the taking of a total in said columnar position of the carriage of corresponding sign to the total in said mechanism.

11. In combination, in an accounting machine having a registering mechanism and a traveling paper carriage, means controlled by the paper carriage for conditioning the machine to cause it to automatically take a total from said registering mechanism in a predetermined columnar position of the carriage, and means governed by the registering mechanism and controlled by the paper carriage for causing the registering mechanism to be automatically conditioned for the taking of a total of corresponding sign to the total in said registering mechanism.

12. In combination, in an accounting machine, registering mechanism adapted to be conditioned for addition or subtraction, means for conditioning the machine for the taking of a total from said registering mechanism, means governed by said registering mechanism when an overdraft occurs therein for causing operation of the machine to condition the registering mechanism for the taking of a negative total therefrom, and means for maintaining said registering mechanism in said position for a second negative total operation.

13. The combination in an accounting machine having registering mechanism adapted to be conditioned for addition or subtraction and a total taking means, of means controlled by the registering mechanism when an overdraft occurs therein for causing operation of the machine to automatically condition the register mechanism for the taking of a negative total therefrom, means for locking the total taking means in total taking position, and connections for causing said total taking means to lock the conditioning means in negative total taking position.

14. In combination, in an accounting machine, a registering mechanism, means for conditioning the machine for addition or for subtraction, amount determining devices on which an old balance may be set up and entered in the registering mechanism and on which items may be entered for addition to and for subtraction from said balance, means for automatically conditioning said machine to take a total from said registering mechanism and to leave the same therein so that said old balance and said added and subtracted items may be subtracted and added respectively to said registering mechanism to cancel said total, and means for warning the operator that said registering mechanism is not clear when it is not clear after said operations.

15. The combination in an accounting machine of a registering mechanism including register pinions, actuators therefor, and means governed by both the pinion of highest and next to highest order of the registering mechanism and independently of the other register pinions for warning the operator when the registering mechanism is not clear after a predetermined series of operations.

16. The combination in an accounting machine of a registering mechanism including register pinions, actuators therefor, a total taking means, and means governed by the pinion of highest and the pinion of next to highest order of the registering mechanism and independently of the other register pinions for preventing operation of the total taking means when the reg-

istering mechanism is not clear after a predetermined series of operations.

17. The combination in an accounting machine of a registering mechanism provided with pinions, actuators therefor, means for conditioning the machine for addition or for subtraction, a total taking means, and means governed by the conditioning means and by the pinion of highest and the pinion of next to highest order for preventing the taking of a total when the registering mechanism is not clear after a predetermined series of operations.

18. The combination in an accounting machine of a total taking means, a depressible motor bar, a traveling paper carriage, means for holding the motor bar in depressed condition to cause repeat operations of the machine, means for releasing said motor bar, means controlled by the paper carriage for automatically conditioning the total taking means to take a total in predetermined columnar positions of the carriage, means for locking the total taking means in total taking condition, and connections operated by the motor bar releasing means for releasing the total taking means when the motor bar is released.

19. The combination in an accounting machine having registering mechanism, a withdrawal key, and a traveling paper carriage, of connections operated by the withdrawal key for controlling the registering mechanism, and means governed by the paper carriage for automatically disabling the withdrawal key connections in predetermined columnar positions of the carriage while the withdrawal key remains in operated position.

20. The combination in an accounting machine having registering mechanism, a withdrawal key, and a traveling paper carriage, of connections operated by the withdrawal key for controlling the registering mechanism, means for latching the withdrawal key in depressed position, and means governed by the paper carriage for automatically disabling the withdrawal key connections in certain columnar positions of the carriage while the withdrawal key remains depressed.

21. The combination in an accounting machine of a registering mechanism, a printing mechanism, a withdrawal key having connections for controlling both of said mechanisms, and means for automatically disabling the control of the registering mechanism by said withdrawal key while leaving the same in control of the printing mechanism.

22. The combination in an accounting machine having a registering mechanism, a withdrawal key having connections for controlling the same, and a traveling paper carriage, of a non-add mechanism governed by the paper carriage for automatically placing the registering mechanism in non-add condition, and connections operated by said non-add mechanism for automatically disabling the withdrawal key connections.

23. The combination in an accounting machine of a registering mechanism adapted to be conditioned for addition or subtraction, a printing mechanism, a withdrawal key and connection for controlling the printing mechanism and conditioning the registering mechanism to perform subtraction, a traveling paper carriage, and means governed by the paper carriage for automatically non-adding the registering mechanism and releasing the same from control by the withdrawal key while leaving said withdrawal key in control of the printing mechanism.

24. The combination in a machine of the class described of amount determining devices, differential mechanism, registering mechanism for registering items entered in the machine, means for changing the machine from addition to subtraction condition and vice versa to enable items first entered in the machine to be entered again as of opposite sign in the same registering mechanism, and proving means controlled jointly by the conditioning means and by the registering mechanism for locking certain portions of the machine when the items entered the second time are not the same in amount as and of opposite signs to those first entered in the machine.

25. In a machine of the class described, the combination of a registering mechanism having a set of adding wheels and a set of subtracting wheels, actuators therefor, means for conditioning the registering mechanism to cause either of the sets of wheels to control the extent of movement of the actuators to take totals, and means controlled by both sets of wheels for automatically selecting the set of wheels which shall control the extent of movement of the actuators in the taking of a total.

26. In a machine of the class described, the combination of a registering mechanism having a set of adding wheels and a set of subtracting wheels, actuators therefor, a "fugitive 1" mechanism, means for engaging the adding wheels and actuators to perform addition and to take a positive total and to engage the subtraction wheels and the actuators to perform subtraction and to take a negative total, an operating means, means for causing an automatic series of operations of said operating means during one of which a total is taken, and means set by said registering mechanism and actuated by said operating means during its automatic series of operations for automatically selecting the set of wheels that is to engage the actuators to take the total in accordance with whether the total in the registering mechanism is positive or negative.

27. The combination in an accounting machine having plural registers, of means for conditioning the machine for addition or for subtraction on said registers, a total taking means for said registers, a control device for each register responsive to the negative or positive character of the total in its register, proving means governed by said control devices and by said conditioning means for locking the total taking means against operation when there is a positive or a negative total in a register, and releasing means for moving said control devices to a released condition to permit release of the total taking means.

28. In a machine of the class described, the combination of a registering mechanism having adding and subtracting pinions provided with transfer projections, actuators for operating said registering mechanism, a device for controlling the taking of a total from said registering mechanism, and means under the control of the transfer projections of the pinions of highest order for preventing effective operation of said total-taking device except when the registering mechanism is clear after a predetermined series of operations of the machine.

29. In a machine of the class described, the combination of a registering mechanism, actuators therefor, total taking means, an operating means, a paper carriage movable to different

columnar positions, step-by-step mechanism controlled by said carriage and actuated by a predetermined number of operations of said operating means, and means controlled by said step-by-step mechanism for automatically causing a total to be taken from said registering mechanism when the machine is operated with the carriage in a predetermined columnar position.

30. In a machine of the class described the combination of a registering mechanism, actuators therefor, an operating means, a paper carriage movable to different columnar positions, a total taking means for controlling the taking of a total, step-by-step mechanism controlled by said carriage and actuated by a predetermined number of operations of said operating means, means controlled by said step-by-step mechanism for automatically conditioning said total taking means to cause a sub-total to be taken when the machine is operated with the carriage in a predetermined columnar position, means for automatically retaining said total taking means in its operative position for another operation of the machine to thereby enable the total to be taken a second time, and means for automatically releasing said total-taking means after said second totaling operation.

31. The combination in an accounting machine of an operating means, a traveling paper carriage, a total-taking means, a normally disabled means operable directly by said operating means for conditioning the total-taking means to take a total after a predetermined number of operations of said operating means, and connections controlled by said carriage for enabling said normally disabled means.

32. The combination in an accounting machine of an operating means, a traveling paper carriage, said machine having provisions for spacing cycles of operation in a predetermined columnar position of the carriage, a total-taking means, normally disabled means operable by said operating means to condition the total-taking means for taking a total, and means actuated by said paper carriage in a predetermined columnar position thereof to condition said normally disabled means so that it will cause said machine to be conditioned by said spacing cycles of operation of said operating means to take a total in said columnar position of said carriage.

33. The combination in an accounting machine of a registering mechanism, a traveling paper carriage, a total-taking means, means governed by said carriage for automatically operating the total-taking means to tend to condition the machine to take a total, and connections conditioned by said carriage in a predetermined columnar position thereof and operated by said total-taking means as it is moved to total-taking position to place the machine in sub-total-taking condition.

34. The combination in an accounting machine of amount determining devices, registering mechanism, means for conditioning the machine to add to or subtract from said registering mechanism the items entered on said amount determining devices, means acting automatically after the last of said items has been registered to cause said machine to automatically take a total from said registering mechanism, and means controlled by said registering mechanism for automatically conditioning said registering mechanism to cause said total to be taken in accordance with the positive or negative character of the total in said registering mechanism.

35. The combination in an accounting machine of amount determining devices, registering mechanism, printing mechanism, means for conditioning said machine to add to or subtract from said registering mechanism the items entered on said amount determining devices, means acting automatically after the last of said items has been registered to cause said machine to automatically take a total from said registering mechanism, and means controlled by said registering mechanism in accordance with the positive or negative character of the total therein for automatically conditioning said machine to print the true amount of said total both when it is positive and when it is negative.

36. The combination in an accounting machine of amount determining devices, registering mechanism, a traveling paper carriage, means for conditioning the machine to add to or subtract from said registering mechanism the items entered on said amount determining devices, means acting automatically after the last of said items has been registered to cause said machine to continue to operate, means controlled by said carriage for causing said machine to automatically take a total in a predetermined subsequent columnar position of said carriage, and means governed by said registering mechanism and controlled by said carriage for automatically conditioning said machine in said columnar position of said carriage to take said total as a true total in accordance with whether it is positive or negative.

37. The combination in an accounting machine of amount determining devices, registering mechanism, conditioning means for conditioning said machine to add to or subtract from said registering mechanism items entered in said amount determining devices, and proving mechanism conditioned by movement of said registering mechanism and of said conditioning means in the reentry of said items in said registering mechanism in a reverse manner to lock a portion of said machine if said second entries are not exactly the reverse of said first entries of said items.

38. In combination, in a machine of the class described, a registering mechanism, actuators therefor, a paper carriage movable to different columnar positions, total-taking means, an operating means, means for causing an automatic series of operations of said operating means, and means controlled by said carriage and actuated by said operating means during said series of operations to cause a total to be automatically taken during one of said automatic operations.

39. In a machine of the class described, amount determining devices, differential mechanism, an item registering mechanism, a traveling paper carriage, means controlled by said carriage for automatically conditioning the machine to take a total from said registering mechanism after said items have been entered in it and to leave said total in said mechanism, means for changing the machine from addition to subtraction condition and vice versa to enable the items first entered to be reversely entered in said registering mechanism, a manually manipulatable total-taking means, and proving means controlled by said registering mechanism for locking said manually manipulatable total-taking means against operation when the registering mechanism is not cleared by said second entry of items.

40. An accounting machine having a registering mechanism adapted to receive items entered in said machine, said registering mechanism hav-

ing a plurality of pinions, a total-taking means for taking a total of the items entered in said register, means for conditioning the machine to permit said items to be reversely entered in said register to clear it, and means conditioned by the movement of the parts of the machine in the second entry of said items and acting independently of said register pinions to prevent operation of a portion of the machine when the register is not cleared by said second entry of items.

41. In combination in an accounting machine, an operating means, a total taking means, a traveling paper carriage, means operated directly by said operating means to condition said total taking means for taking a total during a certain operation of said operating means, and connections controlled by said paper carriage for determining which of said operations of said operating means shall condition the total taking means for taking the total.

42. An adding and listing machine having amount determining devices, differential mechanism, registering mechanism for adding or subtracting items entered in said machine, means for inserting a "fugitive 1" in said registering mechanism, a total taking means operable to take a positive or negative total from said registering mechanism, means operable to change the machine from addition to subtraction condition and vice versa whereby items first entered in said registering mechanism can be entered a second time as of opposite sign, and proving means acting to lock a portion of said machine when the second entry of said items does not correspond in amount and/or is not of opposite sign to the first entry, said proving means having portions controlled by the negative or positive condition of said machine so as to be effective for both a positive and negative condition of said registering mechanism.

43. A machine of the class described having amount determining devices, actuator racks, a regular registering mechanism for receiving items entered on said amount determining devices, a total taking means freely operable to take a total of said items after they have been entered by differentially positioning said actuator racks under the control of said registering mechanism, said total taking means taking said total and leaving it in said registering mechanism, means for conditioning said machine for addition or subtraction after said total has been taken to enable the items first entered to be entered in said regular registering mechanism a second time as of opposite sign to the first entry, and proving mechanism controlled by said regular registering mechanism acting to lock a portion of the machine when the second entry of said items does not clear said regular registering mechanism.

44. A machine of the class described having amount determining devices, a registering mechanism for receiving items entered on said amount determining devices, a total taking means for taking a total of said items after they have been entered, means for conditioning the machine for addition or subtraction to enable the items first entered to be entered a second time as of opposite sign, and proving mechanism having portions conditioned by the movement of parts of said machine associated with said registering mechanism during the re-entry of said items acting to condition said proving mechanism to lock a portion of said machine against operation unless said second entry is exactly the reverse of the first entry.

45. A machine of the class described having a registering mechanism provided with register pinions for receiving items entered in the machine, total-taking means freely operable to take a total from said registering mechanism while there is an amount therein and to leave said total in said registering mechanism, means for changing the machine from addition to subtraction condition and vice versa to enable items first entered in the registering mechanism to be entered a second time in the same registering mechanism as of opposite sign, and proving mechanism brought into operation during the second entry of said items acting to lock a certain portion of said machine when the second entry of any item does not correspond in numerical value with and/or is not of opposite sign to the first entry, said proving mechanism acting to lock said portion of said machine independently of the register pinions at the time the locking action occurs.

46. A machine of the class described having amount determining devices, differential mechanism, registering mechanism including a plurality of pinions for registering items entered in the machine, total taking means for taking a total from said registering mechanism and leaving the same therein, means for changing the machine from addition to subtraction condition and vice versa to enable items first entered to be entered again as of opposite sign in the same registering mechanism, and proving means controlled by movement of the register pinion of highest order during the second entry of said items for automatically locking certain portions of the machine when the second entry of items is not exactly the reverse of the first entry.

47. A machine of the class described having a traveling paper carriage, a registering mechanism for receiving items entered in said machine, a total-taking means operable in a predetermined columnar position of said carriage to take a total from said registering mechanism and leave the same therein, means for changing the machine from addition to subtraction condition and vice versa to enable items first entered in said machine to be entered a second time as of opposite sign, proving mechanism brought into operation for the second entry of said items, and means conditioning said proving mechanism to cause it to operate in a predetermined columnar position of said carriage to lock a certain portion of said machine when the second entry of said items does not correspond in numerical value with and/or is not of opposite sign to the first entry.

48. A machine of the class described having amount determining devices, differential mechanism, registering mechanism for receiving items entered on said amount keys, a traveling paper carriage, a total taking means operable in a predetermined columnar position of said carriage and after said items have been entered to take a total from said registering mechanism by causing said registering mechanism to determine the position of said differential mechanism, means for conditioning said machine to enable said items to be entered a second time, and proving mechanism automatically rendered active for the second entry of said items, said proving mechanism having portions operable in a predetermined columnar position of said carriage to lock a portion of the machine when said second entry of items does not correspond in amount to the first entry.

49. In a machine of the class described, a plu-

rality of actuators of different denominational orders, a registering mechanism capable of addition or subtraction, said registering mechanism having a plurality of pinions of orders corresponding to and adapted to be connected to said actuators, a printing mechanism controllable by said registering mechanism for printing the exact amounts in said registering mechanism, means for automatically introducing a "fugitive 1" into said registering mechanism to place the same in correct numerical condition when the total in said registering mechanism changes from positive to negative and vice versa, a total taking means for conditioning said machine to take and print from said registering mechanism the actual total contained therein, and means controlled by said registering mechanism acting automatically to condition certain elements of said machine so that, when a total is taken, the true positive or the true negative total will be automatically printed in accordance with whether the total in said registering mechanism is positive or negative.

50. In a machine of the class described, a plurality of actuators of different denominational orders, a plurality of register pinions of corresponding orders, means for causing an operating connection between said pinions and actuators in one relation for addition and in another relation for subtraction, means for introducing a "fugitive 1" into said set of register pinions, a total taking means for taking from said register pinions and printing the total actually in said pinions, and means acting to automatically condition the machine for a subtraction-type of connection between the pinions and actuators when a total is taken with a negative total in said set of pinions.

51. In a machine of the class described, a plurality of actuators of different denominational orders, an addition-subtraction registering mechanism, means for causing a connection between said racks and said registering mechanism, a printing mechanism controlled by said actuators for printing the amount in said registering mechanism, means for automatically introducing a "fugitive 1" into said registering mechanism to place the same in correct numerical condition when the total in said registering mechanism changes from positive to negative and vice versa, a total taking means, and means controlled by said registering mechanism in response to the character of the total in said registering mechanism acting, when there is a negative total in said registering mechanism, to automatically condition said machine to enable a true negative total to be taken by a single connection between said registering mechanism and said actuators when said machine is operated after being conditioned for total taking by said total taking means.

52. In a machine of the class described, an addition-subtraction registering mechanism, a printing mechanism controlled by said registering mechanism for printing the exact amounts in said registering mechanism, means for automatically introducing a "fugitive 1" into said registering mechanism to place the same in correct numerical condition when the total in said registering mechanism changes from positive to negative and vice versa, a total taking means including a member movable to condition said machine to take and print from said registering mechanism the actual total contained therein, and means controlled by said registering mechanism in response to the negative or positive character of the total in said registering mechanism acting to automatically condition said machine so that, by movement of said total taking member only, the machine will be conditioned to cause it, when operated, to print a true positive or a true negative total in accordance with the character of the total in said registering mechanism.

53. A machine of the class described having a forward and return stroke of movement, a plurality of actuators of different denominational orders movable to differential positions during the forward machine stroke and returnable to normal during the return stroke, a registering mechanism, means operable to cause said registering mechanism to be connected to said actuators after said actuators have moved to differential positions and prior to their return to normal for causing adding or subtracting operations, means for causing said connection to be an addition type of connection when addition is to be performed and a subtraction type of connection when subtraction is to be performed, a printing mechanism controlled by said actuators for printing the amount in said registering mechanism, means for automatically introducing a "fugitive 1" into said registering mechanism to place the same in correct numerical condition when the total in said registering mechanism changes from positive to negative and vice versa, a total taking means for conditioning said machine to cause the connection between said registering mechanism and said actuators to take place before said actuators start to move to differential positions during the forward machine stroke, and means controlled by said registering mechanism in response to the positive or negative character of the total in said mechanism acting to automatically condition the machine so that, when the machine is conditioned for total taking by said total taking means, the total taking connection between said registering mechanism and said actuators prior to movement of the actuators will be a subtraction type of connection when the total in said registering mechanism is negative whereby the true negative total will be printed when the machine is operated after being conditioned for total taking by said total taking means.

54. An adding and listing machine having a printing mechanism, an addition-subtraction registering mechanism adapted to yield a positive total when in addition position and a true negative total when in subtraction position, means for inserting a "fugitive 1" into said registering mechanism to place the same in correct numerical condition when the total in said registering mechanism changes from positive to negative and vice versa, total taking means for taking from said registering mechanism and printing the exact total in said registering mechanism, and means governed by said registering mechanism in response to the positive or negative character of the total in said mechanism acting automatically to cause said registering mechanism to be placed in addition position for the taking of a positive total or in subtraction position for the taking of a true negative total in accordance with the nature of the total in said registering mechanism to thereby automatically condition the machine to enable a true total to be taken directly from said registering mechanism by said total taking means without any attention on the part of the operator as to the positive or negative character of said total.

55. A machine of the class described having actuator racks, a tumbling registering mechanism comprising a set of addition pinions meshing with a set of subtraction pinions, said sets of pinions being carried by a support that is rockable to tumble either set of pinions into position for engaging said racks, means acting to automatically insert a "fugitive 1" into said registering mechanism, and means controlled by the pinion of highest order of said registering mechanism causing said registering mechanism to be automatically tumbled to subtraction position when the machine is operated for total taking with the addition pinions in active position and with said registering mechanism in negative condition.

56. An accounting machine adapted to be given cycles of operation including a spacing operation prior to a total taking operation, said spacing operation comprising one or more cycles of machine operation, a registering mechanism, a traveling paper carriage, total taking means for taking a total from said registering mechanism, normally inactive means operable during predetermined operations of the machine to place said total taking means in total taking condition, means for operating said machine through a spacing operation in a predetermined columnar position of said carriage, and means governed by said carriage for causing said normally inactive means, during said spacing operation, to place said means in total taking condition to cause a total to be taken during the total-taking operation.

57. A machine of the class described having a motor operated driving means, amount keys upon which items may be entered, a printing mechanism, a registering mechanism, a traveling paper carriage movable to different columnar positions, total taking means for conditioning said machine to take from said registering mechanism and print the total in said registering mechanism, and means controlled by said carriage causing said machine, after an item has been entered in said machine in a predetermined columnar position of said carriage, to be automatically operated by said motor driving means and automatically conditioned so that a total will be automatically taken from said registering mechanism and printed in a predetermined columnar position of said carriage without any manipulation of the machine on the part of the operator.

58. An accounting machine having a motor driving means adapted to give said machine cycles of operation including a blank or spacing cycle to prepare certain parts prior to total taking, amount keys upon which items may be entered, a printing mechanism, a registering mechanism, a traveling paper carriage, a total taking means for conditioning said machine to take from said registering mechanism and print the total in said registering mechanism, means operating after an item has been entered in said machine in a predetermined columnar position of said carriage to cause said driving means to automatically operate said machine through a spacing cycle and a total taking cycle of operation, and means controlled by said carriage causing said total taking means to automatically take the total from said registering mechanism during said total taking cycle.

59. A machine of the class described having means adapted to give said machine cycles of operation including a spacing operation to restore certain parts to normal prior to a total taking operation, said spacing operation comprising one or more machine cycles, amount keys upon which items may be entered, a printing mechanism, a registering mechanism adapted to accumulate either positive or negative totals, a traveling paper carriage, total taking means for conditioning said machine to cause it to take from said registering mechanism and print the total in said registering mechanism, means operable, after an item has been entered in said machine in a predetermined columnar position of said carriage, to cause said machine to be given spacing and total taking operations, means controlled by said paper carriage automatically conditioning said machine to cause a total to be taken and printed during said total taking operation, and means governed by said registering mechanism automatically causing the total so printed to be a positive or a true negative total depending upon the character of the total in said registering mechanism.

60. A machine of the class described adapted to be given cycles of operation, a power driving means for normally giving said machine single cycles of operation, means for entering positive or negative items in said machine, a registering mechanism capable of addition or subtraction whereby either a positive or a negative total may be accumulated in said registering mechanism, a printing mechanism controlled by said registering mechanism to print the total in said registering mechanism, and means conditioned by a single control member causing said machine to be automatically operated through a plurality of cycles of operation and causing said machine, during said cycles of operation and when there is a negative total in said registering mechanism, to be conditioned to take and to then be caused to take and print the true negative total.

61. A machine of the class described having a motor driving means adapted to give said machine cycles of operation including a spacing cycle to prepare certain parts prior to total taking, amount keys upon which items may be entered, a printing mechanism, a registering mechanism adapted to accumulate either positive or negative totals, a traveling paper carriage, a total taking means for conditioning said machine to take from said registering mechanism and print the total in said registering mechanism, means operating automatically, after an item has been entered in said machine in a predetermined columnar position of said carriage, to cause said driving means to automatically operate said machine through a spacing cycle and a total taking cycle of operation, means controlled by said carriage for causing said total taking means to automatically take the total from said registering mechanism during said total taking cycle, and means governed by said registering mechanism for automatically causing the total so printed to be a positive or a true negative total depending upon the character of the total in said registering mechanism.

62. In a machine of the class described adapted to be given cycles of operation, a power driving means for normally giving said machine single cycles of operation, means for entering positive or negative items in said machine, a registering mechanism capable of addition or subtraction whereby either a positive or a negative total may be accumulated in said registering mechanism, a traveling paper carriage, a printing mechanism controlled by said registering mechanism to print the total in said registering

mechanism, means controlled by said paper carriage in a predetermined position of the latter causing said machine to automatically go through a plurality of cycles of operation, and means conditioned automatically during said cycles of operation, when there is a negative total in said registering mechanism, conditioning said machine to take and then causing it to take and print the true negative total.

63. In a machine of the class described, a totalizer adapted for additions and subtractions, differential actuators for said totalizer, means for materially embodying the sign of the total in said totalizer comprising a setting member adapted to be adjusted in different positions corresponding respectively to positive and negative totals, and means operated by the totalizer upon a passage from a positive to a negative total or vice versa for adjusting said setting member in a different position, control means adapted to adjust the machine for taking totals, and means controlled in common by said control means and said setting member for relatively adjusting said actuators and said totalizer for taking positive or negative totals.

64. A machine of the class described having a plurality of actuators, a totalizer capable of addition and the yielding of positive totals when connected in one relation to said actuators and of subtraction and the yielding of true negative totals directly when connected in another relation, means for inserting a "fugitive 1" into said totalizer, means settable by said totalizer in accordance with the sign of the total therein, total-taking control means for conditioning the machine to enable it to take the total actually in said totalizer, and means controlled in common by said settable means and said total-taking control means for governing the relation of the connection between the totalizer and actuators for positive and negative totals.

65. A machine of the class described having a plurality of actuators, a totalizer capable of addition and the yielding of positive totals when connected to said actuators in one relation and of subtraction and the yielding of negative totals when connected in another relation, a "fugitive 1" mechanism for inserting a "fugitive 1" into said totalizer, means settable by said totalizer in accordance with the sign of the total in said totalizer, total-taking control means for conditioning said machine to take from said totalizer the total actually in said totalizer, and means conditioned potentially by said settable means at the time said registering mechanism changes from positive to negative condition and dependent for its final action upon the operation of the machine for total taking, for causing said machine, when operated to take a total, to automatically connect the totalizer to the actuators in subtraction relation without requiring the operator to condition the machine for that purpose.

66. A calculating machine having actuators and a registering mechanism adapted to be connected to one another in one relation for addition and the taking of positive totals and in another relation for subtraction and the taking of negative totals, a "fugitive 1" mechanism operable to insert a "fugitive 1" in said registering mechanism, a printing mechanism, total-taking control means for conditioning certain elements of said machine to cause said machine, when operated, to take from said registering mechanism directly and print the exact total in said registering mechanism, said total-taking control means being free to be moved to total-taking position immediately after an item-entering machine operation and with the total in said registering mechanism either positive or negative, and means controlled by said registering mechanism in accordance with its positive or negative condition and governed by said total-taking control means when the latter is moved to total-taking position, acting to automatically determine the addition or subtraction relation of the connection between said registering mechanism and said actuators as the machine is operated whereby said machine, when operated after said total-taking control means has been set in total-taking position, will take a true positive or true negative total, as the case may be, from said registering mechanism.

67. A machine of the class described having a printing mechanism, a registering mechanism operable to perform addition and accumulate positive totals and to perform subtraction and accumulate negative totals, column-printing control means for controlling the column in which printing occurs, a total-taking means, and means controlled by said registering mechanism and said column-printing control means operating automatically, when said machine is conditioned for total taking by said total-taking means and operated, to cause said machine to be conditioned for the taking of a positive or a true negative total in accordance with the sign of the total in said registering mechanism.

68. A machine of the class described having an add-subtract registering mechanism operable to perform addition and to be conditioned for the taking of a positive total and to perform subtraction and to be conditioned for the taking of a true negative total directly, a tens-transfer mechanism operable to arrest the register pinions both in the taking of a positive and a negative total, a "fugitive 1" mechanism operating to automatically insert a "fugitive 1" in said register, total-taking means, and means controlled by the register pinion of highest order in accordance with the negative or positive condition of said registering mechanism operating automatically to condition certain elements of said machine so that, when said machine is operated for total taking, a positive or a true negative total will be taken directly from said registering mechanism in accordance with the sign of the total in said registering mechanism without requiring the operator to condition the machine for the character of the total.

69. A machine of the class described having a plurality of actuators, a registering mechanism, said registering mechanism and actuators being connectible in one relation for addition and the taking of positive totals and in another relation for subtraction and the taking of true negative totals directly, a tens-transfer mechanism operable to arrest the register pinions both in the taking of positive and negative totals, a "fugitive 1" mechanism for inserting a "fugitive 1" in said register, total-taking means, subtraction-controlling means, and means controlled by the pinion of highest order of said registering mechanism operating, when the latter changes from positive to negative condition, to govern said subtraction-controlling means to automatically cause the connection between said actuators and registering mechanism to be a subtraction type of connection when, after an item-entering operation, said machine is operated for total taking, whereby the register will be placed in proper con-

dition for direct negative total taking, without requiring the operator to condition it for that purpose.

70. A machine of the class described having power means for giving it cycles of operation, a registering mechanism capable of addition and subtraction, total-taking means, a printing mechanism, column-printing control means for controlling the column in which printing occurs, and means operated by power derived from said power means independently of said column-printing control means but controlled thereby for automatically conditioning said total-taking means for total taking when said machine is conditioned to print in a predetermined column.

71. A machine of the class described having power means for giving it cycles of operation, a registering mechanism capable of addition and subtraction, a total-taking means, a traveling paper carriage, and means operated by power derived independently of the travel of the carriage but under the control of said carriage for automatically conditioning said total-taking means for total taking.

72. A machine of the class described having a motor-driving means, a registering mechanism capable of addition and subtraction, a total-taking means, power means operable by said motor drive for conditioning said total-taking means for total taking, a traveling paper carriage, and means controlled by said carriage for causing said motor drive to operate said power means to condition said total-taking means for total taking and for causing said motor drive to automatically operate said machine to take the total for which said machine is conditioned.

73. A machine of the class described having a registering mechanism adapted to be conditioned for addition and the accumulation of positive totals and for subtraction and the accumulation of negative totals, a traveling paper carriage, means controlled by said carriage for automatically conditioning said machine for total taking, and means controlled by said registering mechanism in accordance with the sign of the total therein for governing the manner in which said machine shall be conditioned for total taking during said automatic total-taking operation.

74. A machine of the class described having a power means for giving it cycles of operation, a registering mechanism capable of addition and subtraction, a total-taking means, a traveling paper carriage, a step-by-step mechanism drivable by said power means and operable to condition said total-taking means for total taking, and means controlled by said carriage for enabling and disabling said step-by-step mechanism to thereby control the column in which the total shall be taken.

75. A machine of the class described having a power-driving means normally operable to give said machine single cycles of operation, a registering mechanism, a total-taking means, step-by-step means operable by said power-driving means, said step-by-step means being normally inactive, total-taking control means for causing said driving means to automatically give said machine a predetermined number of successive cycles of operation for total taking, said control means also rendering said step-by-step means active, and means controlled by said step-by-step means to cause said total-taking means to condition said machine to take a total automatically during the last of said successive cycles of operation.

76. A machine of the class described having a power-driving means normally operable to give said machine single cycles of operation, a traveling paper carriage, a tabulating mechanism for said carriage normally operable during each machine cycle, a registering mechanism, a total-taking means, control means for causing said power-driving means to automatically give said machine a predetermined number of successive cycles of operation for total taking, and for controlling said tabulating mechanism to cause said carriage to remain stationary for all but the last of said total-taking cycles, and for conditioning a mechanism that acts to automatically condition said total-taking means for total taking during the last of said successive cycles, and means for automatically enabling said tabulating mechanism for the last of said successive cycles to thereby cause said carriage to be moved after the total is taken.

77. A machine of the class described having a power-driving means normally operable to give said machine single cycles of operation, a registering mechanism, a total-taking means, a step-by-step cam means operable by said power-driving means, said step-by-step means being normally inactive, total-taking control means for causing said power-driving means to automatically give said machine three successive cycles of operation for total taking, said control means also rendering said step-by-step means active, a spring-urged arm engaging said step-by-step cam means and connected to said total-taking means, said arm being released near the end of the second successive cycle to thereby condition said total-taking means for total taking during the third of said cycles.

78. A machine of the class described having power means for giving it cycles of operation, indexing means for indexing items in said machine, actuators and a registering mechanism connectible in one relation for addition and the taking of positive totals and in another relation for subtraction and the taking of negative totals directly, a "fugitive 1" mechanism for inserting a "fugitive 1" in said registering mechanism, means operable to cause said machine to go through spacing and total-taking operations for the taking of a negative total, power-driven means operating during said operations to condition said machine to take and for causing it to take a true negative total, said power-driven means including portions governed by the registering mechanism causing said actuators and registering mechanism to be conditioned, during the spacing operation, for a subtraction type of connection during the total-taking operation, said power-driven means also including other portions for conditioning the machine to cause it to take the negative total during the total-taking operation.

79. A machine of the class described having means normally operable to give it single cycles of operation, a registering mechanism capable of addition and subtraction, a total-taking means, and total-taking control means operable to set said machine into operation and to cause it to go through three cycles of machine operation automatically for total taking, said control means operating in conjunction with a means controlled by said registering mechanism when the latter changes from positive or negative condition to cause said machine to be conditioned during the first two automatic cycles for the taking of a negative total and to cause a true negative total to be taken during the third cycle of automatic operation.

80. A machine of the class described having a power-driving means for giving the machine cycles of operation, actuators and a registering mechanism connectible in one relation for addition and the taking of positive totals and in another relation for subtraction and the taking of true negative totals, a traveling paper carriage movable from column to column as an incident to machine cycles, means controlled by said carriage for causing said driving means to give said machine a predetermined number of successive cycles, means controlled by said registering mechanism in response to the sign of the total in it and set during one of said successive cycles in a column preceding a total-taking column to govern the relation of the connection between the registering mechanism and actuators, and means controlled by said carriage for causing a total to be automatically taken while the machine is cycled in the total-taking column, whereby the machine is automatically conditioned in accordance with the sign of the total and the total automatically taken.

81. A machine of the class described having means for giving it cycles of operation, a traveling paper carriage provided with moving means normally operable to move the carriage from one column to another at the end of each cycle of machine operation, a registering mechanism capable of addition or subtraction, a total-taking means, and control means operable to cause said machine to automatically go through preparatory and total-taking cycles of operation, and means operating during said cycles to condition said machine and to cause it, during the total-taking cycle, to take a true negative total, said control means also controlling said carriage-moving means to cause said carriage to remain stationary until after said total is taken.

82. A machine of the class described having a power-driving means normally operable to give the machine single cycles of operation, a registering mechanism capable of addition or subtraction and of accumulating positive or negative totals, a printing mechanism normally operated during each cycle of machine operation and arranged to be controlled by said registering mechanism in total taking, total-taking control means operable to cause said power means to automatically operate said machine through three successive cycles of operation for total taking, and means preventing operation of said printing mechanism during the first two of said cycles, said total-taking control means also serving to control mechanism for causing said machine to be conditioned during the first two of said three cycles for the taking of a total of a sign corresponding to the sign of the total in said registering mechanism and for conditioning mechanisms for causing said total to be automatically taken during the third cycle.

83. A machine of the class described having a power-driving means normally operable to give said machine single cycles of operation, a traveling paper carriage controlled by a tabulating mechanism normally operable during each machine cycle, a registering mechanism capable of addition or subtraction and of accumulating positive or negative totals, a printing mechanism normally operated during each machine cycle and arranged to be controlled by said registering mechanism in total taking, a total key, means responsive to the sign of the total in the registering mechanism for locking said total key when the registering mechanism goes negative, control means operable while said total key is locked to cause said power means to automatically operate said machine through three successive cycles of operation for total taking, control means preventing operation of said printing mechanism and controlling said tabulating mechanisms to prevent carriage movement during the first two of said cycles and controlling mechanism for causing said machine to be conditioned during the first two of said three cycles for the taking of a negative total during the third cycle, and means automatically enabling said printing and tabulating mechanism for the third of said cycles.

84. In a machine of the class described, an automatic repeat mechanism for causing a series of automatic operations of the machine, a total-taking means, a step-by-step mechanism for automatically conditioning said total-taking means for total taking, and means controlled by said repeat mechanism for enabling and disabling said step-by-step mechanism.

85. A machine of the class described having a registering mechanism capable of addition and of accumulating positive totals and of subtraction and accumulating negative totals, a printing mechanism, column-printing control means for causing printing to occur in predetermined columns on paper supported in said machine, and means controlled by said column-printing control means and governed by said registering mechanism, operating automatically, after an item-entering cycle of machine operation, to cause said machine to automatically take a positive or a true negative total in accordance with the sign of the total in said registering mechanism.

86. A machine of the class described having means for giving it cycles of operation, a registering mechanism capable of addition and the accumulation of positive totals and of subtraction and the accumulation of negative totals, a printing mechanism, means for conditioning said machine to enable it to print a true negative total, and means automatically operating to maintain said machine in negative total-taking condition after said true negative total has been printed to enable said total to be printed a second time during the next succeeding cycle of machine operation.

87. A machine of the class described having means for giving it cycles of operation, a registering mechanism capable of addition and the accumulation of positive totals and of subtraction and the accumulation of negative totals, means controlled by said registering mechanism in accordance with the sign of the total in it for governing the manner in which said machine shall be conditioned for total taking, means for causing said machine to be given a plurality of successive cycles for conditioning it to take and for causing it to take a true negative total while leaving said total in the machine, and means automatically operating to maintain said machine in negative total-taking condition after said first negative total has been taken to thereby enable said total to be taken a second time during the next succeeding cycle of machine operation.

88. A machine of the class described having means for giving it cycles of operation, an add-subtract registering mechanism capable of addition and the accumulation of positive totals and of subtraction and the accumulation of negative totals, a printing mechanism, column-printing control means for controlling the column in

which printing occurs, means for conditioning said machine to enable it to print a true negative total when a negative total exists in said registering mechanism, means controlling said cycling means to cause said machine to be given another cycle of operation after said negative total is printed, means controlling said column-printing control means to cause printing to occur in a different column during said extra cycle, and means acting to automatically maintain said machine in negative total-taking condition for said extra cycle whereby said negative total can be printed in another column during said extra cycle.

89. A machine of the class described having means for giving it cycles of operation, an add-subtract registering mechanism capable of addition and the accumulation of positive totals and of subtraction and the accumulation of negative totals, a printing mechanism, a traveling paper carriage, means for conditioning said machine to enable it to take and print a true negative total when a negative total exists in said registering mechanism, means controlled by said carriage for causing said cycling means to give said machine another cycle of operation after said negative total is printed and with said carriage in a different position than when said negative total was printed, and means automatically maintaining said machine in condition to print said negative total during said additional cycle of machine operation and in said different position of said paper carriage.

90. A machine of the class described having a registering mechanism capable of addition and subtraction, a subtraction-conditioning means operable to condition said machine for subtraction and negative total taking, means governed by said registering mechanism for placing said subtraction-conditioning means in subtraction condition when a negative total occurs in said registering mechanism, means for conditioning said machine to enable the negative total to be taken while leaving it in the machine, and a latching means for automatically latching said subtraction conditioning means in position to enable a second negative total to be taken, and means for releasing said latching means after said second total has been taken.

91. A machine of the class described having a registering mechanism capable of addition and the accumulation of positive totals and of subtraction and the accumulation of true negative totals, a total-taking means controllable by a total key, locking means operating automatically to lock said total key against depression when a negative total occurs in said registering mechanism, and means operable independently of said total key to condition said machine to take and to cause it to take a true negative total.

92. A machine of the class described having a motor-driving means for giving it cycles of operation, a registering mechanism capable of addition and the accumulation of positive totals and of subtraction and the accumulation of negative totals, a total-taking means controllable by a total key for taking positive totals, locking means operating automatically to lock said total key when a negative total occurs in said registering mechanism, and means for conditioning said driving means while said total key remains locked to cause it to automatically give said machine a predetermined number of successive cycles of operation during which said machine is conditioned for taking a negative total and during the last of which said negative total is automatically taken.

93. A machine of the class described having a motor drive for giving it cycles of operation, a registering mechanism capable of addition and the accumulation of positive totals and of subtraction and the accumulation of true negative totals, total-taking means controllable by a total key, locking means operating automatically to lock said total key when a negative total occurs in said registering mechanism, control means operable while said total key remains locked to condition said driving means to cause it to automatically cycle said machine through three successive cycles of machine operation during the first two of which said machine is conditioned to take a negative total, and means operating to automatically condition said total-taking means for a total-taking operation during the third of said cycles of machine operation.

94. A machine of the class described having means for giving it cycles of operation, indexing means for indexing items in said machine, an algebraic registering mechanism controlled by said indexing means, actuators, said registering mechanism and actuators being connectible in one relation for addition and the taking of positive totals and in another relation for subtraction and the taking of negative totals, printing mechanism, total-taking means including a total-control means for automatically bringing about, after an item-entering operation, first, a spacing operation, and then, a total-taking operation of said machine, and additional means controlled by said registering mechanism in accordance with the sign of the total therein acting during said spacing and total-taking operations to condition said machine for a subtractive connection between the actuators and registering mechanism during said totaling operation in the event said registering mechanism contains a negative total.

95. A machine of the class described having an indexing means for indexing items in said machine, two sets of register pinions, means for causing positive and negative indexed items to be selectively entered in one of said sets of pinions as true items and in the other set of pinions as the complement thereof, total-taking means for conditioning the machine to take the total directly from either set of pinions, and means governed by said sets of pinions for automatically selecting, for a totaling operation, the set of pinions which contains the true total.

ROBERT L. MULLER.