

Feb. 24, 1942.

J. T. FERRY

2,274,053

TABULATING MACHINE

Filed Aug. 26, 1937

8 Sheets-Sheet 1

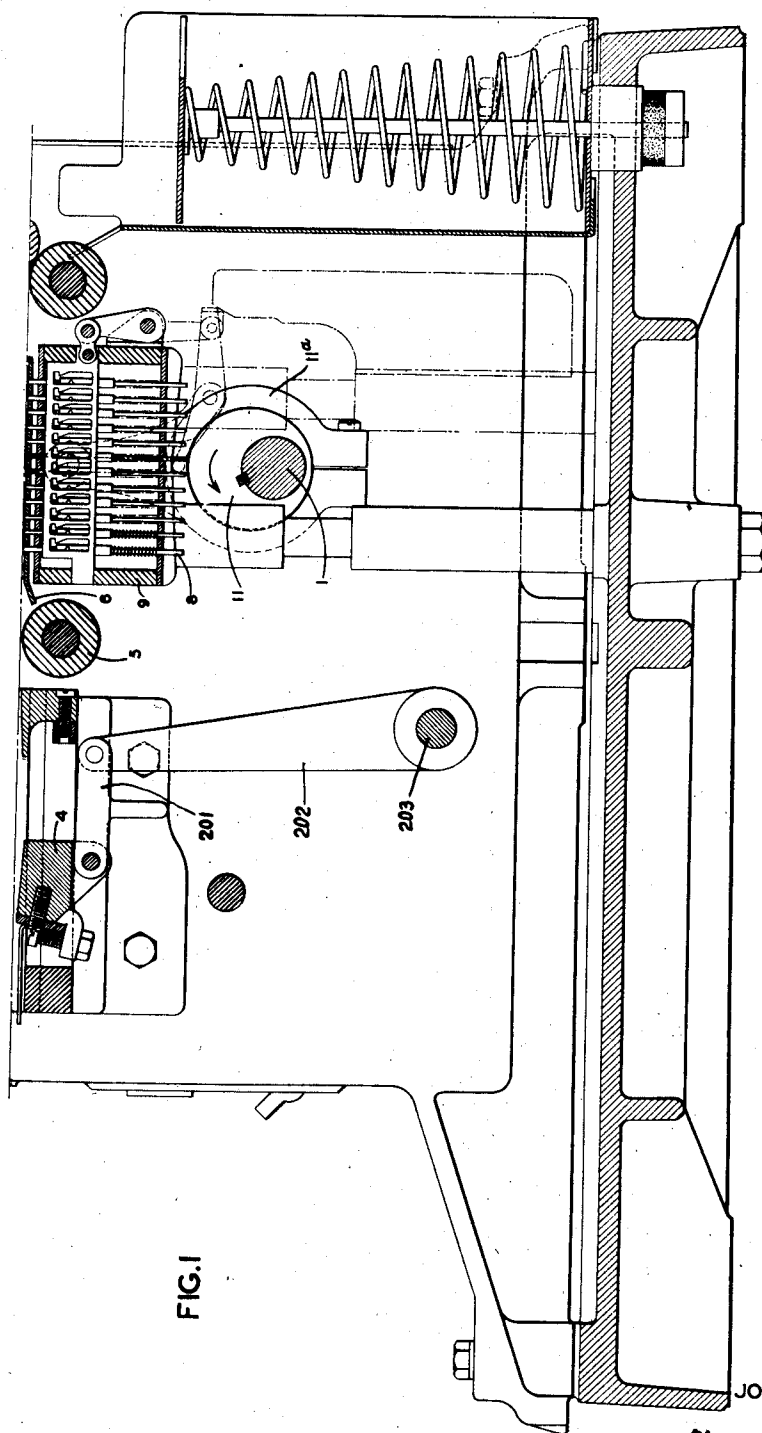


FIG. 1

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TABULATING MACHINE

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8 Sheets-Sheet 2

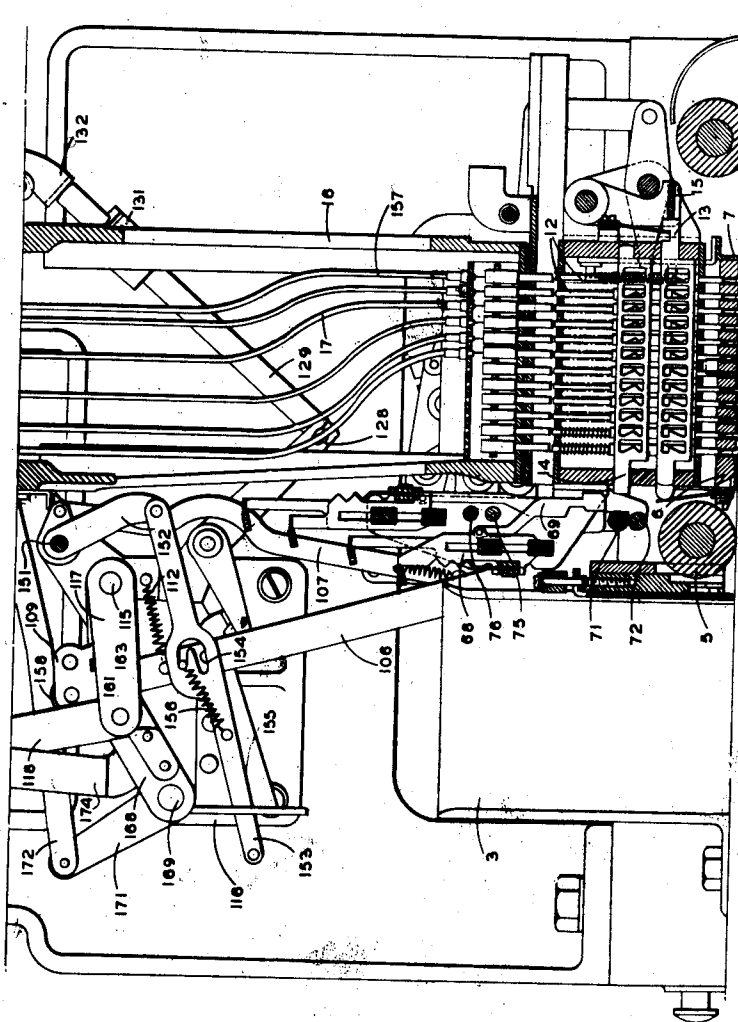


FIG. 2

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TABULATING MACHINE

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8 Sheets—Sheet 3

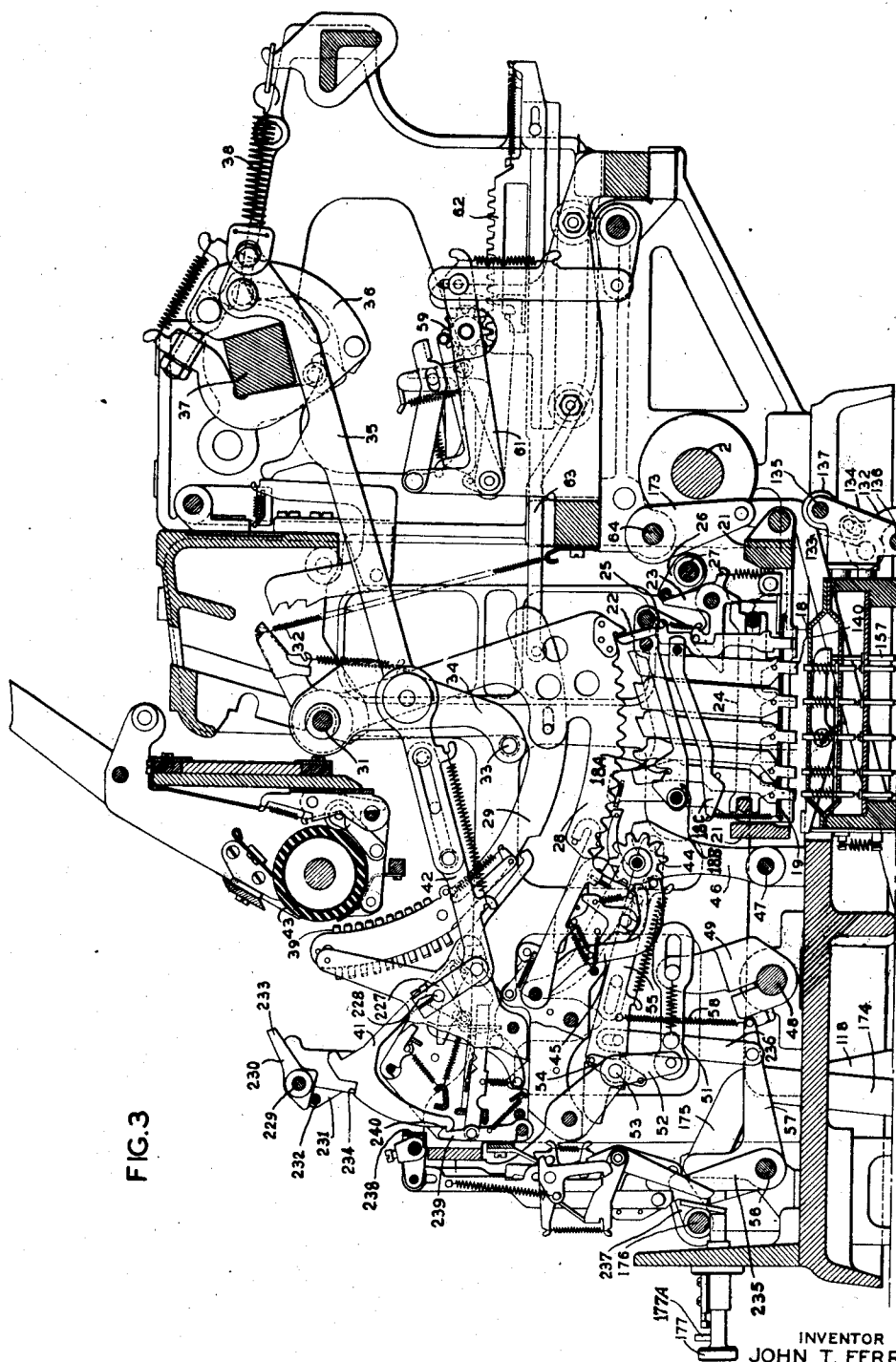


FIG. 3

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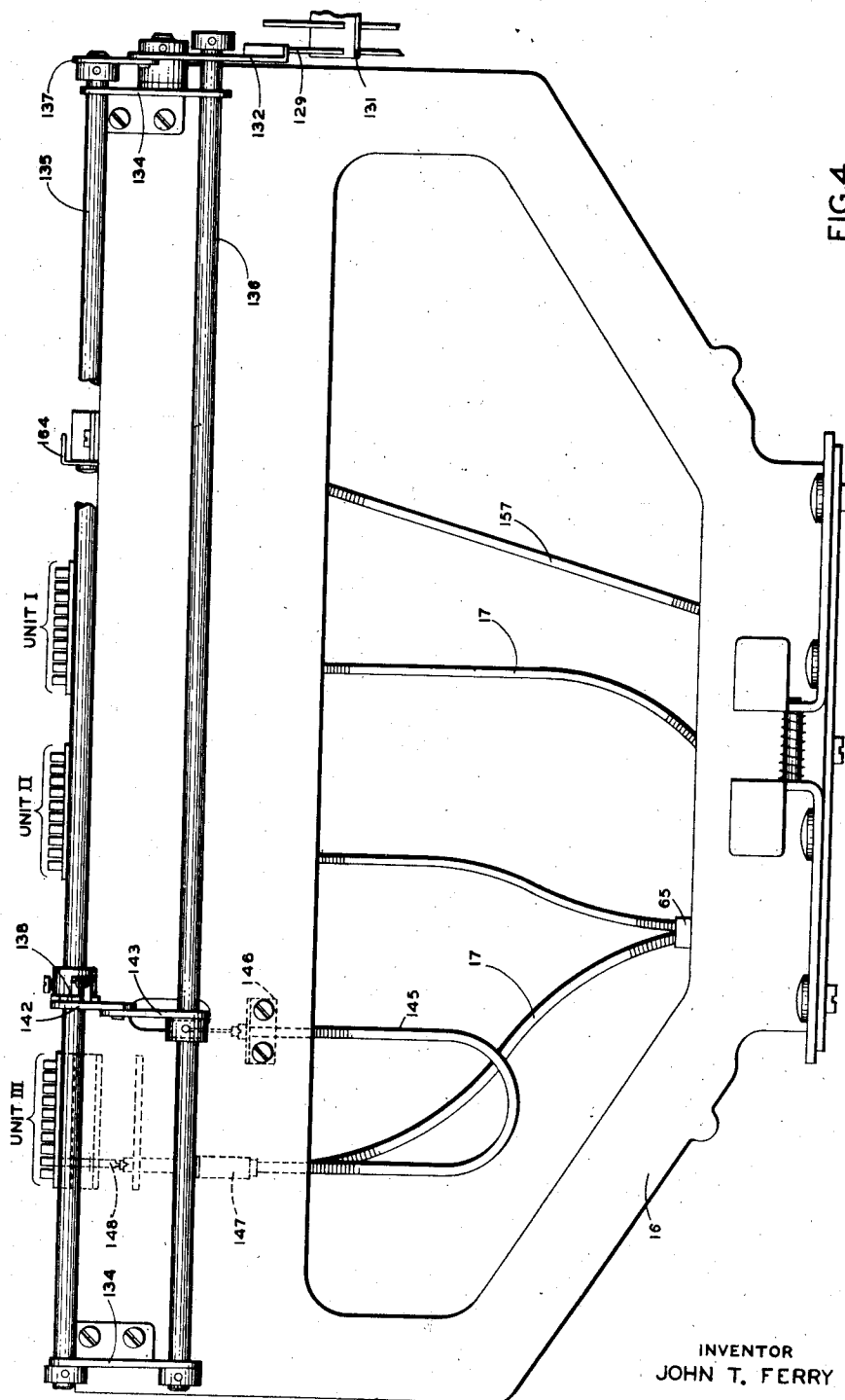
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TABULATING MACHINE

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8 Sheets-Sheet 4



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TABULATING MACHINE

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8 Sheets-Sheet 5

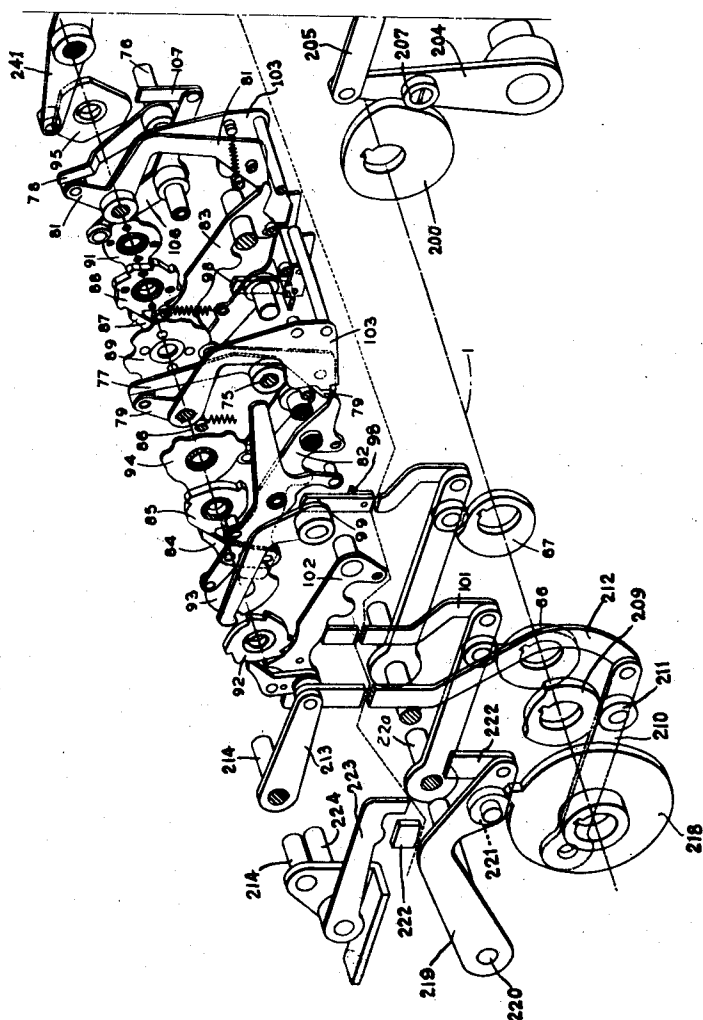


FIG. 5

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2,274,053

8 Sheets-Sheet 6

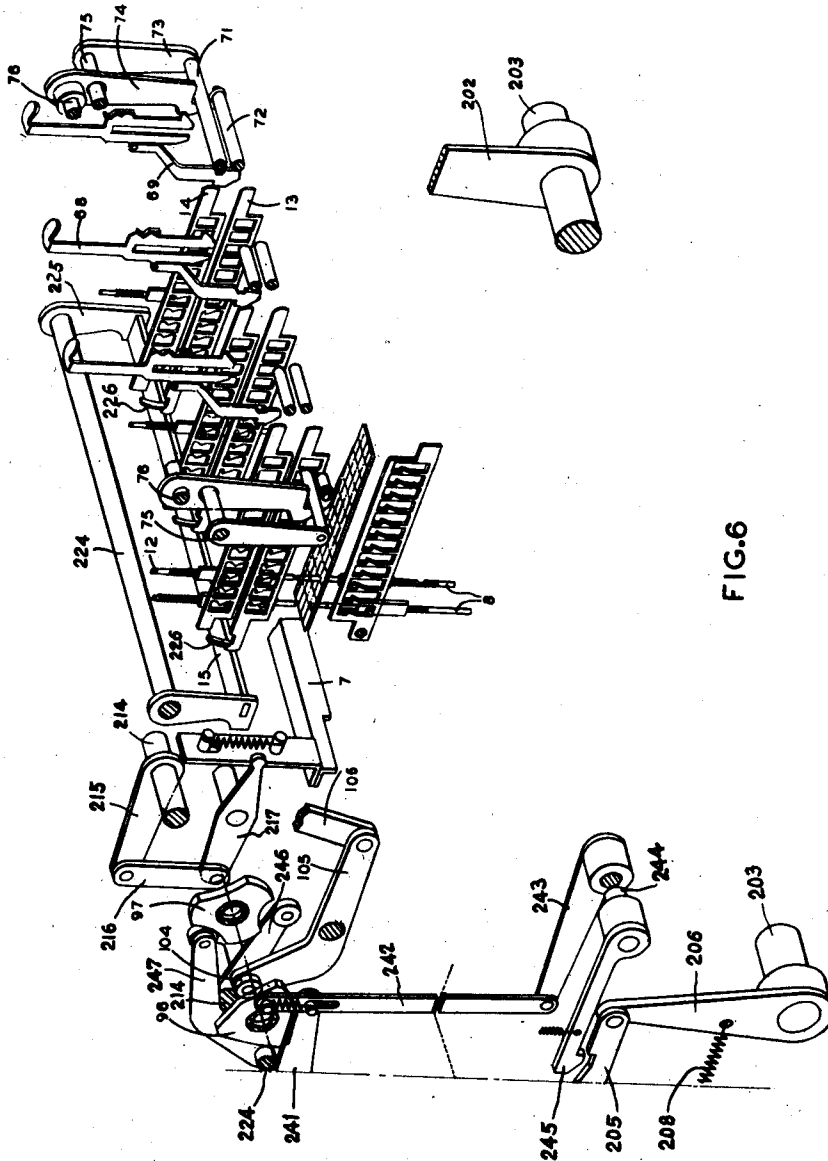


FIG. 6

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TABULATING MACHINE

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8 Sheets-Sheet 7

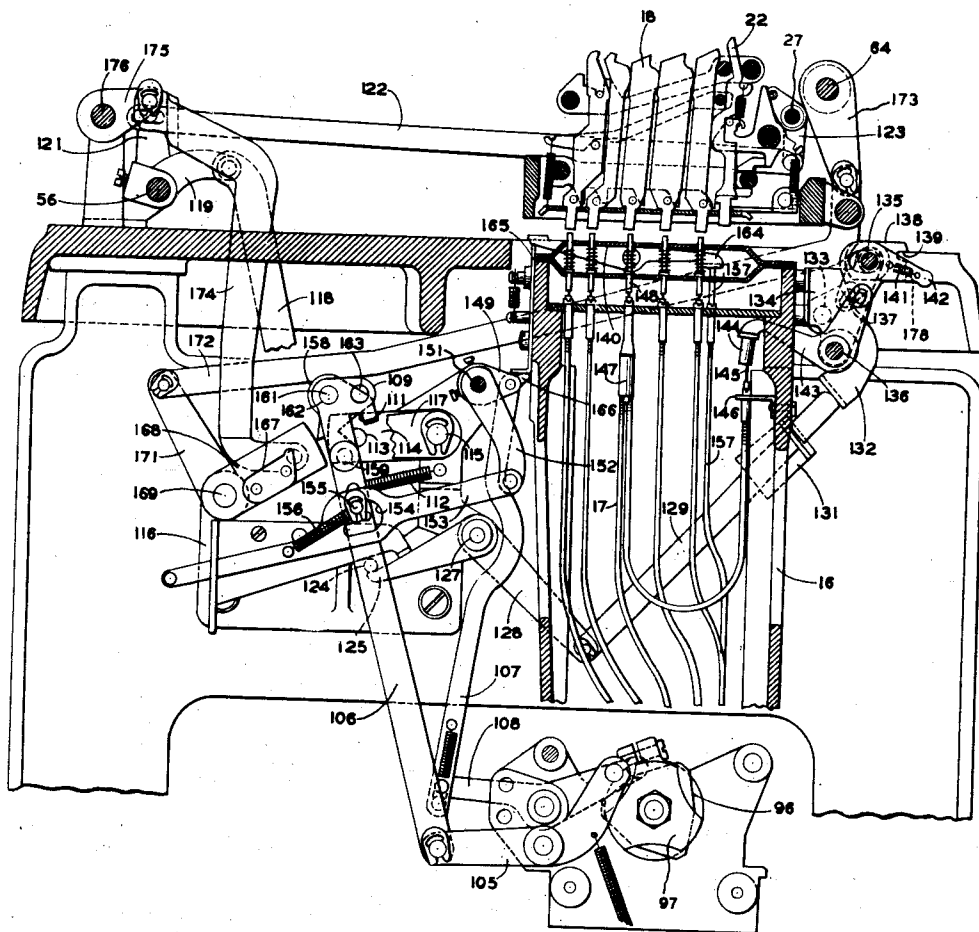


FIG. 7.

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2,274,053

TABULATING MACHINE

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8 Sheets-Sheet 8

MAN NO.	GROSS EARNINGS	SOCIAL SECURITY DEDUCTION
TOTAL CONTROL { 1230	120.10	1.20.60
1231	135.50	1.36.00
1232	99.50	1.00.00
1233	99.40	99.90
1234	99.60	1.00.10
	5 ADDED IN THIS ORDER	
	ON PRELIMINARY	
	TOTAL STROKE.	
	THESE COLUMNS	
	NOT PRINTED.	
FINAL TOTAL	4.10	

FIG.11.

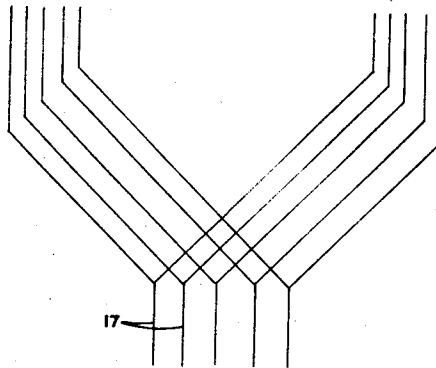


FIG.9.

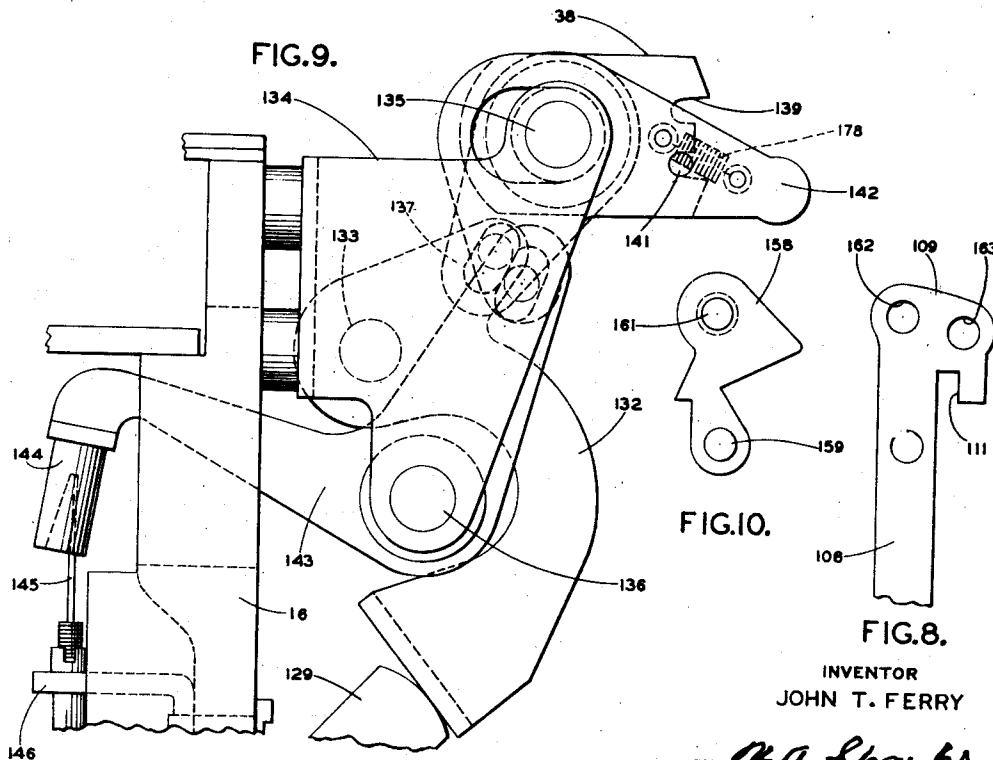


FIG.10.

FIG.8.

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UNITED STATES PATENT OFFICE

2,274,053

TABULATING MACHINE

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Application August 26, 1937, Serial No. 161,081

4 Claims. (Cl. 235—61.6)

This invention relates generally to tabulators capable of performing successive minor and major total taking operations automatically from a single change in designating matter, and more particularly to a machine of this type wherein a minor total taking operation may be rendered ineffective to control the computing mechanism of the machine for total taking, and instead cause the entry of an unchanging definite amount into a predetermined accumulator during the machine cycle in which the minor total taking operation would normally take place.

An accounting problem which may be carried out on the machine of the present invention is the problem of computing the tax to be paid by employees under the provisions of the Social Security Act and of computing the total wages paid by an employer for the purpose of determining the tax to be paid by the employer under the provisions of the same act. This act provides that each employee shall be taxed to the extent of one per cent of his wages over a certain period and that his employer shall also be taxed one per cent of the gross earnings of his employees. A further provision of the act requires that when an employee's salary is composed of a certain number of dollars and an additional fraction of a dollar the employee shall pay a tax based upon the next higher even dollar wage only if the fraction of a dollar be fifty cents or more. For example an employee who earned a taxable wage of \$15.80 would pay a tax based upon a wage of \$16.00 and would have sixteen cents deducted from his wage, but if he earned only \$15.20 he would pay a tax based upon a wage of \$15.00 and would pay only fifteen cents tax. It is evident that in the case of large corporations or firms having a great number of employees the preparation of a report stating the wages paid to each individual employee for a certain period, the tax to be deducted from such wages, and the gross earnings of all the employees would necessitate a great amount of labor and the expenditure of a considerable amount of time when done by hand.

The machine of the present invention provides a means of mechanizing the preparation of the above report through a system of punched card accounting. Assume for the sake of illustration that the company applying this system pays its employees on a piece work or hourly basis. At the end of each day a record card is punched for each employee with the perforations therein divided into two fields. Field I is punched with the social security number of the employee and

field 2 with the amount of wages due the employee for the day. At the end of the week, the cards representing the daily wages earned by all of the employees during that week are assembled and run through a mechanical sorter thereby arranging the cards in groups according to their various social security or designating numbers. The cards are now ready to be placed in the tabulator which produces a report sheet on which will be printed on a single horizontal line, the employee's social security number, his total wages for the week and the exact amount of the deduction to be made. There will likewise be printed on the report sheet the total wages earned by all of the employees during the week from which the tax to be paid by the employer may readily be determined by inspection.

The mechanism of the invention disclosed herein is mounted in a standard Powers type tabulator similar in its general construction and operation to machines disclosed in numerous patents and previous applications owned by the assignee of the present application. The card feeding and analyzing mechanisms of the Powers machine, for example, are disclosed in the patent to William W. Lasker, No. 2,044,119 issued June 16, 1936. An original form of the adding and printing mechanism used herein is disclosed in the patent to James Powers, No. 1,245,502 issued Nov. 6, 1917, and earlier still in the patent to Hubert Hopkins, No. 1,039,130 issued Sept. 24, 1912.

The machine of the present invention is, like the standard Powers tabulator, equipped with a plurality of computing units, each comprising a printing unit and an associated standard accumulator. In carrying out the present invention, three of the usual seven computing units of the standard Powers tabulator are employed, and, though any desired three units may be used, it will be assumed for convenience of description that units I, II, and III are utilized in carrying out the invention. Each of these three units is provided with a front or group total accumulator while unit II is also provided with a rear or grand total accumulator. All of these accumulators are normally conditioned to add. One computing unit, preferably unit I, is actuated directly from field I of the cards and serves to print the designation number of each separate group of cards or, what is the same thing in the present instance, the social security number common to each employee's group of cards. By a method of non-print control, unit I is permitted to print only on the first machine operation following a total-taking operation, or a grand total

taking operation, and accordingly each employee's social security number is printed from the first card of the employee's group of cards. The social security number from each of the remaining cards in the group is accumulated by the front or group total accumulator of unit I, but printing of the accumulated numbers is suppressed. When the cards of a particular employee for a weekly period have been tabulated, the machine enters upon a group total taking operation. During this operation, a total is taken from the front or group total accumulator of unit I and the accumulator is then cleared, but the printing of the total thus taken is suppressed. At the end of the group total taking operation, the front or group total accumulator of unit I is conditioned to receive the social security number from the first card of the following group of cards and to print this number on the report sheet. Field 2 is connected, by a method of Y wiring in the translator, to computing units II and III so that the data in this field, that is, the daily wages of each employee, is entered simultaneously into these two separate units. The weekly wages of an employee are thus accumulated in the front or group total accumulator of units II and III and in the rear or grand total accumulator of unit II. The daily wages of the employee received from each card of an employee's card group are not printed by units II and III, for, by a method of non-print control, printing of the amounts received from the individual cards of a group is suppressed. But when the cards of a particular employee for a weekly period have been tabulated and the weekly wages of the employee have been accumulated in the front or group total accumulators of units II and III and in the rear or grand total accumulator of unit II, a group total taking operation is initiated during which a total is taken from the front or group total accumulators of units II and III but not from the rear or grand total accumulator of unit II. The non-print control for units II and III is set to permit the totals thus taken to be printed, but the printing hammers of the two lowest denominational orders in unit III are prevented from printing with the result that printing of the two lowest denominational orders of the total from the front or group total accumulator of unit III is suppressed. As a result of the suppression of the printing of the two lowest denominational orders of the total representing the weekly wages of the employee, the total actually printed from unit III represents one per cent of the employee's weekly salary or the amount of his social security deduction for the week. Thus, if an employee's weekly salary, as accumulated in the front accumulator of unit III, is \$25.10 and the printing of the two lowest denominational orders of this figure is suppressed, an amount of \$.25 is total printed from unit III. This amount obviously represents the employee's social security deduction for the week.

In the example just given, the total of the employee's weekly salary is \$25.10 and the proper social security deduction is \$.25. But, if the employee's weekly salary had been \$25.80, his social security deduction should be not \$.25 but \$.26, for where the weekly salary of an employee includes a fraction of a dollar and that portion is \$.50 or more, the employee must as previously stated, pay a tax based on the next higher even number of dollars. To enable the proper social security deduction on an employee's weekly wages to be printed from the front accumulator of unit

III during a group total operation, it is necessary to carry 5 to the tens denominational order of this accumulator before the total from this accumulator is printed. Thus, if the total of an employee's weekly wages, as accumulated by this accumulator, is \$25.80, a 5 must be added to the tens denominational order of the accumulator, leaving a total of \$26.30 standing therein, or if the total is \$25.10, a 5 must be added, leaving a total of \$25.60 standing therein. Then when the first group total is printed from the front or group total accumulator of unit III, an amount of \$.26 will be printed, which is the proper social security deduction for a weekly salary of \$25.80, and when the second group total is printed, an amount of \$.25 will be printed, which is the proper social security deduction for a weekly salary of \$25.10.

The operation of carrying this additional amount of 5 into the tens denominational order of the front or group total accumulator of unit III is effected in the following manner. The Powers machine is provided with an automatic total taking control mechanism, the operation of which is initiated automatically upon a change in designation. A means is provided whereby this mechanism may be caused to perform either a single operation or two successive operations upon a change in designation. During the first of two successive operations, this mechanism initiates a group total operation and during the second of such operations it initiates a grand total operation. In the present machine, this means is set to cause two successive operations of the total taking control mechanism upon a change of designation or social security number. Instead of initiating a group total operation, however, the first operation of the total taking control mechanism causes the entry of a "five" into the tens denominational order of the front or group total accumulator of unit III, thereby conditioning said unit to print the proper social security deduction during a group total operation, as has been previously explained. The second operation of the total taking control mechanism, instead of initiating a grand total taking operation, initiates a group total taking operation during which a group total is taken from the front or group total accumulators of units I, II, and III and during which these accumulators are cleared. As previously explained, printing of the total taken from unit I is suppressed, and printing of the two lowest denominational orders of the totals taken from unit III is suppressed, but the balance of the total taken from unit III and the total taken from the front accumulator of unit II are printed. It will thus be evident that the employee's weekly wage is printed from the front accumulator of unit II and the employee's social security deduction is printed from the front accumulator of unit III during the group total operation initiated by the second operation of the total taking control mechanism, while the employee's designation or social security number is printed from unit I during the cycle in which the first card of the group representing the employee's wages for a weekly period was sensed. The machine is provided with the usual line-space mechanism for spacing the report sheet. This mechanism is set so that it does not operate to advance the report sheet when the employee's social security number is printed, but operates to advance the report sheet only after printing has been effected during a total or grand total taking operation. It is thus evident that the designation or social security

number printed from unit I, the employee's total weekly wage printed from unit II and the total weekly social security deduction printed from unit III appear on the same line of the report sheet.

The total of the weekly wages of all the employees is accumulated in the rear or grand total accumulator of unit II. A grand total is taken from this accumulator under control of a special control which initiates a single operation of the previously mentioned total taking control mechanism during which a grand total taking operation is initiated instead of the usual group total operation.

After each group of cards representing the week's work of each employee has been tabulated it is evident that the amount contained in the accumulator associated with unit III should be the amount of his total social security deduction, and that the amount contained in the front accumulator associated with unit II will be his total wages for the week. If, however the amount present in units II and III includes a fraction of a dollar and that fraction exceeds forty-nine cents then the amount printed in unit III would not be the true social security deduction. For example the amount \$25.80 would be printed in this unit as 25 (last two orders being blank) which would be incorrect.

The mechanism of the invention, although operable by the total control mechanism is mounted in the translator unit of the machine. A simple manipulative means is provided whereby the mechanism for carrying a "five" into the tens denominational order of the front or group total accumulator of unit III may be disabled or, if desired, the entire translator may be removed and replaced by one of a different construction if the machine is to be used for a different work. For convenience in referring to the carry mechanism of the present invention, it seems desirable to term it a "total carry mechanism" to distinguish it from the usual tens carry or tens transfer mechanism which operates during tabulating cycles of the machine.

One object of this invention is to effect automatically, and through entirely mechanical means, the entry of an unchanging definite amount into an accumulator after each group listing operation of a tabulator.

Another object of this invention is the provision of a total carry mechanism for use in a tabulator, said mechanism to be associated with the translator unit of the machine and subject to manual manipulation in order that it may be rendered effective or ineffective at the will of the operator.

Other objects and structural details of my invention will be apparent from the following description when read in connection with the accompanying drawings wherein:

Figs. 1, 2, and 3 comprise a composite view in right-hand cross section through unit II of the entire machine.

Fig. 4 is a view of the rear of the translator showing the arrangement of wires therein and the position of the several machine units.

Figs. 5 and 6 comprise a composite view in exploded isometric of the total control mechanism.

Fig. 7 is a view in right-hand cross section of the mid portion of the machine showing the chain of mechanism operable to effect the total carry operations. The section is taken through unit III of the translator just in front of the column of second lowest denominational order.

Fig. 8 is a detailed view of the head of the total link.

Fig. 9 is an enlarged detailed view in right-hand side elevation of the rear of the translator.

Fig. 10 is a detailed view of the adjustment plate on the head of the total link.

Fig. 11 is a view illustrating a typical report sheet with certain explanatory notes and diagrams added.

In the structural description to follow, reference is made at several points to the act of automatically initiating an operation of the total taking control mechanism. For purposes of brevity, this act is frequently referred to as "tripping a total." It will be understood, therefore, that in the following description each occurrence of the phrase "tripping a total," or its equivalent, indicates the automatic initiation of the total taking control mechanism.

MACHINE OPERATION

As previously mentioned the mechanism of the invention is mounted in a Powers tabulator and the means for driving the machine, for feeding and analyzing the record cards and for adding and printing the data contained on the cards is old and well known in the art. With the exception of the above mentioned alterations in the total control unit and incidental changes necessary to permit the use of 90-column cards in the present machine, the mechanism of the base herein is the same as that disclosed in the Lasker Patent 2,044,119. The present invention is aimed at a method of executing an automatic total carry so that the major portion of the description will be devoted to that operation. Before entering into a detailed discussion of the above mechanism, however, a brief summary of the general features of construction and operation of the well known Powers machine will be given.

The machine itself is generally considered as being divided into three cooperating sections or parts. First of all the base (Figs. 1 and 2) where the card feeding, analyzing, and total tripping operations occur; then the intermediate section (Fig. 2) comprising chiefly the translator which is a unitary removable structure containing wires arranged in any suitable manner to transmit the data on the cards into the desired computing units; and lastly the head section (Fig. 3) in which is mounted the adding and printing mechanism of the machine. The machine is power driven, usually through an electric motor (not shown), and contains a pair of constantly rotating shafts 1 and 2 (see Figs. 1 and 3 respectively). The shaft 1 may be called the main base shaft since it controls all of the positively driven operations in the base, while shaft 2 performs a similar function to some extent in the head of the machine.

CARD FEEDING AND ANALYZING

Referring now to Figs. 1 and 2 there is shown therein the card magazine 3 in which is placed the stack of cards to be tabulated. The cards are adapted to be fed serially from the magazine into position for sensing by a picker knife and block 4, controlled by a cam 200 fixed to the shaft 1, and a pair of power driven feed rolls 5. The picker knife and block 4 is connected by a link 201 to an arm 202 which is fixed to a rock shaft 203 (Figs. 1 and 6). The shaft 203 is rocked cyclically by the cam 200 through an arm 204 (Fig. 5) connected by a link 205 to an arm 206 fixed to shaft 203. The arm 204 carries a follower 207 which cooperates with cam

200 with which it is held in engagement by a strong spring 208 connected between arm 206 and the frame. In sensing position the card lies between a pair of perforated plates 6 and limits against a reciprocating card stop 7 controlled by a cam 209 fixed to shaft 1. The card stop 7 is controlled by the cam 209 through linkage now to be described. A pivoted arm 210 (Fig. 5), carrying a follower 211 cooperating with cam 209, is connected by a link 212 to an arm 213 fixed to a rock shaft 214. Also fixed to the shaft 214 is an arm 215 (Fig. 6) connected by a link 216 with a lever 217 which has its free end projecting into an opening in a bracket supporting the card stop 7. It will be understood that the linkage consisting of elements 215, 216, and 217, shown in Fig. 6, is duplicated at the other side of the card stop 7. From the description of the linkage controlled by cam 209, it will be evident that the card stop 7 is cyclically lowered and raised by the cam 209, thereby arresting each card in the sensing chamber just before the data recorded on the card is sensed and permitting the card to be ejected from the sensing chamber after the sensing operation has been completed. The card is adapted to be read by a plurality of pins 8, arranged in 45 columns of 12 pins to the column, all of the pins being supported in a vertically reciprocal pin box 9. The means for effecting the vertical reciprocation of the pin box 9 (Fig. 1) includes a pair of eccentrics 11 (only one shown) fixed to the shaft 1 and a pair of eccentric straps 11a (only one shown), each of the latter having one end surrounding a corresponding eccentric 11 and another end connected to a pin (not shown) pivoted in a casting (not shown) attached to one side of the pin box frame. At those points of the card which are perforated the pins 8 associated with these perforated points pass through the card during the upward travel of the pin box 9 and elevate a corresponding intermediate pin 12. The pins 12 are equal in number and arrangement to the pins 8 and there is associated with each column a pair of locking slides 13 and a pair of change of designation slides 14. The function of the slides 13 is to lock in raised position all of the pins 12 which have been elevated by corresponding sensing pins 8. The slides 13 are retracted once for each machine cycle by a bail 15 controlled by a cam 218 (Fig. 5) fixed to shaft 1. Cooperating with the cam 218 is an arm 219 pivotally mounted on a stud 220 and carrying a follower 221. Connected to the free end of arm 219 is a vertical arm 222 cooperating with a horizontal arm 223 which is fixed to shaft 224. Also fixed to shaft 224 is a pair of bail arms 225 (Fig. 6) carrying the bail 15 which abuts against the rear end of each of the locking slides 13. The slides 13 are normally urged towards their locking position or towards the rear of the machine by the individual leaf springs 226 which form part of a comb spring extending across the rear of the slides 13. It will be evident from the foregoing description that once during each machine cycle, the cam 218 effects the actuation of the bail 15, thereby retracting the slides 13 against the action of the leaf springs 226 and releasing any intermediate pins 12 which may previously have been locked by the slides 13 in their elevated position. The retraction of slides 13 occurs near the end of the machine cycle when the sensing pins 8 are very close to their highest elevated position. Therefore if identical designation matter appears on successive cards the originally elevated pins 12 will not be permitted to

descend. The slides 14 cooperate with each column of pins 12, in a well known manner, to trip a total whenever a change of designation occurs in a manner later to be described. Positioned just above the intermediate pins 12 is a translator 16 which supports a plurality of Bowden wires 17 one of which may be associated with each pin 12. The translator of the present machine contains certain novel mechanism necessary to the operation of inserting a predetermined amount in the tens denominational order accumulator wheel in the front accumulator of unit III during the total cycle preceding a grand total cycle and will be described in considerable detail further on. For the present it may be merely said that the elevation of a pin 12 will press its corresponding Bowden wire 17 to cause the elevation of the proper digit stop 18 (Fig. 3) in whichever of the various units the actuated wire 17 extends. The present machine operates on 90-column cards through the use of the familiar six point two hole code so that six pins 8, six corresponding pins 12 and six wires 17 represent one column of a card. The sixth point of each column, however, is used only as a control hole so that five translator wires per column are sufficient to represent the numerals 1 to 9. The above mentioned digit stops 18 of each unit are arranged in a basket 19 supported in a common stop tray or frame 21. One stop basket 19 usually supports 10 columns of stops 18, each column being composed of five digit or numeral stops and a normally effective zero stop 22. The present invention requires three such units. A stop basket of the 90-column type used herein is disclosed in the patent to Lasker No. 1,780,621 issued Nov. 4, 1930. Each of the zero stops 22 is resiliently connected to a bell-crank 23 spring tensioned to move in a clockwise direction (Fig. 3) and so hold its associated zero stop elevated. The stops 22 are adapted to be lowered at the start of the machine cycle either individually during tabulating operations, through a slide 24, or as a group during total taking operations by a bail 25 supported between a pair of arms 26 (one shown) secured to a shaft 27. The shaft 27 is adapted to be rocked, in a manner later to be described, only during total taking operations. The stop basket illustrated herein and that disclosed in the above patent are generally the same in principle of operation. There are, however, a few points of structural difference between the two baskets. In the present construction, the "nine", or left-hand stop 18 in each column is formed with a laterally extending pin 18A which normally rests in a notch cut in a fixed arm 18B. Elevation of a "nine" stop will dislodge the pin 18A from its notch and permit that column of stops to shift a short distance forwardly when contacted by an associated actuating rack. A spring pressed arm 18C operates upon another pin on each of the "nine" stops 18 and serves to restore its associated "nine" stop to normal. Positioned just above each column of stops 18 is an actuating sector 28 which, along with its associated type sector 29, is pivoted on a shaft 31 supported between the side frames of the machine. The type sectors 29, and the actuating sectors 28 secured thereto, of each unit are tensioned to move in an upward clockwise direction about their pivot 31 by springs 32 but are normally retained in retracted position by a bail 33 supported between a pair of arms 34 also pivoted on the shaft 31. The bail 33 is normally held in retracted position by a link 35 connected to one of the arms

34 and extending towards the rear of the machine where its far end is resiliently connected to a lever 36 secured to a rock shaft 37. A strong spring 38 tensioned between the framework of the machine and the link 35 holds the link retracted. Two links 35 are provided for each computing unit, each link being connected to one of the arms 34 which carry the bail 33 for the unit. The shaft 37 is given a reciprocable rocking motion once for each cycle of the shaft 2, so that during the first 180° of rotation of the shaft 2 the bail 33 is driven forward positively thus permitting all of the sectors 28 and 29, which are not retained at zero by the stops 22, to follow under tension of their springs 32. During the second 180° of rotation of the shaft 2 the bail 33 returns to normal, under tension of the spring 38, thereby restoring all of the released sectors to normal. The shaft 37 is rocked by the shaft 2 through a linkage which has long been employed in Powers tabulators in commercial use. This linkage is disclosed in Fig. 10 of the application of J. M. McDonnell, S. N. 156,304, filed on July 29, 1937. As this linkage forms no part of the present invention, it is not illustrated herein. Each of the type sectors 29 has ten type elements 39 mounted thereon, which, during listing operations are variably positioned at the printing line according to the setting of the associated column of digit stops 18. The type elements 39 are adapted to be struck by hammers 41, released by an extension 42 on one of the pair of links 35, to effect printing against a platen 43. The extension 42 is connected to an arm 227 fixed to a rod 228 which carries the usual hammer latch releasing bail (not shown). At the proper point in the cycle, the link 35 and its extension 42 rock the rod 228 in a clockwise direction, thereby releasing the printing hammers 41 in a well known manner.

Pivotally mounted on a rod 229 above the printing hammers 41 of each computing unit are a plurality of non-print latches 230 individual to the printing hammers 41 of the unit. Pivotally mounted on the outside of the end printing hammers 41 of each computing unit is a pair of ball arms 231 (only one shown) carrying a ball 232. The ball arms 231 are spring-biased in a clockwise direction with the ball 232 normally resting against the end of the non-print latches 230, as shown in Fig. 3. To disable any printing hammer 41 of a particular computing unit, the ball 232 is moved in a counter-clockwise direction manually and the corresponding non-print latch 230 is moved manually in the same direction to position its end 233 in a notch 234 of the printing hammer 41. The ball 232 is then released to hold the non-print latch in effective position. When the printing hammers of this particular computing unit are released by the rocking of rod 228, the effective non-print latch 230 prevents the printing hammer from striking the type 39 which is then in printing position. From the foregoing description, it will be evident that printing in the two lowest denominational orders of unit III may be suppressed by manual manipulation of the non-print latches 230 in the two lowest denominational orders of this unit.

The actuating sectors 28 cooperate in a well known manner with an accumulator comprising a set of gear wheels 44 supported between a pair of arms 45 (one shown) and adapted to be moved in and out of engagement with teeth on the sectors 28 by a pair of cam arms 46 (one shown) both of which are secured to a short shaft 47.

The cam arms 46 are adapted to be rocked at variable points in the machine cycle so that the wheels 44 may engage the sectors 28 either on the return stroke of the sectors or on their forward stroke. During listing or adding operations the wheels engage their racks at the beginning of the return stroke and are turned away from zero a number of tooth spaces proportionate to the distance required for the sectors to return to normal. During total taking operations the wheels engage the racks 28 at the beginning of the forward stroke and rotate in the opposite direction until they clear by reaching zero. The cam arms 46 receive their actuation from a rock shaft 48 through a chain of mechanism comprising arm 49 on shaft 48, link 51 connected to arm 49, arm 52 connected to link 51 and secured to a shaft 53, a pin carrying rocker arm 54 also secured to shaft 53, and a pitman 55 adapted to cooperate with the rocker arm 54 at one end and connected to the left-hand cam arm 46 at its other end. The shaft 48 is driven from the main head shaft 2 by means which have long been employed in commercially used Powers tabulators. This means is disclosed in Fig. 10 of the J. M. McDonnell application, S. N. 156,304, filed on July 29, 1937.

ACCUMULATOR TIMING

As previously explained, each of the units I, II and III is provided with a front or group total accumulator 44, while unit II is also provided with a rear or grand total accumulator 59 (Fig. 3). The accumulator timing may best be described in connection with Fig. 3 which illustrates the front and rear accumulator of unit II, for the front accumulators of units I and III are similar in their timing to the front accumulator of unit II.

The front accumulator 44 (Fig. 3) is normally in add condition. When the front group total shaft 56 is in unrocked position, a spring (not shown) holds the bell-crank 57 rocked in a counter-clockwise direction with the front edge of the upright arm of the bell-crank limiting against a pin in an arm 235 fixed to the front group total shaft 56. When the bell-crank 57 is in this position, the link 236 holds the pitman 55 in its raised position wherein the upper pin in the crank arm 54 engages a notch in the upper edge of the pitman. The front accumulator 44 remains in add condition as long as the upper pin in the crank arm 54 remains in engagement with the upper notch of the pitman 55. With the front accumulator 44 in add condition, the shaft 48 is rocked in a counter-clockwise direction before the ball 33 is advanced to permit the forward movement of the type sectors 29 and the rack sectors 28. Through the previously described linkage, the rocking of shaft 48 rocks crank arm 54 in a clockwise direction, thereby shifting the pitman 55 rearwardly and disengaging the front accumulator 44 from the rack sectors 28. After the disengagement of the front accumulator 44 from the rack sectors 28, the ball 33 is advanced thereby permitting the type sectors 29 and the rack sectors 28 to be moved forward until they are arrested by the engagement of a heel on the rack sectors 28 with a raised stop 18. At the end of the first half of the cycle, after the type sectors 29 have been set, the extension 42 rocks rod 228, thereby releasing the printing hammers 41 and permitting printing, unless printing is otherwise suppressed. Before the rack sectors 28 and the type sectors 29 are returned to their normal position by the bail 33, the shaft 48 is rocked in

a clockwise direction, thereby rocking the crank arm 54 in a counter-clockwise direction and shifting the pitman 55 forwardly to engage the front accumulator 44 with the rack sectors 28. During the return movement of the rack sectors 28 the amount represented by the forward movement of these sectors is entered into the front accumulator 44. It will be understood that the usual tens transfer mechanism is associated with the front accumulator 44 whereby a tens carry is made to an accumulator wheel of higher denominational order when the accumulator wheels of the next lower denominational order pass through zero. The tens transfer mechanism employed may be the same as that disclosed in the previously mentioned Hopkins Patent No. 1,039,130, in the Powers Patent No. 1,245,502, or in the Lasker Patent No. 2,151,406.

To condition the front accumulator for total-taking the front total shaft 56 is rocked in a clockwise direction and held rocked during the total cycle. Upon the rocking of shaft 56, the arm 235 rocks the bell-crank 57, thereby causing the spring 58 to move the pitman 55 into a lower position in which the lower pin on the crank arm 54 engages the notch in the lower edge of the pitman.

At the time the pitman 55 is lowered by the rocking of the front total shaft 56, the pitman is in its extreme forward position and the lower pin on the crank arm 54 is behind the notch in the lower edge of the pitman. When the shaft 48 is rocked in a counter-clockwise direction before the bail 33 begins its advance, the crank arm 54 is rocked in a clockwise direction but the pitman 55 remains in its extreme forward position, for the lower pin on the crank arm 54 does not engage the notch in the lower edge of the pitman until the end of the clockwise movement of the crank arm 54. At the pitman 55 remains in its extreme forward position during the advance of the rack sectors 28 and type sectors 29, the type sectors are advanced in accordance with the amount standing in the front accumulator 44. After the type sectors have been thus positioned, the extension 42 rocks the rod 228 in a clockwise direction, thereby releasing the printing hammers 41 to print the total taken from the front accumulator 44, unless the printing of the total is otherwise suppressed. Before the type sector 29 and the rack sectors 28 begin their return movement under control of the bail 33, the shaft 48 is rocked in a clockwise direction, thereby shifting the pitman 55 rearwardly and disengaging the front accumulator 44 from the rack sectors 28. The rack sectors 28 and the type sectors 29 are then restored to their normally retracted position by the bail 33, while the front accumulator 44 remains out of engagement with the rack sectors. At the end of the total cycle, the shaft 56 is restored to its normal unrocked position whereupon the link 236 raises the pitman 55 to its normal position. During the first half of the following accumulating cycle, the pitman 55 remains in its extreme rearward position, thereby retaining the front accumulator 44 disengaged from the rack sectors 28 during that half of the cycle, for the upper pin in the crank arm 54 does not engage the notch in the upper edge of the pitman 55 until the shaft 48 has completed its rocking movement in a counter-clockwise direction. At the beginning of the second half of this accumulating cycle, however, the crank arm 54 shifts the pitman 55 to its extreme forward position thereby engaging the front accumulator 44

with the rack sectors 28 in the same manner as in other accumulating cycles.

During the taking of a grand total from the rear accumulator 59 of unit II, the front accumulator 44 of this unit must be conditioned to non-add to prevent the grand total taken from the rear accumulator from being transferred to the front accumulator. To condition the front accumulator 44 of unit II to non-add when the front grand total shaft 176 is rocked to initiate a grand total taking operation, an arm 237 is fixed to the shaft 176 in alignment with the bell-crank 57 of unit II. Upon the rocking of the grand total shaft 176, the arm 237 rocks the bell-crank 57 in a clockwise direction, thereby causing the link 234 to move the pitman 55 into an intermediate position in which neither the upper nor the lower notch in the pitman is engaged by a pin on the crank arm 54. The arm 237 corresponds to the arm 127 shown most clearly in Fig. 19 of the patent to W. W. Lasker 2,151,406. As explained in this patent the arm 127 lowers the pitman, which controls the front or group total accumulator, at the beginning of the grand total cycle to retain the front accumulator disengaged from the associated rack sectors during the taking of a grand total from the rear or grand total accumulator, and thereby prevents the transfer of the grand total to the front accumulator.

The rear or grand total accumulator 59 of unit II is likewise normally in add position. The mechanism for controlling the timing of this accumulator may be readily understood from Figs. 8 and 19 of the patent to Lasker No. 2,151,406. Referring to Figs. 6 and 8 of this patent, the shaft 14 corresponds to the main head shaft 2 of the present application. Fixed to the shaft 14 is a disc 40a having on its inner face a cam 40 which cooperates with two pivoted bell-cranks 41 and 41a. The lower bell-crank 41 conditions the rear or grand total accumulator 34' for adding and the upper bell-crank 41a conditions it for total-taking. The control of the rear accumulator 34' is effected through an arm 42 carrying at its free end a stud 422 adapted to engage a shoulder on the vertical arm of either bell-crank 41 or 41a and having its other end connected to an arm 119 which is fixed to shaft 43. Also fixed to shaft 43 is an arm 44 resiliently connected to a cradle 45 which supports a rod carrying the rear accumulator 34'. A strong spring 120 connected to an arm 178 which is fixed to shaft 43 tends to rock shaft 43 in a counter-clockwise direction and thereby retain the rear accumulator in engagement with the rear actuating racks. Another spring tends to move the stud 422 on arm 42 into engagement with the shoulder on the upper bell-crank 41a but an arm 41 fixed to the rear grand total shaft 164 bears on an extension 421 of stud 422 and holds this stud in engagement with the lower bell-crank 41, thereby conditioning the rear accumulator 34' to add as long as the rear grand total shaft 164 remains unrocked. The shaft 164 in Fig. 8 of Patent No. 2,151,406 corresponds to the rear grand total shaft 64 shown in Fig. 3 of the present application. When the arm 42 is controlled by the lower bell-crank 41, the rear accumulator 34' is disengaged from the associated rear racks during the first half of each cycle and engaged with these racks during the last half of each cycle, thereby being conditioned for adding.

The rear or grand total accumulator 34' is conditioned for total taking by shifting the stud 422 in the arm 42 into engagement with the upper

bell-crank 41a. As shown in Figs. 8 and 19 of Patent No. 2,151,406, this is effected by rocking the front grand total shaft 7. Through a link 123 the rocking of the front grand total shaft 7 causes the rear grand total shaft 164 to rock. Upon the rocking of the rear grand total shaft 164, the previously mentioned arm 47 is rocked in a counter-clockwise direction, thereby permitting the spring-biased arm 42 to be raised to bring its stud 422 into engagement with the shoulder on the upper bell-crank 41a. When the arm 42 is in this position and is controlled by the upper bell-crank 41a, the cam 40 actuates the bell-crank 41a in the second half of the cycle, thereby permitting the rear accumulator 34' to remain in engagement with its actuating racks during the first half of the cycle, and to be disengaged from these racks during the second half of the cycle. It will be understood that this timing of the rear accumulator will cause a total to be taken therefrom. At the end of the grand total cycle, the front and rear grand total shafts are restored to their unrocked position, whereupon the arm 47 again places the arm 42 under control of the bell-crank 41, conditioning the rear accumulator to add.

In the machine of the present application, the front grand total shaft 176 (Fig. 3) corresponds to the front grand total shaft 7 shown in Fig. 19 of Patent No. 2,151,406, and, as previously stated, the rear grand total shaft 64 of the present application corresponds to the rear grand total shaft 164 of the patent. In the machine disclosed in the present application, the front and rear grand total shafts 176 and 64, respectively, are rocked individually by separate means. Accordingly, no link 123, as shown in Fig. 19 of the Patent No. 2,151,406, is provided in the machine disclosed in the present application.

When a total is taken from the front or group total accumulator 44 of the unit II in the present application, the rear or grand total accumulator 59 of the same unit must be conditioned to non-add in order to prevent transfer of the total to the rear accumulator. The mechanism provided for this purpose may be understood from an examination of Figs. 8 and 19 of Patent No. 2,151,406. Fixed to the group total shaft 8 is an arm 117 connected by a link 118 to a lever 188 which in turn is connected to a link 49. Resiliently connected to the link 49 is a bell-crank 48 which is adapted to cooperate with a shoulder on the arm 119 which is fixed to the shaft 3. At the time a total is taken from the front or group total accumulator, the rear or grand total accumulator is in add condition with the stud 422 of arm 42 in engagement with a shoulder on the lower bell-crank 41. Accordingly, at the beginning of the first half of the cycle during which a total is taken from the front accumulator, the cam 40 rocks the bell-crank 41 in a counter-clockwise direction, rocking shaft 43 in a clockwise direction and disengaging the rear accumulator from its actuating racks. When the shaft 43 is rocked clockwise, the bell-crank 48, which has been moved into effective position by the rocking of the group total shaft 7, engages the shoulder on the arm 119, thereby preventing the spring 120 from rocking the shaft 43 in a counter-clockwise direction at the beginning of the second half of the total cycle to engage the rear accumulator 34' with its actuating racks. Accordingly, the bell-crank 48 prevents the rear accumulator from engaging its racks during the second half of the total cycle, and thus condi-

tions the rear accumulator to non-add. When the front group total shaft 8 is restored to its unrocked position, the bell-crank 48 releases the arm 119, thereby permitting the shaft 43 to rock in a counter-clockwise direction under the influence of spring 120 to bring the rear accumulator 34' into engagement with its actuating racks, a position assumed by the accumulator at the end of a normal adding cycle.

From the foregoing description, it will now be clear how the rear or grand total accumulator 59 (Fig. 3) of unit II in the machine of the present application is controlled. During normal tabulating cycles of the machine, this rear accumulator is maintained in add condition so that it receives the same entries as the front or group total accumulator 44 of the same unit. When a group total operation is initiated, and the front group total shaft 56 is rocked, the rear or grand total accumulator 59 is conditioned to non-add, thereby preventing the transfer to this accumulator of the group total taken from the front accumulator. But when a grand total operation is initiated, and the rear grand total shaft 64 is rocked, the rear or grand total accumulator 59 is conditioned for total-taking.

The zero stops

The control of the zero stops 22 (Fig. 3) is to be considered from three points of view, namely, their control during accumulating cycles, during group total-taking cycles and during grand total-taking cycles. The method of controlling the zero stops 22 during the three different types of cycles just mentioned is well known in the art and is fully disclosed in the previously mentioned patent to W. W. Lasker, No. 2,151,406.

Referring to Fig. 28 of this patent, there are shown a plurality of zero stops 30 associated with the rack sectors of a single computing unit. The zero stops 30 shown in this figure correspond to the zero stops 22 shown in Fig. 3 of the present application, the bell-cranks 31 shown in this figure correspond to the bell-cranks 23 shown in Fig. 3 of the present application, the bail arms 33 shown in this figure correspond to the bail arms 26 shown in Fig. 3 of the present application, the shaft 124 shown in this figure corresponds to the shaft 27 shown in Fig. 3 of the present application, the shaft 14 in this figure corresponds to the shaft 2 shown in Fig. 3 of the present application, and the shaft 164 shown in this figure corresponds as previously stated to the rear grand total shaft 64 shown in Fig. 3 of the present application.

The zero stops 30 (Fig. 28 of the Patent 2,151,406) are held normally in raised position by springs 31' (Fig. 2 of this patent). As previously explained in connection with Fig. 3 of the present application, a particular zero stop 22 is lowered by a bar 24 which is cammed to the right in Fig. 3 when a stop pin 18 is raised. To assure that the bar 24 will be capable of lowering the corresponding zero stop 22, the zero stops are automatically lowered during each tabulating cycle before the rack sectors 28 begin their forward movement, and if a stop pin 18 associated with any zero stop 22 is then raised, the cam bar 24 retains the zero stop in depressed position. But those zero stops 22 associated with the columns of stop pins 18 in which no pin is raised are again elevated before the rack sectors 28 begin their forward movement.

The mechanism for lowering the zero stops before the stop pins 18 have been raised is shown

in Fig. 28 of Patent No. 2,151,406. Fixed to the shaft 14 is a cam 166 with which there cooperates a follower carried by an arm 163 loose on the rear grand total shaft 164. The arm 163 is provided with a gear sector which meshes a similar gear sector on an arm 167 fixed to the rear group total shaft 124. Also fixed to shaft 124 is an arm 168 cooperating with a stud 174 carried by one of the bail arms 33. The arrangement is such that the cam 166 rocks the bail 33a counter-clockwise to lower the zero stops 30 and subsequently, when the follower on arm 163 leaves the high dwell on cam 166, the bail arm 33a is rocked in a clockwise direction, permitting the zero stops 30 which are not held down by cam bars 24 (Fig. 3 of the present application) to be elevated before the rack sectors begin their forward movement.

During the taking of a group total from the front or group total accumulator, the zero stops must be lowered. For this purpose, a link 122 (Fig. 7 of the present application) similar to the link 123, shown in Fig. 19 of Patent No. 2,151,406, is connected between an arm fixed to the front group total shaft 56 (Fig. 3 of the present application) and an arm 123 fixed to the rear group total shaft 27 (Fig. 3 of the present application). Accordingly, when the front group total shaft 56 is rocked, the shaft 124 rocks the bail 33a (Fig. 28 of Patent No. 2,151,406) or the bail 25 (Fig. 3 of the present application) in a counter-clockwise direction, thereby lowering the zero stops during the group total operation.

The zero stops must likewise be lowered during the taking of a grand total from the rear or grand total accumulator 59 (Fig. 3 of the present application) in unit II. In the present application, it will be remembered, the rear grand total shaft 64 (Fig. 3) is rocked independently of the front grand total shaft 176 (Fig. 3). Fixed to the rear grand total shaft 64 is an arm similar to the arm 169 shown in Fig. 28 of Patent No. 2,151,406. When the rear grand total shaft 64 is rocked, this arm bears against the bail 25 (Fig. 3 of the present application), which is similar to bail 33a (Fig. 28 of Patent No. 2,151,406), thereby lowering the zero stops 22 in unit II.

The nonprint controls

The non-print controls must be set to condition unit I to non-list the designative data, that is, to print the designation or social security number from the first card of an employee's group of cards, but to suppress printing from the remaining cards of the group, and to suppress printing during group total-taking and grand total-taking operations. They must also be set to condition units II and III to non-list the quantitative data, that is, to suppress printing of the items entered from the individual cards, and to print group totals and grand totals.

The method of non-print control utilized in the machine of the present invention is well known in the art and has been in use for some time on commercial Powers machines. The non-print control of each computing unit is actuated by a pair of push buttons 177 and 177A (Fig. 3). In general, to set the non-print controls of computing unit II to non-list quantitative data, the push button 177A is pulled out and the push button 177 is pushed in. The similar push buttons 177A and 177 associated with computing unit III are operated in a similar manner to condition unit III to non-list quantitative data. But to condition unit I to non-list designa-

tive data, both push buttons 177A and 177 associated with this unit are pulled out.

The operation of the push buttons 177A and 177, associated with unit I, in the manner mentioned, will move a non-print bail 238 in that unit to "open" position during the first cycle following a group total or grand total cycle and to "closed" position during other cycles of the machine. When the non-print bail 238 is in "open" position and the printing hammers 41 are released by the hammer latches 239, the non-print bail 238 is so positioned that it cannot engage the shoulders 240 of the printing hammers, and accordingly cannot prevent printing by the hammers. But when the non-print bail 238 is in "closed" position and the printing hammers 41 are released by the hammer latches 239, the non-print bail is so positioned that it engages the shoulders 240 of the printing hammers 41, thereby preventing printing by the printing hammers.

As the non-print bail 238 of computing unit I is moved to "open" position during the first cycle following a group total or a grand total cycle, and to "closed" position during other cycles, it will be evident that the designation or the social security number is printed, from the first card of an employee's group of cards during that cycle, while printing of the social security number is suppressed during other tabulating cycles and during group total and grand total cycles.

The operation of the push buttons 177A and 177 associated with unit II, in the manner mentioned, will move the non-print bail 238 in that unit to "closed" position during tabulating cycles and to "open" position during group total and grand total cycles. It will thereby be evident that in computing unit II, printing of the daily wages of an employee, which are read from the individual cards of that employee, will be suppressed, but printing of the weekly total of each employee's wages, taken from the front or group total accumulator 44 of the unit and printing of the total of all the employee's wages, taken from the rear or grand total accumulator 59 of the unit, will be permitted.

It will likewise be evident that in computing unit III, printing will be suppressed during tabulating cycles, but printing of the weekly social security deduction from each employee's wages will be permitted. The non-print bail 238 of unit III will be moved to "open" position during grand total cycles of the machine, but printing will be suppressed during such cycles by the zero stops 22 of this unit which are not lowered during grand total cycles.

The foregoing general description of the non-print controls affords a sufficient explanation of their functions in the present machine and of the manner of setting them to perform these functions. It is believed that this general description of these controls is sufficient in this application, as such controls form no part of the present invention. For a detailed description of the mechanism by which the non-print controls are set to perform the functions described above, reference may be made to the patent to William W. Lasker, No. 2,255,670, issued September 9, 1941.

The digit stops 18, the actuating sectors and racks, the accumulators, and the mechanism for controlling the engagement and disengagement of the accumulator and the actuating racks is considered, in the present case, as constituting the accumulating mechanism of the machine.

Keeping in mind the general statements of the construction and operation of a standard Powers

tabulator given in the preceding paragraphs we will turn now to a more detailed study of the arrangement of wires in the translator, the means for instituting the various grades of total taking operations and the relation of the mechanism of my invention to the machine as a whole.

Referring to Fig. 4 there is shown therein the translator 16 with the wires 17 thereof extending into the several units. The wires 17 are indicated as extending from two separate fields of the card with the wires associated with field 1 extending directly into unit I. The translator wires actuated from field II of the cards end in a joining cup 68 (see Patent 2,107,184 to W. W. Lasker, dated February 1, 1938) from each of which extends two separate wires 17 one going into unit II and the other into unit III. Field 2 therefore is Y wired into two separate units of the machine and data present in this field will be entered simultaneously into both units. For the sake of clearness of illustration only one wire 17 is shown extending from each of the two fields but it should be understood that more are used in the machine itself.

TOTAL CONTROL MECHANISM

All of the Powers tabulating machines of the later type are adapted to institute total taking operations automatically upon a change in a minor designating field, or successive total and grand total operations upon a change in major designating field. As previously mentioned the operating medium for tripping a total lies in the change of designation slides 14 (Fig. 2) which cooperate with the intermediate pins 12. The mechanism for instituting total taking operations in the present machine is comprised in a normally inactive cam and ratchet unit controlled by a pair of cams 66 and 67 (Fig. 5) mounted on the main shaft 1 of the machine. This total control unit is positioned at the upper left-hand side of the base section and is the same as the total control unit described in the patent to William W. Lasker, No. 2,237,908, issued April 8, 1941. An original form of this total control mechanism is disclosed in the previously mentioned Patent 2,044,119. The mechanism of the above patent is, however, adapted to institute a single total taking operation only, whereas in its modified form, as employed in the above and present applications it is possible to institute either a single total taking operation or two successive operations, according to whether the change of designation occurs in a minor or major control field. In a standard type tabulator the first total operation causes a group total to be taken from all of the front or group total accumulators, while the second operation serves to cause a grand total to be taken from the rear or grand total accumulators. The present machine contains a simple adjustment means which enables it to operate either in the above manner or, as will be presently described, it may function in such a manner as to prevent the initial total operation from ever reaching the computing section of the machine and instead cause such operation to effect the entry of a five into the tens denominational order of the front or group total accumulator of unit III. The same adjustment means renders the following or second total operation ineffective to take a grand total from the rear or grand total accumulator of unit II and instead causes it to take a group total from the front or group total accumulators of units I to III, inclusive. A grand total may be taken from the

rear or grand total accumulator of unit II either through the use of a special control card or by resetting the adjustment means to normal.

For a detailed description of the modified total control unit, including the means for instituting successive total operations from a single change in designation, reference is hereby made to the previously mentioned Patent No. 2,237,908. Figs. 5 and 6 of the present application illustrate substantially the same subject matter in the same manner as comparable views Figs. 6 and 7 respectively of the above patent. As shown in Figs. 2 and 6 herein a plurality of settable slides 68 are positioned directly in front of and slightly above the pin box which supports the intermediate pins 12. The slides 68 are equal in number to the columns of the card and each is provided with a pivoted dependent interponent 69, the lower end of which normally lies just above and in front of the nose of an associated slide 14. A pair of bail rods 71 and 72 supported respectively between a pair of arms 73 and 74 (Fig. 6), secured to shafts 75 and 76, are positioned in front of all of the slides 14 but lie out of the path of movement of the slides. The slides 68 are hand settable and each has three vertical positions. First with the lower end of its interponent 69 above the slides 14 and the bail rods 71 and 72, second with the end of the interponent lying between the nose of its associated slide 14 and the bail rod 71, and third with the interponent between the slide 14 and the bail rod 72. It is evident that in the first of the positions noted above, the slide 14 in the same column as the raised interponent may reciprocate freely in response to movements of the pins 12 and will be ineffective to rock the interponent 69 or either of the bail rods 71 or 72. In the second and slightly lower position of a slide 68 the lower end of its interponent 69 lies directly between the nose of a slide 14 and the upper bail rod 71. The elevation or descent of a pin 12 in this column, therefore, will cause the slide 14 leftward (Fig. 2) or rightward (Fig. 6) and through interponent 69 will cause bail rod 71 to rock in a clockwise direction to rock its associated shaft 75 through a short arc in the same direction. In the third position of slide 68 the lower end of the interponent 69 lies directly opposite the bail rod 72 so that operation of the corresponding slide 14 will rock bail rod 72 and bail 71 also, through arms 74, to rock both shafts 75 and 76 in a clockwise direction as shown in Fig. 2. The slides 68, therefore, may be set to control two operations. Either the shaft 75 may be rocked alone or shafts 75 and 76 may be rocked together. As is fully described in the above patent and briefly described hereafter the rocking of shaft 75 alone causes the initiation of a single total taking operation, whereas the rocking of both shafts 75 and 76 together causes two successive total operations. When the machine is used for the purpose outlined in the early part of the description all of the slides 68 associated with field 1 of the cards (social security number) are depressed to the third position described above so that any change in designating number will immediately be reflected in a movement of one or more slides 14 to rock both shafts 75 and 76 to trip off two successive total operations in the following manner.

Referring now to Fig. 5, it will be seen that an arm 77 is secured to the shaft 75 and that a similar arm 78 is secured to the shaft 76. The arms 77 and 78 are positioned directly in front of the

normally inactive total control unit and are adapted to cooperate respectively with a pair of latches 79 and 81 which normally hold ineffective a pair of pawl arms 82 and 83. Pivoted to the outer end of the arm 82 is a feed pawl 84 which is adapted to cooperate with a ratchet wheel 85 secured to a sleeve which is keyed to a shaft 86. Pivoted to the arm 83 is a feed pawl 87, similar to the pawl 84, which is adapted to cooperate with a second ratchet wheel 88 secured to another sleeve which is loosely mounted on the shaft 86. Ratchet wheel 88 is one part of an assembly which further comprises a detent cam 89 and a shifting cam 91. All three of the above members are secured to the above mentioned sleeve which is loosely mounted on the shaft 86. Ratchet wheel 85 is one member of a second assembly, comprising a third ratchet wheel 92, a cam 93, a detent cam 94 and three additional cams, shown in Figs. 5 and 6, numbered 95, 96, and 97, this second assembly being secured to the other of the above mentioned sleeves which is fixed to the shaft 86. The function of pawl arm 83 is to advance the ratchet wheel 88 and thereby the assembly of which it is a part in a series of step-like motions under the control of cam 67, through the medium of push rod 98. The push rod 98 is connected to the push rod 99, and like the push rod 99, it is controlled by the cam 67. The pawl arm 83 is, however, normally latched upward out of the path of movement of the rod 98 by the latch 81. The rocking of shaft 76 will, however, release the arm 83, through arm 78, and on the next upward movement of the rod 98 the assembly 88, 89, and 91 will be fed one tooth space in a clockwise direction, as viewed from the left-hand side of the machine. The pawl arm 82 is also adapted to be controlled by cam 67, through push rod 99, and after shaft 75 has been rocked will advance the ratchet wheel 85 and thereby the shaft 86 one step simultaneously with the advancement of ratchet 88. The third ratchet wheel 92 is adapted to be controlled by the previously mentioned cam 66 through a push rod 101 and an associated pawl arm 102. There is no latching means connected with the pawl arm 102 so that it rises and falls with the push rod 101 with each cycle of the cam 66. Because of the arrangement of teeth on the ratchet wheel 92, however, the pawl is prevented from rotating the shaft 86 while the control unit is in rest position. As soon as the shaft 75 is rocked though, the shaft 86 will receive one step of rotation, through the ratchet wheel 85, thus bringing the teeth on ratchet 92 into cooperative relation with the feed pawl on the arm 102, thereby permitting the shaft 86 to receive two more steps of movement under the actuation of cam 66. Through means illustrated but not completely described herein the pawl arm 82 is normally engaged by an auxiliary latch 103 after the first actuation of ratchet wheel 85. Then upon the second step of rotation of the shaft 86, pawl arm 82 is reengaged by its regular latch 79, so that, after the third step of rotation of shaft 86 and the assembly secured thereto, both pawl arms 82 and 102 are ineffective and the control unit is normalized. The above condition of operation wherein the control unit is normalized after only three steps of operation occurs only when the shaft 75 has been rocked alone. When shafts 75 and 76 have been rocked together, however, the cam 89, of the assembly 88, 89, and 91, will, upon its first step of movement, prevent the auxiliary latches

103 (one of which is also provided for the pawl arm 83) from engaging their arms 82 and 83 and will also hold ineffective the regular latches 79 and 81. The disabling mechanism operated by the cam 89 remains effective until the fourth cycle of operation of the cam 67 by which time the cam 89 has advanced four steps and the shaft 86 has advanced five steps, at which time the latches 79 and 81 are permitted to reengage their pawl arms 82 and 83 to again normalize the control unit. The auxiliary latches 103 are disengaged from the arms 82 and 83 after the shaft 86 has been advanced six steps, which occurs near the end of the fourth cycle of operation of the total control unit. After the third step of movement of the shaft 86, therefore, the mechanism is prevented from normalizing and is instead caused to index immediately into a second series of operations at the end of which second series it is relatched and normalized. The two successive total operations, then, require six steps of movement of the shaft 86, but because of the arrangement of the cams 66 and 67 these six steps of movement are performed in four cycles of the shaft 1 or four machine cycles. The functions performed during these several steps of operation are as follows:

Upon the first step of movement of shaft 86, the following operations occur. Associated with cam 95 (Fig. 5) is a lever 241 carrying at one end a follower which cooperates with cam 95 and connected at its other end to a link 242 (Fig. 6) which is connected to an arm 243 fast on a rock shaft 244. Fixed to the other end of shaft 244 is an arm 245 which has at its free end a shoulder normally retained out of engagement with a notch in the link 205 by a spring. When the shaft 86 takes its first step, the roller on lever 241 is raised by the high dwell on cam 95, and through the linkage just described, the shoulder on arm 245 is brought into engagement with the notch in link 205, thereby holding the picker blade 4 in retracted position, and preventing card feeding.

Associated with cam 97 (Fig. 6) is an arm 246 which is fixed to shaft 214 and has at its free end a follower cooperating with cam 97. Upon the first step of shaft 86, the follower on arm 246 is moved onto the high dwell of cam 97, thereby rocking shaft 214 clockwise, and through arm 215, link 216, and lever 217, lowering the card stop 9, thereby retaining the card in the sensing chamber.

Also associated with cam 97 is an arm 247 which is fixed to shaft 224 and carries at its free end a follower cooperating with the cam 97. Upon the first step of the shaft 86, the follower on arm 247 moves onto the high dwell on cam 97, thereby rocking shaft 224 counter-clockwise and through ball 15 moving the locking slides 13 towards the front of the machine to unlock any pins 12 which may previously have been locked in elevated position.

During this time the machine goes through an idle cycle, thereby permitting the trip transfer pawls to be reset to condition the machine for a total taking operation. Just before the end of the idle cycle, the shaft 86 is again advanced (by cam 66). The cycle following the idle cycle is normally the total cycle of the machine and the only operation in the control unit during the total cycle is to place a high point of the cam 96 beneath a roller 104 on an arm 105, thereby pulling downward an operating link 106. When the machine of the present invention is used for standard tabulating work, the operation of the

link 106 during this cycle causes the rocking of total shafts 27 and 56 in the head of the machine (Fig. 3) to initiate a group total taking operation. When used for total carry operations, however, this first operation of the link 106 will not rock the shafts 27 and 56, but will instead cause the previously mentioned entry of five into the second lowest or tens denominational order of the front or group total accumulator 44 (Fig. 3) of unit III in a manner soon to be described. The third step of operation of the shaft 86 serves to normalize the cams 95, 96 and 97. The notched disc 93 is likewise normalized at the end of the third step of shaft 86. The normalizing of disc 93 is, however, without effect at this time, for the latches 79, 81 and the auxiliary latches 103 are held disengaged from the arms 82 and 83 by the centering disc 89. Upon the normalization of cam 95 at the end of the third step of shaft 86, the follower on lever 241 rides onto the low dwell of the cam thereby disengaging the shoulder on arm 245 from the notch in arm 205. During the interval between the third and fourth steps of shaft 86, the cam 200 holds the card picker 4 (Fig. 1) in retracted position, thereby preventing card feeding during the interval in which arm 205 is unlatched. Upon the normalization of cam 96 at the end of the third step of shaft 86, the follower 104 on arm 105 moves onto the lower dwell of cam 96, thereby raising the T-link 106. Upon the normalization of cam 97 at the end of the third step of shaft 86, the followers on the arms 246 and 247 ride onto the low dwell of cam 97, thereby tending to restore the ball 15 to ineffective position and to raise the card stop 7. But during the interval between the third and fourth steps of the shaft 86, the shaft 224 is rocked in a counter-clockwise direction by the cam 218 and the shaft 214 is held rocked in the same direction by the cam 228, thereby holding the locking slides 13 in ineffective position and the card stop 7 in lowered position until they are again placed under control of the total control mechanism upon the fourth step of the shaft 86.

Inasmuch as the latches 79, 81, and 103 continue to be held disabled after this third step of movement the assembly 88, 89, and 91 is advanced a third step under the control of cam 67 at approximately 30° of main shaft travel after the previous operation of shaft 86 by cam 66. Simultaneously with the advancement of the above assembly the shaft 86 is also advanced one step, thereby rendering cams 95 and 97 and disc 93 again effective. Upon this fourth step of the shaft 86, the card feed is again disabled under the control of cam 95, and the locking slides 13 are disabled and the card stop is held in lowered position under control of cam 97. Upon the next or fifth actuation of shaft 86, cam 96 will again pull down the operating link 106. Upon the third step of the assembly 88, 89, and 91, however, which occurs simultaneously with the fourth step of the shaft 86, the cam 91 effects the depression of a link 107, through lever 108, thereby shifting the operating link 106 (see Figs. 5 and 7) a short distance laterally in a manner soon to be described. Thus, when the link 106 is pulled on the following machine cycle, it occupies a slightly different position than when it was first pulled. When the machine is set for standard tabulating work this second operation of the link 106 serves to rock the previously mentioned front grand total shaft 176 and rear grand total shaft 64, thereby initiating a grand total taking

operation from the rear accumulators and conditioning the front or group total accumulators to non-add. In total carry work, however, this operation causes the rocking of shafts 27 and 56, thereby extracting a total only from the front accumulators. Upon the fourth step of cams 88, 89, and 91, which occurs after the fifth step of the shaft 86 and shortly after the beginning of the fourth machine cycle, the follower on the arm 108 tends to move onto the low dwell of the T-link shift cam 91, but, as will be explained in more detail later, since the T-link 106 is held pulled at this time by the cam 96, the T-link cannot be returned into its normal position. After the fourth step of the cams 88, 89, and 91, the cam 89 permits the latches 81, 79 and 103 to reengage the arms 83 and 82, thereby preventing further actuation of these arms by the cams 67. The sixth and last step of the shaft 86 normalizes the cams 93, 95, 96, and 97 and conditions the machine for a new set of listing operations. The normalizing of cam 93 disengages the auxiliary latches 103 from the latches 102 and 103 which are now retained by the latches 79 and 81. The normalizing of cam 95 disengages the shoulder on arm 245 from the notch in link 205, thereby reenabling the card feeding mechanism. The normalizing of cam 96 permits the T-link 106 to be raised into its normal position. When the T-link 106 is raised, it is returned into normal position or shifted by the spring 112 (Fig. 7). The normalizing of cam 97 raises the card stop 7 and returns the ball 15 into ineffective position, thereby rendering locking slides 13 again effective. At this time, the card which initiated the two total taking operations has been sensed, and after the intermediate pins 12, which have been raised by the sensing of the card, are locked up by the locking slides 13, the card is fed out of the sensing chamber.

OPERATION OF TOTAL LINK AND HALF CENT CARRY MECHANISM

As shown in Figs. 2 and 7 the operating link 106 extends upwardly and forwardly in the machine and is formed with a rearwardly extending head or shoulder 109 in the lower left-hand edge of which is cut a notch 111 (see also Fig. 8). The link 106 is pivoted, at its lower end, to its operating arm 105 and is tensioned towards the rear of the machine by a spring 112. Due to the tension of spring 112 the upper rear edge of the link 106 normally bears against a stud 113 (Fig. 7) formed on an arm 114 pivoted to a stud 115 integral with an auxiliary frame member 116. Also pivoted on the stud 115 and secured to the arm 114 through a collar (not shown) surrounding the stud, is another arm 117. As shown in Fig. 2 the arm 117 extends forwardly of its pivot 115 and is connected at its front end to an upwardly extending link 118 which is in turn connected through an arm 119 to the previously mentioned front group total shaft 56. Anything which rocks the arm 114 downward, or counterclockwise as viewed in Fig. 7, therefore, will rock the shaft 56 and, through arm 121 on shaft 56, link 122, and arm 123, will also rock the rear group total shaft 27. The only means for rocking the arm 114 resides in the total pull link 106. Returning now to the construction and function of the link 106 it will be seen (Fig. 7) that in the normal position of the link the notch 111 thereof lies directly above the stud 113 and that if the link is pulled in this position the arm 114 will not be rocked due to lost motion between the notch and stud. The

first total operation, therefore, is ineffective to rock the shafts 56 and 27 and the mechanism of the head goes through its usual accumulating operation during this cycle. Formed integrally with the link 106 and positioned on its inner surface is a stud 124 adapted to cooperate with the forward end of arm 125. The arm 125 is secured at its rear end to a collar (not shown) loosely mounted on a shaft 127 supported by the auxiliary frame 116. Also secured to the collar on shaft 127 is another arm 128 extending rearwardly and downwardly and connected at its lower end to an upwardly extending link 129 guided near its far end in a bracket 131 secured to the inner side of the left-hand side frame of the machine. As shown in Figs. 4, 7, and 9 the free end of the link 129 normally lies just beneath a bent over ear formed at the lower end of a lever 132 pivoted at 133 to a bracket 134 secured to the rear of the translator 16 at its right-hand side (see Fig. 4). Member 134 is one of a pair of brackets secured to opposite ends of the translator and between which is rotatably supported a pair of shafts 135 and 136. Secured to the extreme right-hand end of the shaft 135 (as viewed in Fig. 4) is an arm 137 connected by a pin and slot connection to the lever 132. It is evident, therefore, that on the first of the two downward pulling motions of the link 106 before the T-link 106 has been shifted from its original position as shown in Fig. 7, the stud 124 thereon will depress the arm 125 thereby pushing the link 129 upward, through arm 128, to rock the lever 132 in a counterclockwise direction (Fig. 9) and impart, through arm 137, a slight clockwise rocking motion to the shaft 135. Secured to the shaft 135 to the rear of unit III of the machine is an arm 138 (see Figs. 7 and 9) in the rear edge of which is cut two detent notches or indentations 139. Normally seated in the lower notch 139 is a stud 141 integral with one arm of a bell-crank lever 142 pivoted on the shaft 135. The other arm of the lever 142 extends downwardly and is connected through a pin and slot to one arm of a second bell-crank lever 143 pinned to the shaft 136. The other arm of the lever 143 extends forwardly through an opening in the rear translator frame and is formed with an open cup-like member 144 at its front end. Positioned inside the member 144 is one end of a Bowden wire 145, supported, through its outer sheathing, by a bracket 146 secured to the translator frame 16. As shown in Fig. 7 the opposite end of the Bowden wire 145 extends into a joining cup 147. Also extending into the joining cup 147 is the regular translator wire 17 representing the numeral "5" in the second lowest denominational order of unit III. Extending out of the cup 147 is a single wire which is adapted to elevate an associated pin 148 thereby raising the number 5 digit stop 18 in the second lowest or tens denominational order stop pins associated with the front of group total accumulator 44 of unit III. The pins 148 which elevate the digit stops 18 are standard equipment on all Powers tabulators employing Bowden wires in the translator and are provided merely to insure a definite elevation of the digit stops and to simplify the assembly of the translator. The pins 148 are supported between a pair of plates 140, a set of which is provided for each unit of the machine. A clockwise rocking motion of the shaft 135, therefore, will be transmitted through member 139, lever 142 and lever 143 to the special Bowden wire 145 to elevate the number five digit stop of the desired

column in unit III. It is evident that upon the elevation of this digit stop 18 the zero stop 22 associated with that column will be depressed by the associated cam bar 24, thereby permitting the sectors 28 and 29 (Fig. 3) in that column to move forward to printing position under the control of bail 33. As the front group total shaft 56 and the rear group total shaft 27 are not rocked during the first of the two total taking operations initiated by the total taking control unit, the zero stops 22 in each of the units I, II, and III are momentarily lowered by the previously mentioned cam carried by the main head shaft 2, but all of the zero stops 22 are again raised except the five stop in the tens denominational order in unit III which is retained in depressed position by the associated cam bar 24 (Fig. 3). Accordingly, the rack sector 28 and the type sector 29 of the tens denominational order in unit III are alone free to advance under control of bail 33, while all of the other rack and type sectors in units I, II, and III are retained in retracted position by their zero stops. Since the rack sectors 28 and type sectors 29 of units I and II are retained in retracted position by their zero stops 22, printing from these two units is obviously suppressed, for the printing hammer latches 239 can be released only when the type sectors 29 have advanced beyond their zero position. Though the rack sector 28 and the type sector 29 of the tens denominational order in unit III moves forward to its "5" position, and the printing hammer latch 239 corresponding to this type sector is released, the operation of the corresponding printing hammer 41 is blocked by the non-print bail 238 of unit III. It will be remembered from the preceding description of the operation of the non-print controls, that the non-print bail 238 of unit III is positioned to permit the operation of the printing hammers 41 only during group total and grand total operations. But since the front group total shaft 56 is not rocked during the first of the two total taking operations initiated by the total taking control mechanism, the non-print bail 238 is retained in a position to block the printing hammers 41 of unit III during this operation and accordingly printing is suppressed when the rack sector 28 and the type sector 29 of the tens denominational order of unit III advances to its "five" position. On the return stroke of the sectors the accumulator wheels 44 will engage the sectors 28 and a "5" will be added into the wheel of second lowest order. It is evident that if an amount equal to or greater than the amount being added in is already present in this wheel, then a tens carry of one digit will be effected into the wheel of next higher order. If an amount less than five is in the wheel, however, no carry will be made. Upon the completion of the above operation the amount contained in the accumulator of unit III is a representation of the true social security deduction and the machine is now in condition to print a total.

It will be recalled that immediately following the raising of link 106 after the first operation there is an intervening idle cycle during which the trip transfer pawls are reset and the link 106 shifted laterally to a new pulling position. Referring to Fig. 7 it will be seen that the previously mentioned link 107 (controlled by cam 91 of the total control unit) is connected at its upper end to an arm 149 secured to a shaft 151 supported between the side frames of the machine. Also secured to the shaft 151 is an arm 152 con-

nected at its lower end to the rearward end of a lever 153. The lever 153 is formed with a slot 154 cut in its mid portion through which is passed a pin 155 on the link 106. A spring 156 tensioned between the pin 155 and the lever 153 provides a resilient force for retaining the two in engagement. It is evident that the depression of link 107, through cam 91 will rock the shaft 151 in a clockwise direction (Fig. 7) thereby shifting the link 106 a short distance laterally towards the front of the machine against the tension of the spring 112. This slight lateral movement of the link 106 is sufficient to move the notch 111 in the head 109 out of alignment with the pin 113 on arm 114 and to place the lower rear edge of the head just above the pin and in position to operate it. Just prior to the end of the intervening idle cycle the operating link 106 is pulled for the second time and this time will rock the lever 114 and through the above mentioned chain of mechanism operated by lever 114 will also rock the front and rear groups total shafts 56 and 27 to extract a total from the front or group total accumulators 44 of units I, II, and III. It will be remembered that the rocking of the front group total shaft 56 causes the non-print bail 238 of unit I to suppress printing by that unit, and causes the non-print bails 238 of units II and III to permit printing from those two units. The rocking of shaft 56 likewise rocks the rear group total shafts 27 through link 122 (Fig. 7) to lower the zero stops 22 in units I, II, and III. The rocking of the front group total shaft 56 also conditions the rear or grand total accumulator 59 of unit II to non-add, thereby preventing the transfer of the group total to the grand total accumulator. In the second pulling position of the link 106, the pin 124 thereon will clear the forward end of the arm 125 so that no operation of the total carry-mechanism will take place.

Mechanism is also provided in the present machine whereby the rear or grand total accumulator 59 of unit II may be cleared to obtain a final or grand total of the data entered in this unit. As previously explained, this grand total will represent the wages paid to all of the employees for a weekly period. This operation is performed through the medium of a special control wire 157 (see Figs. 4 and 7) in cooperation with a settable means now to be described. As shown in Figs. 7 and 10 a plate 158 is pivoted at 159 to the upper left-hand surface of the link 106 and is provided with a plunger 161 which is adapted to be entered into either of two holes 162 or 163 cut in the head 109 of the link 106. When the machine is used for total carry work the plate 158 is positioned with its plunger 161 in the hole 162. In this position a forward shoulder of the plate extends slightly to the left of the link 106 and a rear angled shoulder thereof passes across the top of the notch 111. In addition to the two lateral pulling positions of the link 106 already described the link is adapted to be shifted to still another or third position under the control of the wire 157. As shown in Fig. 7 the upper end of the special wire 157 lies directly beneath the rearmost end of a lever 164 pivoted at its mid-point to the framework of the translator. The forward end of the lever 164 extends slightly beyond the front edge of the translator and overlies a slide 165 slidably mounted on the translator and spring tensioned in an upward direction. The lower end of the slide 165 is formed as a bent over lug and overlies an arm 166 secured to the previously mentioned shaft

151. As previously mentioned, a clockwise rocking motion of the shaft 151 causes the link 106 to be shifted laterally towards the front of the machine. The elevation of the wire 157 causes the shaft 151 to rock a farther distance in a clockwise direction through members 164, 165, and 166, than is possible through an operation of the link 107 so that the link 106 will shift into a position wherein the head 109 thereof is out of cooperative relation with the stud 113 and wherein the forward shoulder of plate 158 may engage a lug 167 on an arm 168. The arm 168 is secured to a collar (not shown) loosely mounted on a short shaft 169 supported by the auxiliary frame 116. Also secured to the collar on shaft 169 is an arm 171 connected, through a link 172 and arm 173 to the previously mentioned grand total shaft 64. It is evident, therefore, that if the link 106 is pulled while in the position to which it is shifted by wire 157 the result will be the rocking of the rear grand total shaft 64 which as previously noted lowers the zero stops 22 and changes the timing of the rear or grand total accumulator 59 of unit II to cause a grand total to be taken from this accumulator. The arm 168 is also connected, through link 174 and arm 175 to a front grand total shaft 176 to rock this shaft at the same time shaft 64 is rocked. The rocking of the front grand total shaft 176 conditions the non-print bail 238 of unit II to permit printing of the grand total from unit II and changes the timing of the front or group total accumulator 44 of unit II to prevent the transfer of the grand total to that accumulator.

The wire 157 is controlled by a special perforation usually punched in a separate control card, bearing only this perforation. In the column of the card in which the control hole appears the corresponding settable slide 68 (Fig. 6) is depressed one position below normal so that the operation of the associated slide 14 will trip off a single total operation. The last item card of a set is followed by a blank card and immediately following the blank card is the special control card. When the blank card enters the machine the previously elevated intermediate pins 12 are permitted to descend thereby causing the total control mechanism to go through the successive operations previously described to clear the front accumulators. The blank card is then ejected from the machine and the control card enters the sensing chamber and is sensed. The intermediate pin 12 which overlies the control hole is raised and its associated slide 68 operated to initiate a single operation of the total taking control mechanism. At the same time the special wire 157 is operated by the pin 12 to cause the shifting of link 106 to its third position. The T-link 106 is pulled when cam 66 (Fig. 6) causes shaft 86 to advance a second step near the end of the first cycle following the initiation of the operation of the total-taking control mechanism. The shaft 86 begins its advance slightly before the end of this cycle and has completed its second step at 0° of the second cycle, as may be seen from inspection of the contour of cam 66 in Fig. 5. Accordingly the pull on T-link 106 is initiated shortly before 360° of the first cycle and the link is completely pulled downward at 0° of the second cycle. Referring to Fig. 34 of Patent No. 2,044,119, it will be seen that the pins 163, corresponding to the locking studs of the intermediate pins 12 of the present application, are above the locking surfaces of the locking slides 161 of this patent, corresponding to the locking

slides 13 of the present application, between 345° at the end of one cycle to 15° of the following cycle. The special control card, which initiated the total taking operation during which the grand total is to be taken from the rear accumulator 59 of unit II, remains in the sensing chamber during the ensuing total-taking operation. This card is sensed three different times. Referring to Fig. 4 of Patent 2,044,119, it is sensed at 275° of the cycle preceding the initiation of the total-taking operation, it is sensed at 275° of the total conditioning cycle, and it is sensed again at 275° of the total cycle. When it is sensed the second time during the total conditioning cycle, the special pin 157 remains elevated from 345° of the total conditioning cycle until 15° of the total taking cycle. During this interval, the forward shoulder of the plate 158 remains in engagement with the lug 167. Accordingly, when the T-link 106 is pulled down at 0° of the total taking cycle, the front grand total shaft 176 and the rear grand total shaft 64 are rocked in the manner explained above. While the T-link 106 remains pulled down during the total-taking cycle, the spring 112 cannot shift the T-link 106 to its normal position, even though the pin 157 may be lowered early in the total-taking cycle. The resulting total obtained from the rear accumulator in unit II will be a final total of all of the data entered into this unit and will indicate that the machine is clear.

The report prepared by the machine

Referring to Fig. 11 there is shown therein a diagrammatic representation of some of the Bowden wires 17 along with a sample report sheet on which various notations are made for the purpose of aiding in an understanding of the function of the machine.

It will be remembered that each time a designation number, i. e., the Man No. changes, the total control mechanism becomes effective and passes through two successive operations. During the first operation the pull link 106 is ineffective to rock the total shafts 56 and 64 due to the lost motion between stud 113 and slot 111. However, during this first operation, the pin 124 on the link 106 causes the operation of the total carry mechanism to elevate the "five" stop in unit III, thereby causing a five to be added into the tens order as the sectors are restored during the latter half of this cycle.

Between the two successive operations of the total control mechanism, the pull link 106 is shifted so that the head becomes effective to rock the front total shaft 56 and thereby the rear total shaft 64 during the second of the successive operations, thereby taking a total from the front accumulators in units II and III, which totals are printed under gross earnings and social security deduction. In the second column the true total, the man's gross earnings, is printed and in the third column the total to which the five has been added is printed, minus the last two digits, thus giving in dollars and cents the amount to be deducted from the workman's pay.

The final total is taken from the rear accumulator in unit II by shifting the link 106 through the use of a control card as described above.

MEANS FOR DISABLING THE TOTAL CARRY MECHANISM

An important feature of the machine of the present invention is its easy adaptability to various types of accounting work. The total carry mechanism may be disabled while the machine continues to function in the usual manner. As

shown in Figs. 7 and 9 the previously mentioned bell-crank lever 142 operable by the notched member 139 is formed with a slot in its mid-portion through which the shaft 135 extends. A spring 178, tensioned between the lever 142 and member 139 serves the dual purpose of retaining the stud 141 on lever 142 seated in the lower notch in member 139 and of causing the rear of the slot in lever 142 to bear against the shaft 135. The lever 142 is easily accessible to manual control so that the pin 141 thereon may be shifted at will into either the upper or lower notch of member 139. With the pin 141 seated in the lower notch in member 139 it is evident that every time the shaft 135 is rocked a total carry operation will be effected in unit II. If, however, the lever 142 is shifted upwards so that its pin 141 lies in the upper notch of member 139 the result will be to rock the bell-crank lever 142 a short distance in a clockwise direction (Figs. 7 and 9). Under the above condition of operation the shaft 135, when rocked, will still rock the levers 142 and 143 but the distance it causes them to move is not sufficient to depress the Bowden wire 145 and accordingly no total carry will be effected in the tens denominational order of the front or group total accumulator 44 of unit III.

As previously stated the plate 158 on the upper end of T-link 106 has a pin or plunger 161 (Figs. 8 and 10). The plate has already been described with the plunger 161 in hole 162 of the link 106. However, when the plate 158 is moved to place plunger 161 in hole 163, it will be noted that the overhanging shoulder thereon will lie well across and block slot 111 in link 109 so that when the link 106 is pulled down the lost motion previously referred to will not occur. Therefore, in this instance, the first pull down of link 106 will contact pin 113 on arm 114 and operate the front and rear group total shafts 56 and 27.

It will also be noted that when the link 153 is adjusted so that pin 155 on link 106 is in the lower portion of slot 154 the T-link 106 is moved to the left so that its rear head shoulder is over pin 113. Therefore, on the first total taking stroke downward of T-link 106 the head 109 will contact stud 113 to take a total from the front accumulators while the second downward stroke thereof will shift the link to a position to contact lug 167 to take a grand total from the rear accumulators.

While I have described what I consider to be a highly desirable embodiment of my invention, it is obvious that many changes in form could be made without departing from the spirit of my invention, and I, therefore, do not limit myself to the exact form herein shown and described, nor to anything less than the whole of my invention as hereinbefore set forth, and as hereinafter claimed.

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

1. In a machine of the class described, an accumulator, a total taking control mechanism including a total operating link having a plurality of operative positions, a group total shaft, means operated upon a change in record-card designation to initiate a series of cyclic operations of said control mechanism and said link, means operated by the link upon the first cyclic operation thereof to enter a fixed amount into the accumulator prior to taking a total therefrom, means thereafter operated by the total taking

control mechanism to move the link to another position, and means operated by the link upon its next cyclic operation to actuate the group total shaft.

2. In a machine of the class described, an accumulator, a total taking control mechanism including a total operating link having a plurality of operative positions, a group total shaft, a grand total shaft, means operated upon a change in record card designation to initiate a series of cyclic operations of said control mechanism and said link, means operated by the link upon the first cyclic operation thereof to enter a fixed amount into the accumulator prior to taking a total therefrom, means thereafter operated by the total taking control mechanism to move the link to another position, means operated by the link upon its next cyclic operation to actuate the group total shaft, means responsive to the sensing of a special hole in a card to move the link to still another position, and means operated by the link upon its next cyclic operation to actuate the grand total shaft.

3. In a machine of the class described, an accumulator, a total shaft, a total taking control mechanism including a total operating link, said link having at least two operating positions and provided with a cut-away portion and an adjacent shoulder, said total taking control mechanism, when actuated, successively operating said link a plurality of times, means for entering a fixed amount into said accumulator and operated by said link when said link is first operated, said cut-away portion permitting the first operation of the link without operating the total shaft, means operated by the total taking control mechanism to shift the link to a second position, said total taking control mechanism again operating said link in its second position, means for

operating said total shaft and engaged by said shoulder in the second operation of the link to operate said shaft, said link when operated in its second position failing to operate said entering means.

4. In a machine of the class described, an accumulator, a group total shaft, a grand total shaft, a total taking control mechanism including a total operating link, said link having a plurality of operating positions and provided with a cut-away portion and an adjacent shoulder, said total taking control mechanism, when actuated, successively operating said link a plurality of times, means for entering a fixed amount into said accumulator and operated by said link when it is first operated, said cut-away portion permitting the operation of the link without operating the group total shaft, means operated by the total taking control mechanism to shift the link to a second position, said total taking control mechanism operating said link in its second position, means for operating said group total shaft and engaged by said shoulder in the second operation of the link to operate said group total shaft, said link when operated in its second position failing to operate said entering means, means for shifting the link to a third position, means operated by the passage through the machine of a card with a special control hole therein to actuate said last mentioned shifting means, means for operating said grand total shaft, further means controlled by said special-hole card to initiate another operation of said total taking control mechanism and means on said link when operated in its third position to engage the grand-total-shaft-operating means to operate said shaft.

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