

June 30, 1936.

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2,046,027

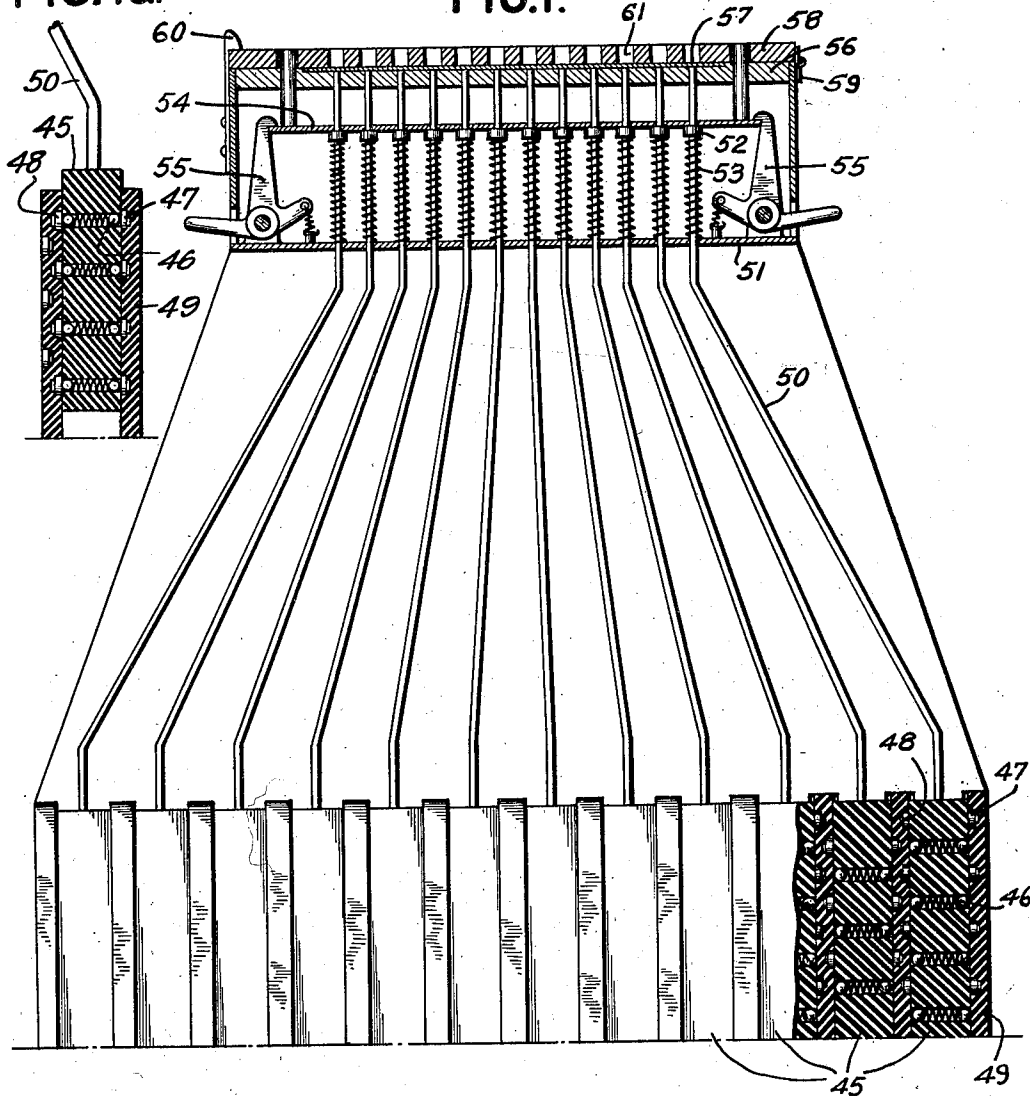
TABULATING MACHINE

Filed Oct. 24, 1931

5 Sheets-Sheet 1

FIG. 1a.

FIG. 1.



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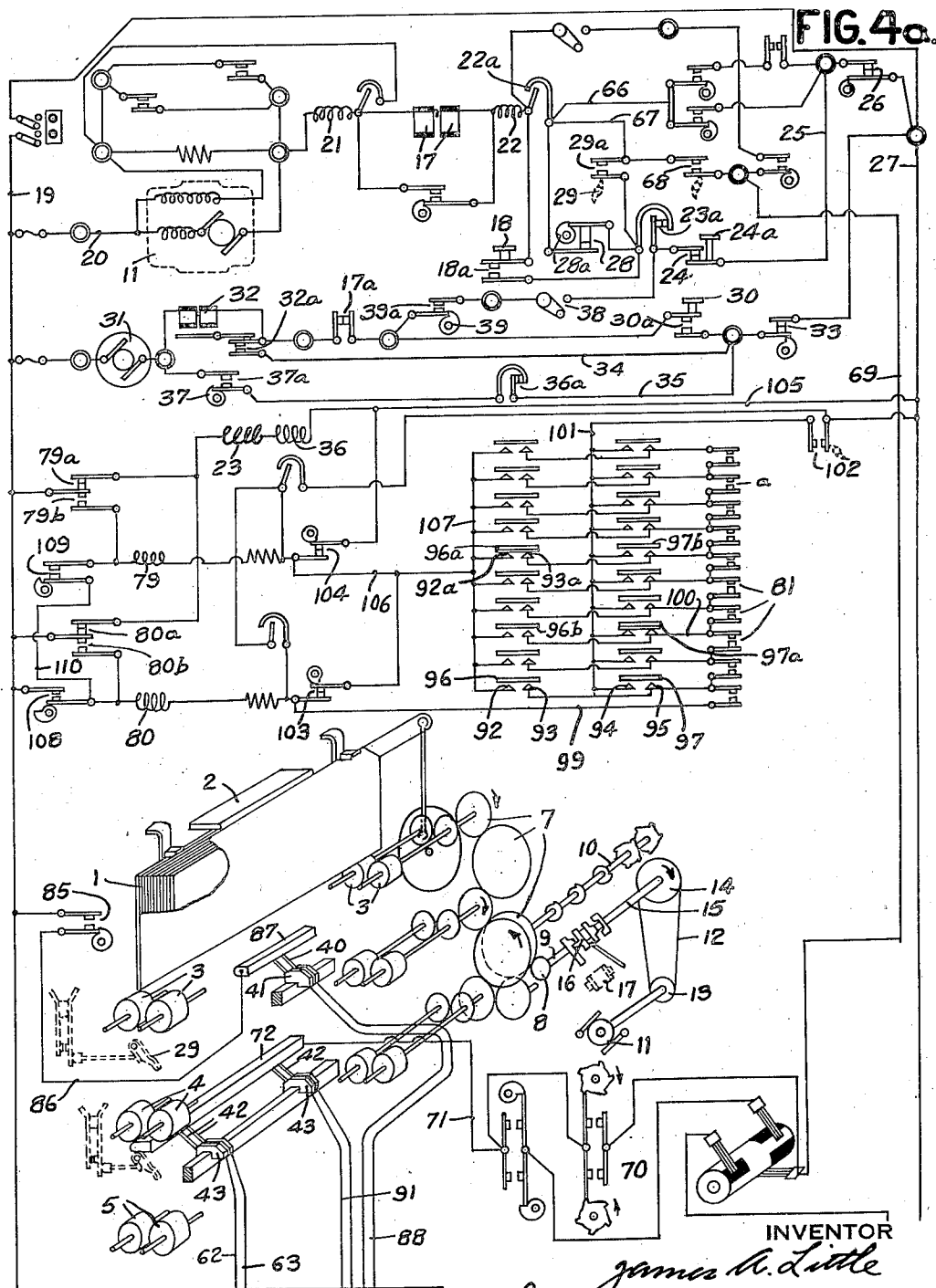
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5 Sheets-Sheet 3



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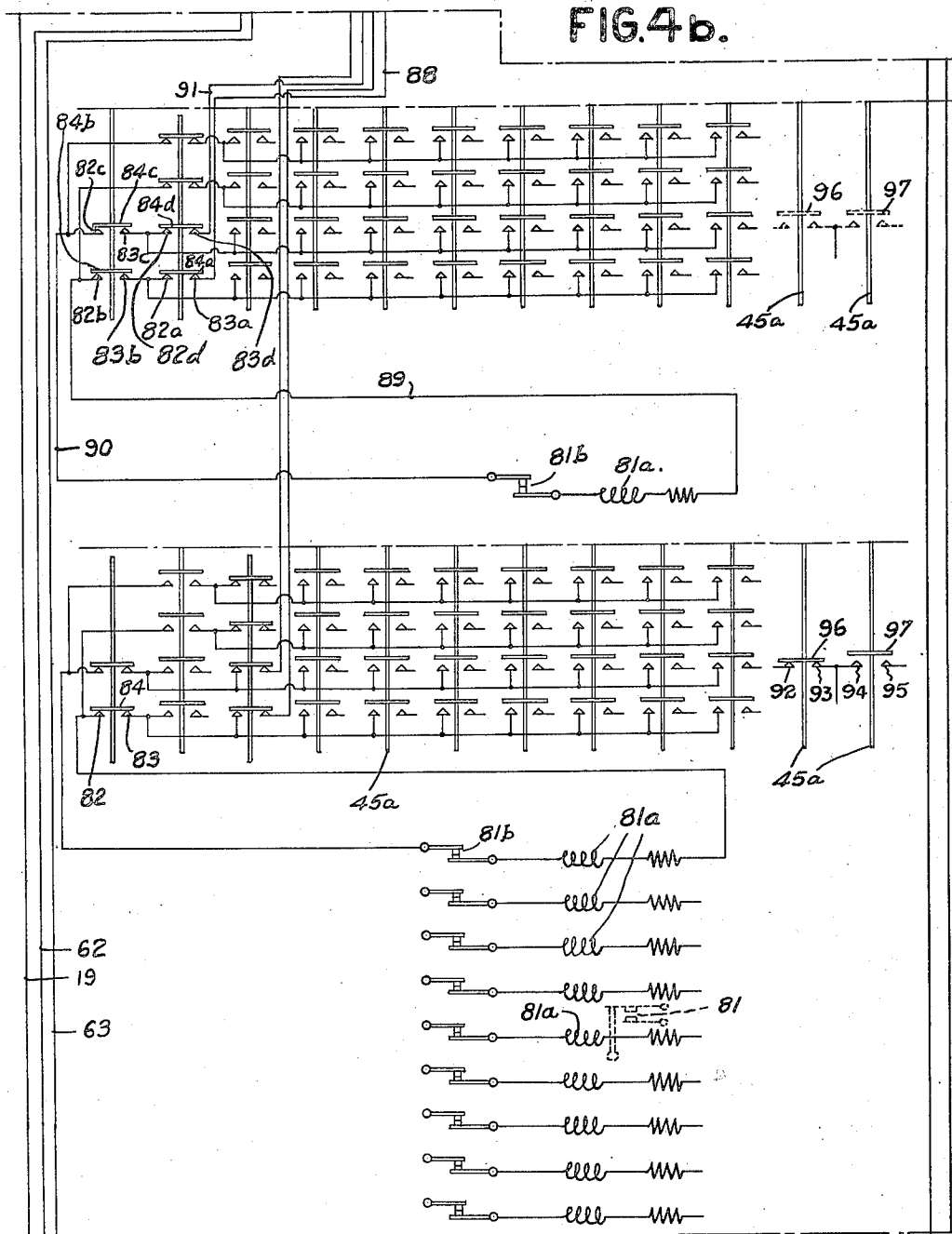
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TABULATING MACHINE

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5 Sheets-Sheet 4

FIG. 4b.



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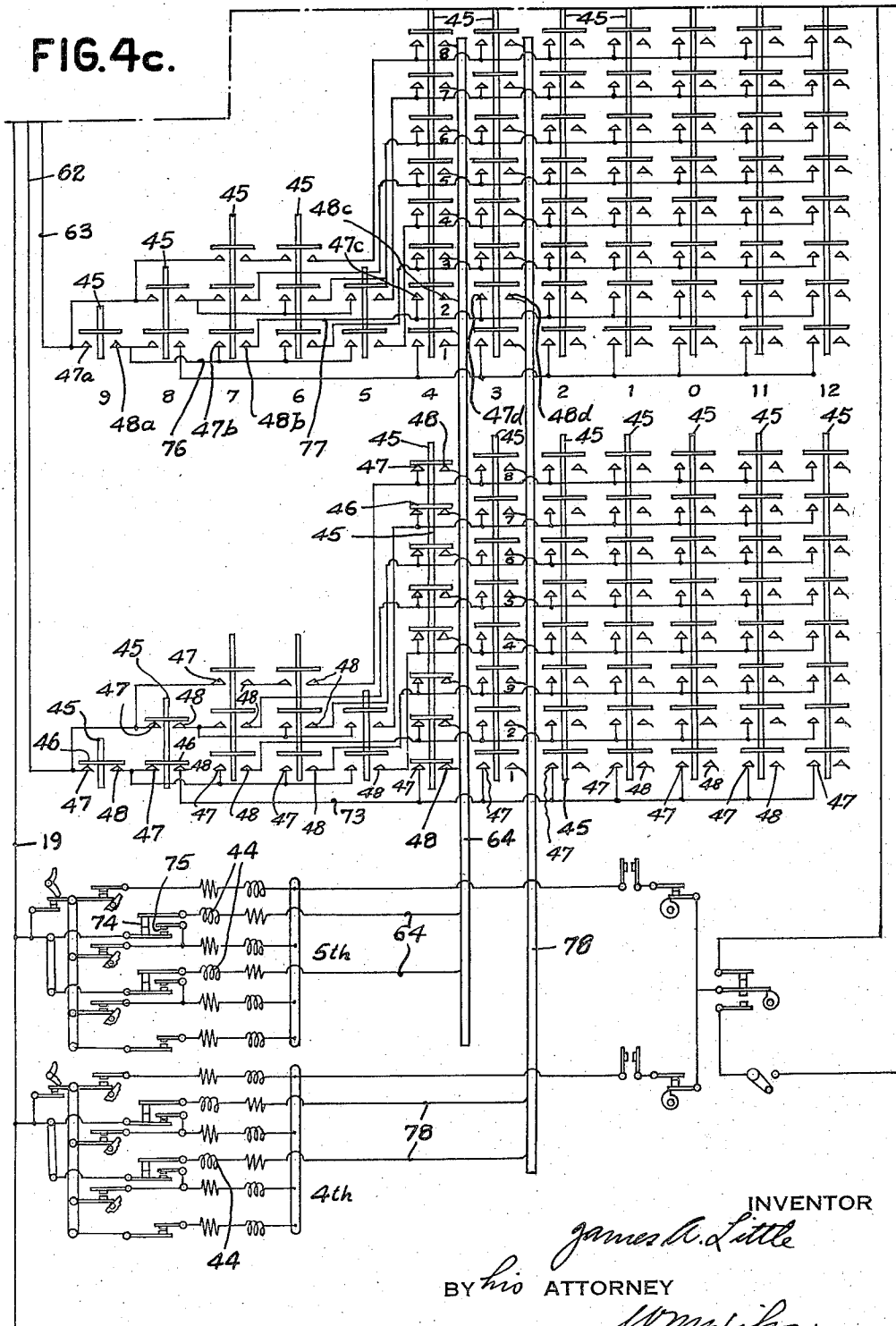
2,046,027

TABULATING MACHINE

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5 Sheets-Sheet 5

FIG. 4c.



UNITED STATES PATENT OFFICE

2,046,027

TABULATING MACHINE

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Application October 24, 1931, Serial No. 570,855

2 Claims. (Cl. 235—92)

This invention relates to perforated card controlled accounting machines and more particularly to means for effecting connections from the various columns of the control cards to the desired columns in the accumulators and from the various columns in the accumulators to the desired columns of printing type members so that the data taken from the accumulator may be distributed to the proper columns on the printed report sheet. The connections may also be effected from the several columns of the card directly to the desired columns of the report sheet without going through the accumulators.

In tabulating machines of the Hollerith type, the cross connections referred to here are commonly effected by the use of plug wires which are connected between various plug sockets on a connection board. The sockets are connected to certain columns of the card and to columns in the accumulator as well as to the columns of printing type. To connect any particular card column to the particular order in an accumulator a plug connection will be made between the two plug sockets in question. Similar connections are made from sockets representing columns on the card to sockets representing columns upon the report sheet or sockets representing particular columns in an accumulator to sockets representing the desired columns on the report sheet. Often in accounting systems certain types of reports are required periodically. The data for making up these reports is taken from perforated cards where it is arranged in predetermined order. The plugging up of the machine to make out these reports is usually the same. According to my invention a plate or card is punched in particular positions and then placed in the machine and the machine set under control of such card. This setting effects electrical connection between the various columns on the data card to the various orders in the several accumulators and also to the various columns of printing type.

For any set report which is to be made up under control of data cards on which the data is entered according to a particular form, a connection control card will be punched to effect the proper connections. Whenever it is desired to make out the particular report that connection control card will be inserted in the machine. Whenever slight changes are desired in the connections to effect a change in the form of report or where the data is rearranged on the data cards a new connection control card will be made up to take the place of the one being discarded. In the present embodiment of the invention a con-

nection control card is placed in the machine above a plurality of rows of sensing pins. The card is locked in position and the pins are then released to be pressed by springs against the card. Wherever a perforation appears the pin will pass through but where there is no perforation the pin will be stopped by the card. Each pin is connected to a sliding member which carries several contact points adapted to cooperate with other contact points. The contacts are normally open but when the sensing pin passes through a perforation in the set up card the slide moves and closes the contacts associated therewith thus effecting a definite connection between a column on the card and a column in the accumulator or from a column on the card to a column of printing type or from a column in the accumulator to a column of printing type.

These and several other connections for controlling various operations of the machine such as the taking of totals in response to a major or minor change in groups of cards will be more specifically pointed out in the following description of the invention.

The present invention is in certain respects related to that disclosed in copending application filed by A. E. Gray on October 2, 1931, Serial No. 566,443. The present invention is designed to perform certain of the operations performed by the Gray disclosure but with more simplified mechanisms.

Referring to the drawings wherein I have shown by way of example one form of mechanism for carrying out the invention:

Fig. 1 is a detail view partly in section showing the set up control card and the sensing pins and contacts controlled thereby.

Fig. 1a shows one of the slides 45 in its set position.

Fig. 2 is a portion of a card showing the manner in which it is punched to effect the desired plugging set ups from the card to the accumulators and listing columns.

Fig. 3 is a portion of a card punched to effect group control connections.

Figs. 4a, 4b, 4c taken together constitute a wiring diagram showing the control of an electric tabulating machine and the various plugging connections adapted to be controlled in accordance with my invention.

In illustrating my invention, I have shown the manner in which the device will be incorporated with perforated card controlled accounting machines of the type disclosed in U. S. Patents #1,762,145 and No. 1,933,308. The machine as a

whole is therefore omitted in the present disclosure and certain parts thereof are shown diagrammatically in the wiring diagram in the present case.

Referring to Fig. 4a, the perforated cards for controlling the operations of the machine are shown at 1 and are adapted to be fed one at a time by a card picker 2 to successive sets of feed rollers 3, 4, 5. These rollers are connected to driving gearing designated 7 as a whole. A gear 8 on a driven shaft 9 is adapted to effect operation of the gearing 7 and the feed rollers as well as the card picker 2. The shaft 9 also operates the cam shaft 10 which carries numerous cams for effecting the opening and closing of various contacts at predetermined times in the cycle of the operation of the machine. A driving motor 11 is adapted through a belt 12 and pulleys 13, 14 to operate a driving shaft 15. A clutch 16 controlled by an electromagnet 17 is adapted to couple the shaft 9 to shaft 15 to effect operation of the card feed mechanisms and the cam shaft 10.

The motor 11 is also shown in dotted lines (in the wiring diagram) and may be energized for operation by depression of the start key 18 to close contacts 18a. This completes a circuit through the motor as follows: from left side of the line 19, through wire 20, motor 11, relay coil 21, card feed clutch magnet 17, relay coil 22, contacts 18a, contacts 23a, which are normally closed, stop key contacts 24 also normally closed, wire 25, cam contacts 26, and back to the other side of the line 27.

The energization of magnet 22 closes the contacts 22a and holds them closed so that as the start key 18 is now released permitting contacts 18a to open, the circuit will continue from the coil 22 through contacts 22a, contacts 28 to contacts 23a, etc., as just described.

As soon as the cards commence to feed through the machine, they will actuate the card lever 29 and close contacts 29a. During a part of each cycle of the machine, contacts 28 are opened by cam 28a and the circuit continues through contacts 29a which are closed during that time. Should cards fail to feed and the contacts 29a are thus opened when contacts 28 open the circuit will be broken and the machine will stop.

The machine may also be stopped by depression of the stop key 24a thus breaking the circuit through the motor 11. The magnet 17 also controls contacts 17a, opening them when energized and permitting them to close when deenergized. Thus, whenever the machine is stopped and the magnet 17 becomes deenergized, the contacts 17a close.

Totaling operation

After the machine has stopped feeding and analyzing cards and accumulating and listing under control of these cards, a total of data accumulated may be taken by depression of the total key 30. This closes a circuit through the reset or total operating motor 31, from the left side of the line 19 through motor 31, magnet 32, contacts 17a, total key contacts 30a, cam contacts 33, back to the other side of the line 27. The energization of magnet 32 closes contacts 32a so that as the total key is released the current will pass through contacts 32a, wire 34, etc. back to the other side of the line. The motor 31 operates the machine to take a total under control of the accumulators and to reset the accumulators.

Where only minor totals are being taken, one total cycle of operations is sufficient but in taking major and minor totals, it is sometimes desirable to take the major total during the cycle following the taking of the minor totals so that in such cases two cycles of totaling operations are necessary. When a single totaling cycle is being performed the reset motor 31 will be stopped at the end of the cycle. The stopping of this motor is effected by shunting the current around the magnet 32 thus permitting the magnet to release its armature so that contacts 32a will open. The shunt circuit is closed only long enough to permit contacts 32a to open and is then broken at the end of the cycle. The shunt circuit is through contacts 37a closed by cam 37, wire 35, contacts 36a and cam contacts 33.

The machine is adapted to automatically go into a totaling operation at the end of separate groups of cards. The group control mechanisms bring about the opening of the circuit through contacts 23a thus deenergizing magnet 17 and permitting contacts 17a to close. In setting the machine to take automatic totals a switch 38 is closed before the machine is started. At the end of each accumulating or listing cycle a cam 39 momentarily closes contacts 39a.

If the circuit through magnet 17 has been broken during the cycle, when contacts 39a close the circuit will be established through the reset motor 31, magnet 32, contacts 17a, contacts 39a, switch 38, stop button contacts 24, wire 25, contacts 26 to the other side of the line. As soon as magnet 32 is energized, contacts 32a are closed as we have seen so that when contacts 39a open again the current will pass around through wire 34 to thus hold the circuit through motor 31. The contacts 23a are controlled by a magnet 23 and contacts 36a are controlled by a magnet 36. Both of these magnets when energized serve to open their contacts 23a, 36a respectively. Normally the magnets 23, 36 are deenergized and become energized when the cards change from one group to the next and the feeding of cards stops. Contacts 36a open at this time so that the shunt circuit around the reset motor will not interfere with the circuit through the contacts 32a until after the completion of the one or two totaling cycles of operation. The manner in which energization of magnets 23 and 36 is controlled will be described later.

Accumulating and listing

It is understood that as the cards 1 are fed downwardly between the rollers 3, 4 and 5 the index point positions in each column pass successively between the upper perforation sensing brushes 40 and cooperating contact blocks 41 and then between the lower sensing brushes 42 and their corresponding contact blocks 43. The accumulating and listing devices of the machine operate synchronously with the passage of the index point positions with respect to the sensing brushes so that when a perforation is sensed in a particular position in a column the value corresponding to the position will be received by the particular accumulator order and also printed if the machine has been previously set to list. The accumulating and listing is effected by the energization of accumulating magnets 44.

In machines of the Hollerith type in which the lower sensing brushes 42 are used to control the accumulating and listing operations, any of the brushes may be connected to control any order of any accumulator and any column of printing

type. This interconnection between the brushes and orders of the accumulators is effected by plug wire connections. Each sensing brush 42 is connected by a wire to a plug socket in a plug board. Also each of the accumulator magnets 44 is connected by a wire to a plug socket in the plug board. A plug connection between these various sockets thus effects a desired connection between the brushes 42 and the magnets 44.

According to my present invention the plugging connections between the sockets on the plug board are done away with. Instead of running the connections from the brushes and accumulator magnets to sockets in a plug board, they are run to separate sets of contacts in a connection device and means are provided for differently interconnecting these contacts to effect the desired connection between the brushes and magnets. Such an interconnecting device is shown in Fig. 1. Here a plurality of slides 45 is shown. Each slide carries several contact members 46 adapted to interconnect contacts 47 on one side and contacts 48 on the other. The contacts 46 carried by the slides 45 as shown in the present instance are in the form of two metal balls pressed apart by a spring so that the balls are constantly in contact with the frame 49 which carries the slides 45 and in which the contacts 47, 48 are embedded. In their normal position as shown in Fig. 1, all of the contacts 46 are disengaged from their respective contacts 47, 48 and when a particular slide 45 is raised to its upper position all of its contacts 46 interconnect all of their respective sets of contacts 47, 48 as shown in Fig. 1a.

There are twelve slides 45 to a column and the number of columns may correspond with the number of brushes 42 or in other words, the number of columns of data on the cards 1. Each slide 45 is connected to a rod 50 which reaches upwardly through a plate 51 and is provided with a collar 52 against which a spring 53 presses upwardly to raise the slide 45. A plate 54 through which the rods 50 also pass is adapted to engage all of the collars 52 so as to depress all of the rods and thus lower all of the slides 45 to inoperative or ineffective position. Spring pressed latches 55 are adapted to hold the plate 54 in its lowered position. The upper ends of the rods 50 rest in perforations in a plate 56 above which the card 57 is adapted to be placed. A locking plate 58 hinged at 59 and latched at 60 is provided with large perforations 61 corresponding to the position of the rods 50 and is adapted to lock the card 57 in position. After the card has been locked in this position, the restoring plate 54 may be unlatched to permit all of the rods 50 to press upwardly against the card. Wherever perforations appear in the card in positions corresponding to certain of the rods 50 those rods will be permitted to rise, moving their slides 45 into contact engaging position. Thus, by properly punching holes in the card 57 any desired setting of the slides 45 may be effected to connect the card sensing brushes to the various accumulator magnets 44.

In Fig. 4c two sets or columns of the slides 45 of Fig. 1, along with their contact points 47, 48 and interconnecting contact members 46 are shown. The several index point positions of these sets are designated 0 to 9 and 11 and 12. One of these sets (the lower one) is connected through wire 62 to one of the contact blocks 43 (Fig. 4a) associated with one of the sensing brushes 42. The other set is connected by a wire 63 to another

contact block 43 associated with another sensing brush 42. The wire 62 is connected to several of the contacts 47. More specifically wire 62 is connected to three of the contacts 47 associated with contact slides 45 of the ninth, eighth, and seventh positions in the particular column of slides. The contacts 47 are variously connected to one another as shown in the drawings. That is, certain of the contacts 47 associated with one of the slides 45 are electrically connected to other 10 contacts 47 associated with other slides 45. Also in some instances, the contacts 47 are connected with certain of the contacts 48.

The contacts 48 associated with the slides 45 belonging to the 5, 6, 7, 8, and 9 index point 15 positions on the card are also connected as shown to contacts 47 in the several horizontal rows. The contacts 48 associated with the slides 45 belonging to the 0, 1, 2, 3, 4, 11, and 12 positions are connected through wires such as wires 64 to the accumulator magnets 44. For instance, the contacts 48 of the 4 position are connected to the accumulator magnets of one of the accumulators, in the present case, the fifth accumulator; a different one of the contacts 48 being connected 25 to each of the magnets 44 in this accumulator. Thus, the contact 48 in the lowermost row is connected through a wire 64 to the magnet 44 associated with the units order in this accumulator. The next contact 48, that is, the one in 30 the second horizontal row from the bottom is connected through a wire 64 to the magnet 44 of the tens order of this accumulator, etc. If it is desired to connect the brush 42 farthest to the left in Fig. 4a with the units order in the 5th 35 accumulator, the slides 45 in the set or column of slides to which this brush is connected (the lower one in Fig. 4c) will be so set that current coming from wire 62 to the contacts 47 will be connected through to the wire 64 associated with 40 the units order magnet 44. According to the arrangement disclosed it is thus necessary to move the slides 45 of the 8 and 9 positions as shown in Fig. 4c. Current passing through a perforation in the card 1 will thus take the following course: Beginning at the right side of 45 the line 27 and tracing the circuit backward for convenience, current passes through contacts 26, wire 25, contacts 24, 23a, 29a, 68, wire 69 through the device designated 70 as a whole to wire 71, 50 common bar 72, individual sensing brush 42, corresponding contact block 43, wire 62 to the contact 47 across the connecting contact 46 in the "9" position which is the one farthest to the left in Fig. 4c, contact 48, then to the contact 47 of 55 the "8" position and across the corresponding connecting contact 46 to the next contact 48, then through wire 73, to all the contacts 47 in the lowermost horizontal row belonging to the 4, 3, 2, 1, 0, 11 and 12 positions. As only the slide 45 60 belonging to the 4 position has been set the current in the circuit which we have traced to this point will pass through the contact 48 in this position and through wire 64 to the accumulator magnet 44 of the units order, then through contacts 74 and back to the other side of the line 19.

Two accumulators and two orders in each of these accumulators are shown. In actual practice, of course, eight or nine orders would be used in each accumulator. The several orders 70 of an accumulator are connected to the several contacts 48 associated with a particular one of the slides 45.

Assuming that eight columns on the different cards 1 are to be connected to the eight orders 75

in the fifth accumulator, the slides 45 of the 4 position (which controls the connection to the fifth accumulator) of eight of the columns or sets of slides 45 will be set to close the gaps between contacts 47, 48. This will connect all of these eight columns to the proper accumulator, i. e. the fifth. The lowermost contacts 48 in each column are connected to the units orders of the accumulators, the next contacts 48 above these to the tens orders and so on up to the uppermost contacts 48 which are connected to the tens of millions orders. Setting of the ninth and eighth slides 45 connects that particular sensing brush to the units order of an accumulator. The setting of the slides 4, 3, 2, 1 and 0 determines which accumulator is connected to the sensing brushes. In order to carry current from the next brush to the tens order the next column or set of slides 45 must be properly set. In this instance, the ninth and seventh slides 45 will be depressed so that current will pass from wire 63 and contact 47a to contact 48a, wire 76, contact 47b, contact 48b, wire 77, contact 47c, contact 48c, individual wire 64 to the corresponding accumulator magnet 44. The same brushes 42 may also be connected to another accumulator, for instance, the fourth accumulator by setting the slides 45 of the 3 position in each of the columns or sets of slides. Thus, the current coming from the brush 42 besides being conducted from contact 8 and then to the fifth accumulator, also passes from contact 47d to contact 48d and then through the individual wire 78 to the accumulator magnet 44 of the fourth accumulator. This interconnection for accumulating also controls listing as will be understood by those familiar with tabulating machines on the market.

Group control

It will be understood that the contacts 23a (Fig. 4a) are normally closed and will be opened by the energization of magnet coil 23. Also, if when these contacts are opened, the auto total reset switch 38 is in closed position, the machine will proceed to take totals under control of the accumulators.

The energization of magnet coil 23 is effected by the closure of contacts 79a or 80a. Contacts 79a, 80a are in turn controlled by the several group control contacts 81. Contacts 81 are associated with magnet coils 81a as indicated in dotted lines in Fig. 4b. The energization of coil 81a serves to close the contacts 81. One of the coils 81a is associated with each of the contacts 81 and is adapted when energized to close its contact. The circuit of each coil 81a also includes a contact 81b which is opened by the coil 81a when the latter is energized. This breaks the circuit through the coil without permitting the contacts 81 to again open until a later time in the cycle of the machine as will be more fully understood by reference to the above patents where it will be seen that when these contacts are closed, they are latched in such position until a later point in the cycle. Ordinarily, the coils 81a are connected to the upper and lower perforation sensing brushes 40, 42 by plugging connections. According to the present invention, the connections are effected by the setting of slides 45a (Fig. 4b) to bridge contacts 82, 83 by means of a contacting member 84.

In Fig. 4b two sets or columns of the slides 45a and contacts 82, 83 and contacting members 84 are shown. The contacts 82, 83 are variously connected to each other and to the upper and lower contact blocks 41, 43 and to the magnet

coils 81a as shown. Some of the contacts 83 are shown not connected and it is to be understood that these have connections to additional contact blocks 41, 43 in a manner similar to the connections shown.

As the cards are fed through the upper and lower brushes 40, 42, if a perforation appears at the upper brush 40 at the same time the perforation in the lower card appears at the corresponding brush 42, a circuit will be established from the left side of the line 19 through contacts 85 which are closed while the cards are under the brushes, then through wire 86, common supporting bar 87, individual sensing brush 40, corresponding contact block 41, wire 88, contact 83a (Fig. 4b), interconnecting member 84a, contact 82a, contact 83b, contact member 84b, contact 82b, wire 89, magnet coil 81a, contact 81b, wire 90, contact 82c, contact member 84c, contact 83c, contact 82d, contact member 84d, contact 83d, wire 91, contact block 43, corresponding sensing brush 42, common connecting bar 72, wire 71, through the device 70, wire 69, etc. back to the right side of the line 27. The lower set of slides 45a is shown with the first and third slides counting from the left side, in set or lowered position so as to connect the next set or column of brushes 40, 42 with another one of the magnet coils 81a to control its contacts 81. In this manner the columns on the card through the brushes 40, 42 may be variously connected to the magnet coils 81a to control the various contacts 81. The circuits which are adapted to be closed through the contacts 81 are shown as including contacts 92, 93, 94, 95 and interconnecting members 96, 97. The members 96, 97 are shown as carried by certain of the slides 45a (Fig. 4b).

The cards may be divided into major and minor groups. In other words, cards containing data associated with the various days of the months may be grouped in proper order so that the cards of the first day are run through the machine, followed by the cards for the next day and so on until the cards for all the days of the month have been run through the machine. At the end of a run of cards for one day, a total of data representing transactions for that day may be taken. Such a total is commonly referred to as a minor total. A total for each successive day may be taken until the end of the month is reached at which time a total for all the days of the month may be taken and this is commonly referred to as a major total, and includes all of the minor totals. Some of the contacts 81, by appropriate connecting, may be used to bring about the taking of a minor total at the end of a run of cards for each day and others of those contacts may be used to bring about the taking of a major total at the end of the run of all of the cards for all of the days of the month.

The members 96 and 97 are carried by certain of the slides 45a as shown in Fig. 4b. The contacts 92, 93 are associated with the taking of major group totals and contacts 94, 95 with the taking of minor group totals. If it is desired to take a total upon a minor group change in three columns on the card the slide 45a associated with the third of these columns will be set so as to lower the contacting member 97a (Fig. 4a) into cooperation with its contacts 94, 95. If the perforations in the three columns are the same in the upper and lower card the three lowermost contacts 81 will thus be closed during the sensing cycle. After the cards have been sensed

and the contacts 81 set, a circuit will be established through the contacts as follows: from the left side of the line 19 through contacts 80b, which are closed at this time, coil 80, wire 99, across lowermost set of contacts 81, to the second set, then to the third set, then through wire 100 to the associated contacts 95, 94 (contacts 95, 94 associated with the other contacts 81 being open) through the corresponding contact member 97a to wire 101, through card lever contacts 102 which are closed while cards are feeding through the machine and back to the right side of the line 27.

It is to be understood that the magnet coil 80 is energized at the outset of the accumulating operations and effects the closing of contacts 80b and opening of contacts 80a. During part of the card cycle, the circuit through coil 80 passes through contacts 103, contacts 104, wire 105 to the right side of the line. After contacts 81 have been closed, the contacts 103, 104 open for a short time and the current then flows through the contacts 81.

Should there be a disagreement between the two cards, that is, the one under the lower and the one of the upper set of brushes, the contacts 81 associated with the column in which the disagreement occurs will not be closed and the circuit through the magnet 80 will fail. This will permit the contacts 80b to open and contacts 80a to close. A circuit will then be closed through contacts 80a, magnet coil 23, magnet coil 36, wire 105 to the right side of the line. The energization of magnet 23 as we have seen opens contacts 23a thus stopping the feeding of cards and the operation of the motor 11 and instituting a total taking series of operations.

Major total

Assuming that the 4th, 5th, 6th sets of contacts 81, counting from the bottom in Fig. 4a, are to be used to control the taking of a major total, the 6th connecting member 96a will be depressed to close the contacts 92a, 93a. This is effected by the lowering of the corresponding slide 45a in Fig. 4b. Normally while the machine is operating to accumulate, the coil 79 is energized and serves to hold the contact 79a open and contact 79b closed. The circuit will thus be closed from the line 19, through contacts 79b, coil 79, contacts 104, wire 105, to the other side of the line. After the contacts 81 have been closed, contacts 104 are opened momentarily so that the circuit then passes from line 19 and contacts 79b, which are closed while cards are feeding, to coil 79, through wire 106 to the common wire 107, contacts 92a, connecting member 96a, contact 93a, to the 6th set of contacts 81 (counting from the bottom), then through the 5th and 4th sets of contacts 81 and across contacting member 97a, wire 101, contacts 102, to the other side of the line. If the major group number is the same on the upper and lower cards and the three sets of contacts 81 are thus closed, the completion of the circuit will serve to maintain magnet coil 79 energized thus holding contacts 79b closed and contacts 79a open.

Should there be a disagreement in the major group control number in any one of the three columns the corresponding set of contacts 81 will not be closed and when contacts 104 open, the circuit through magnet 79 will fail, permitting contacts 79b to open and 79a to close. This establishes a circuit through the magnet coil 23, causing contacts 23a to open as previously pointed out to bring about a totaling operation.

If a minor total is being taken, but one totaling cycle will be needed, but if a major total as well as a minor total is being taken then two totaling cycles are required. This is controlled in the following manner: If the change in group occurred in the minor total, opening contacts 80b and closing contacts 80a, but permitting contacts 79b to remain closed and contacts 79a to remain open, then near the end of the totaling cycle when the contacts 108 close a circuit will be established from the line 19, through contacts 108, magnet 80, contacts 103, contacts 104, wire 105 to the other side of the line. Magnet 80 will then open contacts 80a closing contacts 80b, thus deenergizing magnet 23 permitting contacts 23a to close again to restart the machine for feeding cards and accumulating. If both the major and minor have changed then at the end of the first totaling cycle when contacts 108 close establishing the circuit through magnet 80 and opening contacts 80a, contacts 79a are still closed so that the magnet 23 is not deenergized and the machine continues into the next totaling cycle of operations. During this next cycle, contacts 109 are closed establishing a circuit from the left side of the line through contacts 80b now closed, wire 110, contacts 109, magnet 79, contacts 104, wire 105 to the other side of the line. Thus, during this second cycle of totaling operations the coil 23 is energized to start card feeding and accumulating.

It should be noted that when both major and minor totals are being taken, contacts 109 are closed in the first totaling cycle as well as in the second but this takes place before the closing of contacts 108 so that no circuit is established through coil 79. Later in the cycle, contacts 108 are closed after contacts 109 have again opened. This establishes the circuit through coil 80 without establishing it through coil 79. Now in the second totaling cycle when contacts 109 are closed it will be seen that the circuit which could not have been established through coil 79 in the first totaling cycle is established at this time.

The circuit through the magnet 23 also includes magnet 36 which when energized opens contacts 36a. If contacts 36a are open, then when contacts 37a are momentarily closed a circuit through the total control magnet 32 will be shunted, permitting contacts 32a to open, thus deenergizing the total or reset motor 31. When a major total is being taken contacts 36a do not close until after completion of this total.

We have described the manner in which group controlling on three columns for a minor group and three columns for a major group is effected by operation of the third connecting member 97a to close the minor circuit through the three contacts 81 and the operation of the sixth connecting member 96a to close the major circuit from wire 107 to the next three sets of contacts 81 and then through the connecting member 97a to the wire 101. This, of course, is one way in which the connection may be effected and according to this method of connecting the minor circuit is independent of the major circuit.

The connection may be effected in other ways as for instance, by setting the third major connecting member 96b and the 6th minor connecting member 97b. Now the major control circuit will be from the line 19 through contacts 79b, magnet 79, wire 106 to wire 107 through contacting member 96b to the fourth set of contacts 81 (counting from the bottom), then through the fifth and sixth sets of these contacts, across con-

necting member 97b to wire 101 to the right side of the line. The minor circuit will be from line 19 through contacts 80b, magnet 80, wire 99 to the lowermost set of contacts 81 then through the successive sets of these contacts including the 6th set then across contacting member 97b to wire 101, etc. It will be noted in this case that the minor control circuit includes the three contacts 81 controlled by the major group. Thus, if a change takes place in the minor group and not in the major group the minor group magnet 80 will become deenergized permitting contacts 80a to close and contacts 80b to open but the major group circuit will not be affected so that its contacts 79a and 79b will not be changed. On the other hand, should a change take place in the major group number on the cards, the minor group circuit as well as the major group circuit will be broken since the minor circuit must pass through the major group contacts 81.

In Fig. 2, a card 57 is shown which may be punched to control the connections from the various columns of the data card to the various orders of the different accumulators and printing devices. A dotted line III is shown across the card dividing the seven upper index point positions from the five lower ones. The seven upper ones, as we have seen, control the selection of the accumulators and printing devices while the five lower positions determine the column or order.

In Fig. 2, it will be seen that eight columns numbered three to ten inclusive are punched to select counter number two. For this purpose, the 3 index point position in all of these columns is perforated to effect the setting of the corresponding slides 45 to connect all of these columns to counter number two. The five positions below the line III of these columns are provided with two perforations to each column, each combination differing from the other to connect the several columns to different orders in the number two accumulator or counter. For the purpose of illustration the rest of the counters are shown as connected to only two columns on the card. Where a machine having five counters or accumulators and seven banks of printing devices is used, five accumulators or counters may be connected as indicated in Fig. 2 and the additional banks of printing devices designated printing bank 6 and 7 may also be connected as indicated. This card as has been explained is perforated in this manner and then placed in the device shown in Fig. 1 and clamped in position, after which the rods 50 are released to be variously set according to the arrangement of perforations in the card to set their slides 45 correspondingly. While eight columns of the card in

Fig. 2 are shown as connected to the counter or accumulator No. 2 and only two columns are connected to the order of the accumulators Nos. 1, 3, 4 and 5, it is, of course, understood that this is merely an arbitrary arrangement, as in most instances more than two columns or two orders of an accumulator will be used. If it is desired to connect eight of the sensing brushes 42 to eight orders of an accumulator then eight columns on the card of Fig. 2, representing that particular accumulator, will be punched to connect those particular orders of the accumulator to the sensing brushes. If a different number of orders of an accumulator are to be connected to the sensing brushes 42 then such number of orders will be connected by punching that number of columns on the card of Fig. 2 to connect them to the brushes.

The group control slides 45a are arranged in a separate device similar to the devices of Fig. 1 and therefore need not be shown in detail. The card for controlling the setting of the slides 45a is shown in Fig. 3 at 112. Here the perforations in the several index point positions ranging from zero to nine determine the connections from the columns on the data cards 1 or in other words, from the sensing brushes 40, 42 to the several magnets 81a for controlling the contacts 81. The eleven and twelve positions are perforated as explained to control the grouping of the contacts 81 for major and minor control.

I claim:

1. In a tabulating machine, a plurality of elements for sensing data in a plurality of columns on a record, a plurality of accumulating devices, means for selectively associating one of said accumulating devices with a group of said elements, additional means for selectively associating the individual elements of such group with the separate orders of the selected accumulating device, and a form cooperating with both of said means for effecting selective setting thereof, the parts of both of said means being normally urged toward set position and said form acting to restrain some of them in non-set position.

2. In a record controlled machine, a plurality of elements for sensing data in separate parts of a record, an accumulating device, movable members for selectively associating a group of said elements with said accumulating device, additional movable members for operatively and selectively associating the individual elements of such group with the several orders of the accumulating device, means tending to set said members, and a perforated form card for controlling the setting of all of said members.

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