

March 31, 1936.

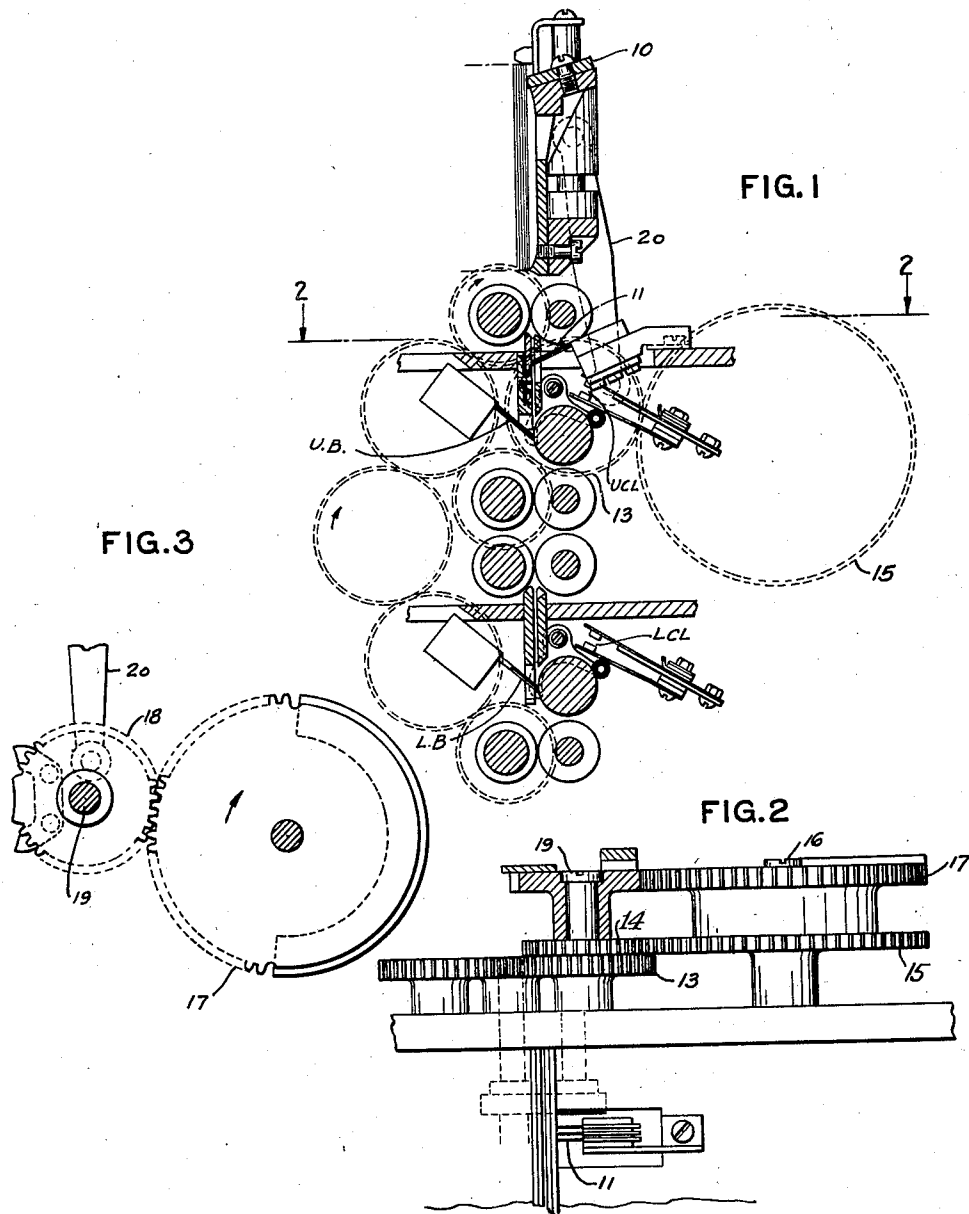
G. F. DALY

2,036,024

TABULATING MACHINE

Filed Dec. 30, 1933

6 Sheets-Sheet 1



Inventor

George F. Daly

By

A. C. Maby
Attorney

March 31, 1936.

G. F. DALY

2,036,024

TABULATING MACHINE

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6 Sheets-Sheet 2

FIG. 4

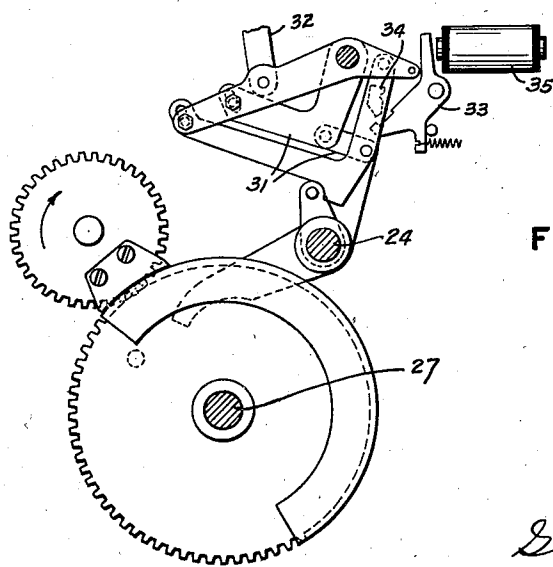
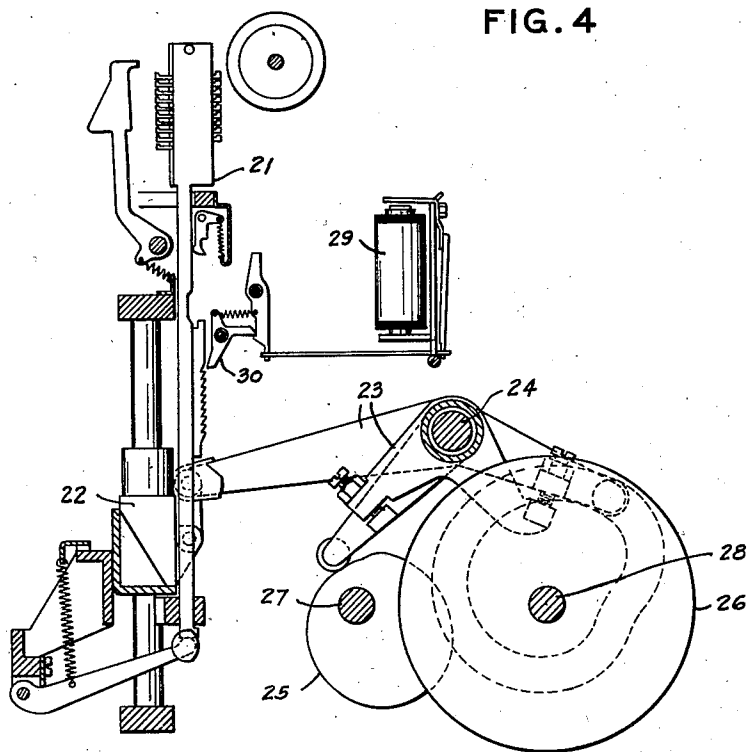


FIG. 5

INVENTOR
George F. Daly
BY *A. Conley*
ATTORNEY

March 31, 1936.

G. F. DALY

2,036,024

TABULATING MACHINE

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6 Sheets-Sheet 3

FIG. 6

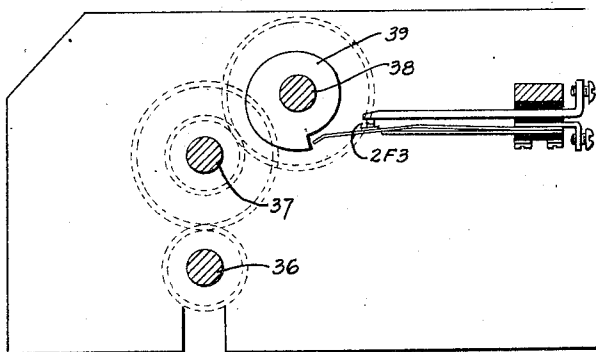


FIG. 7a

12
x
0
1 GAS
2 GAS ARC
3 MERCHANDISE
4 BALANCE
5 D.R. ESTIMATE
6 ELECTRIC
7 POWER
8 GAS & ELECTRIC
9 DELINQUENT

12345678

FIG. 7b

12
x MISC
0
1
2
3
4
5
6
7
8
9

12345678

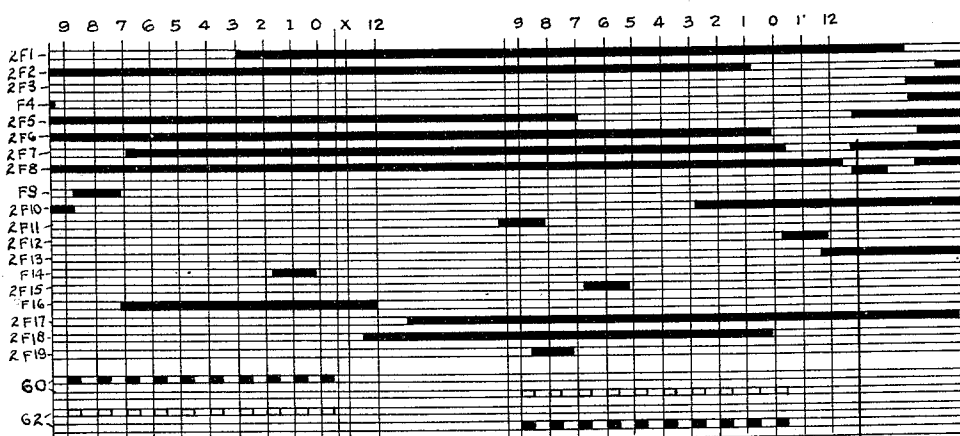


FIG. 9

INVENTOR
George F. Daly
BY *A. C. Maby*
ATTORNEY

March 31, 1936.

G. F. DALY

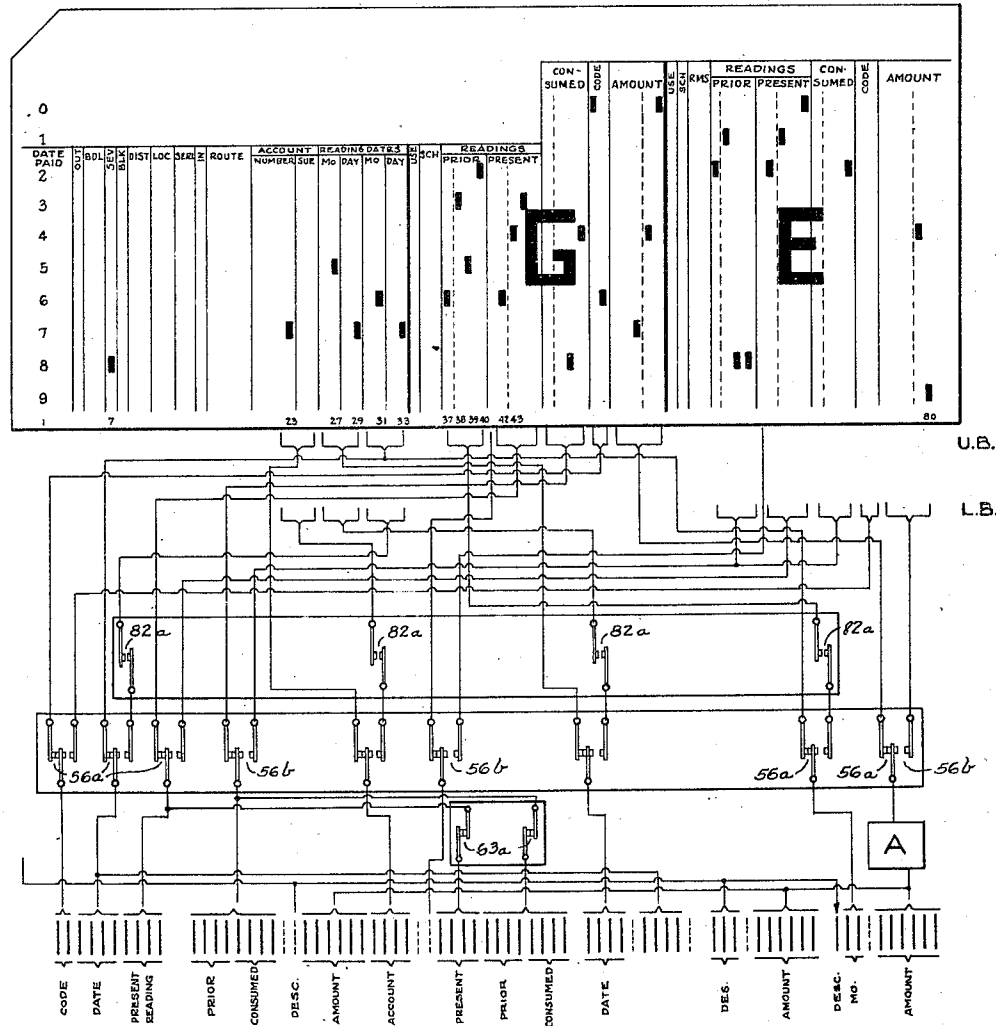
2,036,024

TABULATING MACHINE

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6 Sheets-Sheet 4

FIG. 7



GAS & ELECTRIC CO.										GAS & ELECTRIC CO.										GAS & ELECTRIC CO.									
TURNER TIRE CO.										TURNER TIRE CO.										TURNER TIRE CO									
4 FRANKLIN ST.										4 FRANKLIN ST.										4 FRANKLIN ST.									
JUNE BILL										JUNE BILL										JUNE BILL									
STATE OF ACCT										STATE OF ACCT										STATE OF ACCT									
DESC. AMOUNT										DESC. AMOUNT										DESC. AMOUNT									
UNITS										UNITS										UNITS									
CONSUMED										CONSUMED										CONSUMED									
DATE										DATE										DATE									
PRESENT										PRESENT										PRESENT									
PRIOR										PRIOR										PRIOR									
METER READING										METER READING										METER READING									
GAS										GAS										GAS									
ELECT										ELECT										ELECT									
AMOUNT										AMOUNT										AMOUNT									
5.60										5.60										5.60									
.49										.49										.49									
7.40										7.40										7.40									
.49										.49										.49									
13.98										13.98										13.98									

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INVENTOR
George F. Daly
BY
A. C. Maby
ATTORNEY

March 31, 1936.

G. F. DALY

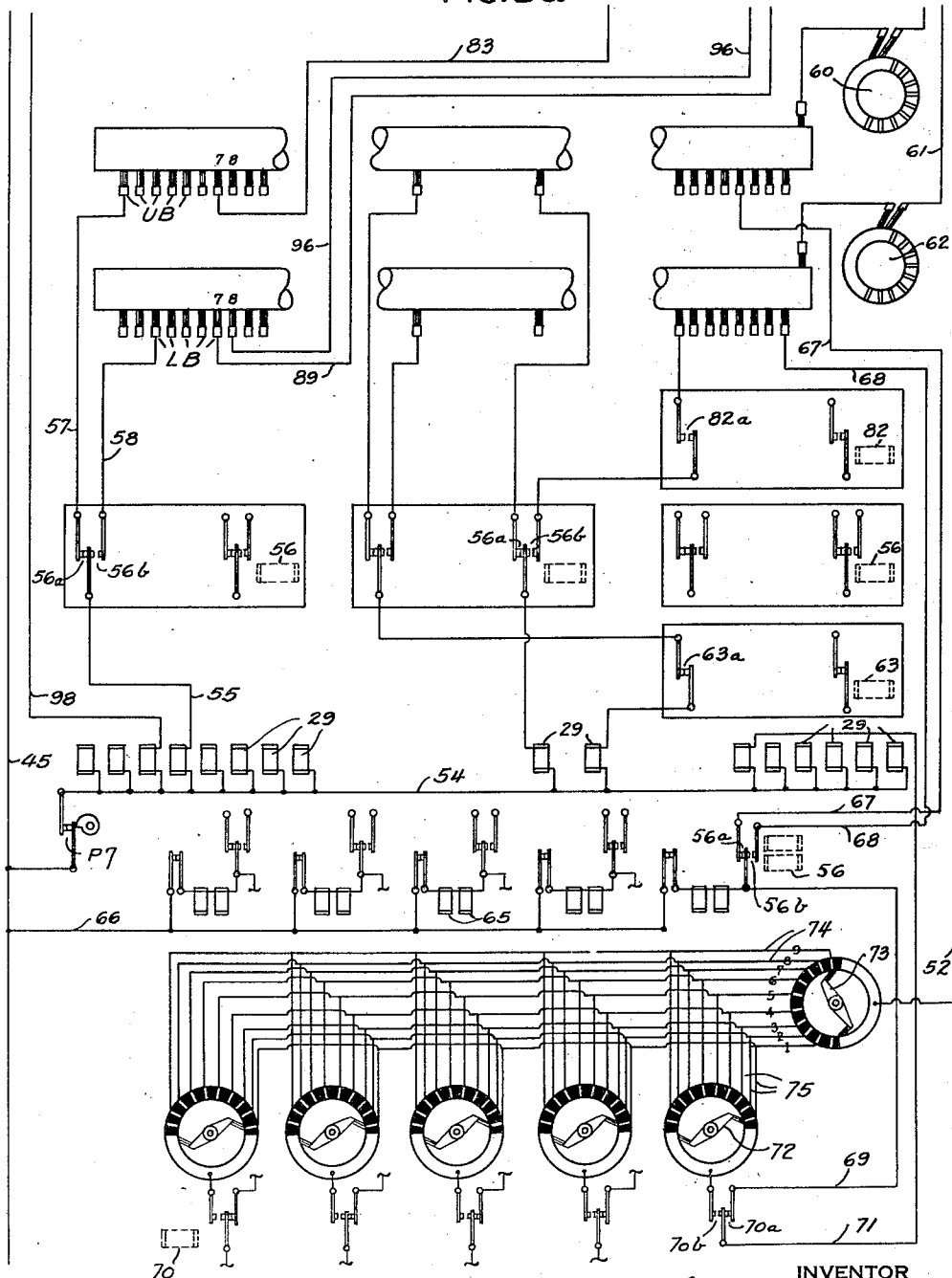
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TABULATING MACHINE

Filed Dec. 30, 1933

6 Sheets-Sheet 6

FIG. 8a



INVENTOR

George F. Daly

BY

Attorney

UNITED STATES PATENT OFFICE

2,036,024

TABULATING MACHINE

George F. Daly, Johnson City, N. Y., assignor to
International Business Machines Corporation,
New York, N. Y., a corporation of New York

Application December 30, 1933, Serial No. 704,769

9 Claims. (Cl. 101—93)

This invention relates to billing machines and more particularly to machines in which bills or statements are automatically prepared under control of perforated record cards.

5 The invention, while adapted to various uses, will be illustrated and described in connection with the accounting system of a public utility corporation supplying services in connection with electricity, light, power, gas, and the like. It is customary to install meters on the premises of users of electricity and gas on which the consumption of these commodities is registered. An employee of the corporation makes periodic visits to read the meters, entering the readings in a meter reading book which forms the book of original entry. This book shows the last previous and present readings of the meters and the difference between the two representing the consumption of the commodity during the selected period. According to the present invention, it is proposed to form perforated ledger cards from these books of original entry. The ledger cards are punched in differential locations in the well known manner to represent different data and ordinarily a single card is prepared for the consumption of several commodities by each consumer during the accounting period. Thus, each ledger card is punched with identifying data of the consumer, identifying data of the particular commodities, present and previous readings of the meters, the differences between the readings representing the consumption within a period, and the amount due for this consumption of each commodity.

35 The statements, bills, or invoices, which are sent out to consumers at the end of the accounting period may be prepared directly from the perforated ledger cards.

40 The particular method of handling the ledger cards may vary. Ordinarily the cards representing the various types of service to a particular customer are arranged in groups with the cards having data concerning irregular services, such as charges for merchandise, at the head of the group followed by cards having data representing more frequent types of service charges. A particular column of each card is set aside to receive a designating perforation which serves to identify the type of service represented by that card. If a charge remains unpaid at the end of an accounting period, the cards representing such unpaid charges are punched in a second position in the identifying column. This second punching identifies the card as delinquent and in preparing a subsequent statement,

the data derived from such card will be suitably identified.

The broad object of the invention is to provide an improved printing tabulator in which bills or statements may be automatically prepared under the control of variously classified record cards.

A more specific object of the invention resides in the provision of novel mechanism for permitting the printing of a plurality of lines of a bill or statement in response to the analysis of data contained on a single record card.

A further object resides in the provision of prereading instrumentalities for determining in advance of data analysis the manner in which the data analyzing devices shall take cognizance of the data on the record.

A still further object is to provide means controlled in response to a single classification perforation in a card for causing the separate printing of two separate classification designations on successive lines of a bill.

The invention will now be explained more explicitly in connection with the accompanying drawings in which,

Fig. 1 is a cross sectional view of the essential elements of the ledger card feeding and analyzing mechanism.

Fig. 2 is a section taken along lines 2—2 of Fig. 1, showing the intermittent drive for the card picker.

Fig. 3 is a further detail of the intermittent drive.

Fig. 4 is a section of the printing mechanism showing the essential operating elements.

Fig. 5 is a detail showing the spacing mechanism for controlling the line spacing of the bill or statement.

Fig. 6 is a detail of the cam controlled contact devices in the machine.

Fig. 7 is a diagrammatic view showing the arrangement of the data fields of the record card and the relationship between these fields and the type bars of the printing mechanism.

Fig. 7a indicates the coding arrangement of the seventh column of the card for indicating the type of service represented.

Fig. 7b shows the manner of perforating the eighth column of the cards to indicate miscellaneous charges.

Figs. 8 and 8a, placed one above the other, constitute a wiring diagram of the electric circuits of the machine.

Fig. 9 is a timing chart of the cam controlled contact devices.

Referring to Fig. 7, a ledger card is shown in the upper part of the figure, punched to represent all the data pertaining to the consumption of gas and electricity for a certain consumer during an accounting period. This card is of well known form and carries indicia arranged in columns to represent the numerals from 0 to 9. The card is divided into three sections. The right hand section, identified with an "E", receives data related to the consumption of electricity. The central section, identified by "G", receives similar data concerning consumption of gas, and the third or left hand section receives information common to the other two fields.

Where a customer does not require one of these services, the corresponding field is not used.

In Fig. 7a is indicated the manner in which column 7, which is the identifying column, is perforated to indicate the type of service rendered. For example, if the card represents both gas and electric service, a perforation is made in the "8" index point position. If only electricity is represented, a perforation is made in the "6" index point position; and if gas only is supplied, a hole is made in the "1" position. If the charges represented on the card remain unpaid after a bill has been rendered, the identifying perforation in the seventh column is supplemented by an additional hole in the "9" index point position. Such punching is commonly called "under punching" and its manner of controlling the operation of the machine will be explained hereinafter. The same kind of record card may be used to receive information concerning other types of service as indicated on Fig. 7a and a hole in an appropriate position in column 7 will indicate the type of service.

For example, a hole in the "3" position indicates a charge in connection with the purchase of some article. Perforations in such case are obviously not made in the meter reading or consumption fields but the amount due may be punched in the "amount" field of the central portion of the card.

In the lower part of Fig. 7 is shown the manner in which the fields of the bill are arranged to receive the data from the ledger cards and directly above the bill are the type bars (indicated by a horizontal row of vertical lines) which are adapted to control the printing in the columns of the statement directly below. Between the ledger card and the type bars are various lines running from the fields of the card to groups of type bars. These lines indicate diagrammatically the association between the card analyzing devices and the printing devices. Within these lines are included contact devices which, as will be explained hereinafter, shift the relationship between the card fields and type bar groups so that under suitable conditions this relationship may be varied. For example, the fields of the card containing the "prior" and "present" gas meter readings are connected to the appropriate type bar positions through normally closed contacts 56a which permit the positioning of the type bars as the card passes the first or upper brush reading station. The fields of the card which receive the "prior" or "present" electric readings are also connected to the same type bar positions through normally open contacts 56b which, when shifted, permit the same bars to be controlled from the electric portion of the card, as it is analyzed by the second or lower brush reading station.

The separate units of the machine will first be

described to explain their mechanical arrangement, after which the circuits, by means of which the various units are coordinated, will be set forth in detail.

Card feeding mechanism

The card feeding mechanism is shown in its essential details in Fig. 1 and is similar to card feeding mechanisms shown in tabulating machines such as shown in Patent No. 1,762,145, issued June 10, 1930 to G. F. Daly et al., Patent No. 1,822,594, issued September 8, 1931 to C. D. Lake and copending application Serial No. 672,388 of C. D. Lake and G. F. Daly, filed May 23, 1933. Record cards are fed downwardly from a magazine by a picker 10 which advances the record to the feed rollers and these in turn move the card successively past a set of upper brushes indicated at UB and a set of lower brushes LB. These sets of brushes are spaced so that the upper brushes UB analyze the record card during one machine cycle and the lower brushes analyze the card during the succeeding cycle.

In carrying out the present invention, an additional brush station is provided in advance of the upper brushes. At this station a plurality of analyzing brushes 11 are located for the purpose of taking a pre-reading of selected columns of the record card before the card is analyzed by the upper brushes. Associated with the upper and lower brush stations are the usual card lever contacts UCL and LCL which are adapted to close as the record card is passing the upper and lower brush stations.

The present machine is arranged so that a record card is moved completely past brushes 11 and both the upper and lower brush stations and analyzed by all three before the next card is fed from the supply hopper. This is brought about by providing an intermittent feed for the picker knife 10 so that it operates during every second cycle only. This intermittent mechanism is shown in Figs. 2 and 3, where the usual picker knife operating gear 13, which makes one revolution for each cycle of the machine, has connected thereto a gear 14 meshing with a gear 15 freely mounted upon a stud 16. Integral with gear 15 is a mutilated gear 17 which meshes with a corresponding gear 18 freely carried on the stud 19 which also serves as a center of rotation for the gears 13 and 14. With this arrangement, the gear 18 is given a complete turn for every second turn of the gear 13. Pivoted to gear 18 is the connecting link 20 which extends upwardly to the reciprocable picker knife 10.

Printing mechanism

The printing mechanism is substantially that shown in the patents referred to and comprises a plurality of type carriers 21 resiliently carried by crosshead 22, which through the mechanism generally indicated at 23 and pivoted on a shaft 24 is controlled by either cam 25 or cam 26 to move the crosshead 22 and type bars 21 upwardly and then down, once for each cycle of the machine. Cam 25 is carried by shaft 27 which operates only during total taking operations and cam 26 is carried by shaft 28 which operates during tabulating and listing operations. As the type bars 21 move upwardly, a magnet 29, one of which is provided for each type bar, may be energized at differential times during the upward movement of the bar to trip a stopping pawl 30 into engagement with one of the teeth cut in the type bar and thereby

interrupt further upward movement of the type bar with the crosshead.

In this manner, a selected type element on the bar is positioned for printing.

5 The card feeding mechanism and printing mechanism are driven in unison so that the type bars rise to successively present their type elements to the printing platen as a record card passes the upper brushes and as the card subsequently moves past the lower brushes, the type bars make a second excursion. As the card passes either set of brushes, circuits may be completed through perforations in index point positions in the card columns to cause energization of magnet 15 29 so that the amount represented by the perforation may be printed on a record sheet.

The circuits involved will be hereinafter traced in detail in connection with the description of the circuit diagram.

Paper spacing mechanism

20 The usual paper spacing devices are shown in Fig. 5 where the mechanism generally indicated at 31 and mounted for oscillation on shaft 24 is adapted to draw downwardly on link 32 to space the platen. A latch 33 is provided which upon energization of a magnet 35 engages a block 34 carried by the mechanism 31 to hold the devices in the position shown in Fig. 5 to prevent the normal operation of the spacing mechanism. 30 With this arrangement, paper spacing is suppressed while magnet 35 is energized. This mechanism for controlling the normal operation of the paper spacing mechanism is more fully shown and described in Patent No. 1,791,921, issued to C. Campbell, February 10, 1931.

Miscellaneous contact devices

In Fig. 6 is shown the gear connections by means of which some of the contact devices of the machine are driven. Shaft 36, known as the accumulator drive shaft, is driven from the card feeding mechanism and has gear connection with a shaft 37 at a ratio such that shaft 37 makes one revolution for each cycle of the card feeding mechanism. Shaft 37 in turn drives a shaft 38 at a 2:1 ratio so that shaft 38 makes but a half revolution for each machine cycle. Carried by shaft 38 are a number of contact controlling cams for controlling the operation of a number of cam contact devices which are designated with the prefix F or 2F and they perform a complete cycle during two cycles of the feeding mechanism. 50

Circuit diagram

55 The circuit diagram of Figs. 8 and 8a will now be described in detail and the various circuits will be separately described, after which a comprehensive explanation will be made of the manner in which they are coordinated for the solution of particular problems.

60 In the circuit diagram, those cam controlled contacts which operate in synchronism with the card feeding mechanism are designated with the distinguishing prefix 2F or F. Certain cam controlled contacts are operated from the total taking and resetting devices of the machine and these are prefixed with the designation P and during card feeding and listing operations these latter contacts will be in the positions indicated on the circuit diagram; that is, they will be either open or closed. Wherever possible, relay contacts have been shown in juxtaposition to their corresponding coils.

75 In other instances, where they have been separated for clarity in the circuit diagram, the relationship has been indicated by identifying the contacts with the same reference numeral as the controlling coil followed by a lower case letter and in addition, the relay coils have been dotted next to the contacts.

5

Start circuit

Depression of the start key will close contact 44 completing a circuit from line 45, contacts P1, 10 card feed clutch magnet 46, contacts 46a, relay 47, stop key contacts 48, contacts 44, stop key contacts 49, relay contacts 50a, switch 51 to line 52. Energization of magnet 46 will open contacts 46a and include relay magnet 53 in the circuit. Magnet 53 will close its contacts 53a completing the circuit to the driving motor TM which is traceable from line 45, contacts P1, motor TM, contacts 53a, to line 52. Relay magnet 47 acts to provide a holding circuit for the starting circuit which is traceable from line 45, contacts P1, magnet 46, relay magnet 53, magnet 47, contacts 47a, contacts 49, 50a, switch 51 to line 52. This circuit will remain energized until the stop key contacts 49 are manually opened or relay magnet 50 is energized to open contacts 50a. In such event, the circuit will be held through contacts 2F1 which are in parallel connection with contacts 49 and 50a and whose purpose is to break the motor circuit at a definite time to insure the stopping of the machine at the end of a cycle. 20

25 With motor TM in operation and magnet 46 energized, the card feeding mechanism will proceed to feed cards past the analyzing brushes in succession and the printing mechanism will move synchronously therewith to record the data analyzed. Accumulating mechanism (not shown in detail) may be operated at the same time so that the data analyzed may also be accumulated, 30 if desired.

Printing circuits

The printing circuits are shown on Fig. 8a wherein the printing magnets 29 are shown connected to a common wire 54 which runs through cam contacts P1 to line 45. Several of the printing magnets 29 are connected through wires 55 to the common blades of pairs of contacts 56a and 56b, the former of which are normally closed and 50 connected through wires 57 to certain of the upper brushes UB. The normally open contacts 56b are connected through wires 58 to certain lower brushes LB. Thus, as the record card traverses the upper brushes, perforations therein will complete circuits to the printing magnet of which a representative one is traceable as follows: from line 52 (Fig. 8), through switch 51, contacts 50a, upper card lever contacts UCL, wire 59, impulse distributor 60 (Fig. 8a), common contact roll of the upper brushes, perforation in the record card, brush UB, wire 57, contacts 56a, wire 55, print magnet 29, wire 54, contacts P1, to line 45. 55

If, as the record card passes the lower brushes, relay magnet 56 is energized in a manner to be explained, contacts 56b will be closed and printing circuits may be completed as follows: from line 52 (Fig. 8), switch 51, contacts 50a, lower card lever contacts LCL, wire 61 (Fig. 8a), impulse distributor 62, lower brush contact roller, perforation in the record card, lower brush LB, wire 58, contacts 56b (now closed), wire 55, print magnet 29, contacts P1, to line 45. 60

70 It will thus be seen that the same print magnet may be controlled from either the upper or 75

lower brushes which in turn may analyze either the same or different columns of the record card.

In certain positions, the contacts 56a and 56b instead of being directly connected to the print magnet as through a wire 55, may have interposed a pair of contacts 63a controlled by a relay magnet 63 so that the printing circuit may or may not be completed depending upon the operation of relay magnet 63. If magnet 63 is energized during the passage of the card by either brush station, the analysis of columns associated with the contacts 63a will have no effect upon the corresponding printing magnets. Conditions under which this operation takes place will be explained hereinafter. Another manner of associating the analyzing brushes with the printing magnets may involve including a pair of contacts 62a in the circuit between lower brush LB and one of the normally open contacts 56b so that the printing circuit through the lower brushes will be completed only when relay magnet 62 is energized to close contacts 62a.

Adding circuits

The adding mechanism is diagrammatically represented in the lower part of Fig. 8a wherein the adding magnets are represented at 65 and connected through a common wire 66 to line 45. The other terminal of each adding magnet is connected to the common blade of a pair of contacts 56a and 56b. The normally closed contacts are connected through a wire 67 to upper brushes UB and the normally open blade is connected through wire 68 to a lower brush LB. Magnet 56 is arranged to be energized as the card is passing the lower brushes and deenergized while it passes the upper brushes.

In this manner, a circuit may be completed through a perforation in the card sensed by the upper brush and completed through wire 67, contacts 56a, magnet 65, wire 66, to line 45. A branch circuit from contacts 56a may follow through wire 69, normally closed, contacts 70a, wire 71, print magnet 29, wire 54, contact P1 to line 45. Thus, the amount entered into an order of the accumulator under control of the upper brushes may be concurrently printed. Similarly, as the card is passing the lower brushes, a perforation will complete a circuit through wire 68 to concurrently control the same adding magnet 65 and printing magnet 29. It will be noted that for the wiring example illustrated, items may be read from different columnar positions at the upper and lower brushes and enter into common adding and printing devices.

Total printing circuits

The manner in which total printing is effected is the same as disclosed in Patent No. 1,921,451, issued to G. F. Daly, August 8, 1933. Each position of the adding mechanism has associated therewith a brush structure 72 which takes an angular position representative of the value of the item entered in that position. During the total taking cycle, commutator brushes 73 make a complete revolution and successively connect each of a series of wires 74 to line 52 and circuits will be completed to the printing magnets at differential times determined by the setting of the accumulator brushes 72. For example, if a brush 72 is set to represent "9", a circuit will be completed from line 52, through brush 73, "9" wire 74, through "9" wire of the group of wires 75, brush 72, contacts 70b (which are

closed during total taking operations), wire 71, print magnet 29, to line 45 as before.

Since, during total taking operations, the type bars move upwardly in synchronism with the operation of the emitter brush 73, this circuit will be completed at a time when the "9" type element is at printing position and consequently be interrupted in such position. If brush 72 were set to represent "6", a similar circuit would be completed at the "6" time in the cycle to interrupt the type bar with the "6" type element in printing position. The adding and total printing mechanism is more fully explained in the patents referred to and need not, therefore, be explained in further detail herein.

Automatic initiation of total taking

The manner in which total taking is automatically initiated is somewhat similar to that explained in the above mentioned patents. If the switch 76 (Fig. 8) is closed, energization of relay magnet 50 will close its contacts 50b which thereupon complete a circuit from line 52, switch 51, contacts 50b, wire 77, cam contact 2F3 which definitely time the completion of the circuit, switch 76, relay magnet 78, reset clutch magnet 79, contacts P3, contacts F4, to line 45. Magnet 78 closes its contacts 78b to complete a circuit to the reset motor RM, traceable from line 45, contacts F4, motor RM, contacts 78b, wire 80, to line 52. Contacts 78a provide a holding circuit for the magnets 78 and 79 as follows: from line 45, contacts F4 and P3, magnets 79, 78, contacts 78a, 78b, wire 80, to line 52. During the total taking cycle, contacts P3 open to deenergize magnets 78 and 79 and contacts P4 act to keep motor RM energized until their controlling cam permits opening of the contacts and breaking of the motor circuit.

Gas and electric card

The manner in which a dual-card, that is, a card bearing both gas and electric information, controls the machine to prepare a statement bearing information concerning these two types of service only will now be explained in detail.

It will be recalled that dual-cards are provided with an identifying perforation in the "8" index point position of column 7. As the record card is advanced past the upper brushes UB, the data relating to the gas information will be analyzed and entered in the appropriate positions of the type bars through circuits as traced above.

Fig. 7 represents diagrammatically the information that is so entered. Specifically, columns 22 to 25 are connected through a pair of contacts 56a to the type bars which control printing in the second field of the bill. Columns 26 to 29 are similarly connected to the type bars which print in the "date" position in the center of the bill. Columns 30 to 33 which control the "reading date" print in the left hand date position of the bill, also on the stub portion of the bill. In the same manner, columns 37 to 56 of the "G" field are connected to the appropriate positions of the bill to receive this data. The amount field columns 52 to 56 are connected to the accumulator A so that the total bill for the customer may be accumulated.

It will be noted, that as the record card passes the upper brush station, no data is analyzed in the "E" portion of the card. As the record card advances for analysis by the lower brushes, the contacts 56a are opened and contacts 56b are closed.

This is effected by energization of the magnets 56 (Fig. 8) upon closure of cam contacts 2F18 which are adapted to be closed as the record cards pass the lower brushes. A circuit is there-
 5 by completed from line 45, contacts 2F18, magnets 56, wire 81, to line 52. Therefore, as the record card passes the lower brushes, all contacts 56a will be open and contacts 56b will be closed. The "electric" field of the record card
 10 will now be connected to the appropriate columns of the bill. Inspection of Fig. 7 will show that the amount field of the electric information is now connected through closed contacts 56b to accumulator A so that the "electric amount" is
 15 now added to the "gas amount". The other fields of electric information are entered into the same fields that receive corresponding information relating to the gas service. In the left hand portion of the record card the lower
 20 brushes analyze the account number and reading date fields of the card to cause the repeated entry of this information in connection with the electric data. These fields are associated with the type bars through contacts 82a controlled
 25 by a magnet 82 which is energized to close the contacts as the card passes the lower brushes in the following manner: As the cards traverse the upper brushes, the perforation in the "8" index point position is sensed by the upper brush UB
 30 of column 7 and a circuit completed through the perforation to the upper-brush UB, wire 83 (Fig. 8a), cam contacts F9 (Fig. 8) timed to close at the "8" time in the cycle, wire 84, relay magnets 85, 86, 87, cam contacts 2F1, wire 88, to line 45.
 35 Magnet 85 closes its points 85a to provide a holding circuit from line 52, wire 81, contacts 85a, magnets 85, 86 and 87, to line 45. As before, magnet 86 closes its contacts 86a to complete the circuit to magnets 82 from line 45, contact 2F18,
 40 magnets 82, contacts 86a, wire 81, to line 52. The timing of the cam contact devices F9 and 2F1 is such that the magnets 82 remain energized during the transit of the record card past the lower brushes. After the card has passed the
 45 lower brushes, the bill will contain all the data relating to the gas and electric service and if this is all that the consumer is to be charged, the bill is complete with the exception of the total, which is printed during the total taking and
 50 resetting cycle of operations which is initiated at this time in the following manner:

Total printing cycle

As the card passes the lower brushes, the "8" perforation in the seventh column is sensed by the appropriate brush which completes a circuit
 55 extending from the "7" lower brush LB through wire 89 (Fig. 8a), cam contacts 2F19 (Fig. 8), relay magnet 90, cam contacts P5, wire 88, to line 45. Magnet 90 closes its contacts 90a to provide a holding circuit from line 52, wire 81,
 60 contacts 90a, magnet 90, contacts P5, wire 88, to line 45. This circuit remains energized until contacts P5 open during the total taking cycle
 65 of operations.

During the cycle in which the card passes the lower brushes, a pair of cam contacts 2F13 are adapted to close momentarily to complete a circuit
 70 from line 52, normally closed relay contacts 91a, wire 92, control magnet 50, contacts 2F3, wire 88, to line 45. Under conditions, to be explained hereinafter, contacts 91a may be opened at the time contacts 2F13 close so that this circuit cannot be completed.

75 In the present instance where there is but the

single gas and electric card for the consumer, the circuit is completed as described and the resulting energization of magnet 50 will open con-
 5 tacts 50a to interrupt the motor circuit of the card feeding and accumulating mechanism and will close contacts 50b so that the total taking cycle is automatically initiated through a circuit traceable from line 52, switch 51, contacts 50b,
 10 wire 77, contacts 2F3 (now closed), switch 76, magnets 78, 79, contacts P3 and F4 to line 45. This initiates an automatic total taking and re-
 15 setting cycle of operations in a manner explained hereinbefore. During this cycle, the total is read from the accumulator and printed in the appropriate column of the bill through cir-
 20 cuits already traced.

As explained hereinbefore, the total printing circuits include contacts 70a and 70b which are shifted during total taking operations. This shifting is effected in the following manner. At
 20 the beginning of the total taking cycle closure of cam contacts P6 (Fig. 8) will complete a circuit from line 45, wire 88, contacts P5, P6, trip magnet 70, contacts 70c, contacts 90a, wire 81,
 25 to line 52. Energization of magnet 70 will trip the contacts so that 70a will be open and 70b will be closed. After total printing has been effected, mechanical means (not shown) are brought into operation to restore the contacts to
 30 their normal position.

Summarizing briefly, where a consumer's account is represented by the single dual-service-card, the card is fed first past the upper brushes where data relating to gas and data common to
 35 both services are analyzed and printed on the first line of the bill. The card then passes the lower brushes where data concerning electric service are analyzed and printed on the second line of the bill.

Each station controls the entry of the money
 40 item into a common accumulator which thereby acquires a cross addition of the two amount fields of the card. Following this, the machine automatically enters upon a total taking cycle of operation, during which the total amount is printed
 45 on the bill on a third line and the machine is cleared in preparation for the analysis of the first card of the next group.

Gas and electric arrears card

50 If the data on the record card as just analyzed represented data concerning payments which are now in arrears, the card would have an additional perforation made in the "9" index point position of column 7 and the current card would be ar-
 55 ranged to be analyzed subsequently to the arrears card; that is, on the bill there is first listed the information concerning payments in arrears and current charges are listed later.

In connection with the arrears card it is the
 60 practice to eliminate the printing of the meter readings and consumption from the customer's portion of the bill but to show these items on the office stub which is the left hand portion of the statement. The mechanism for effecting this
 65 is controlled by the "9" perforation in column 7 which is analyzed by the special brush 11 as the card passes thereunder. A circuit is set up thereby from line 52 (Fig. 8), wire 81, the "9" hole in column 7, brush 11, lower card contacts 2F8
 70 closed at the "9" position, relay magnet 93, cam contacts 2F5, to line 45. Contacts 93a set up a holding circuit for magnet 93 and also complete a circuit from line 52, wire 81, contacts 93a, upper
 75 contacts 2F8 which close immediately after the

analysis of the "9" position, relay magnet 63, cam contacts 2F6, wire 88, to line 45.

Magnet 94, wired in parallel with magnet 63, is also energized at this time and its contacts 94a provide a holding circuit for both magnets 94 and 63.

Referring to Fig. 7 it will be noted that the "meter reading" and "consumption" fields of the bill are connected to the corresponding record card fields through the normally closed contacts 63a so that if these contacts are open during the time the card passes the brushes, no printing will take place on such portion of the bill. The timing of the operation of the cams 2F5 and 2F6 is such that the circuits through magnet 63 will be maintained throughout the two cycles during which the card passes both upper and lower brush stations. As the arrears card passes the lower brushes, the "9" hole in column 7 will complete a circuit from line brush position, through wire 89 (Fig. 8a), cam contacts CF11, timed to close a relay magnet 95, magnet 91, cam contacts 2F17, wire 88, to line 45. Contacts 59a close to complete a holding circuit for magnets 95 and 91. The contacts 91a, as above stated are in the circuit of control magnet 50 which, since the circuit is thus interrupted, will not be energized after the analyzing of the arrears card and the machine will therefore proceed with the feeding and analyzing of the next following card which will take place in exactly the same manner as explained under the heading above, "Gas and electric card".

Gas card

Where a customer receives only a single service, such as gas, the same dual-card is employed, but only the "gas" portion thereof receives entries.

In column 7, a perforation is made in the "1" index point position to indicate that the card is a gas card. In the analysis of this card, the gas information and the identifying data are analyzed by the upper brushes and entered into the proper type bar positions exactly as though the card were a dual-service-card. As the card passes the lower brushes, however, all printing therefrom will be suppressed. This is effected in the following manner: The contacts 82a (Fig. 7) which are normally open will fail to close since, as explained above, the relay magnet 86 must be energized to permit completion of the circuit through the magnets 82 which cause closure of contacts 82a and since the single service card does not have the controlling perforation in the "8" index point position, magnet 86 remains de-energized. As in the case of the gas and electric card, the control magnet 50 will be energized after the single service card has been analyzed and the machine will enter upon a total taking and resetting cycle of operations. However, the actual printing circuits, during this operation, are suppressed since but a single entry, namely, of the gas amount, has been made in the accumulator and to total print this amount would merely repeat the card reading on the bill and this is not desirable. The manner in which total printing is suppressed is as follows:

Since the circuit through magnet 70 extends through either contacts 90a or 95b to the one side of line and since these contacts are closed only when the card has either an "8" or "9" perforation in column 7, the circuit will accordingly not be completed and the read-out devices

of the accumulator will not be connected to the print magnets for total printing purposes.

Gas arrears card

If the consumer is in arrears in payment of the single gas amount, the previous month's card will be provided with the arrears identifying perforation in the "9" index point position of column 7. This arrears card will, of course, be followed by the current month's card. In this case, as with the arrears card of the dual-service type, the function of the "9" perforation is to suppress the recording on the customer's portion of the bill of the meter readings and consumption. The "9" hole also serves as before to cause the energization of magnet 91 to keep the machine running additional cycles so that the following current month's card may also be analyzed. The money value on the arrears card is, of course, entered into the accumulator and during the subsequent analysis the current month is also added. The "9" perforation will also serve to set up the relay magnet 7, which, by closing its contacts 95b, will complete a circuit from line 52, wire 81, contacts 95b, relay magnet 90, contacts P5, wire 88, to line 45. As before, contacts 90a provide a stick circuit for magnet 90 and subsequently, during the total taking cycle, closure of contacts P6 will energize magnet 70 so that total printing may be effected under control of the several orders of the accumulator.

Electric card

Cards which contain only information relating to electric consumption will have the identifying designation in the "6" index point position of column 7. As this card passes the upper brushes, the information in the left hand field will be transmitted to the type bars for printing on the record sheet. During the second machine cycle, as the card is passing the lower brushes, the remainder of the information will be printed from the "E" portion of the card.

It is to be noted that since there is no "8" perforation in column 7, the relay magnets 82 are not energized during the analysis of this card and consequently, the information in the left hand field is not read a second time by the lower brushes.

Electric arrears card

As in the case of the "gas arrears" card, this type of card receives the underpunching in the "9" index point position of column 7 and the operation is substantially the same as for the "gas arrears" card with the exception of the difference regarding the fields from which the information is read.

Past month readings

In certain instances, it is desirable to bill a customer for two or more current-month service readings; as for example, where the customer has changed his address during the current billing period, he should receive a bill for the service rendered at both the old and new address. A separate card is made out for each address and the data on each is separately listed in much the same manner as though one card were a current month's card and the other an arrears card. In the present case, however, it is not desirable to suppress the meter readings at either address since the customer is entitled to such information. In order to effect this, one of the cards, preferably that containing the data relating to the

old address, is provided with a perforation in the X position of column 8 (see Fig. 7b). The purpose of this perforation is to cause the machine to continue to run after the analysis of this card since, as noted above, the current month card is usually the last card in any group and the machine is normally adapted to automatically enter upon total taking operations after its analysis.

If there had been several address changes for the consumer, there would be an equivalent number of extra cards all X punched in column 8 except the last. The X punching in column 8 is analyzed as the card passes the lower brushes and a circuit is completed from the "8" lower brush LB (Fig. 8a) through wire 96 (Fig. 8), cam contacts 2F12, (timed to close at X), relay magnets 7 and 8, contacts 2F17, wire 88, to line 45. As before, contacts 91a will thus be opened to prevent the interruption of the tabulating motor circuit and the machine will continue to feed the next record card.

Merchandise card

Cards containing data relating to merchandise purchased will all have an X punching in column 8 and this perforation will serve to keep the machine in operation in the same manner as explained in connection with the additional X punched cards described above. The data read from these cards is analyzed by the upper brushes and the amount entered thereby into the accumulator to obtain the total.

Paper spacing control

As explained above in connection with the mechanical description of the paper spacing devices and with reference to Fig. 5, the paper spacing mechanism is arranged in such a manner that the energization of magnet 35 will interrupt its functioning. When the machine is listing from dual-service cards, the machine will space the platen one line preceding the printing of the first or gas item and will effect a second line spacing operation preceding the printing of the second or electric item.

When printing single service cards, the line spacing is effected only during the first machine cycle and is suppressed during the second machine cycle while the same card is passing the lower brushes so that while data may be sensed at both the upper and lower brushes, as in the case of the electric card, the data so analyzed will be printed on a single line of the bill. In the case of the dual-service card, which has an "8" hole in column 7, the analysis of this hole by the upper brush causes the completion of a circuit from the 7 upper brush UB, wire 83, cam contacts F9, relays 35, 86, and 87; to line 45, as before.

Energization of relay 85 causes opening of its contact points 85b so that closure of cam contacts 2F10 during the second card cycle will not energize magnet 35 and the paper spacing devices will remain unlatched and in normal operative condition during this cycle.

Where a single service card is analyzed, which does not have the 8 hole in column 7, contacts 85b will, of course, be in normally closed position and during the second cycle of analysis of the card, closure of cam contacts 2F7 and 2F10 will complete a circuit from line 45, wire 88, contacts 2F7, magnet 35, contacts 2F10, contacts 85b, wire 81, to line 52. Magnet 35 will rock the latching member 33 (Fig. 5) into engagement with the paper spacing devices to prevent their effecting a

spacing operation during the analysis of the card by the lower brushes LB.

Printing the service designation

In several columns of the bill the service designation or description is printed under control of perforations in column 7 and where a single type bar is utilized, the symbolic characters are arranged in the order as shown in Fig. 7a; that is, instead of the usual "1" type element, the symbol G may be substituted and instead of a "6" there would be an EL.

On certain portions of the bill, it may be desirable and convenient to print these designations in more extended form and for this purpose two or three type bars may be associated in known manner so that they act as one; that is, their controlling magnets may be wired in parallel so that an impulse at the "1" time will stop all three bars in their "1" position and each may print part of the designation. For example, with an arrangement of three bars, an impulse stopping the bars in their "6" positions will concurrently position them so that printing of EL will take place from one bar, EC from a second, and T from a third, the entire combination identifying the commodity as "electricity".

For determining the positions at which these description bars are to be positioned, cam contacts F16 are provided which are closed during the analysis of the 7 to 0 index point positions of the record card as it passes the upper brushes. If the commodity is represented by a perforation in any of these positions, a circuit will be completed at a corresponding time from the upper brush in column 7 (Fig. 8a), wire 83 (Fig. 8), cam contacts F16, contacts 87b, wire 98 (Fig. 8a) to one or more print magnets 29, wire 54, contacts P7 to line 45. Where, however, the card is a dual-service card, it is desirable to print the symbol for gas during the first cycle and the symbol for electricity during the second cycle. This is brought about in the following manner:

As previously noted, relay magnet 87 is energized whenever a dual-service card is analyzed, thus causing closure of its contacts 87a and opening of contacts 87b. Contacts 87a are connected to a pair of parallel cam-controlled contacts F14 and 2F15. The former contacts are timed to close at the "1" time in the first cycle and the latter are timed to close at the "6" time in the second card cycle so that a circuit will be completed during the passage of the card by the upper brushes from line 52, wire 81, wire 99, cam contacts F14, contact 87a, wire 98, to the print magnet to present the symbol for gas to the printing position and during the second cycle, as the card is passing the lower brushes and the bill has been spaced to the next printing line, a circuit will be completed from line 52, wire 81, wire 99, contacts 2F15, contacts 87a, wire 98, to the print magnet to interrupt it in position to print the symbol for electricity.

Recapitulation

Summarizing the entire operation of the machine briefly, it may be stated that for any consumer there may be one or more ledger or record cards representing any one or more of the different types of service identified in the chart on Fig. 7a. These cards are arranged to be fed through the machine in any order with the sole requirement that the current month's gas or electric or dual-service card be placed at the end of the group. The other cards of the group will all

Have either a "9" perforation in column 7, indicating arrears charges or they will have an X perforation in column 8, indicating that these are irregular or special charges.

5 The absence of either of these special perforations in the last card is for the purpose, as explained, of causing an interruption in the analyzing and accumulating functions of the machine and the initiation of total taking operations. As
10 the several record cards each pass the several analyzing stations, the data are analyzed therefrom and entered into the appropriate type bar positions and paper spacing is effected for each card with the exception of the dual-service card
15 in which case two paper spacing operations are effected. After the last card of the group has been analyzed and the total taking operations performed, during which the total amount is read from the accumulator and printed on the
20 last line of the bill, the accumulators are cleared and the machine is ready to proceed with the analysis of the next group of cards. The bills may be fed into and out of the machine during total taking operations by means of mechanism
25 of the type disclosed in the Decker patent referred to above, or, if desired, the machine may be caused to come to a stop after total taking operations and the renewal and insertion of bills effected manually.

30 While there has been shown and described and pointed out the fundamental novel features of the invention as applied to a single modification, it will be understood that various omissions and substitutions and changes in the form and details
35 of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention therefore to be limited only as indicated by the scope of the following claims.

What is claimed is as follows:

40 1. In a machine of the class described, a plurality of record analyzing stations, means for feeding a perforated record past said stations in succession, printing mechanism for printing upon
45 a bill and means controlled by each of said stations in response to the analysis of perforations in a passing record for causing said printing mechanism to effect printing on a different line
of said bill.

50 2. In a machine of the class described, a plurality of record analyzing stations, means for feeding a perforated record card past said stations in succession, printing mechanism for printing upon successive lines of a bill, means controlled by one of said stations for causing said
55 printing mechanism to print, upon one line of the bill, data derived from one section of the record card and means controlled by another station for causing said printing mechanism to print, upon another line of the bill, data derived from another
60 section of the record card.

3. The invention set forth in claim 2 in which further means is provided for causing each of said stations to control the printing mechanism to print on each line, common data derived from a single section of the record card.

5 4. In a machine of the class described, a plurality of record analyzing stations, means for feeding a perforated record card past said stations in succession, printing means separately controlled by more than one of said stations to print data derived from the card upon a plurality
10 of lines of a bill, and means controlled by another of said stations for suppressing said printing operations.

15 5. In a printing machine, means for analyzing a field of a record card for data designations, a second means for analyzing another field for data designations, printing means separately controlled by each of said first named means, means for presenting a bill to said printing means and means
20 for line-spacing said bill for each controlling operation of said printing means by either of said analyzing means.

25 6. The invention as set forth in claim 5 in which card pre-reading means is provided for causing the suppression of the operation of one of said analyzing means and suppression of the corresponding line spacing operation.

30 7. In a printing machine, means for feeding and analyzing record cards, printing means controlled thereby to record the result of each card analysis, means normally operative to interrupt the operation of said feeding and analyzing means after the analysis of each card and means controlled in response to the analysis of a predetermined designation on certain of said cards for suppressing the operation of said interrupting means.

35 8. In a cyclically operable printing tabulator, a plurality of record analyzing devices, a printing device, means normally operative to associate said
40 printing device with one of said analyzing devices during one cycle of operation of the tabulator and with another analyzing device during a subsequent cycle of operations whereby each analyzing device will in turn control said printing device
45 and record controlled means for selectively preventing the association of either or both of said analyzing devices with said printing device.

50 9. In a record controlled printing machine, a pre-reading station and a pair of data analyzing stations, printing mechanism controlled by said pair of data analyzing stations, means for feeding a record past each of said stations in succession and means controlled by said pre-reading
55 station in response to the analysis of the card thereat for determining the manner in which said pair of data analyzing stations shall control said printing mechanism.

GEORGE F. DALY.