

Sept. 1, 1959

F. E. HAMILTON ET AL

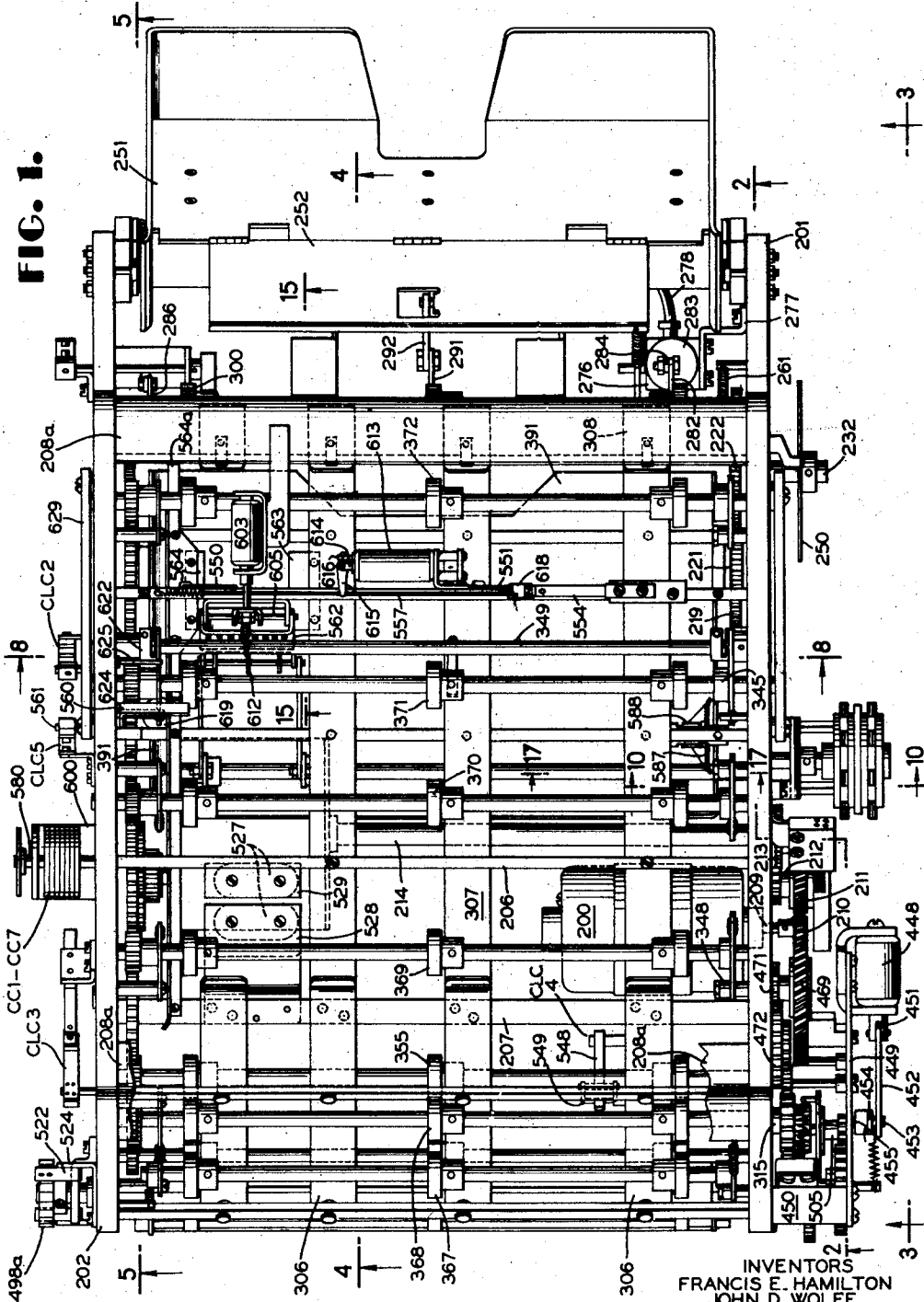
2,902,213

ACCOUNTING MACHINE

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38 Sheets-Sheet 1

FIG. 1.



INVENTORS
FRANCIS E. HAMILTON
JOHN D. WOLFE
CHARLES S. JACKOWSKI

BY
B.R. Guggen
AGENT

Sept. 1, 1959

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38 Sheets-Sheet 2

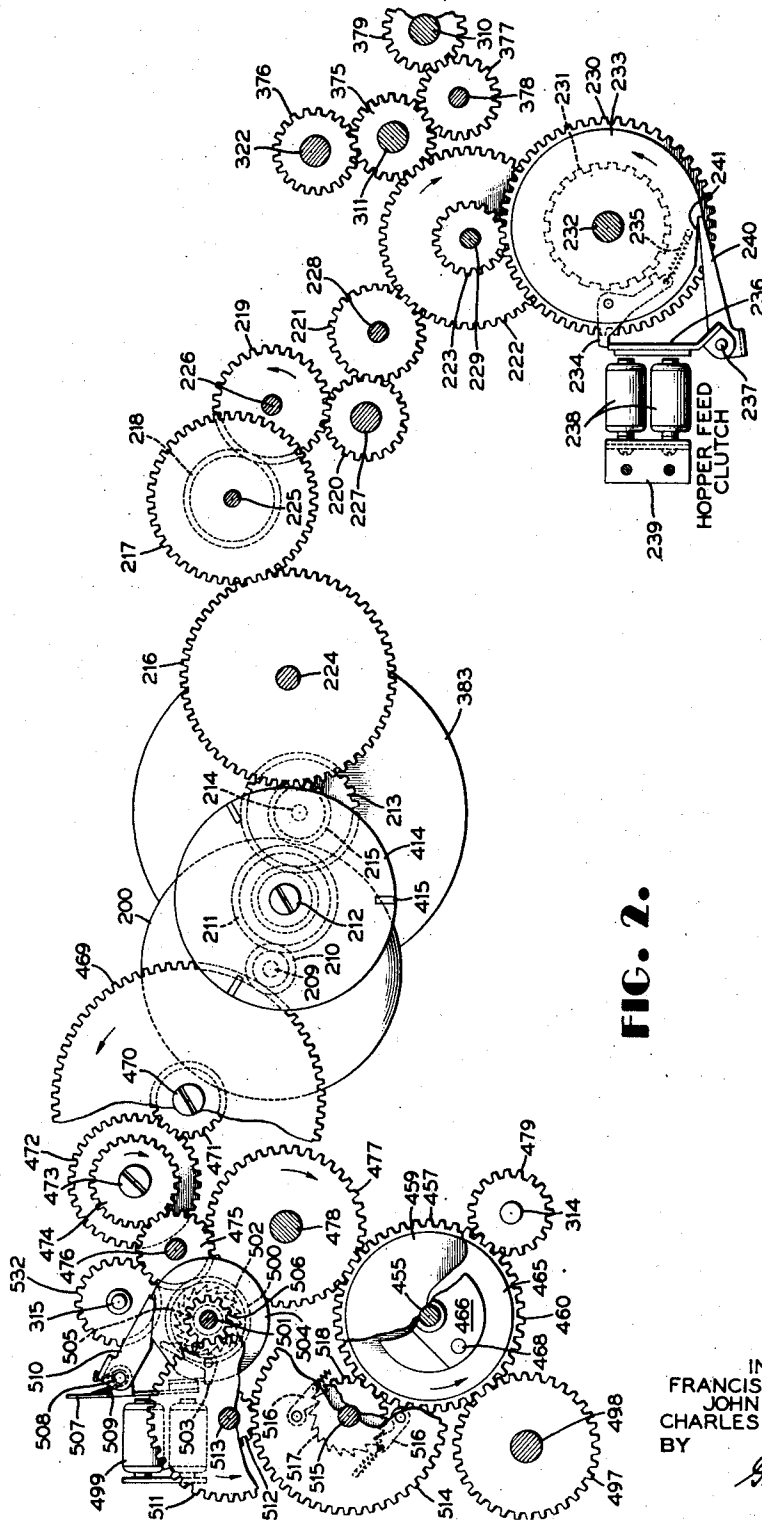


FIG. 2.

INVENTORS
FRANCIS E. HAMILTON
JOHN D. WOLFE
CHARLES S. JACKOWSKI
BY

G. R. Guggen
AGENT

Sept. 1, 1959

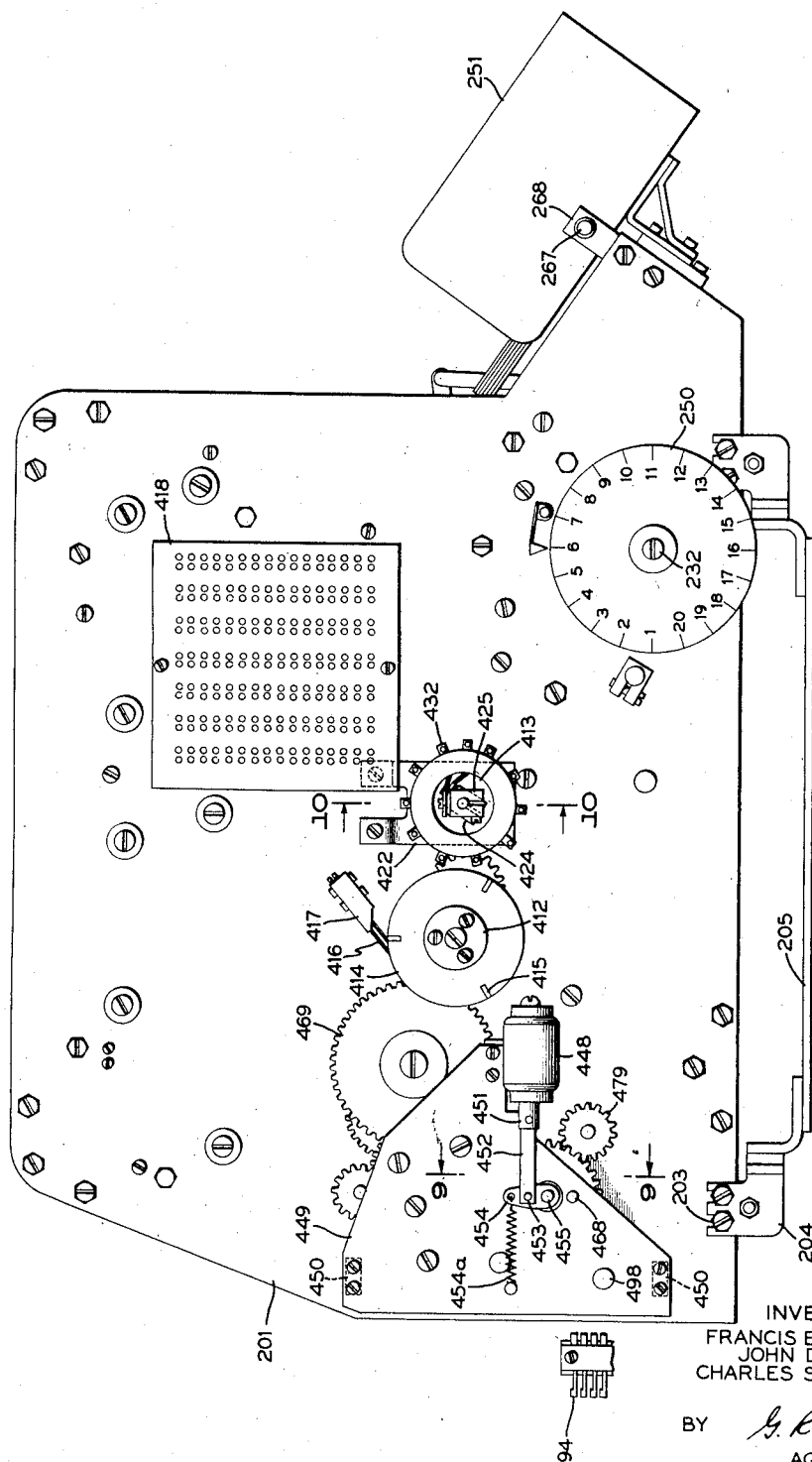
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38 Sheets-Sheet 3



INVENTORS

FRANCIS E. HAMILTON
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G. R. Guggen
AGENT

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ACCOUNTING MACHINE

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38 Sheets-Sheet 4

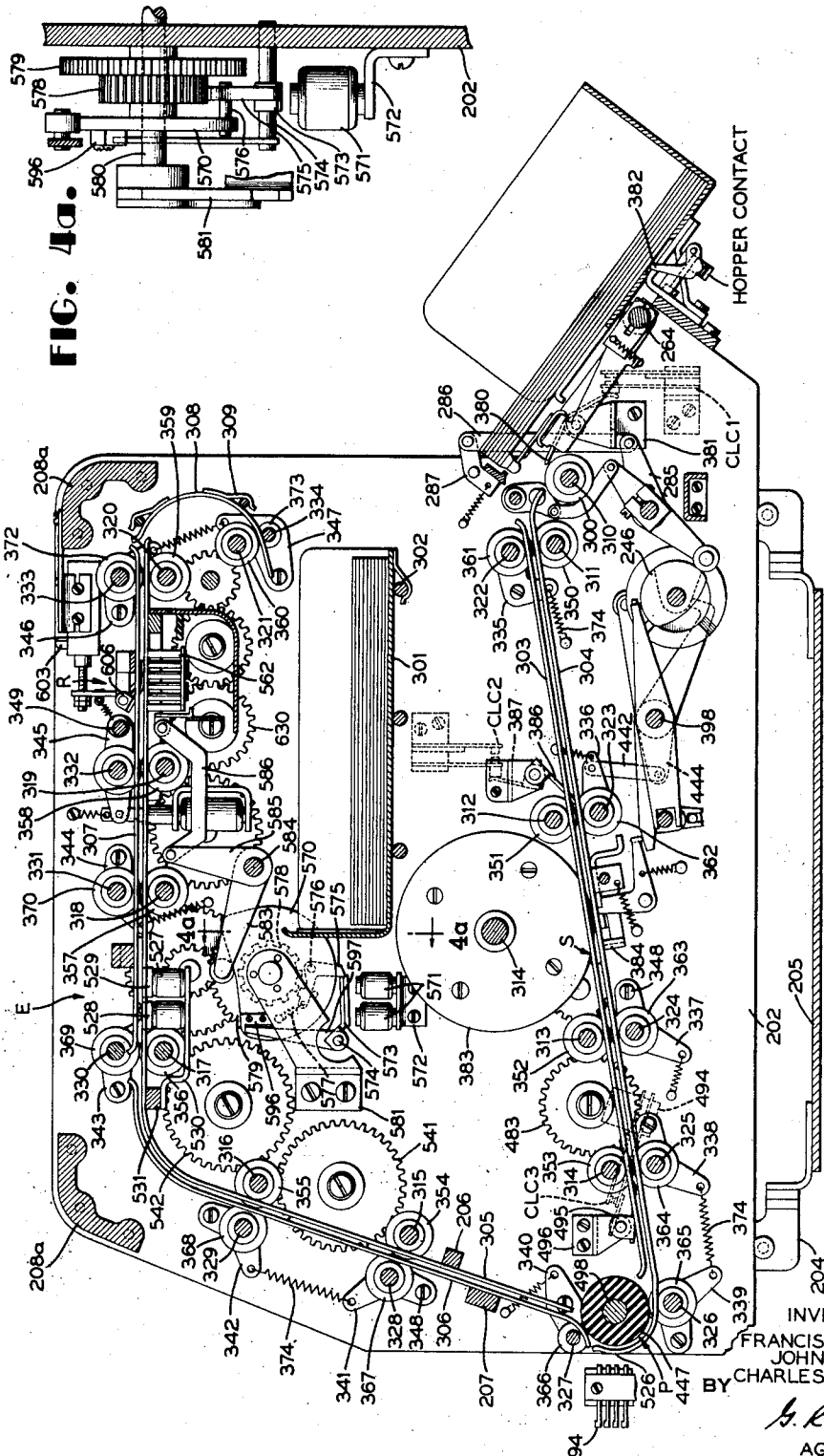


FIG. 4.

INVENTORS

FRANCIS E. HAMILTON

JOHN D. WOLFE

CHARLES S. JACKOWSKI

BY

B. R. Bygner
AGENT

Sept. 1, 1959

F. E. HAMILTON ET AL
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2,902,213

Filed Sept. 28, 1953

38 Sheets-Sheet 5

a - 1	bc - 6
b - 2	abc - 7
ab - 3	d - 8
c - 4	ad - 9
ac - 5	

FIG. 28.

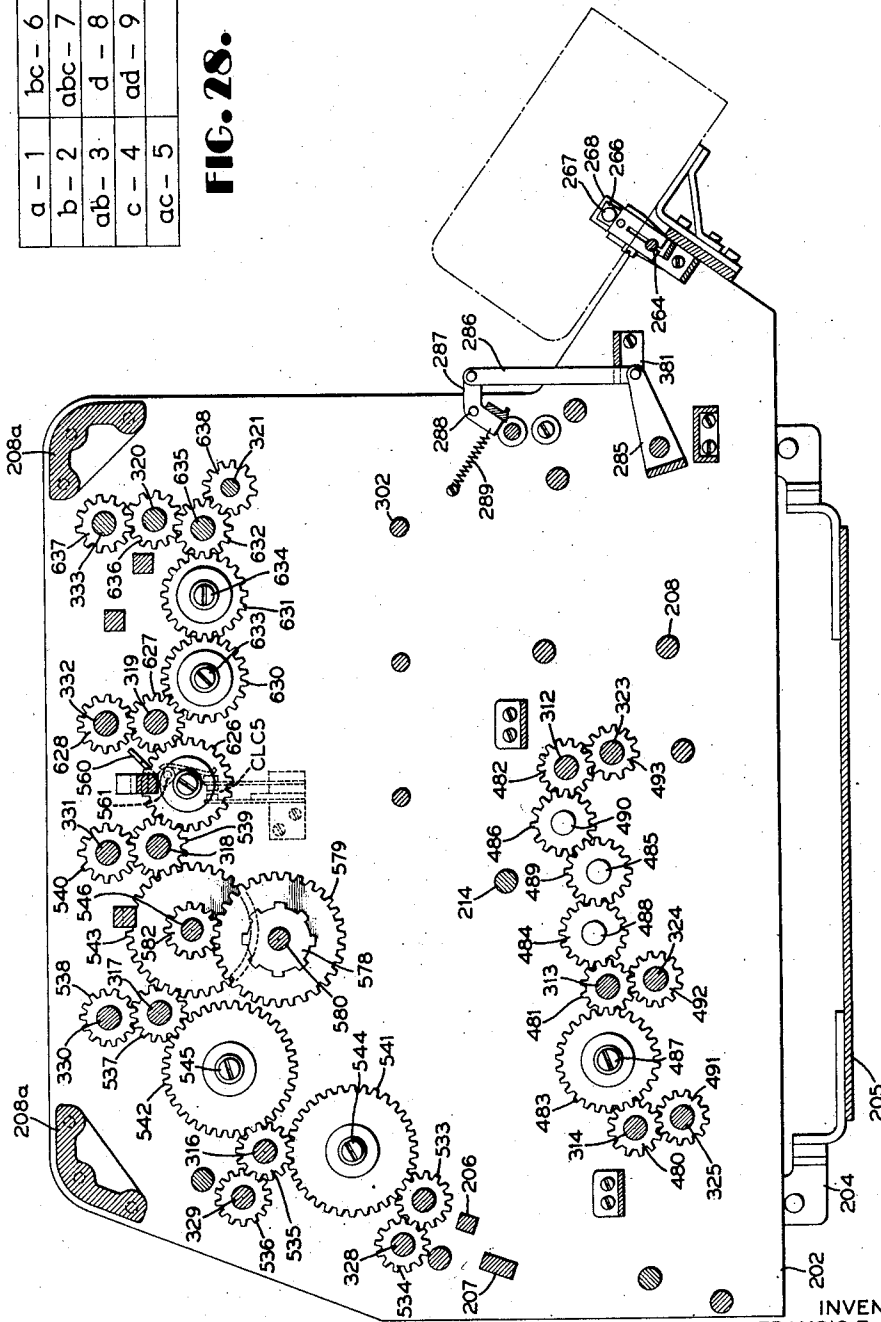


FIG. 5.

INVENTORS
FRANCIS E. HAMILTON
JOHN D. WOLFE
CHARLES S. JACKOWSKI
BY *G. R. Suggs*
AGENT

Sept. 1, 1959

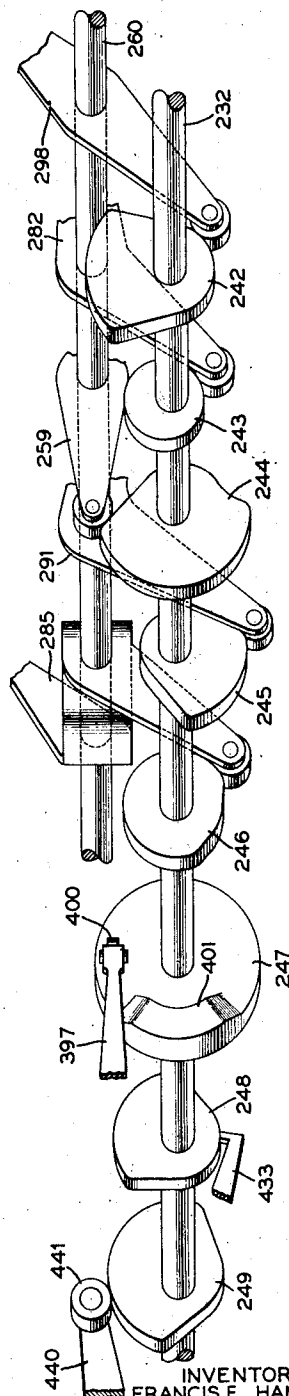
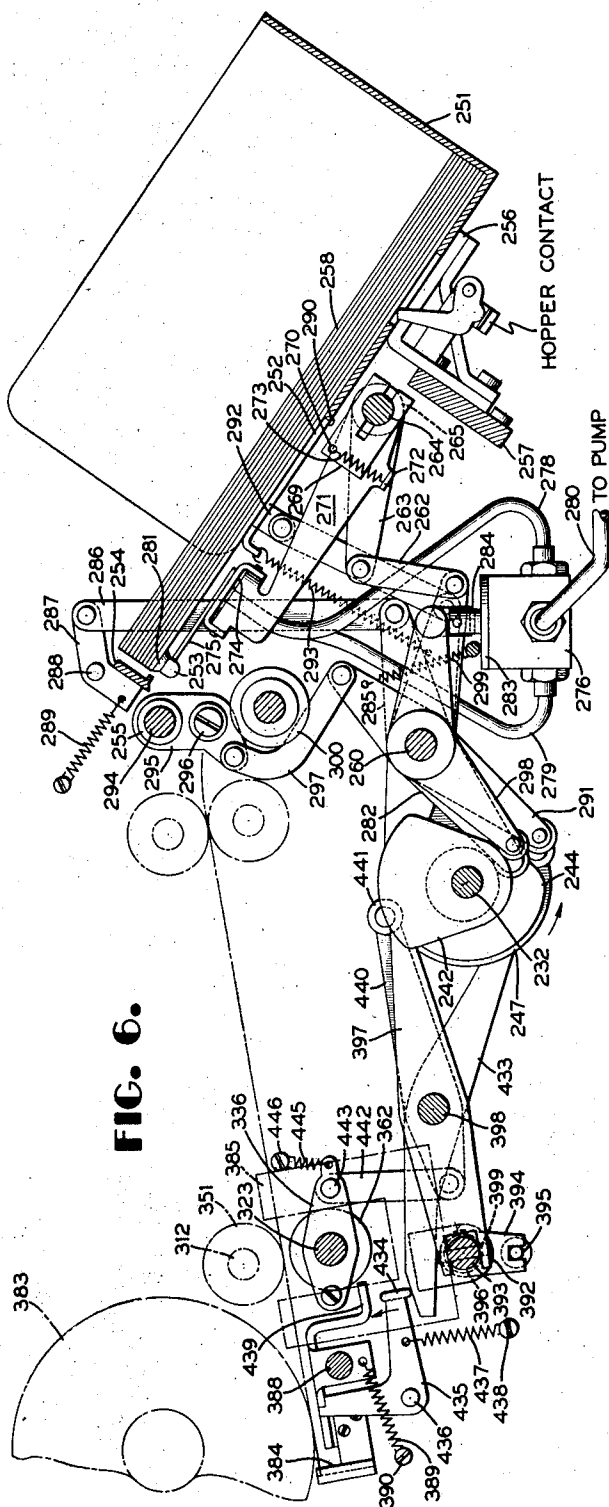
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ACCOUNTING MACHINE

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38 Sheets-Sheet 6



INVENTORS
FRANCIS E. HAMILTON
JOHN D. WOLFE
CHARLES S. JACKOWSKI
BY *H. R. Kugger*
AGENT

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F. E. HAMILTON ET AL
ACCOUNTING MACHINE

2,902,213

Filed Sept. 28, 1953

38 Sheets-Sheet 7

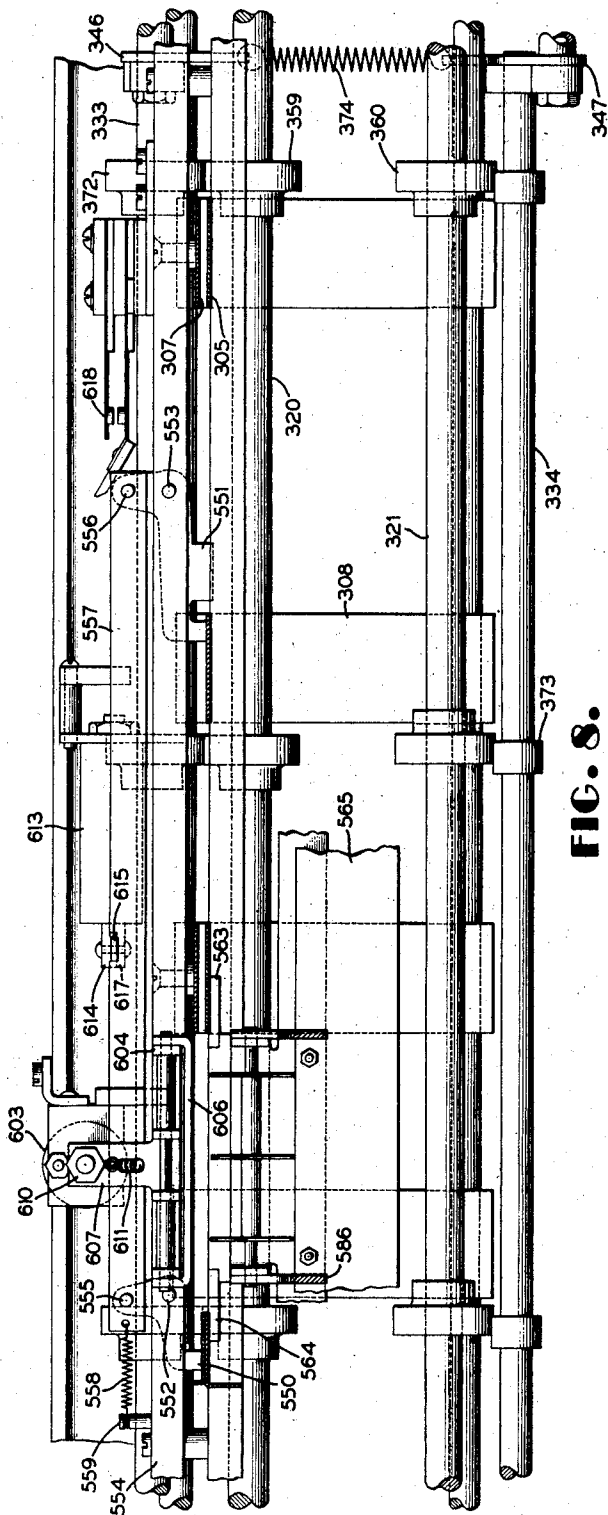


FIG. 8.

		COLUMN																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
a	1-2	8-9	15-16	22-23	29-30	36-37	43-44	50-51	57-58	64-65	71	75	79	84	88	188	216	220	224	228	232
b	3-4	10-11	17-18	24-25	31-32	38-39	45-46	52-53	59-60	66-67	72	76	80	85	89	189	217	221	225	229	233
c	5-6	12-13	19-20	26-27	33-34	40-41	47-48	54-55	61-62	68-69	73	77	82	86	90	190	218	222	226	230	234
d	7	14	21	28	35	42	49	56	63	70	74	78	83	87	191	219	223	227	231	235	

CODE RELAYS

INVENTORS
FRANCIS E. HAMILTON
JOHN D. WOLFE
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BY

H. R. Huggen
AGENT

FIG. 29.

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2,902,213

ACCOUNTING MACHINE

Filed Sept. 28, 1953

38 Sheets-Sheet 8

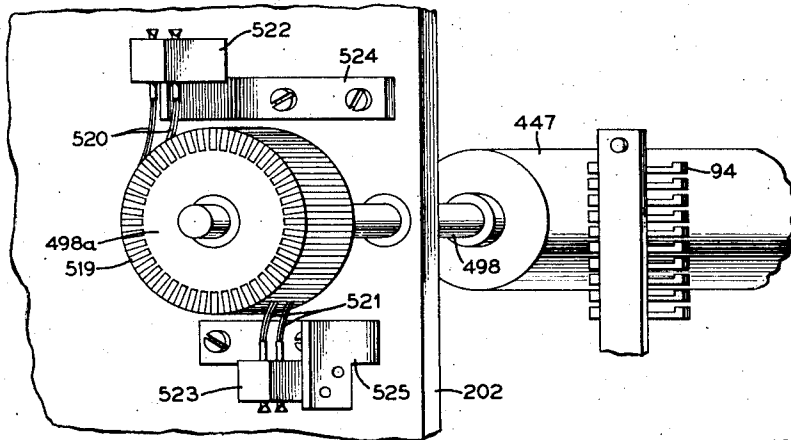


FIG. 11.

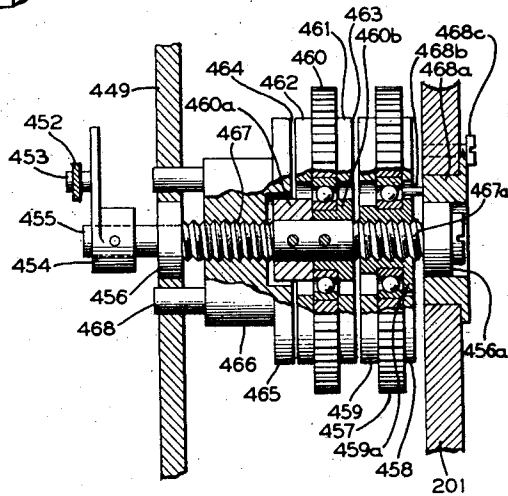


FIG. 9.

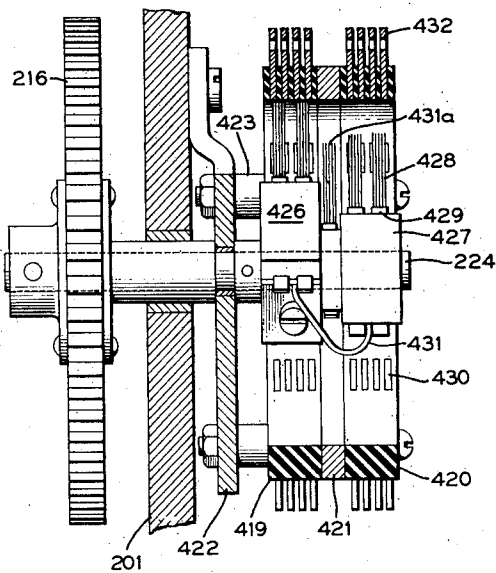


FIG. 10.

INVENTORS
FRANCIS E. HAMILTON
JOHN D. WOLFE
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BY

G. R. Suggs
AGENT

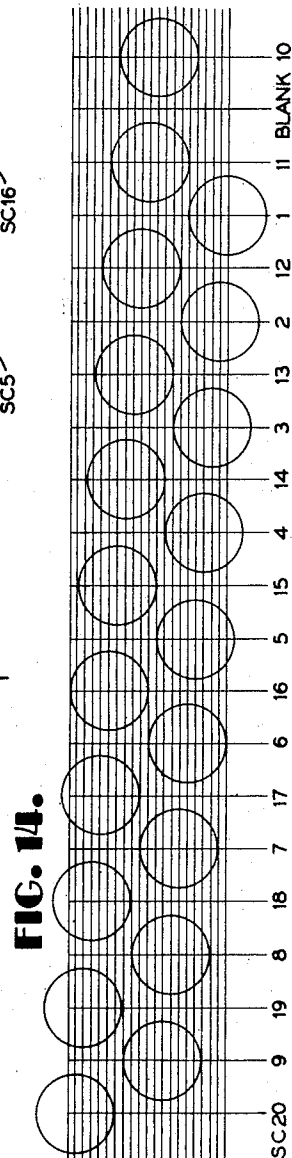
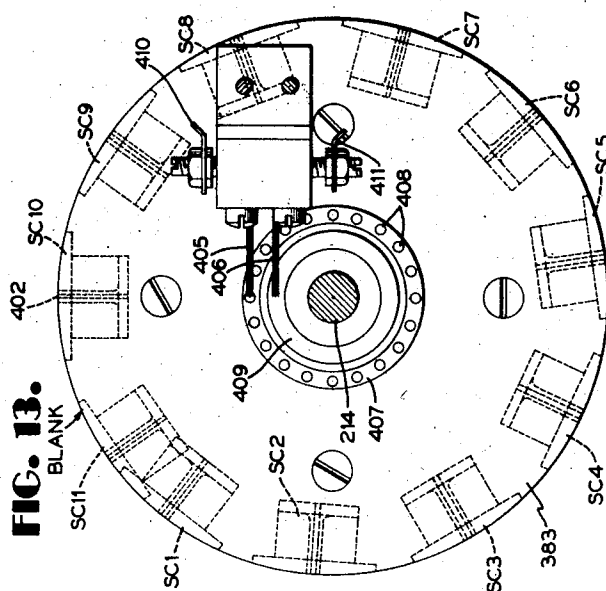
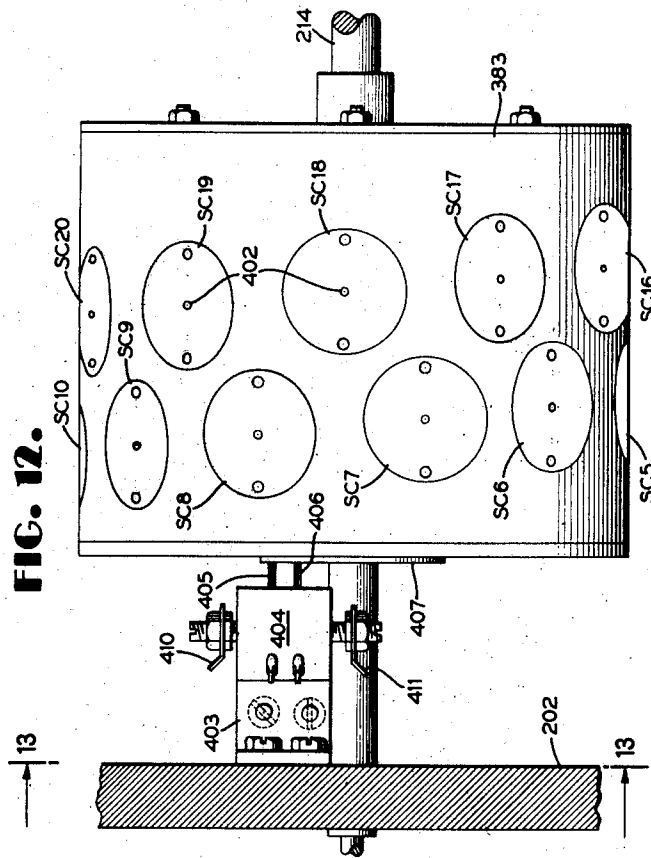
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ACCOUNTING MACHINE

2,902,213

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38 Sheets-Sheet 9



INVENTORS
FRANCIS E. HAMILTON
JOHN D. WOLFE
CHARLES S. JACKOWSKI
BY *G. R. Epper*
AGENT

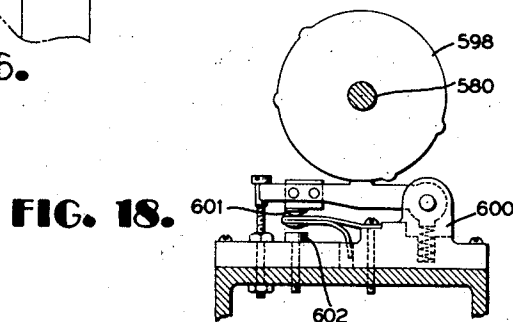
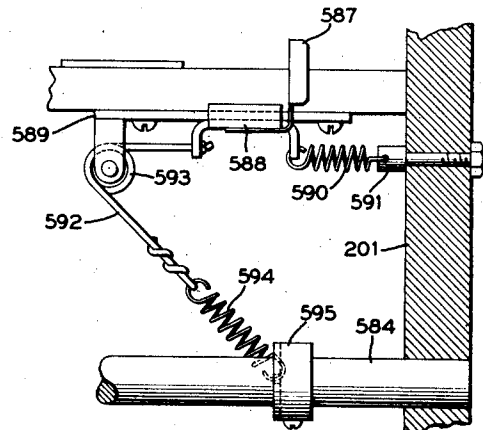
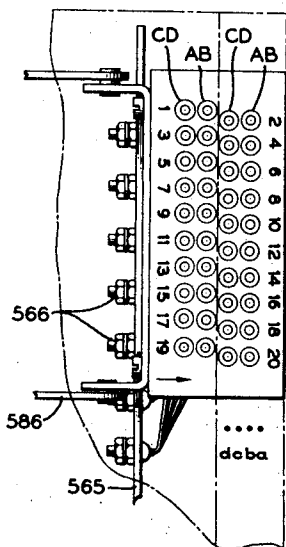
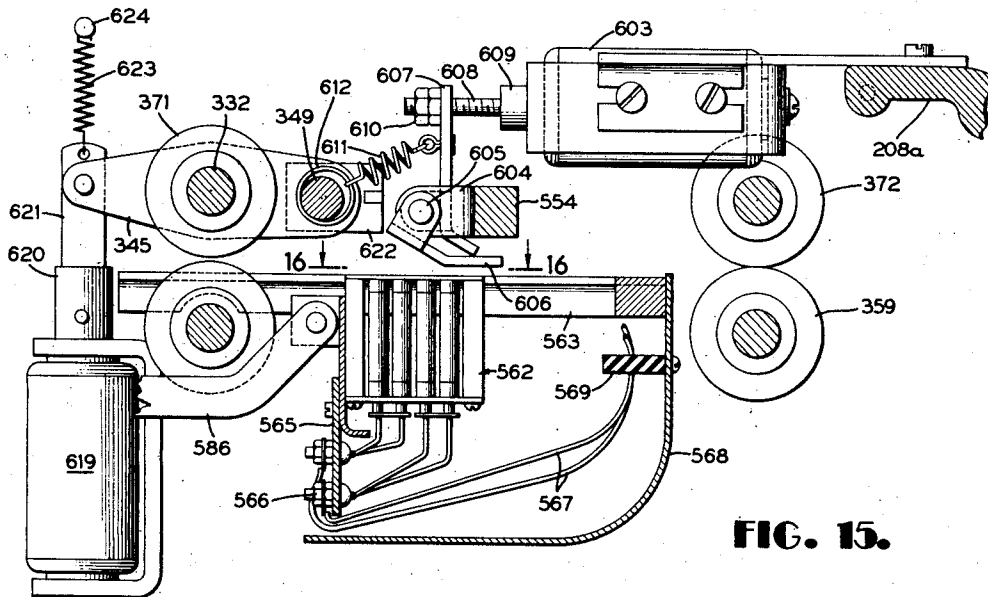
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2,902,213

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38 Sheets-Sheet 10



INVENTORS
FRANCIS E. HAMILTON
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G. R. Guggen
AGENT

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2,902,213

Filed Sept. 28, 1953

38 Sheets-Sheet 11

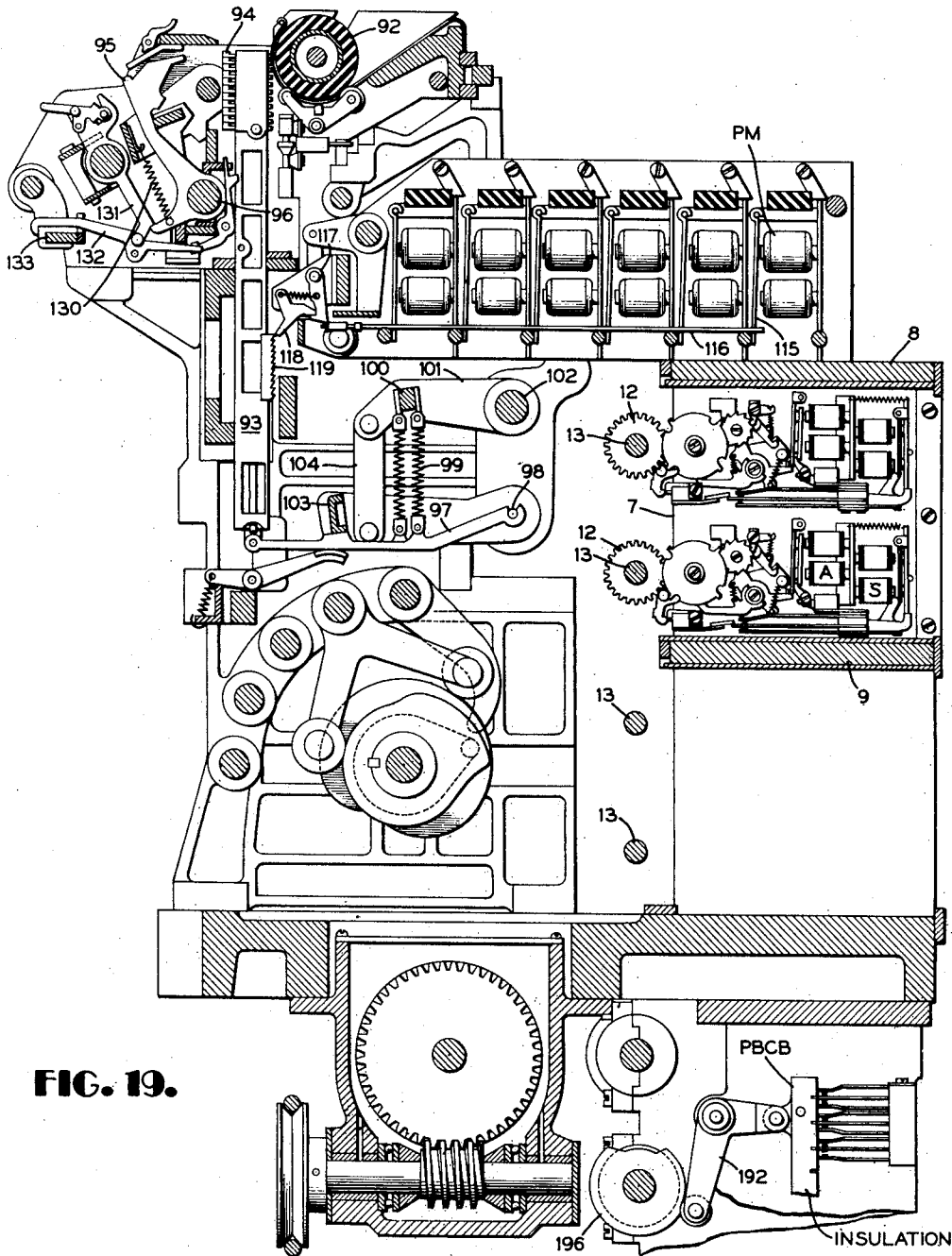


FIG. 19.

INVENTORS
FRANCIS E. HAMILTON
JOHN D. WOLFE
CHARLES S. JACKOWSKI
BY *G. R. Kugler*
AGENT

Sept. 1, 1959

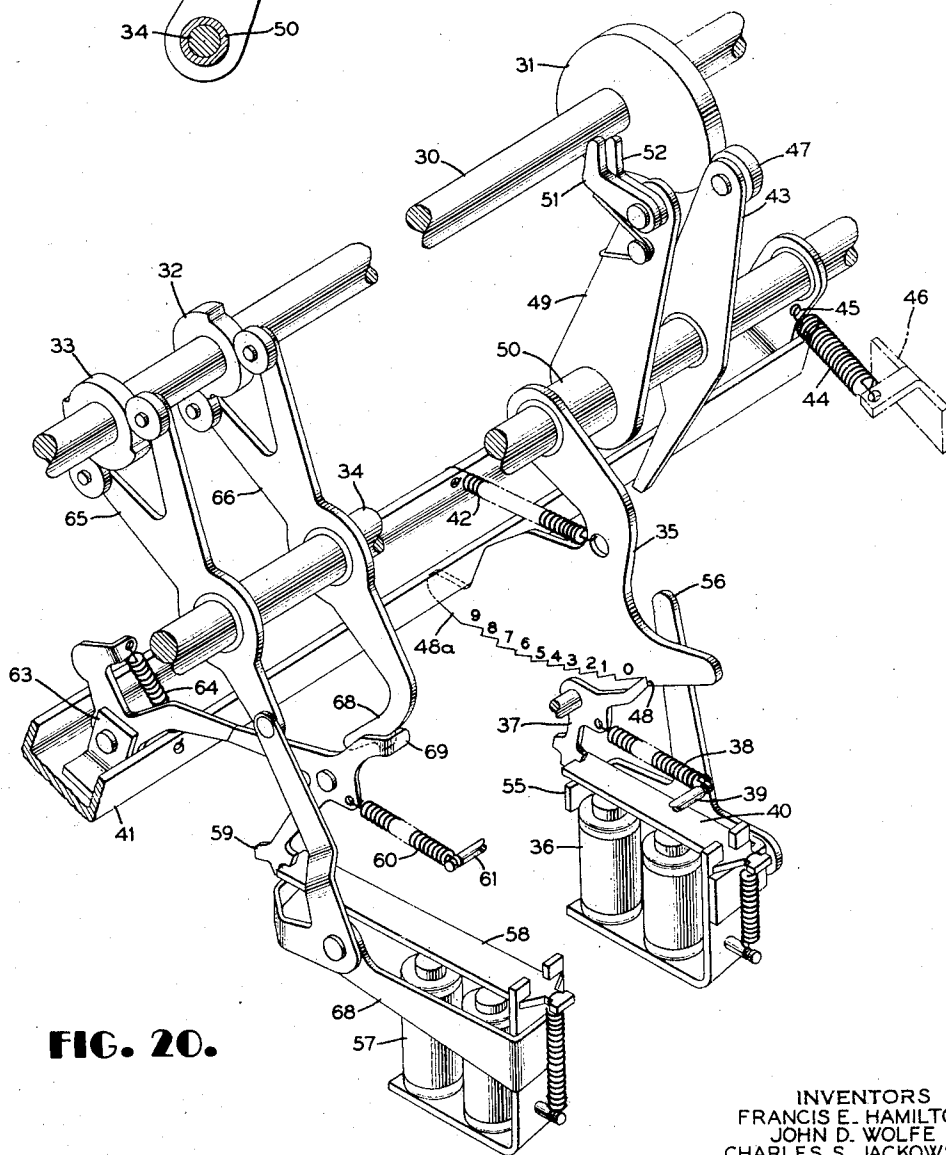
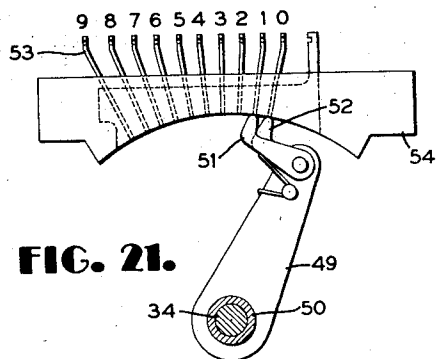
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2,902,213

ACCOUNTING MACHINE

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38 Sheets-Sheet 12



INVENTORS
FRANCIS E. HAMILTON
JOHN D. WOLFE
CHARLES S. JACKOWSKI
BY *B. R. Suggs*
AGENT

Sept. 1, 1959

F. E. HAMILTON ET AL

2,902,213

ACCOUNTING MACHINE

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38 Sheets-Sheet 13

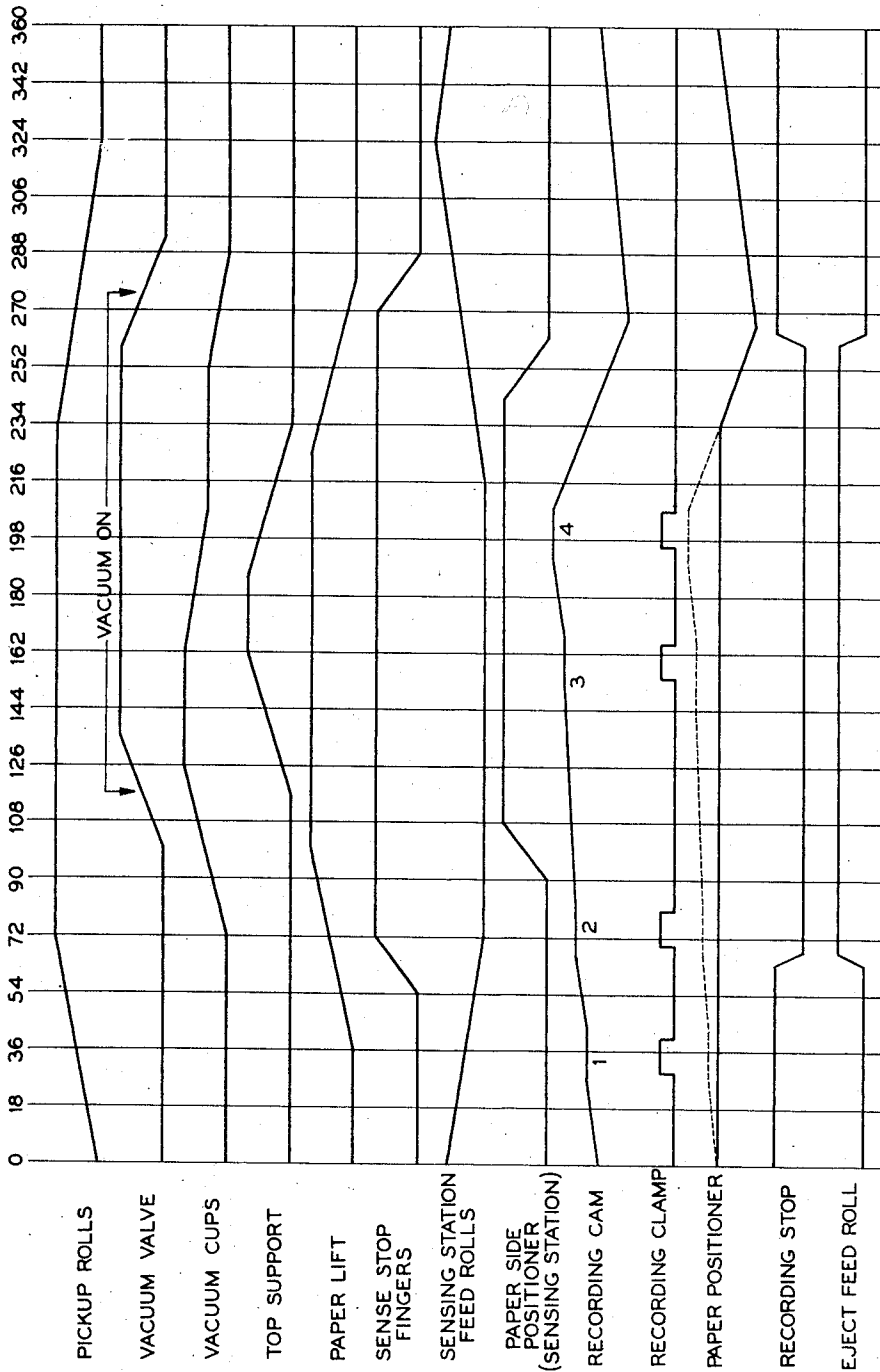


FIG. 22.

INVENTORS
FRANCIS E. HAMILTON
JOHN D. WOLFE
CHARLES S. JACKOWSKI

BY

H. L. Gugga
AGENT

Sept. 1, 1959

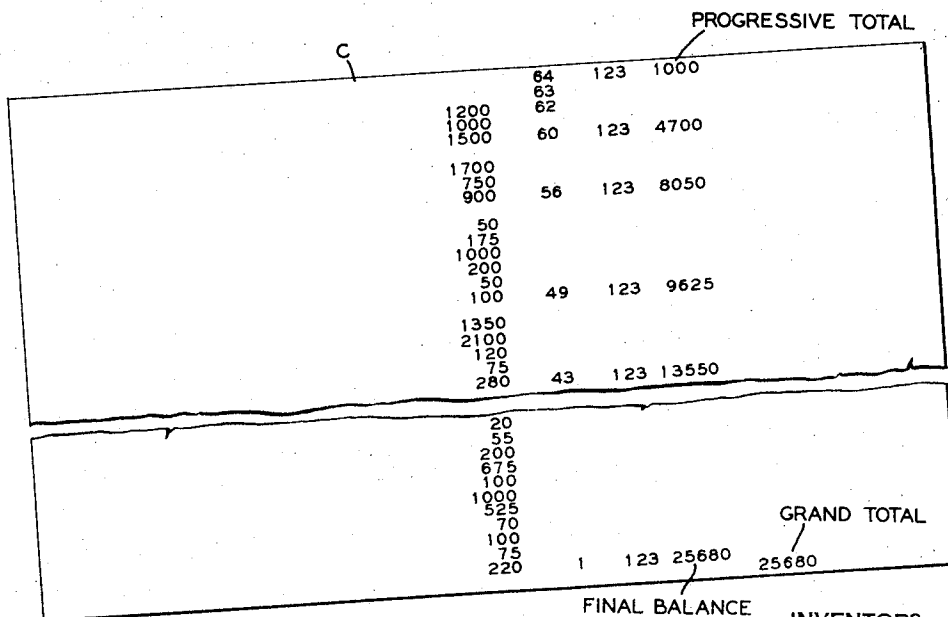
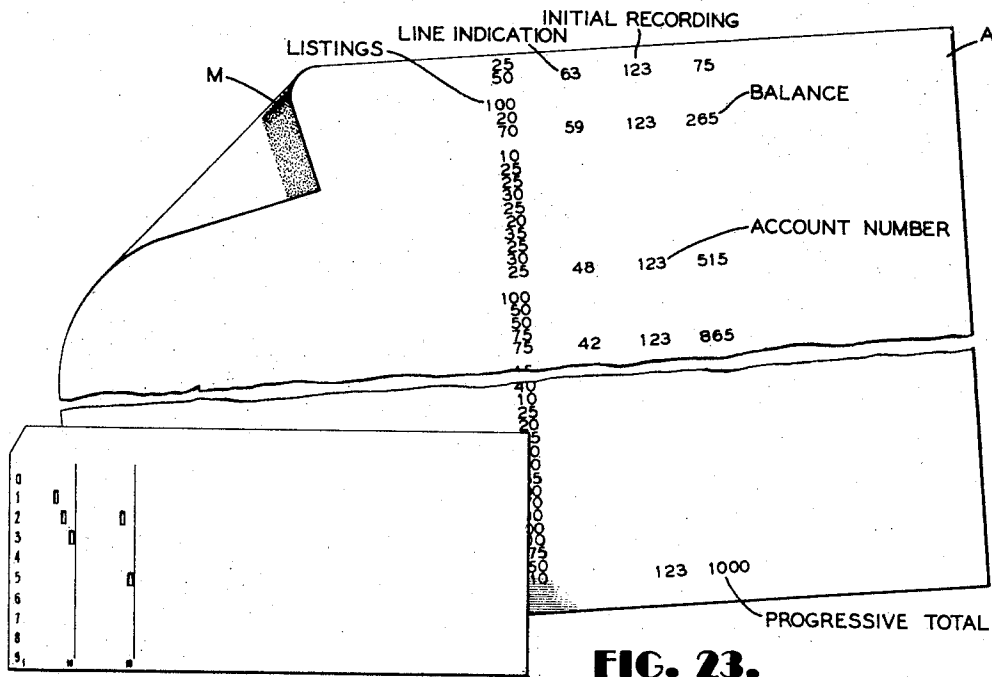
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2,902,213

ACCOUNTING MACHINE

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38 Sheets-Sheet 14



BALANCE INVENTORS
FRANCIS E. HAMILTON
JOHN D. WOLFE
BY CHARLES S. JACKOWSKI
C. S. Jackowski
AGENT

Sept. 1, 1959

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2,902,213

ACCOUNTING MACHINE

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38 Sheets-Sheet 15

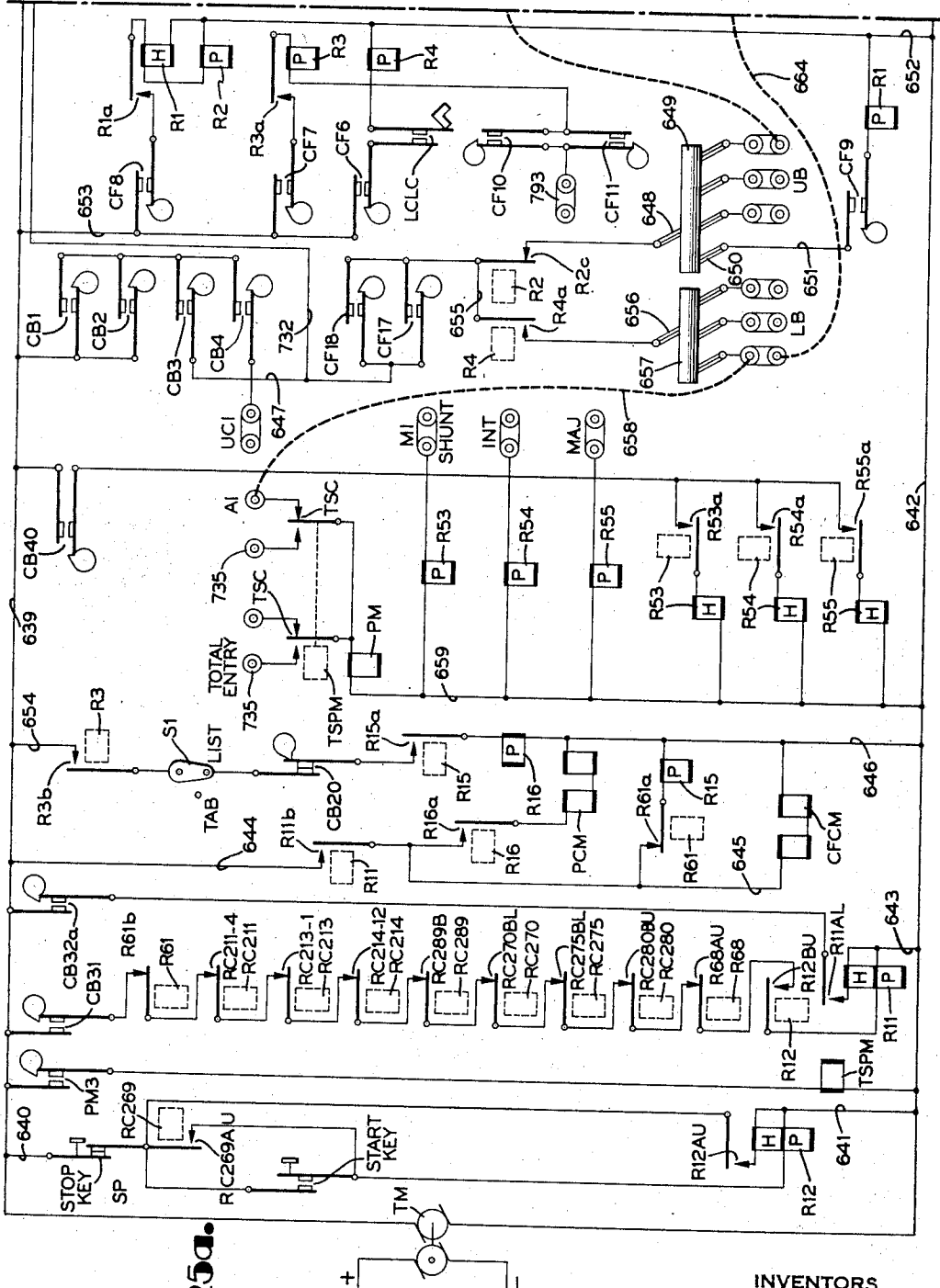


FIG. 25a.

INVENTORS
FRANCIS E. HAMILTON
JOHN D. WOLFE
CHARLES S. JACKOWSKI
BY
B. R. Kugger
AGENT

2,902,213

38 Sheets-Sheet 16

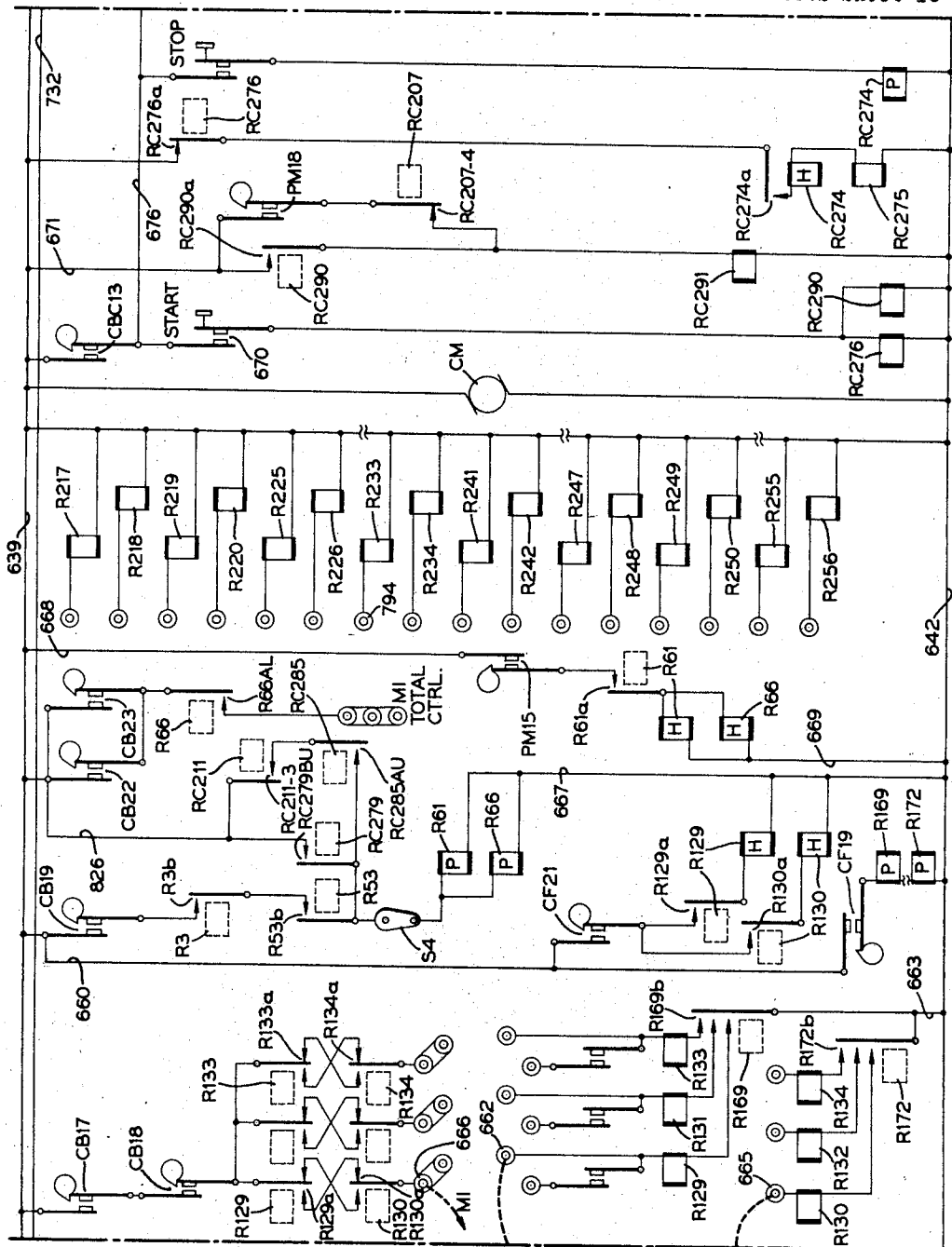


FIG. 25b.

INVENTORS
FRANCIS E. HAMILTON
JOHN D. WOLFE
CHARLES S. JACKOWSKI
BY

G. R. Guggen
AGENT

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38 Sheets-Sheet 19

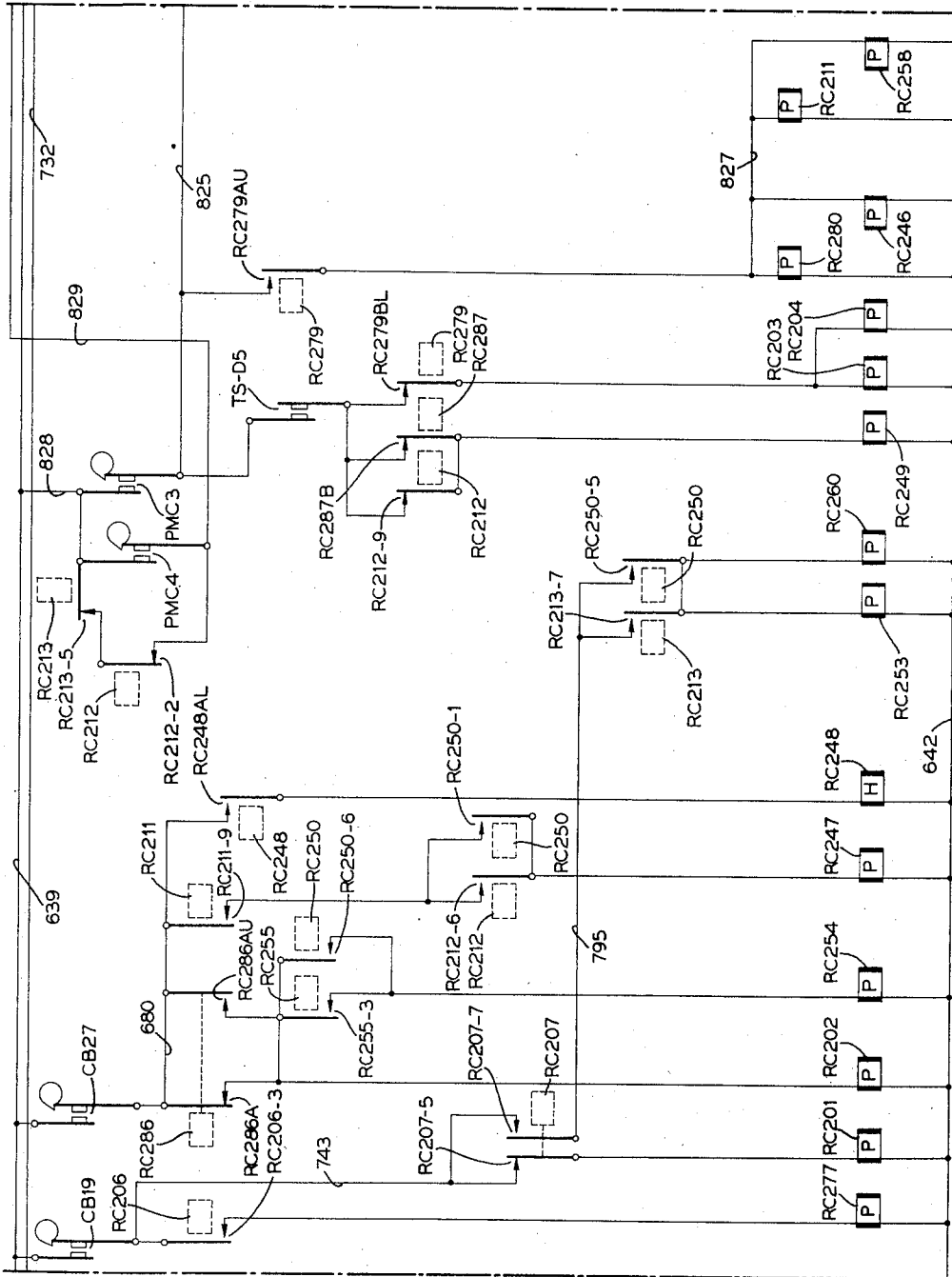


FIG. 25e.

G. L. Guggen
AGENT

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2,902,213

ACCOUNTING MACHINE

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38 Sheets-Sheet 21

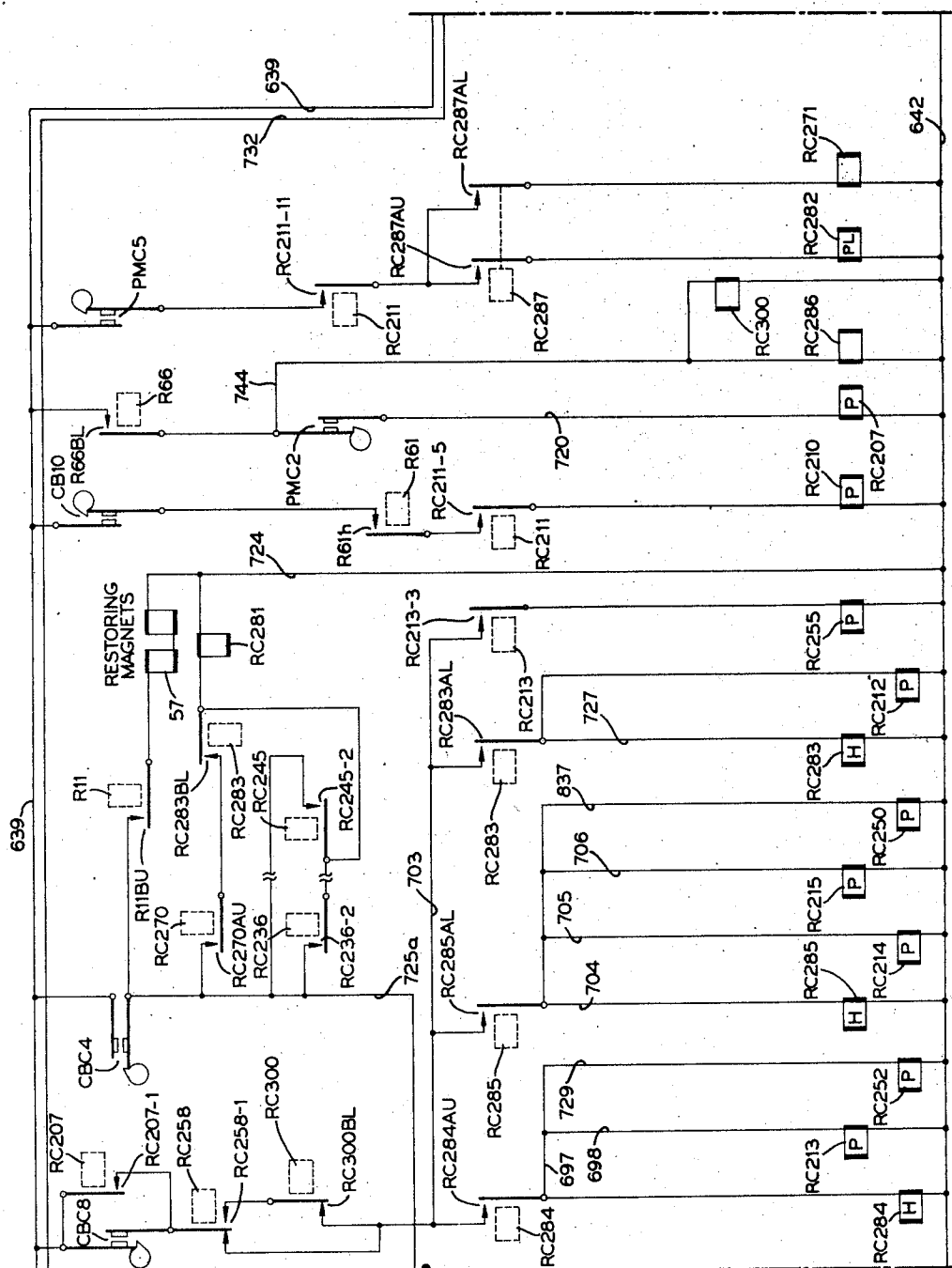


FIG. 25g.

BY

INVENTORS
FRANCIS E. HAMILTON
JOHN D. WOLFE
CHARLES S. JACKOWSKI

B. L. Gagner
AGENT

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ACCOUNTING MACHINE

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38 Sheets-Sheet 22

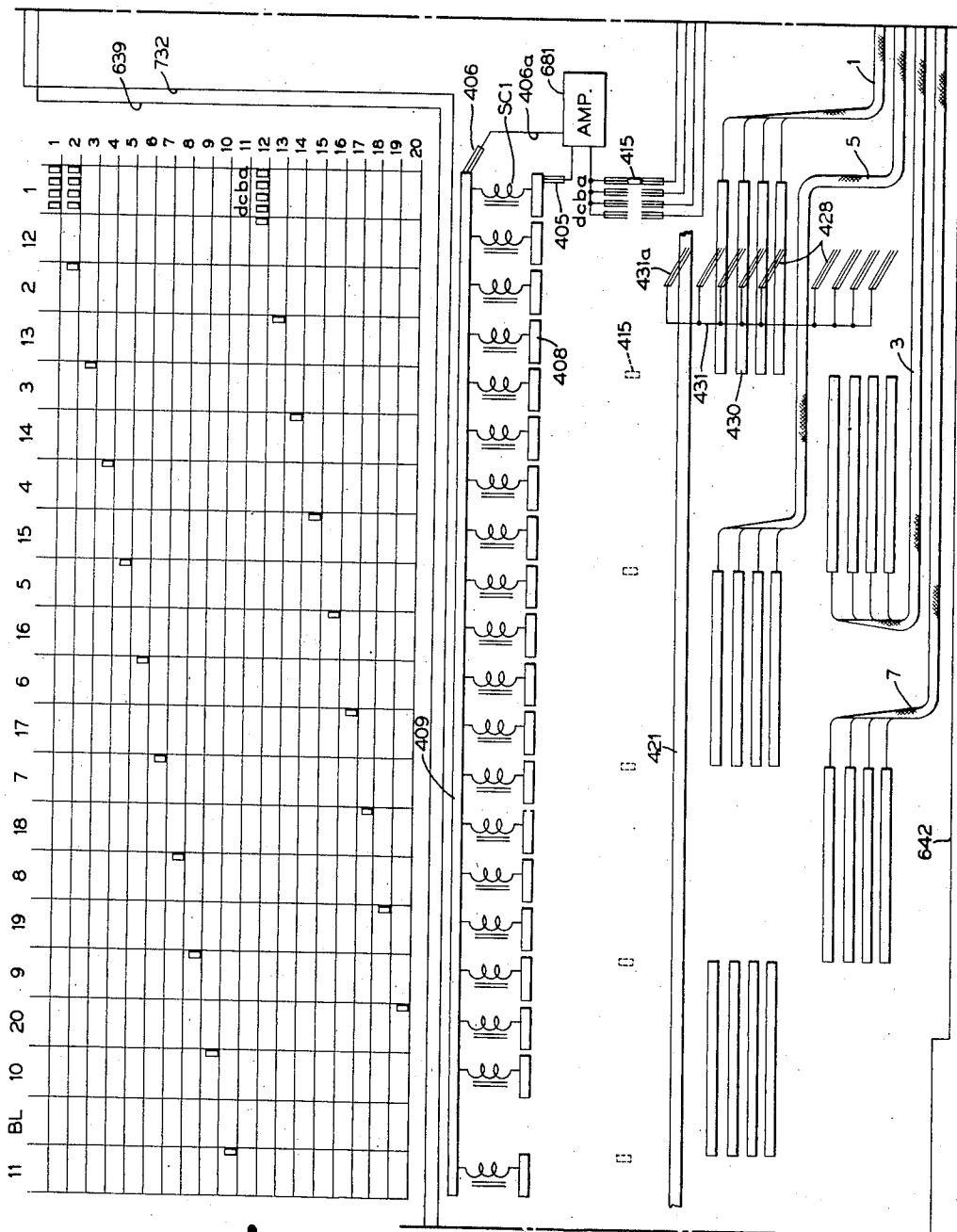


FIG. 25h.

INVENTORS
FRANCIS E. HAMILTON
JOHN D. WOLFE
CHARLES S. JACKOWSKI

BY

B.R. Gugga
AGENT

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38 Sheets-Sheet 23

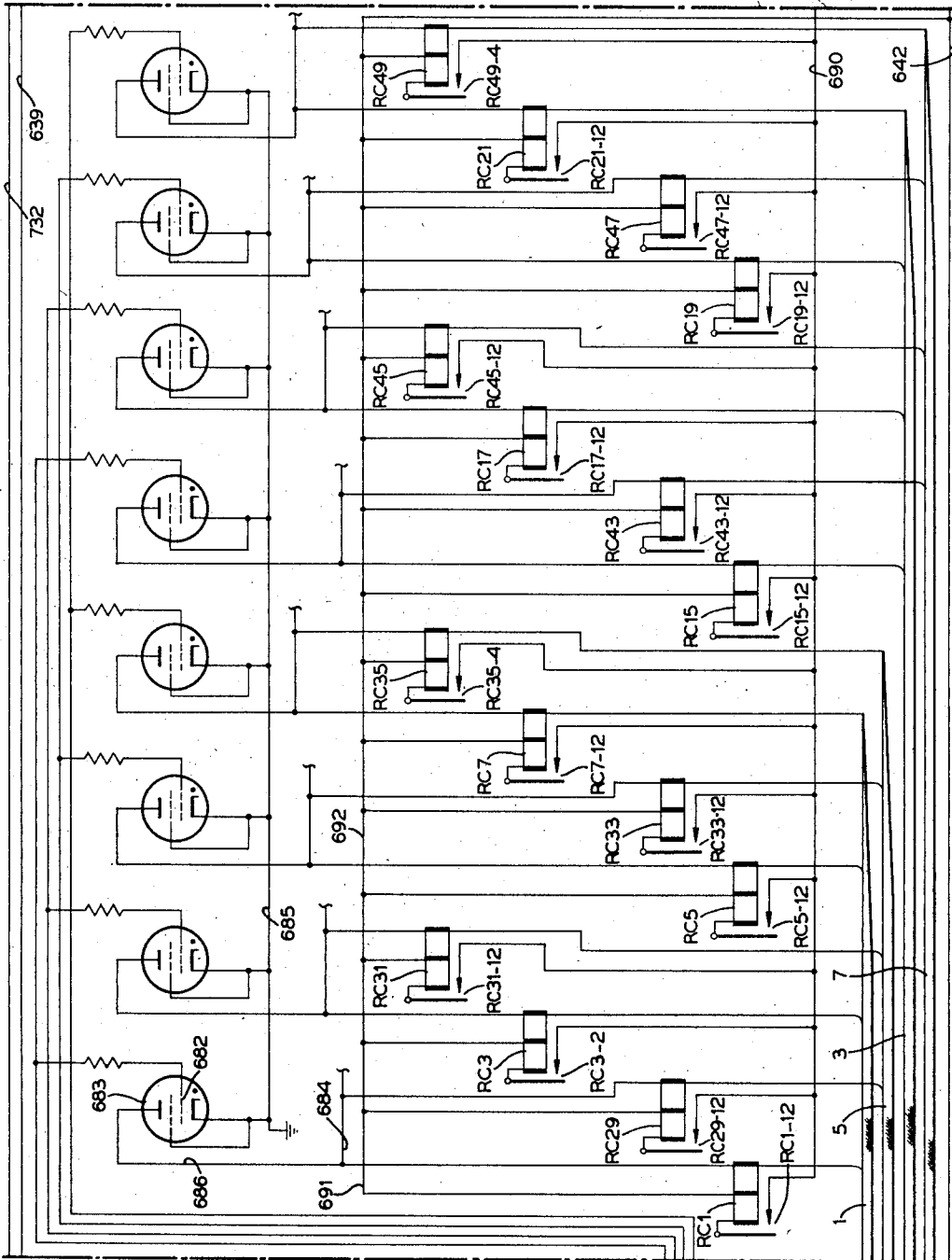


FIG. 25i.

INVENTORS
FRANCIS E. HAMILTON
JOHN D. WOLFE
CHARLES S. JACKOWSKI

BY *G. L. Kupper*
AGENT

Sept. 1, 1959

F. E. HAMILTON ET AL

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ACCOUNTING MACHINE

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38 Sheets-Sheet 24

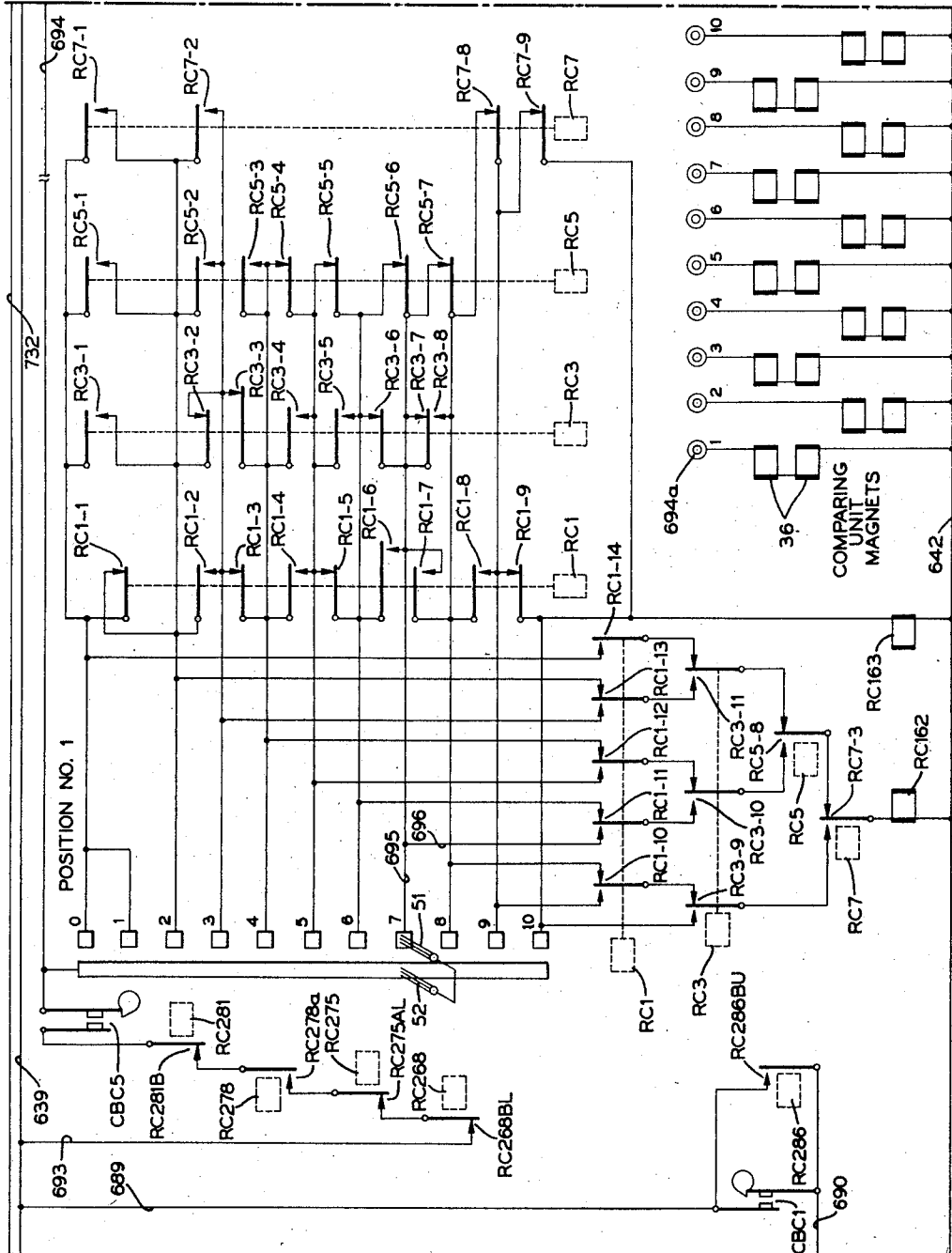


FIG. 25j.

INVENTORS
FRANCIS E. HAMILTON
JOHN D. WOLFE
CHARLES S. JACKOWSKI

BY

h. l. Kugler
AGENT

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ACCOUNTING MACHINE

Filed Sept. 28, 1953

38 Sheets-Sheet 25

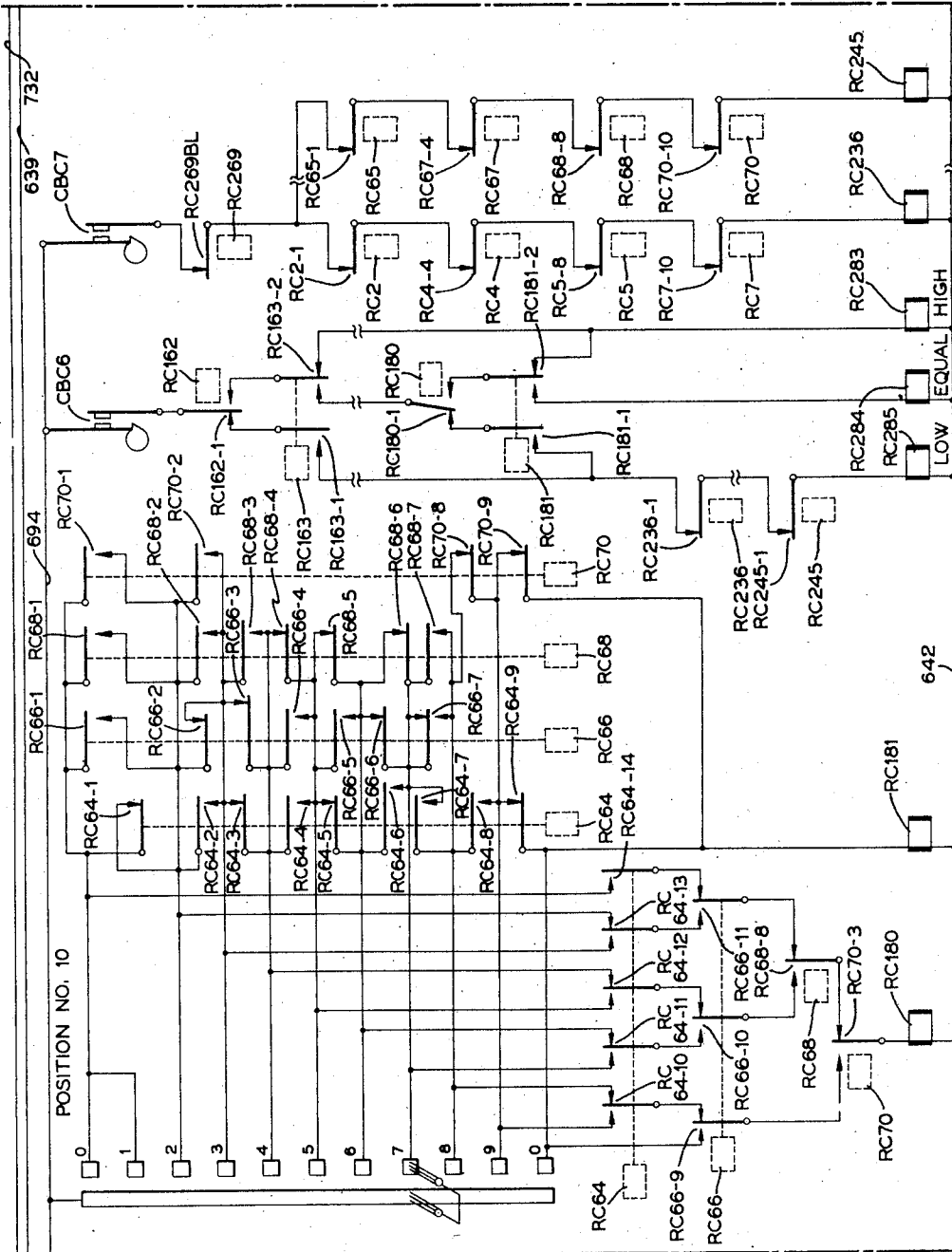


FIG. 25k.

INVENTORS
FRANCIS E. HAMILTON
JOHN D. WOLFE
CHARLES S. JACKOWSKI

BY

S. R. Kugger
AGENT

Sept. 1, 1959

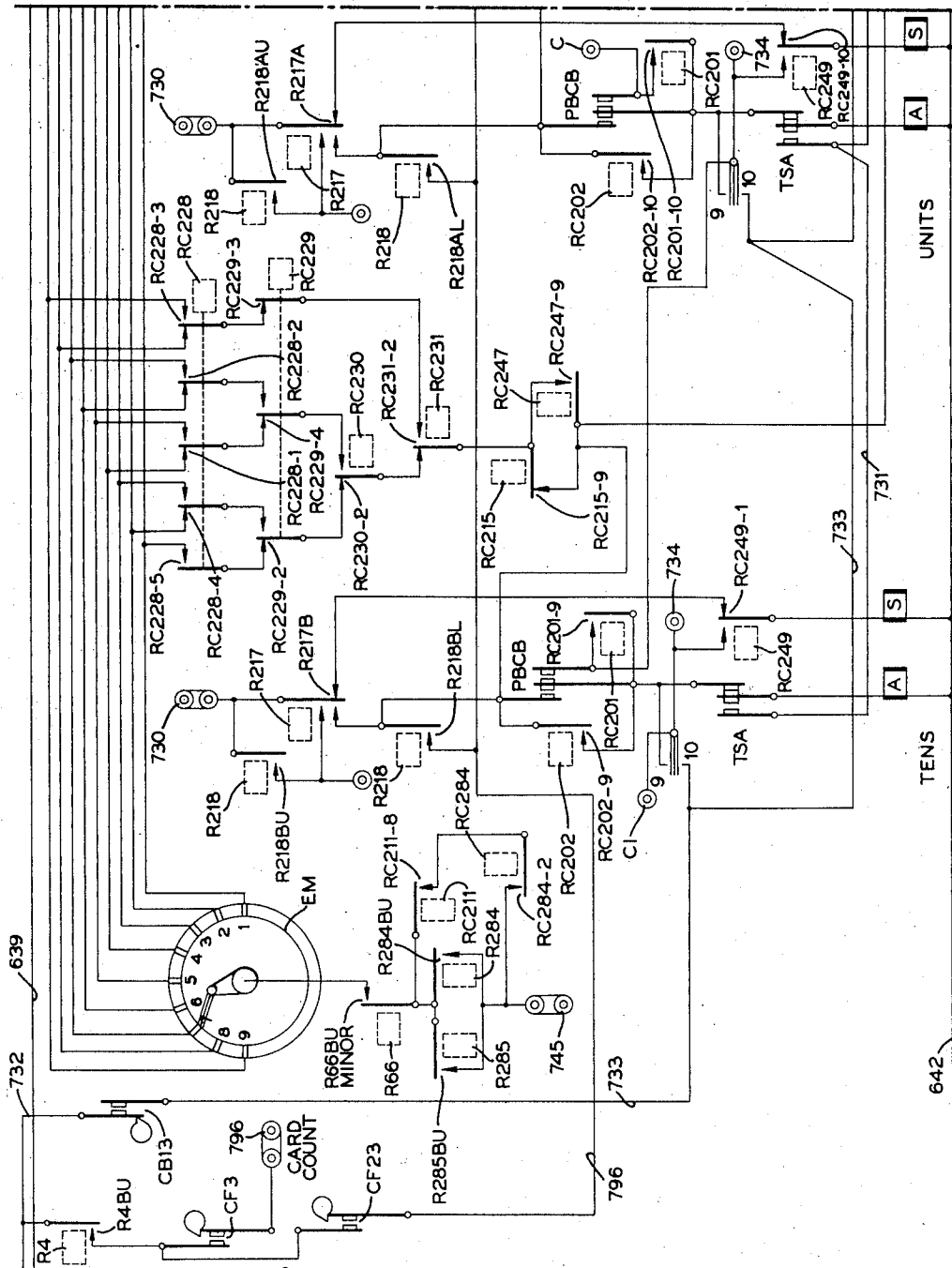
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2,902,213

ACCOUNTING MACHINE

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38 Sheets-Sheet 26



INVENTORS
FRANCIS E. HAMILTON
JOHN D. WOLFE
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G. R. Guggen
AGENT

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ACCOUNTING MACHINE

Filed Sept. 28, 1953

38 Sheets-Sheet 27

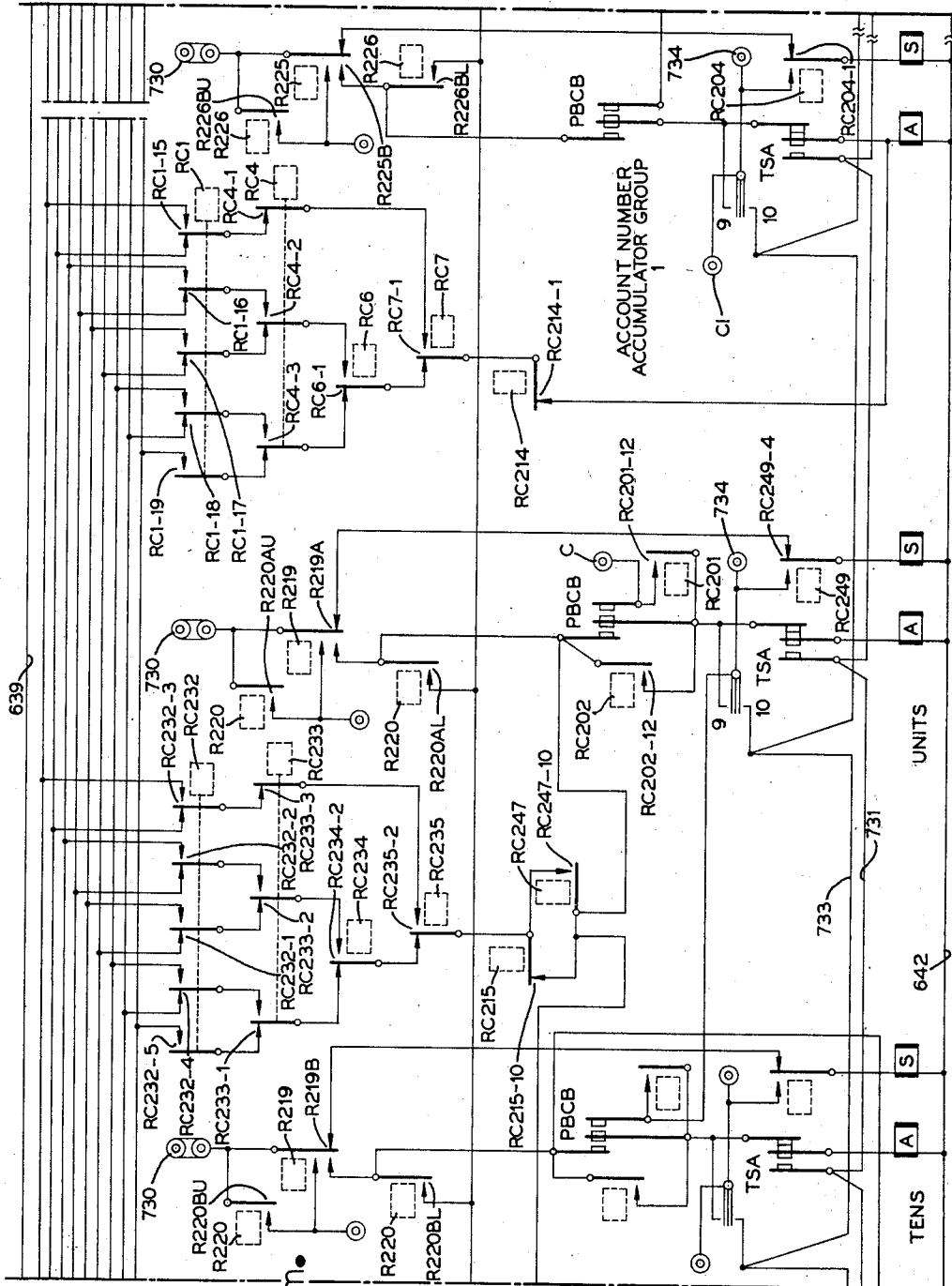


FIG. 25m.

INVENTORS
FRANCIS E. HAMILTON
JOHN D. WOLFE
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BY

G. R. Guggen
AGENT

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ACCOUNTING MACHINE

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38 Sheets-Sheet 28

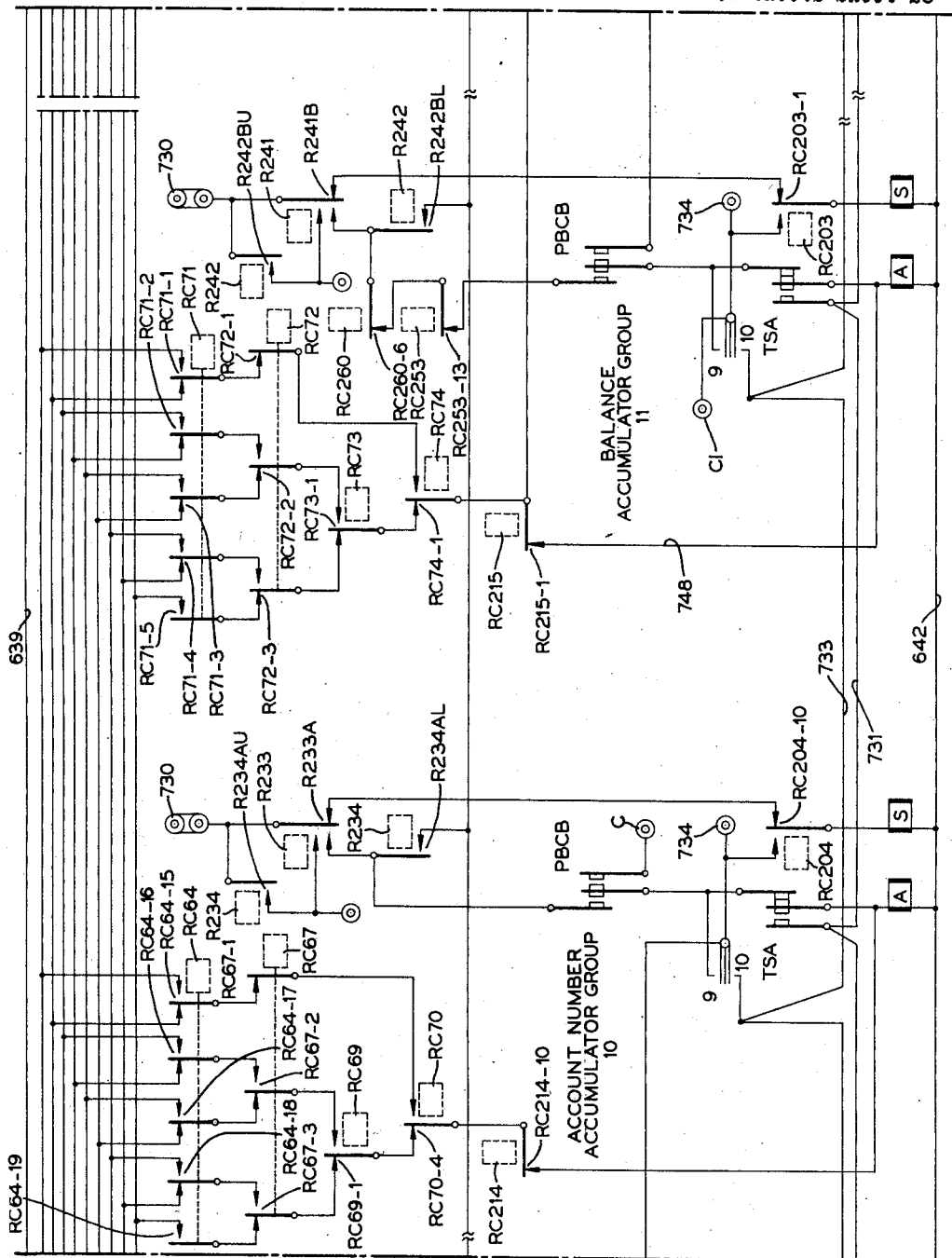


FIG. 25n.

INVENTORS
FRANCIS E. HAMILTON
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BY

B. L. Suggs
AGENT

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ACCOUNTING MACHINE

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38 Sheets-Sheet 29

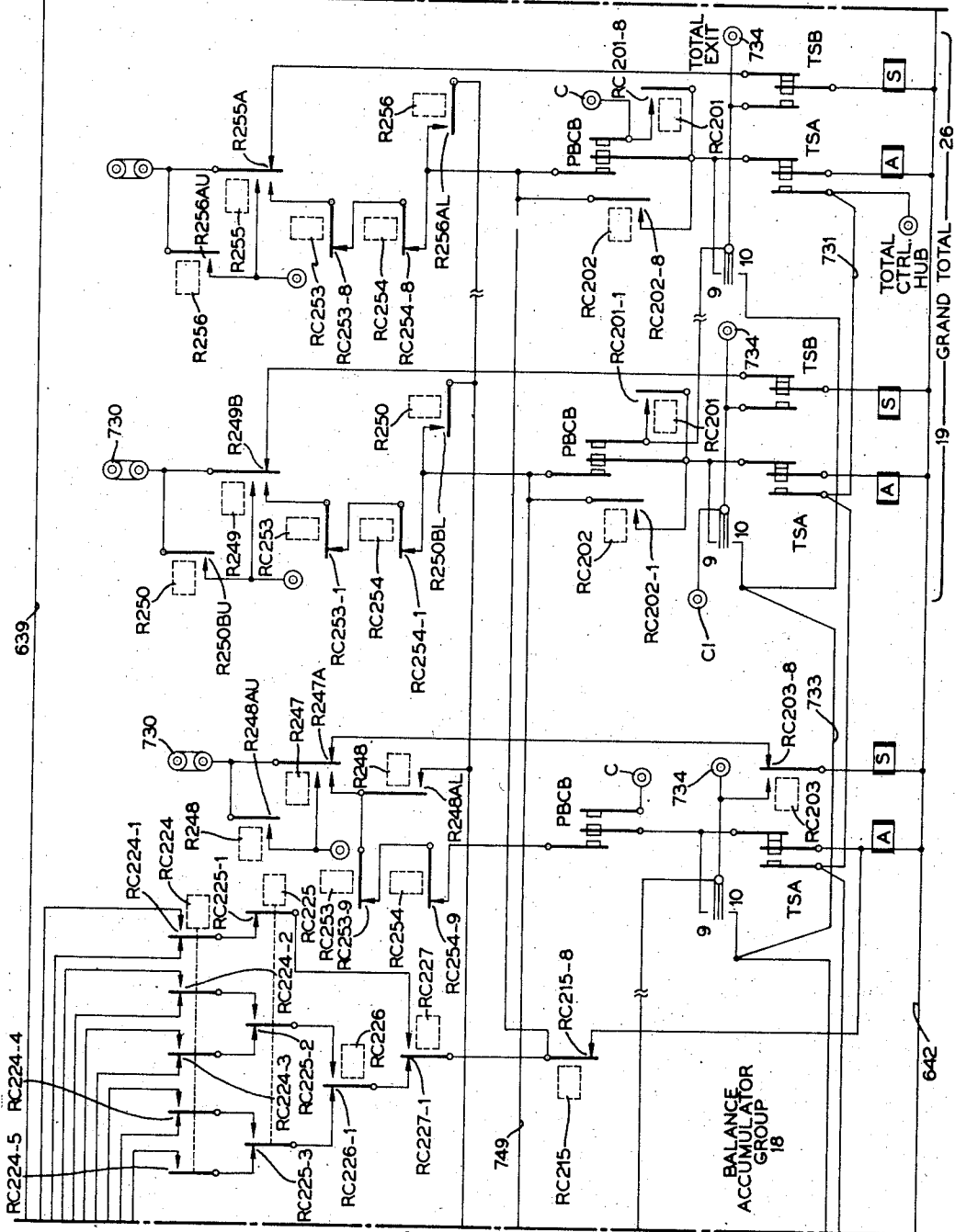


FIG. 25D.

BY

INVENTORS
FRANCIS E. HAMILTON
JOHN D. WOLFE
CHARLES S. JACKOWSKI

AGENT

BALANCE
ACCUMULATOR
GROUP

TOTAL
CTRL. HUB

A

GRAND TOTAL

26

642

Sept. 1, 1959

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ACCOUNTING MACHINE

2,902,213

Filed Sept. 28, 1953

38 Sheets-Sheet 30

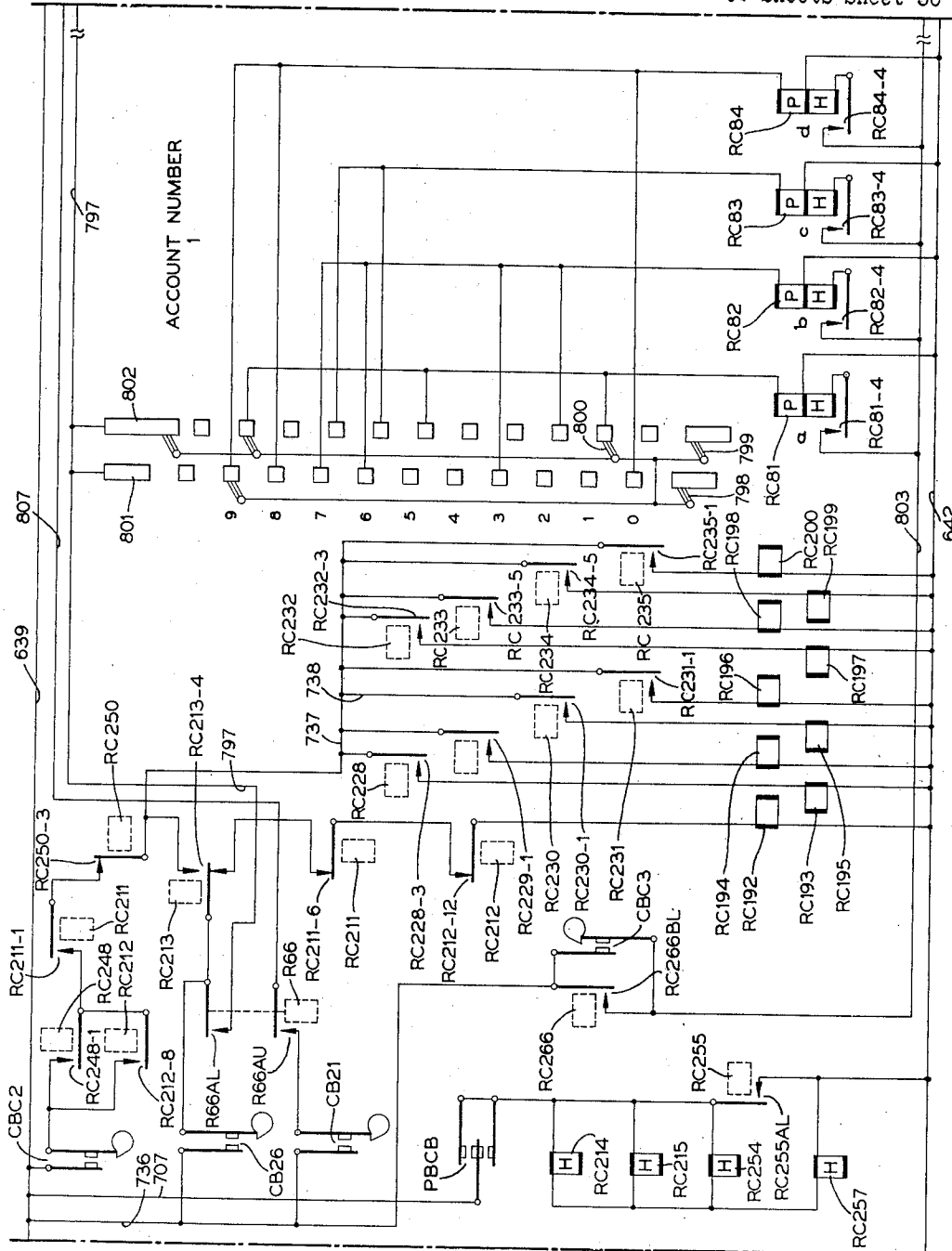


FIG. 25p.

INVENTORS
FRANCIS E. HAMILTON
JOHN D. WOLFE
CHARLES S. JACKOWSKI

BY

G. P. Snyger
AGENT

Sept. 1, 1959

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38 Sheets-Sheet 31

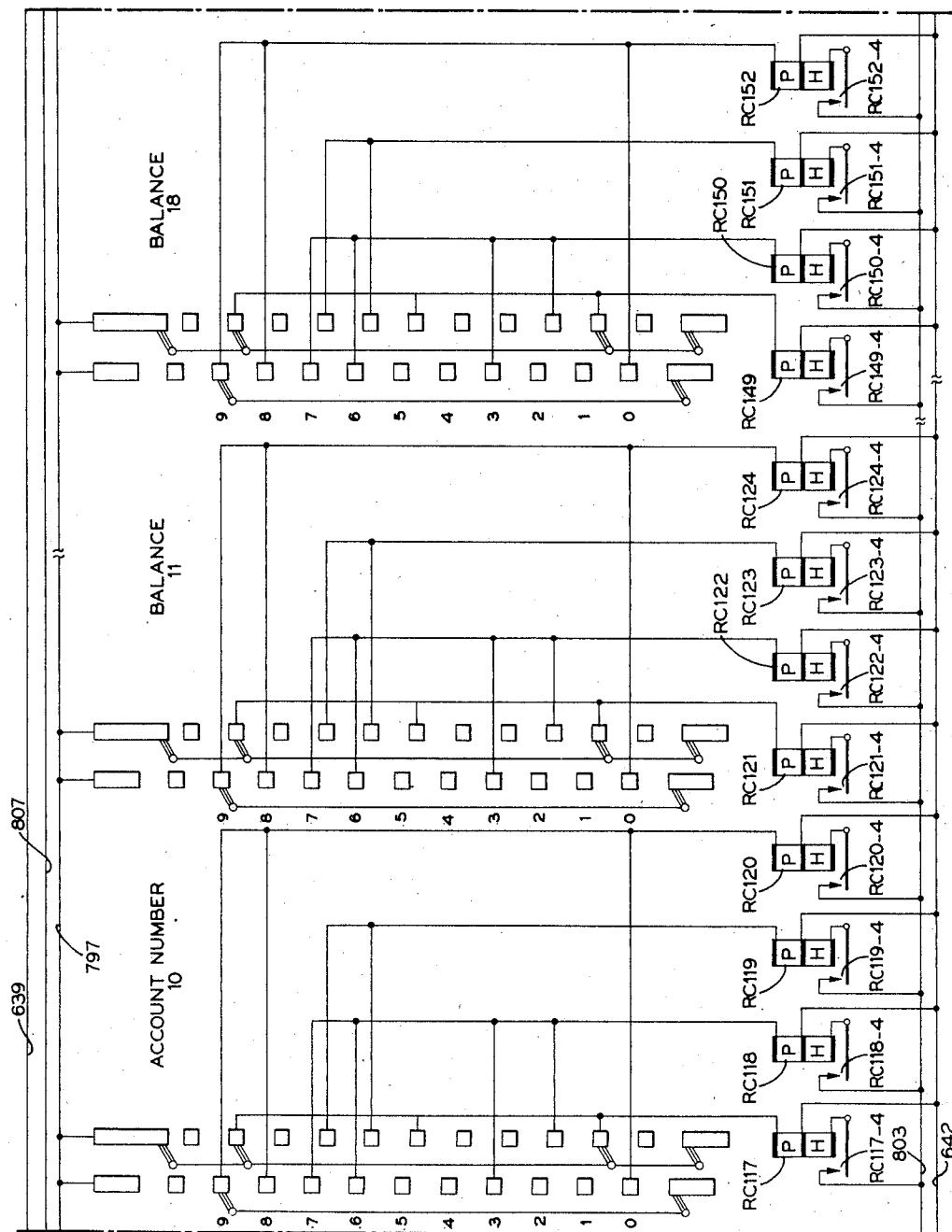


FIG. 25q.

INVENTORS
FRANCIS E. HAMILTON
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CHARLES S. JACKOWSKI

BY

G. L. Gygax
AGENT

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ACCOUNTING MACHINE

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38 Sheets-Sheet 32

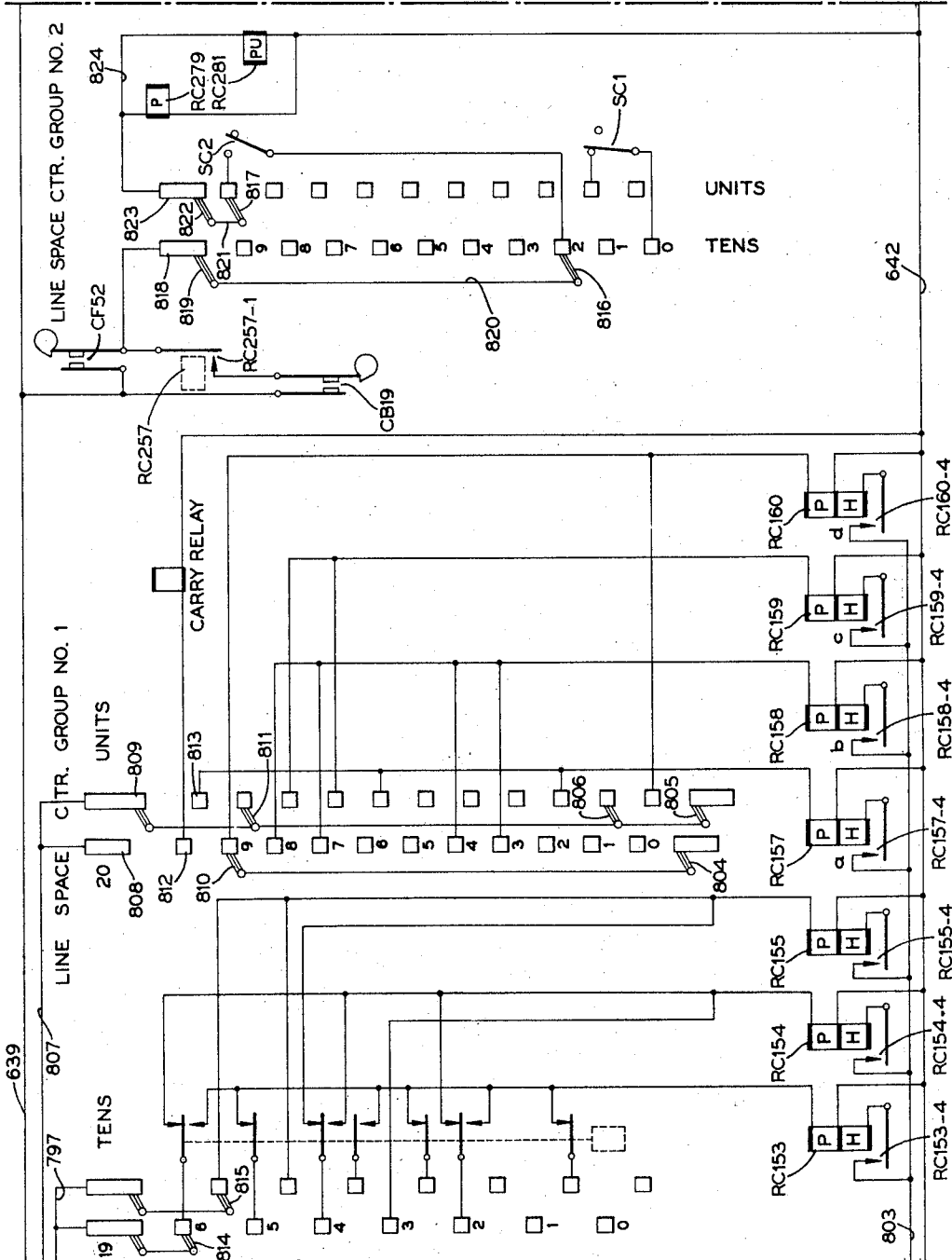


FIG. 25r.

INVENTORS
FRANCIS E. HAMILTON
JOHN D. WOLFE
CHARLES S. JACKOWSKI

BY

G. R. Suggs
AGENT

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2,902,213

ACCOUNTING MACHINE

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38 Sheets-Sheet 33

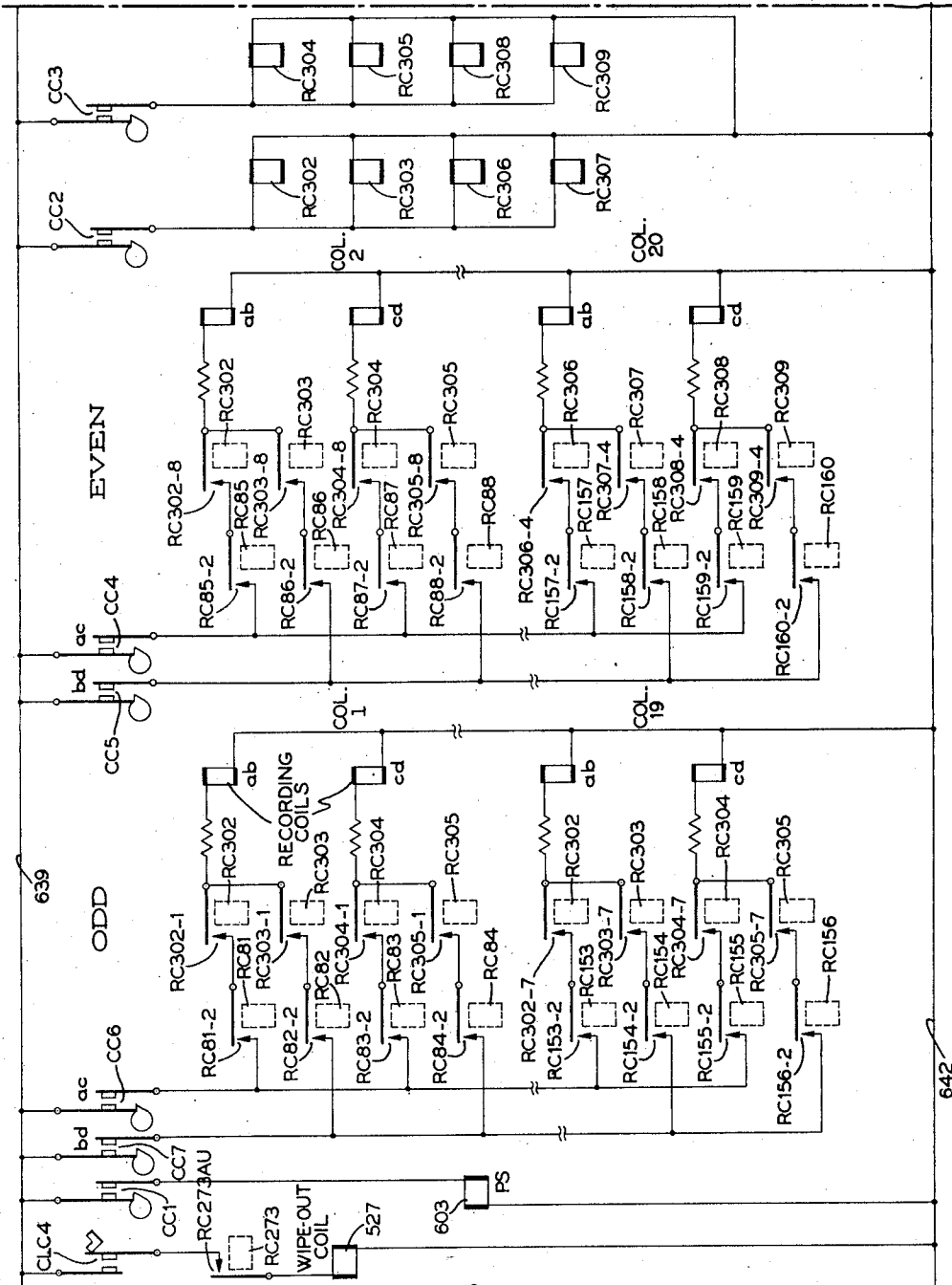


FIG. 25s.

INVENTORS
FRANCIS E. HAMILTON
JOHN D. WOLFE
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BY

H. E. Suggs
AGENT

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ACCOUNTING MACHINE

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38 Sheets-Sheet 34

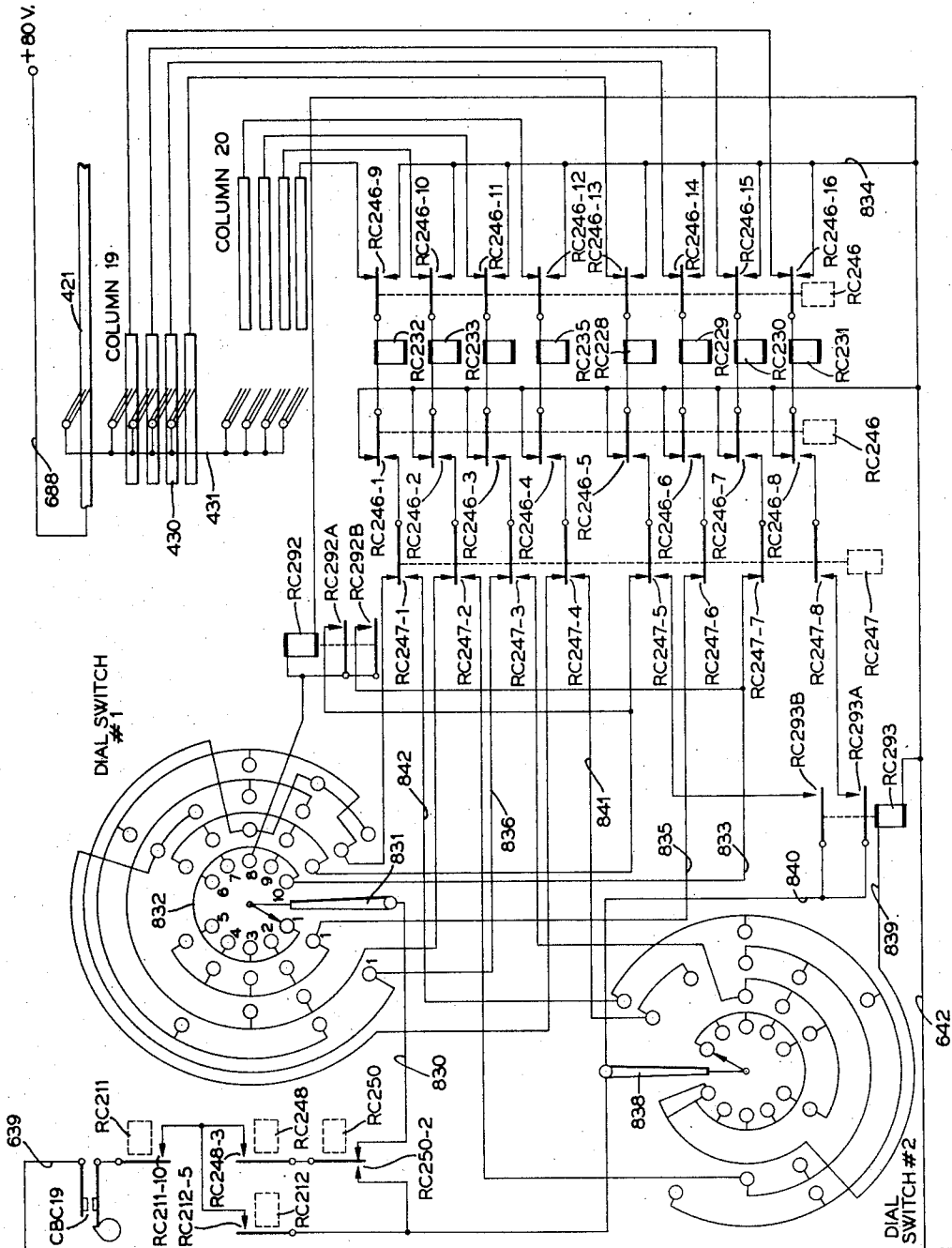


FIG. 25t.

INVENTORS
FRANCIS E. HAMILTON
JOHN D. WOLFE
CHARLES S. JACKOWSKI

BY

G. L. Suggs
AGENT

Sept. 1, 1959

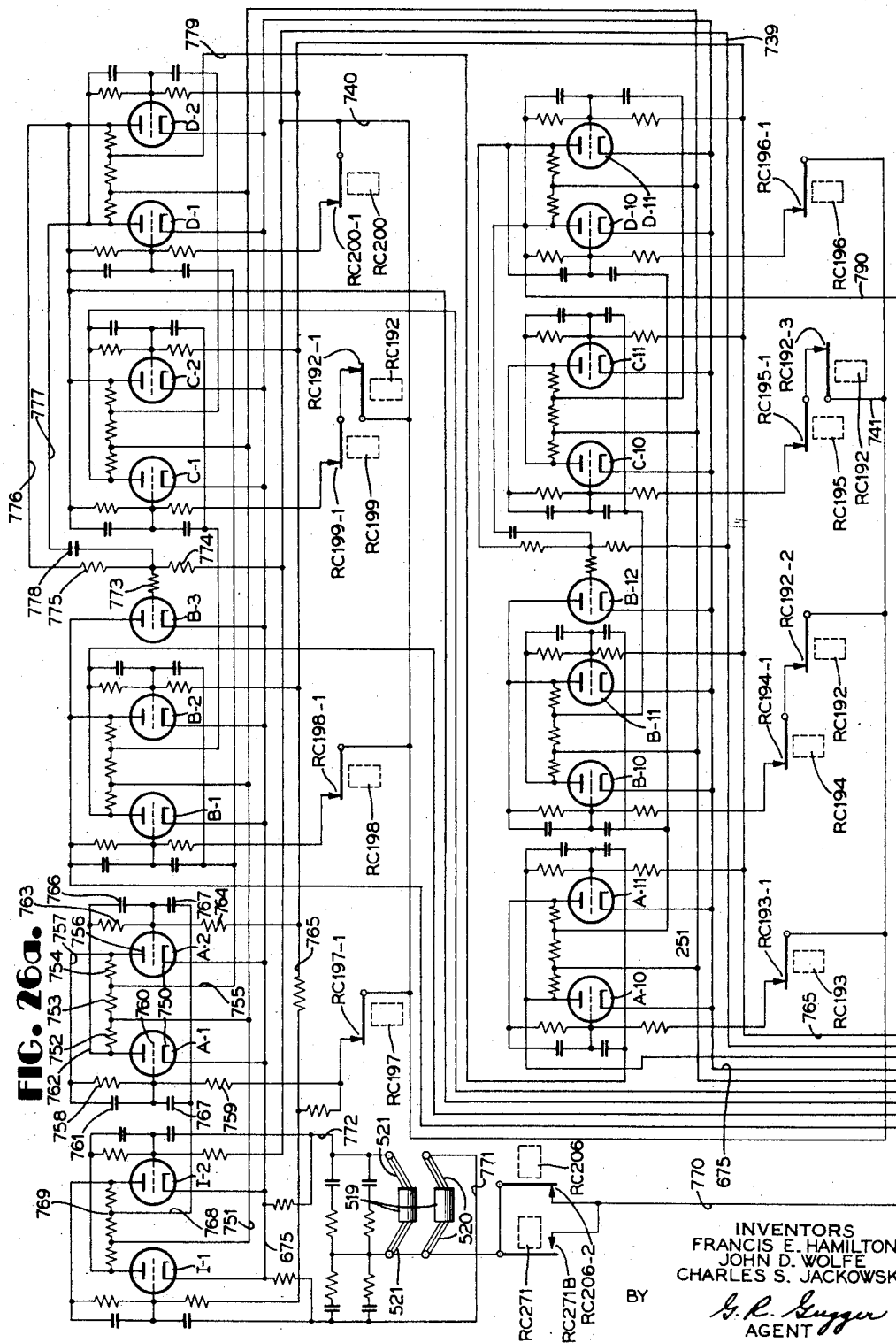
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2,902,213

ACCOUNTING MACHINE

Filed Sept. 28, 1953

38 Sheets-Sheet 35



Sept. 1, 1959

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2,902,213

ACCOUNTING MACHINE

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38 Sheets-Sheet 36

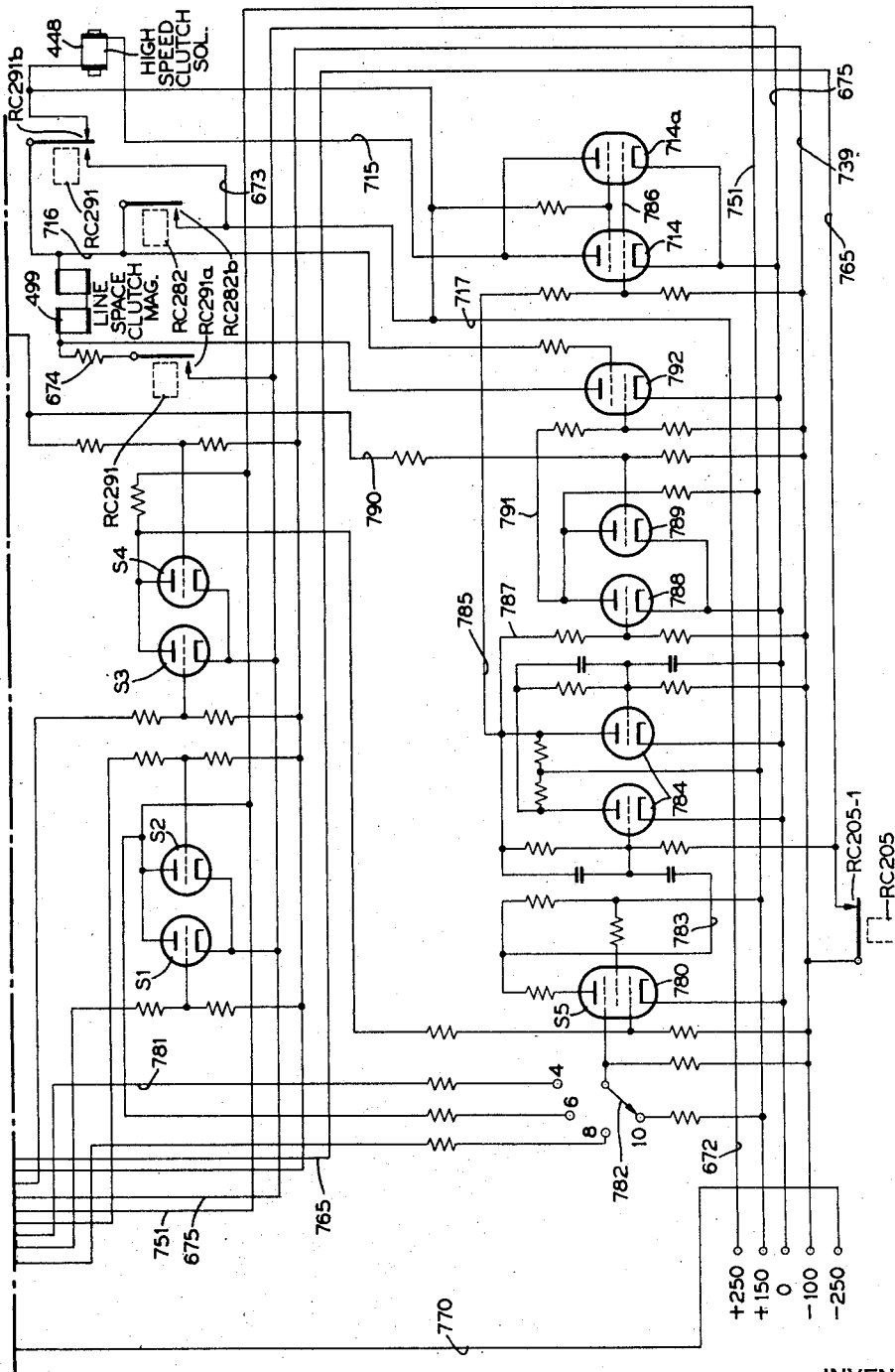


FIG. 26b.

INVENTORS
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BY

G. P. Suggs
AGENT

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2,902,213

Filed Sept. 28, 1953

38 Sheets-Sheet 37

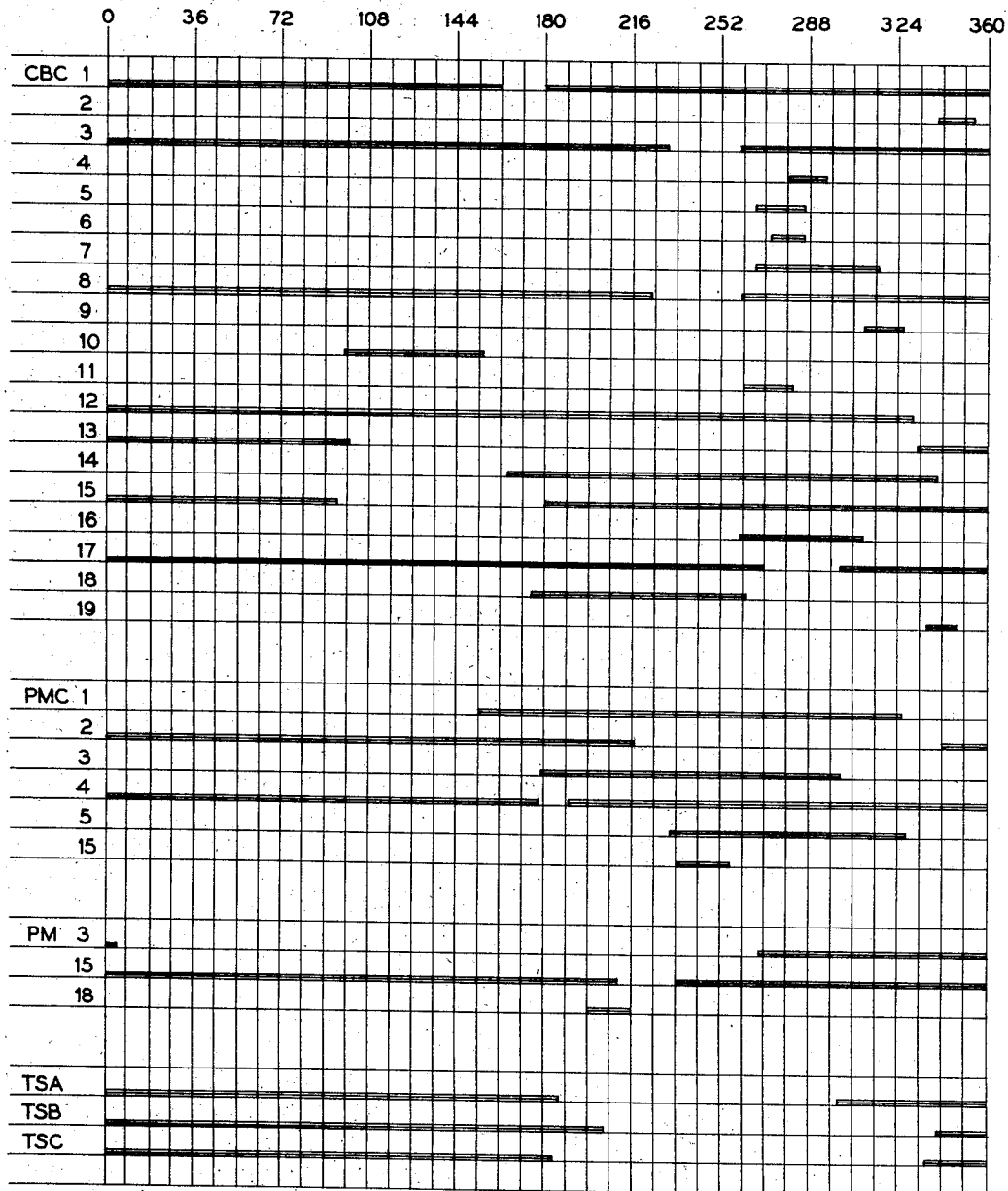


FIG. 27a.

INVENTORS
FRANCIS E. HAMILTON
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BY *A. R. Kugler*
AGENT

Sept. 1, 1959

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2,902,213

ACCOUNTING MACHINE

Filed Sept. 28, 1953

38 Sheets-Sheet 38

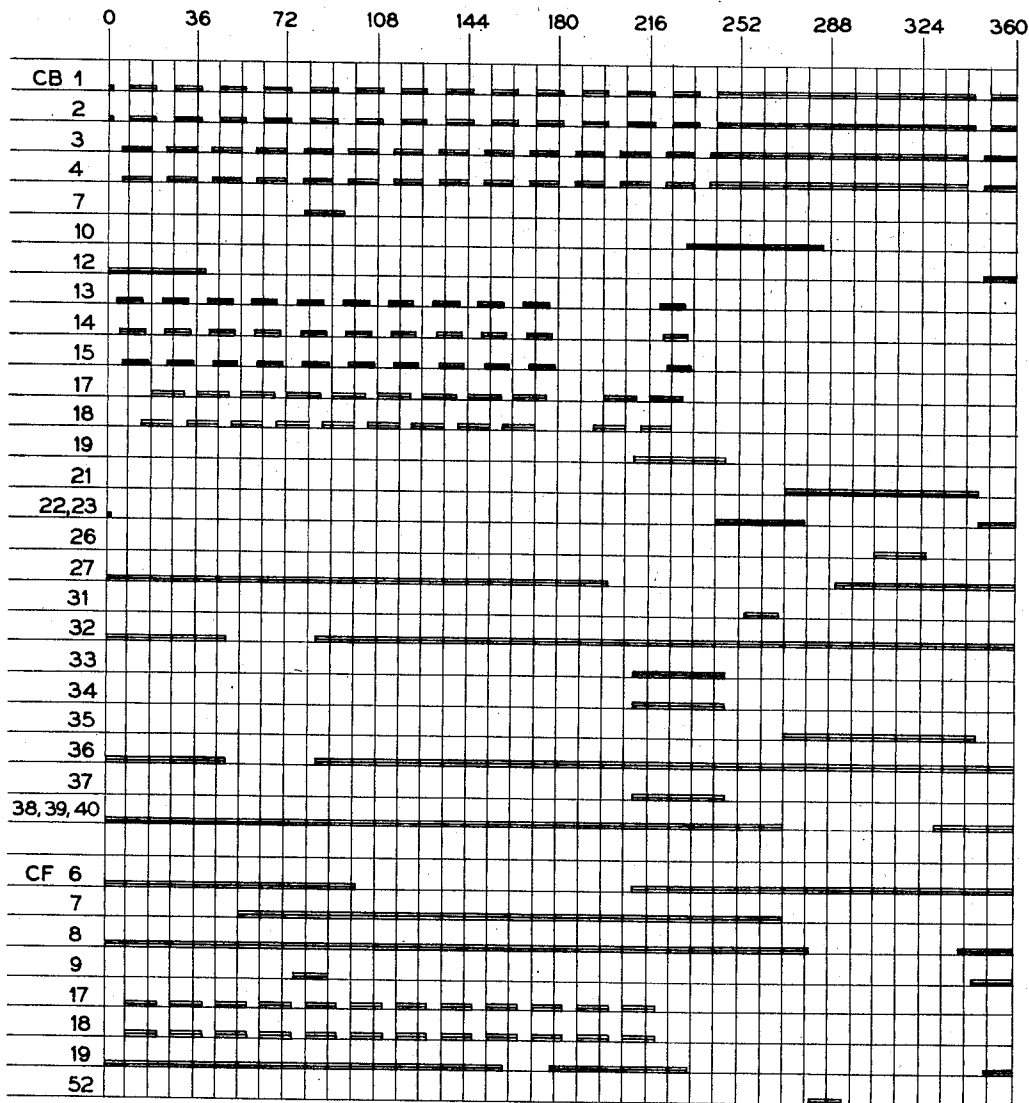


FIG. 27b.

INVENTORS
FRANCIS E. HAMILTON
JOHN D. WOLFE
CHARLES S. JACKOWSKI

BY

G. L. Suggs
AGENT

1

2,902,213

ACCOUNTING MACHINE

Francis E. Hamilton, Binghamton, John D. Wolfe, Johnson City, and Charles S. Jackowski, Endicott, N.Y., assignors to International Business Machines Corporation, New York, N.Y., a corporation of New York

Application September 28, 1953, Serial No. 382,684

28 Claims. (Cl. 235—61.7)

This invention relates to accounting systems and more particularly to a record card controlled ledger posting machine.

In accordance with one embodiment of the invention a ledger posting carriage is operated in conjunction with a record card controlled tabulating machine. The combination functions to automatically feed ledger sheets in the carriage and groups of record cards in the tabulator, compare account number data magnetically recorded on the ledger sheets with similar data punched in the record cards, to sense magnetically recorded data on the ledger sheets representing printing line indication and old balance as well as account number and enter the readings into accumulators in the tabulator, to analyze the groups of record cards by account number and list information punched in the cards onto a ledger sheet bearing a corresponding account number and at the same time enter the information from the cards into balance and grand total accumulators in the tabulator, to total print on a ledger sheet the sum of the old balance and the balances read from the cards bearing a corresponding account number, to wipe out the old balance recorded on the ledger sheet and magnetically record the new balance in it in readiness for subsequent use.

Such a system as this is particularly useful in many accounting practices where it is desirable to have a value bearing medium integrally associated with a printed record to facilitate the lessening of errors in combining data from two different and separate records. An example of a practical use for the system is in a banking operation where it is desired to have a ledger sheet for each checking account which will show a listing of the amounts of money on which checks have been written and also show running balances as groups of entries are made with possibly a grand total balance when the sheet is filled. The ledger sheet carries not only the required information in printed form but also carries information such as printing line indication, account number and balance in the form of magnetic spots. Then, each time that the ledger sheet is run through the carriage to receive entries the old balance is utilized to compute a new up-to-date balance. The old balance is wiped out and the new balance will become the old balance for the next run of the ledger sheet. The account number data is used to control the feeding of ledger sheets with respect to the record cards and insures that entries are made on the ledger sheet from only those cards that correspond in account number. The printing line indication data controls the position on the ledger sheet where new entries are to be printed. When a ledger sheet becomes filled up and there are still entries to be made for that account, the control data conditions the machine so that a blank ledger sheet may be inserted, the required information transposed from the filled sheet to the new sheet and the additional entries posted on the new sheet.

A principal object of the present invention is to provide an accounting system for ledger posting includ-

2

ing improved means for storing balances on the ledger sheets for automatic control of entry into an accumulator and printing of old balances.

A further object is to provide an accounting system as described in the foregoing paragraph, wherein new balance control indicia are recorded repeatedly on a single minor area of the ledger sheet.

A still further object is to provide an accounting machine as described in the preceding paragraphs, wherein the new items are supplied from separate control record feeding means, the control records and the ledger sheets having identifying indicia, the feeding of ledger sheets and control records and the entry and printing operations being subject to the control of comparing means which compare the identifying indicia of the control records and the ledger sheets.

A further object of the present invention is to provide an improved means for the conversion of numbers expressed in one notation to that of a different notation, said different notation being one most readily used in electric accounting machines.

A still further object of the invention is to provide a simple means for rapidly feeding successive ledger sheets through the machine.

An additional object of the present invention is to provide a novel means of predetermining the next printing position of the ledger sheet that is to be used.

A further object of the present invention is, as well, the incorporation of an improved means for accurately positioning the ledger sheet in the printing position of the printing means of the record controlled tabulating machine.

A still further object of the present invention is to provide a comparing means whose function is to make a comparison between the data magnetically recorded on a ledger sheet and the data represented by holes perforated in a tabulating card.

An additional object of the present invention is to provide means for exercising a control over both the functions of the tabulating machine and the ledger feeding carriage in accordance with the preceding object.

Still another object of the present invention is to provide means for progressively carrying forward a total from one ledger sheet to the succeeding ledger sheet and to record said progressive total, electromagnetically in the first mentioned ledger sheet.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of example, the principle of the invention and the best mode, which has been contemplated, of applying that principle.

In the drawings:

Fig. 1 is a plan view of the ledger posting machine.

Fig. 2 is a sectional view taken on line 2—2 of Fig. 1 showing a portion of the driving connections for the posting machine.

Fig. 3 is a view of the right side of the machine taken on line 3—3 of Fig. 1.

Fig. 4 is a sectional view taken on line 4—4 of Fig. 1 showing the various operating stations of the machine and the path of travel of the ledger sheets through said stations.

Fig. 4a is a sectional view taken on line 4a—4a of Fig. 4 showing an end view of the recording clutch mechanism.

Fig. 5 is a sectional view taken on line 5—5 of Fig. 1 showing the remaining portions of the driving connections.

Fig. 6 is a side elevation view of the hopper feeding mechanism.

Fig. 7 is a diametric view showing the main cam shaft and operating cams.

Fig. 8 is a sectional view taken on line 8—8 of Fig. 1 showing the stop finger mechanism and the eject mechanism of the recording station.

Fig. 9 is a view taken on line 9—9 of Fig. 3 showing the high speed clutch mechanism.

Fig. 10 is a sectional view taken on line 10—10 of Fig. 1 showing the 21 spot distributor.

Fig. 11 is a view showing the 44 spot count emitter.

Fig. 12 is a top view of the sensing drum.

Fig. 13 is a side view of the sensing drum showing the arrangement of the sensing coils.

Fig. 14 is a view of a developed chart showing the sensing coil locations with respect to the columns in the ledger sheet.

Fig. 15 is a sectional view taken on line 15—15 of Fig. 1 showing the recording mechanism.

Fig. 16 is a plan view taken on line 16—16 of Fig. 15 showing the top of the recording block.

Fig. 17 is a sectional view taken on line 17—17 of Fig. 1 showing the mechanism for positioning the ledger sheet at the recording station.

Fig. 18 is an end view of one of the circuit breakers of the ledger posting machine.

Fig. 19 is a vertical section taken through the tabulator. The printer, accumulator, control cams and other devices in the machine are illustrated in this view.

Fig. 20 is an isometric view showing the comparing mechanism provided in the tabulator for comparing the punched cards with the ledger sheets.

Fig. 21 is a view showing one of the readout emitters of the comparing mechanism.

Fig. 22 is a timing chart of the mechanical components of the carriage.

Fig. 23 is a view showing a tabulating card and a typical ledger sheet having a progressive total printed at the bottom.

Fig. 24 is a view showing a typical overflow ledger sheet with the progressive total printed at the top.

Figs. 25a through 25t when taken together illustrate the wiring diagram of the machine.

Figs. 26a and 26b when taken together illustrate the wiring diagram of the electronic counter.

Figs. 27a and 27b show a timing chart of the various electrical controlling elements.

Fig. 28 is a chart showing the code arrangement for the magnetic recorded elements.

Fig. 29 is a chart showing the code arrangement of the sensing code relays.

In the drawing the invention is shown incorporated in a ledger sheet carriage associated with a record controlled printing tabulator. The printing machine is of the kind shown in Patents Nos. 2,016,682, 2,079,418 and 2,111,122, wherein mechanisms are shown for feeding record cards one-by-one and analyzing the cards electrically to control the setting of type bars, the accumulation of amounts and total printing of such amounts.

In a record controlled printing tabulator of this type, the record cards bearing value designations may be arranged in various groups, usually three in number, for the purpose of securing totals for accounting subclasses. These groups are called minor, intermediate and major in ascending order of importance. Accumulators, pluggable in nature, are provided for the accumulation of items in each group. When a change from one group to another occurs, automatic controls cause a total cycle to take place during which, the pertinent accumulators read out their totals to a printing unit for inscription upon a ledger. In this application, the record cards in the tabulator are arranged in groups according to account number. When a change from one group to another occurs through different account numbers, then a total cycle is automatically effected to print totals on the ledger sheets.

Referring to Fig. 23, the ledger sheet fed through the

carriage consists of two parts, the first being a sheet of manila paper of trade index 110. The face of the sheet is reserved for printing while the back side carries the second part, a strip M consisting of a film of comminuted paramagnetic material suspended in a film of lacquer which serves as a bond between the paramagnetic material and the supporting ledger sheet. The purpose of the magnetic material is to act as a storage medium for electrical manifestations representing a combinational number notation.

In operation, ledgers are placed in a hopper to be fed to a first station, the sensing station, where the electrical manifestations stored within the magnetic material are sensed. Subsequent to the sensing operation the ledger is moved to a second station, the printing station, where it remains until the next minor, intermediate, or major control change signalizes a total and print cycle. The ledger then moves from the print station passing, at high speed, a third station, the erasing station wherein the old information or data stored in the magnetic material is wiped out and a constant level of magnetic energy installed in the magnetic material in preparation for the succeeding step. Arrival at the fourth station, called the recording station, initiates recording in the magnetic strip along the top of the ledger all the new information or data, desired by the particular accounting system used. Subsequent to the recording operation, and coincident with the feeding of a new ledger from the feed hopper, the completed ledger is sent to the stacker.

Referring to Fig. 28 (Sheet 5), the combinational number notation used to represent the digits zero to nine inclusive, consists of a spatial distribution of four elements aligned in a row. Assume the elements to be named *a*, *b*, *c* and *d*, then, these in combination may be caused to represent any of the digits referred to above. For example, the digit 7 is represented by the combination *a*, *b* and *c*. An element of the number notation takes the form of a spot of magnetically energized material when recorded upon the ledger sheet.

For the purposes of illustrating the invention only part of the available recording space is used. Into the strip of magnetically permeable material there can be recorded twenty columns of numbers. Referring to Fig. 25h and reading from right to left, looking at the rear of the sheet, the numerical data is spot-magnetized in a record of twenty columns in width and four spots deep. The four spots in each column are arranged in a binary code such as the one mentioned above.

In the instant invention, the total of twenty columns is divided into three groups; for example, group one of ten columns is used for control purposes, group two of eight columns is used to record the last balance and group three of two columns is used to record the location of the last line printed upon.

The code arrangement of the perforations in the record cards is of the well-known type wherein the record card has perforations representing the digits 0 through 9 located in different index point positions of a single column.

Printing mechanism

The printing mechanism of a printing tabulator will now be described with reference to a mechanism similar to that shown in Patent No. 2,079,418. In referring to Fig. 19, only those portions of the printing mechanism which are deemed pertinent to the present case will be described. For additional detailed description of the printing mechanism, reference may be made to the above-mentioned patent as well as Patent No. 2,016,682.

The record cards are passed through the usual card feeding and analyzing devices so that they pass a set of upper analyzing brushes and exactly one machine cycle later move in transit past a set of lower analyzing brushes. As the cards pass the lower brushes, the digit perforations are analyzed to control the positioning of the type carrier and type elements to select the digit characters

represented by the particular arrangement of the perforations analyzed.

The printing mechanism includes a platen 92 (Fig. 19) and a series of type carriers 93 each having a plurality of type elements 94 adapted to be struck by a hammer 95 loosely pivoted on a shaft 96. The type carrier is connected at its lower end to an arm 97 fulcrumed at 98. Springs 99 connected to the arms 97 and to a cross beam 100 connected between arms 101 pivoted at 102, tend to raise the arms 97 to raise the type carriers. A restoring bail 103 connected by links 104 to arms 101 is adapted to restore the arms 97 to their lowest or normal position.

The shaft 102 is caused to pivot through cam connections mounted on a shaft 111 (shown in Fig. 1 of Patent No. 2,079,418), said shaft 111 being driven through a chain of gears by a shaft 23'. The shaft 23' turns synchronously with the feeding of the cards through the machine and the bail 103 is thus raised so as to permit the type carriers to rise synchronously with the feeding of the card. Thus when the type element 94 carrying the numeral nine is approaching the printing line with respect to plate 92 and the actuating hammer 95, the nine position on the card will be passing the lower brushes. If there is a perforation in the card at the nine position, a circuit will be closed through the lower brush to the printing magnet PM of that particular column. This will attract the associated armature 115 which is connected to one of the rods 116 which at the other end is connected to the latching member 117 of the particular column. This will release the latching pawl 118 permitting it to cooperate with the ratchet teeth 119 carried by the type carrier to stop the type carrier with the nine type 94 in line for printing.

When the arms 101 raise the bail 103 to permit the type carriers to rise, the springs 99 will be stretched when the type carriers are latched and the arms 97 are stopped in differential positions. After printing has been effected, the arms 101 are then lowered with the bail 103 to restore the type carriers to normal position.

The several type actuating hammers 95 are actuated by individual springs 130 tending to rock them against the type 94 to effect printing. The hammers are normally locked in their inoperative position by individual latches 131. These latches are connected to levers 132 adapted to be moved to the left by a bar 133.

Where listing is to be effected on a ledger sheet, as shown in Fig. 23, while an item is also being accumulated, the printing magnet PM will be connected to receive an impulse through the perforation in the card simultaneously with the transmission of such impulse to the accumulation magnet C or magnet D (Fig. 19).

Accumulating mechanism

To facilitate an understanding of how the ledger carriage and printer cooperate to perform an accounting operation it is thought advisable to very briefly describe the arrangement of the accumulating controls of the printer. For additional detailed description of the accumulating controls, reference may be made to Patent No. 2,079,418.

As used with the present invention each accumulator order of the printing machine is provided with two magnets, such as indicated at A and S in Fig. 19, one of which is used to control the clutching of the related accumulator wheel with the driving means, while the other is used to declutch the wheel from the driving means. The magnets are used for control of the accumulator during accumulating and total taking operations.

Two accumulator orders are mounted on a plate 7 and this plate may be held in the machine by sliding it between supporting frame members 8 and 9. Each accumulator has a gear which is in constant mesh with a gear 12 mounted on a shaft 13. The shaft 13 is continuously driven by the printing machine when the machine is in operation.

The declutching magnet S is operated during subtraction to disengage the accumulator wheel after the entry of a complement. The same magnet is operated during the taking of a clearing total to declutch the wheel at zero. During the taking of progressive total, the declutching magnet is de-energized so that the wheel remains engaged with the driving means to be turned to its original position.

The clutching magnet A is operated during addition, transferring and subtraction operations to start the accumulator wheel turning to add a true number or a complement. When a clearing or progressive total is to be taken the same magnet is energized early in the cycle to engage the wheel with the driver. During ordinary adding operations, the magnets S are not used, the accumulator wheels being clutched at differential times by the magnets A and declutched at the zero position by cams 51 (Fig. 7 of said patent).

Each accumulator order is also provided with a pair of contacts, referred to later in the circuit description as 9-10 contacts, to be used primarily for control of transferring. The contacts, however, exercise further control by being selectively connected to the magnets in the accumulator and other parts of the machine so that they may be used to control the total taking and total printing operations. The one contact is closed when the related accumulator wheel is located in the nine position. The other contact is closed when the wheel passes from nine to zero.

The printer is also provided with certain switch plates having contacts which are used to control total cycle and total printing operations and to prevent back circuits during such operations. The PBCB plate shown in Fig. 19, is a typical switch plate and is mechanically operated through the card feed clutch by the bell crank arm 192 and eccentric cam 196. The purpose of the PBCB contacts is to complete circuits from the adding brushes to the accumulator add magnets during adding time, and also to complete electrical carry circuits to these same magnets during a carrying operation.

Other switch plates called TSA, TSB, and TSC plates are provided in the printer. These plates are similar to the PBCB plate except that they are caused to transfer by pulsing a magnet. All of these plates are impelled to operate at the same time.

The purpose of the TSA contacts is to transfer the accumulator add magnets from the circuit used to start the accumulator wheel turning, when adding or subtracting while feeding cards, to the circuit which energizes the accumulator add magnet and causes the accumulator wheels to turn on a total cycle.

The purpose of the TSB contacts is to transfer the counter subtract magnets from the circuit used to stop the accumulator, when subtracting on card feed cycles, to the circuits used to stop the counter at zero when clearing on a total cycle.

The purpose of the TSC contacts is to transfer the print magnets from the circuit used to stop the type bar when listing on a card feed cycle, to the circuit used to stop the type bar when printing from the accumulators on a total cycle.

Comparing mechanism

In the embodiment of the present invention shown in the drawing, the account numbers recorded in the ledger sheets are compared with the account numbers punched in the tabulating cards to control certain carriage operations and accordingly, the tabulating machine is provided with a special comparing mechanism which is in addition to the standard comparing unit of the machine used to compare between the record cards. The special comparing mechanism is a modification of the comparing mechanism used in the well-known "IBM" collator shown and described in Patent No. 2,359,670.

Referring to Fig. 20, the mechanism comprises a main

drive shaft 30 which is driven from the tabulator in synchronism with the card feed. The shaft has secured thereto a bail operating cam 31 and a pair of restoring cams 32, 33 located close together near the center of the shaft.

A main support rod 34 is secured to the center of the usual side plates (not shown) and has rotatably mounted thereon a series of sectors 35. There are ten sectors in the series to correspond with the number of comparing magnets in the unit, there being ten comparing magnets 36 for comparing the ten columns allotted in the ledger sheet for the account number. There is a stop pawl 37 for each sector and each pawl is located in the plane of its cooperating sector so as to be capable of engaging ratchet teeth formed in the sector. A spring 38 anchored to each pawl and to a spring anchoring bar 39 tends to rock the pawl into engagement with the ratchet teeth on the sector. Normally each pawl is held out of engagement with its sector by means of its associated comparing magnet armature 40.

Rotatably mounted on the rod 34 is a bail 41 associated with the series of sectors. The bail projects through the planes of all the sectors and is connected to each sector by means of a spring 42 which tends to draw its sector into engagement with the bail so that oscillation of the bail will cause the sectors to follow the movement of the bail provided none of the pawls 37 have been released. Oscillation of the bail clockwise is controlled by the cam 31 and the cam follower lever 43 rotatably mounted on rod 34. A heavy coil spring 44, anchored to pin 45 carried by the bail arm and to a bracket 46 secured to the side plate, has a tendency to rock the bail in a counterclockwise direction and to press the roller 47 into contact with cam 31.

There are nine ratchet teeth in each sector 35 and also an abutment 48 comprising a zero stop projecting a greater distance radially of rod 34 than the ratchet teeth so as to arrest the sectors in a zero position by engaging the ends of the stop pawls 37 in every case where a stop pawl is not released by energization of a magnet. In other words, the sectors will always move to zero positions unless stopped in other positions by release of the stop pawls 37. The ratchet teeth have the numerical values shown by the small numerals adjacent the teeth and the cam 31 is so shaped that, as the bail moves in a clockwise direction, the ratchet teeth will pass the ends of pawls 37 in synchronism with the sensing of the index-point positions on the record cards. In other words, the "9" teeth will be opposite the ends of pawls 37 when the brushes reach the "9" index-point position and so on for the other index-point positions.

For the purpose of reading out the value standing in the sectors there is provided a series of ten arms 49 each one of which is integrally connected to one of the sectors 35 through a sleeve 50 for movement with same. The arms are constructed of a non-conducting material and each one supports a pair of pivotable spring biased readout pawls 51, 52 constructed of a conducting material. The pawls 51, 52 for each sector are adapted to wipe over a common strip and a series of segments 53, in a readout emitter 54, as shown in Fig. 21, there being a readout emitter for each sector. The segments 53 have the numerical values shown by the small numerals adjacent the segments with the numerals arranged similar to those on the sectors so that the pawl 51 will wipe over the segments in the order of zero through nine as the associated sector advances over its stop pawl in the order of zero through nine. It can be seen then that if magnet 36 is impulsed, for example, from a six hole in the card, the stop pawl will stop the sector at the sixth tooth or position and pawl 51 will be resting on the sixth segment to read out the value six that is to be compared.

Knockoff mechanism is provided for the armatures of the comparing magnets 36 which comprises a series of

ten separate knockoff bails 55, one for each of the comparing magnet armatures. Each bail is pivoted to the side of its associated magnet and extends transversely of the tip of the related armature 40 on the same side as the coil of the magnet. Secured to each bail is a side arm 56 which extends into the path of bail 41. When bail 41 pushes the sectors back to their starting position by rotation in a counterclockwise direction, the noses of the pawls 37 wipe over the teeth in the sectors and eventually ride up on the smooth portion 48a of the sectors which is made slightly higher than the teeth for the purpose of camming the pawls slightly beyond the latching position. At this point the bail 41 strikes the arms 56 and rocks bails 55 clockwise thereby forcing the armatures 40 into latching relation with the pawls 37.

Normally, movement of the bail 41 is prevented by mechanism controlled by a restoring magnet 57 which is constructed similarly to a comparing magnet. The armature 58 of the restoring magnet engages a shoulder of a stop pawl 59 actuated by a spring 60 anchored to rod 61. The stop pawl 59 projects into the path of a stop arm 62 pivoted to a slotted block 63 secured to the center of the bail 41. A spring 64, anchored to bail 41 and to an ear on the stop arm 62, normally holds the stop arm against the bail which acts as a stop to limit clockwise movement of the stop arm. Energization of magnet 57 will release the stop pawl 59 and free the bail 41 for movement.

The knockoff mechanism for the restoring magnet 57 comprises a pair of cam follower levers 65, 66 rockably mounted on shaft 34 each having two rollers cooperating with one of the cams 32, 33 whereby both levers are oscillated periodically when shaft 30 rotates. Cam 33 is timed in advance of cam 32 so that lever 65 always rocks to the left before lever 66 does.

Lever 65 is connected to an armature knockoff lever 67 pivoted on a bracket 68 secured to the restoring magnet 57. The other arm of the lever 67 has a bent-over lug cooperating with the armature 58. It is apparent that once in each cycle of the shaft 30 the lever 65 will be rocked counterclockwise, thereby operating the lever 67 to force the armature 58 away from the poles of the magnet. Before this takes place lever 66 is similarly rocked and, by engagement of cam portion 68 formed in said lever with ear 69 formed on the pawl 59, said pawl is rocked clockwise slightly beyond its latching position with armature 58. Thus both the pawl 59 and the armature 58 are positively restored.

The foregoing portions of the description are concerned mainly with the controls of the regular printer. The following sections deal with the mechanical arrangement of the novel ledger carriage unit.

Referring now to the drawings, the reference characters designating the elements of the novel devices of the present invention will begin with the number 200. In order to simplify the disclosure of the entire machine, several mechanisms will be described as separate units, and the electrical circuits which control the operation thereof will be described in detail in connection with the discussion of the operation of the entire mechanism.

Carriage frame and drive mechanism

The power supply for driving all of the mechanical units of the carriage is derived from a motor 200 (Fig. 1) suitably secured to the inside face of a side plate 201. Side plate 201 and another side plate 202 are saddled, by means of bolts 203, into brackets 204 (Figs. 3 and 5) secured to a base plate 205 which supports the carriage unit. The carriage unit is positioned on top of the printing tabulator with the only restriction being that the carriage platen be positioned adjacent the type bar unit 93 of the printing tabulator, such as shown in Fig. 4, the connections between the carriage and the tabulator being entirely electrical in nature.

The side plates are joined together by a plurality of square and rectangular tie bars 206, 207, a plurality of tie rods 208 and three strip castings 208a. The motor shaft 209 is journaled in the side plate 201 and through clutch and cam mechanisms and gear trains drives all of moving parts of the carriage. Shaft 209 revolves in a clockwise direction and has fastened thereon a gear 210 which meshes with and drives a double gear 211 (Figs. 1 and 2) fastened on a stub shaft 212 journaled in side plate 201. Double gear 211 in turn meshes with and drives a gear 213 fastened on a sensing drum shaft 214 journaled in the side plates 201 and 202. Also fastened on shaft 214 is another gear 215 which transmits the motor drive through the train of gears 216 to 223, inclusive, mounted on shafts 224 to 229, inclusive, respectively, journaled in side plate 201. The gear 223 drives a gear 230 and ratchet disc 231 integral therewith, said gear and ratchet disc being loose on a main cam shaft 232 journaled in side plates 201 and 202.

Fastened on the cam shaft 232 is a disc 233 having pivotally mounted thereon a clutch pawl 234 which is biased by a spring 235 for driving cooperation with ratchet disc 231. The pawl 234 is normally held out of engagement with the continuously running ratchet disc 231 by an armature plate 236 pivoted on a stud 237 and under the influence of a pair of hopper feed clutch magnets 238 fastened to side plate 201 by a bracket 239. Energization of magnets 238 will release the clutch pawl for engagement with continuously running disc 231 thereby driving disc 233 and the cam shaft 232 in a counterclockwise direction as long as the clutch magnets remain energized. Upon deenergization of the clutch magnets, the armature plate 236 will be restored to normal by a spring (not shown) and the pawl will be latched out of engagement with disc 231 thereby causing the disc 233 and cam shaft 232 to stop. A detent arm 240 on stud 237 cooperates with a notch 241 in the periphery of disc 233 to prevent reverse movement of said disc and the cam shaft when the pawl is latched up. The cam shaft 232 supports a plurality of cams 242 to 249, inclusive (Fig. 7), which serve to drive in timed relationship the various instrumentalities of the carriage. A marked index wheel 250 is fastened on the cam shaft adjacent to the outside face of side plate 201.

Ledger sheet feeding mechanism

Referring to Figs. 1 and 6, the hopper feed mechanism comprises a hopper 251 for holding the ledger sheets and having a hinged plate portion 252, called the "paper lift," whose purpose is to raise the top part of a stack of such sheets, a pair of vacuum cups 253 for cyclically peeling off the bottom sheet from the stack, a pivoted top support member 254 which prevents the stack from drooping when the vacuum cups are peeling off the bottom sheet, and pickup rolls 255 which oscillate to grip and pull ledger sheets from the stack individually and start them feeding through the carriage. The hopper mechanism is located in the rear of the machine, the hopper 251 being supported by a bracket 256 fixed to a plate 257 which is in turn attached to the side plates 201 and 202. The ledger sheets 258 are placed in the hopper face down and rest upon the hinged plate 252 and the vacuum cups 253. The feeding operations of the sheets are timed from the clutched cam shaft 232 as will be presently described.

The latch point of the carriage is at 108° on the carriage index. Depression of a run-in key sets up electrical circuits, to be described later, which cause the hopper feed clutch magnets 238 to be energized at 100° on the tabulating machine index. Then, at this time in the tabulator cycle the hopper feed clutch is unlatched and the cam shaft 232 is connected to the continuously running motor drive as previously explained.

Referring to Figs. 6 and 7, the cam 244 operates the vacuum cups through a follower arm 259 which is loosely

mounted on a shaft 260 journaled in the side plates 201 and 202. The follower arm is urged against the periphery of cam 244 by a spring 261 and is connected, by means of a link 262, to an arm 263 which is pinned to a shaft 264 through a bushing 265. The shaft 264 is journaled in each end of a support bail 266 (Fig. 5) which extends across the width of the carriage, being fixed at the ends to short shafts 267 rotatably mounted in support blocks 268 attached to the side plates 201 and 202. Spaced apart and pinned to the shaft 264 are a pair of block members 269 (Fig. 6) each provided with a stud 270 which projects over an adjacent vacuum cup arm 271. The vacuum cup arms are rotatably mounted on shaft 264 and each is provided with an ear 272 which supports one end of a spring 273 extending from the stud 270 of the adjacent block member 269. The free end of each vacuum cup arm 271 has formed thereon a hollow chamber 274 connected to a hollow plate member 275. The free end of each plate member is connected to one of the vacuum cups 253, said cups having suitable passageways therein communicating between the atmosphere and the hollow plate members 275. The connections between the hollow chambers and the plate members have suitable holes in them so that air may be extracted from the vacuum cups by a vacuum valve 276, attached to the side plate 201 by means of a bracket 277, and a conventional vacuum pump, not shown. The hose connections 278, 279 are provided between the valve and the chambers 274 along with the hose connection 280 from the valve to the pump.

It will be understood that as cam 244 rotates, an upward motion is imparted to the vacuum cups raising them until they contact the lowermost ledger sheet. Cam 244 continues to drive the block members 269 upward, adding to the tension of springs 273 to urge the vacuum cup arms 271 still further upward to insure a seal between the soft rubber lips 281 of the vacuum cups and the lowermost sheet.

At this time, or a time shortly preceding arrival of the vacuum cups at the upward level, cam 243 operates to open the valve 276 to join the vacuum pump to the vacuum cups. Cam 243 oscillates a follower arm 282, which is rotatable on the shaft 260 and connected at the other end to a lid 283 of the valve through a stud 284, thereby periodically raising and lowering said lid. When the lid is open, all of the air is extracted from the interior of the vacuum cups at which time the vacuum cup arms 271 start their downward motion pulling the lowermost ledger sheet with them and creating a gap between said lowermost sheet and the sheet immediately above. The vacuum cup arms are positively driven downward for their return motion by the studs 270 on the block members 269.

Before the vacuum cups went into operation the portions of the ledger sheets that extend out of the hopper were supported by the support member 254 which extends across the width of the carriage.

However, as the vacuum cups move up against the lowermost sheet the support member is retracted from underneath the lowermost sheet and inserted in the aforementioned gap created between the bottom two sheets when the vacuum cups pull downward and thereby serves to support the remaining sheets. The mechanism for operating the support member comprises cam 246 which operates follower arm 285 rotatable on the shaft 260. The follower arm is connected to a link 286 which in turn is fixed to an arm 287 pivoted on a stud 288 attached to the side plate 202. The arm 287 is biased by a spring 289 to urge the cam follower arm against the periphery of cam 246. Support member 254 is fixed to arm 287 and has a sharp edge which is moved in and out from between the bottom two ledger sheets each time that cam 246 rotates.

Now, with the lowermost sheet being pulled down by the vacuum cups and the remainder of the stack of sheets being supported by the support member 254, the hinged

plate portion 252 of the hopper, pivoted on hinges 290, is lowered through the action of cam 245 and follower arm 291 which is connected to the hinged plate by means of a link 292. A spring 293 between the follower arm and the hinged plate urges the follower arm against the periphery of cam 245. This action removes the strain on the vacuum cups by decreasing the radius of bend imparted to the bottom sheet by the downward movement of the cups previously described.

If the radius of the bend in the paper were not increased then failures to feed might occur because of the inability of the vacuum cups to hold on to the porous paper when they resume their downward motion, as they now do, further increasing the gap between the bottom two ledger sheets until the gap is of a width sufficient to permit the entry of three pick-up rolls 255 spaced apart on a feed roll shaft 294. The feed roll shaft is journaled in a pair of links 295 pivoted on studs 296 fixed to the side plates 201, 202. One of the links 295 is connected by an arm 297 to a follower arm 298 which is fixed on shaft 260. The follower arm 298 is urged against the periphery of a cam 242 by a spring 299, said cam 242 being effective at this time to cause the links 295 to pivot clockwise until contact is established between the pick-up rolls 255 and the top side of the bottom ledger sheet. As contact is made, cam 243 effects the closure of vacuum valve 276 to dissipate the vacuum in the vacuum cups and thus release their hold on the ledger sheet.

Coincidentally with the release of the ledger sheet by the vacuum cups, cam 242 causes the rolls 255 to rapidly descend to squeeze the sheet against continuously running feed rolls 300 and as a consequence the ledger sheet is drawn out from beneath the stack of sheets and fed at a high rate of speed to the sensing station of the carriage.

Referring to Fig. 4, it may be seen that the ledger sheets upon feeding through the carriage pass through four stations; namely, a sensing station S, a printing station P, an erasing station E and a recording station R. After passing the recording station they are piled face down in a stacker box 301 which is supported in detachable fashion on three rods 302 extending between the side plates of the carriage. To guide the sheets through the various stations there are provided a plurality of opposing guide blades attached to the tie bars 206, 207 in groups across the width of the carriage (Figs. 1 and 4) so as to form a chute or passageway for the sheets. The guide blades 303, 304 direct the sheets past the sensing station and into printing position at the printing station. Blades 305, 306 and 307 direct the sheets from the printing station past the erasing and recording stations and blades 308, attached to the tie rods 208 by spring clips 309, deflect the sheets into the stacker box.

A plurality of feed roll shafts are shown arranged along the path of travel of the ledger sheets. The shafts 310 to 321, inclusive, are journaled in the side plates of the carriage unit while the shafts 322 to 334, inclusive, are journaled at each end in the arms 335 to 347 inclusive, respectively, all of said arms except arms 336 and 345 being pivotally mounted on studs 348 attached to the side plates 201, 202. The arms 345 are fixed on a shaft 349 journaled in the side plates of the carriage while the arms 336 are connected to a solenoid mechanism to be later described. Each feed roll shaft has a group of three feed rollers fixed thereon (Fig. 1) and extending across the width of the carriage, the shafts 310 to 321, inclusive, supporting rollers 300 and 350 to 360, inclusive, respectively, and the shafts 322 to 334, inclusive, supporting the rollers 361 to 373, inclusive, respectively. The arms 335 to 347, inclusive, are mounted under the tension of springs 374 so that the feed rollers 361 to 373, inclusive, will be normally urged against the opposing rollers 350 to 360, inclusive.

The drive for the various feed roll shafts is taken from the motor shaft through a plurality of gear trains and clutch devices. One such train extends from the motor

shaft 209 (Fig. 2) through the gears 210, 211, 213, 215, 216, 217, 218, 219, 220, 221, 222 and a gear 375 fixed on the feed roll shaft 211 which in turn drives a gear 376 on the feed roll shaft 322. Gear 375 also drives a gear 377 rotatable on a short shaft 378 fastened to the side plate 202, said gear 377 meshing with and driving a gear 279 fixed on feed roll shaft 310 which carries the feed rollers 300 that aid in starting the sheets through the carriage.

From the description of the apparatus up to this point it will be apparent that a ledger sheet from the bottom of the stack of sheets in the hopper will be picked up by the vacuum cup arms and advanced out of the hopper into engagement with the feed rollers 255 and 300, which further advance the sheet into engagement with the feed rollers 350 and 361 which are driven through the gear train just described. As the ledger sheet passes over the feed rollers 300, a lever 380, pivotally supported on a bracket 381 attached to side plate 202, is pivoted counterclockwise to close a card lever contact 1 (CLC1) to complete control circuits which will be described later. There is also shown extending up through the bottom of the hopper a pivoted lever 382 which serves to close a hopper contact when all the ledger sheets have been removed from the hopper, the hopper contact completing circuits which will be later described.

After leaving the feed rollers 350 and 361 the advancement of the ledger sheet is under the control of various clutches and stop devices associated with each of the four main stations in the machine and for this reason it is thought that it would be better to deal with the remaining portions of the driving mechanism as each station is discussed.

Sensing station

The ledger sheet is advanced by the feed rollers 350 and 361 to the sensing station S which comprises a magnetic spot sensing drum 383 (Fig. 4), a pair of stop fingers 384, a paper side positioner 285 (Fig. 6), the pair of feed rollers 351 and 362 and a card lever contact 2 (CLC2). The card lever contact 2, attached to the side plate 202, is closed with each passing of a ledger sheet by a lever 386 pivotally supported on a bracket 387 also attached to the side plate 202. Non-closure of said contact prevents the operation of a comparing unit, to be later described, on idle cycles when there is no ledger sheet at the sensing station. The feed rollers 351 and 362 are normally out of contact with each other and allow the ledger sheet to pass under the sensing drum until stopped by the stop fingers 384.

In order to secure correct sensing of the small magnetically energized spots recorded along the top edge of the ledger sheet, it is essential that the sheet be accurately located under the sensing drum. The two fingers 384 stop the sheet and thereby serve to position it in the one direction, said fingers being fixedly mounted on a shaft 388 journaled in the side plates of the carriage. Springs 389 extending between the fingers and studs 390 normally urge the fingers to project into the path of the sheets. The fingers are retracted, as will be described, at the end of the sensing cycle.

The ledger sheet is also positioned laterally by pressing the sheet against the edge of a guide plate 391 (Fig. 1) fastened along the bottom of the carriage. The sheet is moved by the paper side positioner 385 (Fig. 6), which is a U-shaped plate member fastened to bracket 392 which is fixedly mounted on a shaft 393 adjacent to the inside face of side plate 201. The shaft 393 is slidably mounted between the side plates of the carriage and fixedly supports, near the side plate 202, a bushing member 394 which extends downward and has a slot at the bottom that fits over a stud 395 fixed to side plate 202. Positioned around shaft 393 and extending between bushing member 394 and side plate 202 is a coil spring 396 (Fig. 6) which normally urges the shaft and the plate

member 385 toward the side plate 201 to allow plenty of clearance for the sheet to enter the sensing station.

With the sheet engaged by the stop fingers, the face cam 247 on the main cam shaft is now ready to operate the paper side positioner through a follower arm 397 which is loosely mounted on a shaft 398 journaled in the side plates of the carriage. One end of the follower arm has a slotted portion which fits over the shaft 393 and is pinned thereto by a pin 399. Through the action of spring 396 the follower 400 on the follower arm is urged to ride on the face of cam 247 and upon engaging the high portion 401, the follower arm will be pivoted so that its slotted end will move towards side plate 202 carrying with it the shaft 393 and plate member 385 which positions the sheet against the edge of guide plate 391. The ledger sheet is now accurately positioned at the sensing station and is ready to be sensed by the sensing drum.

The sensing drum 383 is of a steel material and is fixed on the shaft 214 journaled in the side plates of the carriage. The drive for the drum is taken from the motor shaft through the gears 210, 211 and 213, as previously described in connection with the driving connections shown in Fig. 2.

Referring to Figs. 12 and 13, it can be seen that there are twenty sensing coils SC1 to SC20, inclusive, spatially disposed about the circumference of the drum in the manner of a helix as shown in Fig. 14 in developed chart form. Each coil consists of a synthane bobbin having a soft iron core 402 shaped as a rod placed in the center. Wound on the bobbin is a coil of approximately 13,000 turns of fine wire whose winding axis corresponds with the axis of the center core permitting a maximum interlinkage of the lines of magnetic flux.

Fastened to the side plate 202 is a bracket 403 upon which is mounted a block of insulation 404, said block having fastened to it two brushes 405 and 406. The brush 405 rides on a commutator 407, fastened to the sensing drum, wiping over a series of twenty segments 408, each of which is connected to one side of a sensing coil. The other brush 406 rides on a slip ring 409 to which are connected all twenty of the return wires of the sensing coils. Additionally, brushes 405, 406 are provided with external terminals 410 and 411 attached to the insulated block 404.

The sensing drum is continuously rotating at a speed of approximately 1500 revolutions per minute and, whenever a sensing coil passes over a magnetized spot on the ledger sheet, magnetomotive lines of flux will be cut at a high rate of speed inducing a voltage in the windings of the coil and the spot is said to have been sensed. As will be more fully described later in connection with the wiring of the machine, the voltage pulses in the sensing coils are distributed for operation of the carriage by a 3 spot commutator 412 (Fig. 3) and a 21 spot distributor 413 whose function is to provide sufficient time to energize a relay from a sensed spot on the ledger sheet.

The 3 spot commutator 412 consists of a non-conducting ring 414 fixed on the shaft 212 (Fig. 2) and driven from the motor shaft through gears 210 and 211. Ring 414 has three conducting inserts 415 spaced equally around its periphery and these inserts are wiped by a series of eight brushes 416 mounted in staggered relationship in a block 417. The brushes 416 are wired to a plugboard 418 attached to the outside of the side plate 201. The 21 spot distributor 413 (Figs. 3 and 10) consists of two adjacent non-conducting rings 419, 420 joined together by a conductor ring 421 and fastened to a support plate 422 by studs 423, said support plate being bolted to the side plate 201. Extending through center openings of the rings 419, 420 is the shaft 224 which is continuously driven from the motor shaft through the gears 210, 211, 213, 215 and 216. A pair of non-conducting blocks 424, 425 are fixedly supported on the shaft 224 within the center openings of the rings 419, 420, respectively, and support the metal plates 426, 427, 75

respectively. Said metal plates each support two groups of two brushes 428 mounted in pairs in the holders 429. There are, then, four brushes for each of the rings 419, 420 which during rotation of shaft 224 wipe over a series of ten groups of four conducting segments 430 each, arranged around each of the rings. The brushes are commoned together by a wire 431 connected between the metal plates 426, 427, said wire 431 being suitably connected to a common brush 431a which rides on the periphery of conductor ring 421. Terminal extensions 432 of the individual segments are connected to the plugboard 418 to distribute the sensing circuits from the distributor to various relay coils.

The relationship between the peripheral speed of the sensing drum and the peripheral speed of the 3 spot commutator is 1 to 4 and it will be better understood later that four revolutions of the drum are required to completely sense the twenty columns of the ledger sheet.

At the proper time in the feed cycle after sensing is completed, the face cam 247 and its associated mechanism, previously described, operate to move the paper positioner plate member 385 away from the sheet in the sensing station and toward its home position near the side plate 201. Shortly thereafter, the cam 248 operates a mechanism which will lower the sheet stop fingers 384 below the line of travel of the sheets. This mechanism comprises a follower arm 433 (Figs. 6 and 7) pivoted on the shaft 398 and having one end bearing against the underside of the cam 248. The other end of said follower arm projects beneath an ear 434 of a bell crank arm 435 pivoted on a stud 436 fastened to the side plate 202. The opposite end of the bell crank arm is latched up against a flanged portion on one of the stop fingers under the influence of a spring 437 extending between the bell crank arm and a stud 438. In this position the stop fingers are held up into the path of travel of the sheets. However, the follower arm 433 upon engaging the high portion of cam 248 will pivot clockwise striking ear 434 and pivoting the bell crank arm counterclockwise until ear 434 strikes a flanged portion 439 on one of the stop fingers. As a result the shaft 388 will be rotated counterclockwise carrying the stop fingers down out of the path of travel of the ledger sheets.

Coincidental with the lowering of the stop fingers the cam 249 operates a mechanism to cause the lower feed roller 362 to pivot toward upper feed roller 351 in preparation for ejecting the ledger sheet from the sensing station. The mechanism for accomplishing this comprises a follower arm 440 (Figs. 6 and 7) secured to the shaft 398 and having a roller 441 mounted at one end which rides on the periphery of the cam 249. The opposite end of the follower arm is pivotally connected to one of a pair of links 442 which are in turn connected to the two arms 336 through the studs 443. The other arm 336, which is adjacent the side plate 201, is connected by its link 442 to arm 444 (Fig. 4) secured on the shaft 398. A spring 445 extending between each arm 336 and a stud 446 on the side plates normally urges the cam follower against the cam. When the follower engages the low portion of cam 249, the follower arm and shaft 398 will pivot clockwise raising the feed rollers 362 into contact with upper feed rollers 351. The driving connections for the feed rollers 351 and 362 are under control of clutch devices located at the printing station and will be presently described.

Printing Station

The printing station comprises a printing platen 447 (Fig. 4) for supporting the ledger sheet during operation of the printing mechanism, a high speed friction clutch and braking device which controls the feeding of the ledger sheet from the sensing station, first at a high rate of speed and then at a slower rate of speed, a card lever contact 3 (CLC3) which serves to control the operation

of an electronic counter and a line spacing clutch under control of the electronic counter for positioning the ledger sheet on a predetermined line at the printing station.

The movement of the ledger sheet from the sensing station to the printing position is unique in that before the sheet begins to move, the line upon which printing is to be done will have been determined by entering a line indication number into the electronic counter during the sensing of the ledger sheet in a manner to be later described. Upon an equal comparison between the account number of the ledger sheet at the sensing station with the card in the tabulator feed, an impulse will be directed to the high speed clutch solenoid 448 (Figs. 1 and 3) which will result in driving connections being established to the feed rollers 351 and 362 to cause the ledger sheet to be fed out of the sensing station at a high rate of speed of approximately from 142 to 150 feet per minute or 242 line spaces per second.

The high speed clutch solenoid 448 is fastened to a plate member 449 (Fig. 1) which in turn is fastened to the outside of side plate 201 through spacer members 450. The plunger 451 of the solenoid is connected by a link 452 to pivot 453 on an arm 454 (Figs. 1, 3 and 9) fixed on the end of the clutch shaft 455. Shaft 455 is rotatable in bearings 456 and 456a mounted in plates 449 and 201 and supports the components of the high speed friction clutch. Referring to Fig. 9, the clutch comprises a gear 457 mounted on a first threaded portion 467a of shaft 455 and has the collars 458 and 459 and a nut 459a integral therewith. Also mounted on shaft 455 is a gear 460 free to turn thereon but fixed axially by a collar 460a and a bushing 460b, said gear 460 having the collars 461 and 462 integral therewith. Attached to the collars 461, 462 are the friction discs 463, 464, respectively, said friction disc 463 being adjacent to but normally out of engagement with the face of collar 459. The friction disc 464 is adjacent to and normally in engagement with a disc 465 having a threaded bushing 466 integral therewith which meshes with a second threaded portion 467 of shaft 455. Bushing 466 is provided with a pair of pins 468 which slidably extend into plate member 449. A bushing 468a has a pin 468b which fits into a notch in the nut 459a to prevent rotation thereof and provide adjustment of the gap between members 459 and friction surface 463. A screw 468c serves to lock the bushing 468a in position.

Referring to Fig. 2, the drive from the motor shaft extends to the clutch through the motor shaft gear 210, gear 469 rotatable on a stub shaft 470 fastened to side plate 201, a gear 471 integral with said gear 469, gear 472 rotatable on a stub shaft 473 fastened to side plate 201, a gear 474 integral with said gear 472, an idler gear 475 rotatable on a shaft 476 fastened between the plates 449 and 201, and a gear 477 rotatable on a stud 478 which drives the clutch gear 457.

Energization of the clutch solenoid 448 will move the solenoid plunger 451 and link 452 to the right and cause the arm 453 and shaft 455 to pivot in a clockwise direction. This movement of the shaft imparts a horizontal movement to the bushing 466 through the screw thread connection causing the nut 459a to move the gear 457 assembly sufficiently to bring the continuously running collar 459 into contact with friction disc 463 and moving the braking disc 465 away from friction disc 464. Now, the continuously running drive extends from the gear 457 and collar 459, the friction disc 463, collars 461, 462 and gear 460 to an including the friction disc 464.

It is to be noted that in driving from gear 457 through the friction surface 463 to gear 460 the forces are internally contained with no resultant thrust transmitted to shaft 455. When solenoid 448 is de-energized, a spring 454a causes arm 454 to move to the left rotating shaft 455 counterclockwise. This in turn causes driving gear 457 to be disengaged and brake disc 465 to be engaged with friction disc 464 initiating a braking action on gear

460. The pins 468 prevent rotation of the brake disc 465. Here again, the forces are internally contained with no resultant thrust on shaft 455.

The gear 460 meshes with a gear 479 (Fig. 2) fixed to one end of the feed roll shaft 314. At the other end of this shaft there is fixed a gear 480 (Fig. 5) which transmits the drive to the gears 481 and 482, attached to the upper feed roll shafts 313 and 312, respectively, through a train of idler gears 483, 484, 485 and 486 rotatable on the studs 487, 488, 489 and 490 fixed to the side plate 202. The gears 480, 481 and 482 drive the gears 491, 492 and 493, respectively, fixed on the lower feed roll shafts 325, 324, 323, respectively. The feed rolls 351, 352, 353 and 362, 363, 364 (Fig. 4) are now rotating to start feeding the ledger sheet out of the sensing station at high speed.

Also, at this time, the gear 460 drives a gear 497 fixed on platen shaft 498 journaled in the side plates 201, 202 causing the platen 447 to rotate at high speed.

As the ledger sheet moves towards the printing station it closes the card lever contact 3, attached to side plate 202 through a bracket 494 (Fig. 4), by actuating a card lever 495 pivoted on a bracket 496. The card lever 495 is physically located the equivalent of 36 line spaces from the first print line position at the platen. Print spacing is one-eighth inch with a ledger sheet eight and one-half inches long having 68 line spaces of which 64 lines are utilized for printing leaving a one-quarter inch margin at the top and at the bottom of the sheet. The first printing line at the top of the sheet is considered line 64 with line 1 at the bottom of the sheet.

The electronic counter is an accumulating type of device with a capacity of 100. Assuming, for example, that it is desired to print on line 40, which would be the 24th line from the top of the sheet, the figure 40 is entered into the counter. Then, when the ledger, fed at high speed, closes card lever contact 3, a circuit is completed to a count emitter 498a (Figs. 1 and 11) which will impulse the counter for each line space travel of the ledger. After 36 impulses the ledger sheet will be positioned with line 64 in printing position at the platen and the counter set at 76. Ledger feeding and counter impulsing continues until the ledger sheet reaches a preset number of spaces from the desired stop position, as set in the counter, at which time an impulse from the electronic counter will cause the high speed drive to be disconnected by de-energizing the high speed magnet 448 and allowing the brake disc 465 to be applied. Also, the line spacing magnet 499 (Fig. 2) is energized to call in a line space ratchet mechanism which operates at a speed of 6 feet per minute or 10 line spaces per second to feed the ledger sheet at a slow rate of speed to the desired position. With the high speed clutch assembly restored to its normal position, the brake disc 465 will be applied against friction disc 464 to slow up gear 460 to line space speed and to act as a detent to prevent overthrow while line spacing.

The line space ratchet mechanism comprises a gear 500 (Fig. 2) continuously being driven by the gear 475 and loose on a shaft 501 journaled in the plates 201 and 449. Integral with said gear 500 is a ratchet wheel 502 that revolves past a pawl 503 pivoted on a disc 504 which is fixed to a sleeve 505 pinned to the shaft 501. Also attached to the sleeve is a small gear 506. The line space magnet armature 507 pivoted on a stud 508 is normally biased by spring 509 to abut against the pawl and maintain same out of engagement with the ratchet wheel. An arm 510 attached to stud 508 extends into a notched portion on the periphery of disc 504 and serves as a detent.

Energization of the line space magnet allows the pawl 503 to engage the continuously running ratchet wheel 502 and the drive is now transmitted through the disc 504 and gear 506 to a gear 511 and small gear 512 fixed to a shaft 513 journaled in the side plates 201 and 449. The small gear 512 is rotating at the slow line space speed and transmits the drive to a large gear

514 fixed on an auxiliary shaft 515 journaled in the above-mentioned side plates. Gear 514 carries two pawls 516 which are in engagement with and drive a ratchet wheel 517 and gear 518 loose on the shaft. Gear 518, then, drives gear 460, platen drive gear 497 and feed roll drive gear 479 at the slow speed. After the ledger sheet has been slowed to line space speed, it is then moved at this rate until the electronic counter reaches 100 at which time magnet 499 will be de-energized and the line space mechanism latches to accurately position the sheet at the desired line.

In the electronic counter the brake and line space mechanism can be preset to act at 2, 4, 6, 8 or 10 line spaces from 100. The brake is sufficiently strong to slow the feeding mechanism in the preset number of spaces to prevent overtravel of the platen.

It is to be noted that the ledger sheet is under positive control at all times and when the feeding mechanism, including the platen and all the feed rolls in the sensing station, starts moving, the ledger sheet also starts and thus will move only an exact number of line spaces to the printing position. An additional safeguard to insure correct spacing is in the ratchet 517 feed from the line space mechanism to the high speed feed mechanism. This ratchet feed is overdriven when operating at high speed, picking up when the brake is applied and the speed drops to that of the line space mechanism. This will correct the drive to a whole line space and thereafter will move the platen in units of one line space until the end of the movement. During listing, the movement of the ledger sheet is under control of the tabulator platen feed mechanism which feeds the platen and sheet one line space on each up-stroke of the type bars.

Referring to Figs. 1 and 11, the count emitter 498a used to impulse the electronic counter is shown fixed to the end of the platen shaft 498. The emitter has a series of 44 segments 519 spaced around its periphery which act as shorting segments for two pairs of brushes 520, 521 which are mounted in the insulated blocks 522, 523 fixed to brackets 524, 525 respectively, said brackets being attached to the side plate 202. The brushes are arranged so that first one pair will be shorted by a segment and then the other pair will become shorted while the first pair is between segments and so on. The shorting of a pair of brushes will complete a circuit to pulse the counter.

As will be later described in connection with the circuitry of the machine, the action of feeding ledger sheets to and away from the printing station takes place when the tabulator goes through a total cycle. During the total cycle, the ledger sheet at the printing station will be moved to the erasing and recording stations, a ledger sheet located at the sensing station will be moved to the printing station and a new ledger sheet will be moved from the hopper to the sensing station. To accomplish this end the tabulator total cycle will call in the hopper feed clutch magnet 238 and the high speed clutch magnet 448. The ledger sheet at the printing station is then moved at high speed around the platen and into the pair of feed rollers 354, 367 for conveyance to the erasing station E. The sheet is guided around the platen by a series of 8 guide wires 526 (Fig. 4) connected between the sheet guide blades 304, 306, and the rollers 366 which are spring biased against the platen.

Erasing station

The erasing station E is located approximately halfway between the printing and the recording stations and functions to erase all of the recorded spots on the ledger sheet by magnetizing the whole recording strip to the same magnetic level and polarity. The erasing or wiping-out is done by means of a direct current magnet 527 (Fig. 4) having two pole pieces 528, 529 which are long enough to cover the recorded length on the sheet.

Magnet 527 is mounted on a bracket plate 530 attached to cross bar 531 which extends between the side plates of the machine. The ledger sheet must pass over the two pole pieces and energization of the magnet coil saturates the pole pieces creating a magnetic flux which will erase all previous recordings made on the ledger sheet.

The driving connections for feeding the sheet through the erasing station are taken from gear 532 (Fig. 2) fixed on the shaft 315 and continuously driven by gear 475. Referring to Fig. 5, the other end of shaft 315 has fixed thereon a gear 533 which drives a gear 534 fixed on the shaft 328 and it can be seen that the feed rollers 354 and 367, mounted on these shafts, will be continuously rotating as long as the carriage motor is running. The continuous drive further extends from the gear 533 to the gears 535, 536 fixed on feed roll shafts 316 and 329, gears 537, 538 fixed on feed roll shafts 317 and 330 and gears 539, 540 fixed on the feed roll shafts 318 and 331, by means of the idler gears 541, 542 and 543 revolvable on short shafts 544, 545 and 546 attached to side plate 202. Thus, the lower feed rollers 354 through 357 inclusive, and the upper feed rollers 367 through 370 inclusive are continuously operative to feed sheets through the erasing station.

Positioned between the lower feed rollers 355 and 356 is a card lever contact 4 (CLC4), (Fig. 1) mounted on a bracket 547 which is attached to the underside of guide blade 305. A card lever 548 is pivoted on a yoke member 549 attached to said bracket and extends into the path of the ledger sheets. As a ledger sheet passes over the card lever, the card lever contact will be closed to complete a circuit to energize the magnet 527 to effect an erasing operation.

Recording station

The ledger sheet is fed out of the erasing station by the feed rollers 357, 370 and passes between the eject feed rollers 358, 371, which are normally out of engagement with each other, until the sheet strikes a pair of stop fingers 550 and 551 (Figs. 1 and 8) which normally extend down into the path of the sheet and serve to locate the sheet at the recording station.

Referring particularly to Fig. 8, the stop fingers 550, 551 are pivoted on studs 552, 553 attached to a cross bar 554 fixed between the side plates 201, 202. The stop fingers are also pivoted to studs 555, 556 attached to a movable bar 557 which is normally urged toward the side plate 202 of the machine by a spring 558 connected between the bar and a stud 559 fixed to the cross bar. Through the action of spring 558 and bar 557 then, the stop fingers are normally pivoted counterclockwise to extend into the path of the ledger sheet.

In passing into the recording station the ledger sheet will engage a card lever 460 (Fig. 5) fixed on a stud 561 rotatable in the side plate 202 pivoting same clockwise to close a card lever contact 5 (CLC5). Closure of said contact will complete circuits, to be later described, for controlling the run-out of ledger sheets.

The stop fingers will position the ledger sheet over a recording block 562 (Figs. 4 and 15) which is slidably supported on a pair of guide rails 563, 564, said rail 563 being attached to the underside of one of the guide blades 307 and the rail 564 being fastened to the underside of a positioning rail 564a (Fig. 1). As shown in Fig. 16, the recording block contains 40 recording coils of which 20 are indicated as AB coils and 20 as CD coils. There is one AB coil and one CD coil for each of the twenty columns on the paramagnetic strip of the ledger sheet, the coils being so positioned that first the even columns are recorded and then the odd. A plate member 565 is fastened to the recording block and carries terminals 566 for the electrical connections 567 of the coils. The electrical connections are retained within a shield member 568 fastened to a cross bar 569 and the rails 563, 564.

To carry out the recording operation the recording block is moved toward the rear of the machine (in the direction of the arrow in Fig. 16) to enable the recording coils to sweep across the paramagnetic strip of the ledger sheet stopping at intervals to record the desired magnetic spots. Accordingly, there is provided a cam 570 (Fig. 4) which is operated through a clutch mechanism under control of a recording clutch magnet 571 mounted on a bracket 572 fastened to the inside of side plate 202. Magnet 571 is controlled by a circuit breaker in the tabulator which makes at 265° on the next cycle after a total cycle at which time a ledger sheet will be positioned against the stop fingers at the recording station.

Energization of the magnet 571 will cause its armature 573, fixed on a stud 574 revolvable in the side plate 202, to rotate clockwise thereby releasing a pawl 575, pivoted on a stud 576 fastened to the cam and under the influence of a spring 577, for engagement with a continuously running clutch disc 578. The clutch disc and its driving gear 579 are loose on an auxiliary shaft 580 journaled between the side plate 202 and a bracket member 581 fastened to said side plate, said disc and gear being continuously driven through a small gear 582 integral with the gear 543, the pawl 575 transmitting the drive to the cam 570 which is fixed on the auxiliary shaft 580.

The main purpose of cam 570 being to move the recording block for the recording operation, there is provided a follower arm 583 (Fig. 4) fixed on a shaft 584 which is journaled between the side plates 201, 202 and which is normally urged in a counterclockwise direction under the influence of a torsion spring (not shown) to urge the follower on arm 583 against the periphery of the cam. Also fastened on said shaft 584 are a pair of arms 585 which are connected at their free ends to a pair of links 586 fastened to the recording block.

When the clutch is unlatched by magnet 571 the cam 570 rotates and has an initial rise of 120° which through the above described linkage begins to move the recording block towards the magnetic strip in the ledger sheet held by the stop fingers 550, 551. Concurrently, this initial movement of the cam is utilized to actuate a sheet side positioner mechanism which will position the ledger sheet against the rail 564a to accurately locate the sheet at the recording station. This mechanism comprises a positioner plate 587 (Figs. 1 and 17) fastened to a U-shaped body member 588 which is slidable on the edges of a bracket 589 fastened to the underside of one of the tie bars 206. The positioner plate is normally urged toward side plate 202 by a spring 590 which extends between the body member 588 and a stud 591 in said side plate. The other end of the body member has fastened thereto a cord 592 which rides over a pulley 593 pivoted on the bracket 589 and which is fastened to a spring 594. The spring 594 is in turn fastened to an arm 595 fixed on the cam follower arm shaft 584. When shaft 584 pivots clockwise during the initial 120° rise on cam 570, the mechanism will operate to pull the positioner plate against the edge of the ledger sheet locating same against the rail 564a.

At the end of the 120° movement there is a 12° dwell during which time the coils for recording the "b" and "d" designated elements in the even columns are in position to record as shown in Fig. 16. Next there is a 30° movement and a 12° dwell during which time the coils for recording the "a" and "c" designated elements in the even columns are in position to record. After this there is a 72° movement and 12° dwell followed by a 30° movement and 12° dwell during which time the coils for recording the "b," "d," "a" and "c" designated elements in the odd columns are in position to record in that order. In the 60° of movement remaining the cam and recording block are restored and the positioner plate is returned to its normal position by

spring 590. Also, the recording clutch will latch up, there being a camming block 596 (Fig. 4) attached to the cam 570 which cooperates with an arm 597 fixed on the revolvable stud 574 to restore the armature 573 back into the path of pawl 575 disengaging same from the clutch disc after one revolution of the cam.

Fixed on one end of the cam shaft 580 is a series of seven circuit breakers referred to later in the electrical description as CC1 through CC7. A typical one of these circuit breakers is shown in Fig. 18 and comprises a cam wheel 598 fixed on the cam shaft 580 for cooperation with a lever 599 pivotally supported in a mounting block 600. Depression of lever 599 will effect closure of a spring contact 601 with a stationary contact 602 to complete certain operating circuits.

Upon closure of circuit breaker CC1, a circuit to be later described, is completed to energize a pressure plate solenoid 603 (Figs. 1, 4 and 15) which operates mechanism for clamping the ledger sheet tight against the recording coils during the recording intervals. This mechanism comprises a U-shaped bracket 604 fastened to the cross bar 554 and supporting a rod 605 on which is pivoted a pressure plate member 606. Bearing down on the pressure plate is a plate member 607 which is connected at one end to a stud 608 fastened to the pressure plate solenoid plunger 609. The plate member 607 is biased toward the pressure plate and a pair of stop nuts 610 on stud 608 by means of a spring 611 connected between said plate member and a wire 612 looped around the shaft 349. Solenoid 603 will be energized for each recording interval during which time plate member 607 will pivot the pressure plate slightly clockwise about rod 605 to exert a clamping action on the ledger sheet.

At the end of the recording cycle, a circuit breaker in the tabulating machine will bring about the energization of a solenoid 613, mounted on cross bar 554 (Figs. 1 and 8), for the purposes of moving the stop fingers 550, 551 out of the path of the ledger sheet. The plunger 614 of the solenoid has pivoted thereto an arm 615 which has one end positioned in a slot of a stud 616 fixed to the solenoid and its other end positioned in a slot 617 in the movable bar 557. Energization of the solenoid will move the bar 557 toward the side plate 201 causing the stop fingers 550, 551 to pivot clockwise about studs 552, 553 (Fig. 8) and out of the path of travel of the ledger sheet.

As bar 557 moves towards side plate 201, it will close a pair of normally open contacts 618, mounted on the cross bar 554, to effect the energization of an eject solenoid 619 (Figs. 1 and 15). The plunger 620 of said solenoid has fastened thereto a link 621 which is connected to one of the arms 345, said arms 345 being fixed on the shaft 349 by means of block members 622. Energization of the solenoid 619 will cause the arms 345 and shaft 349 to pivot clockwise bringing the feed rollers 371 into contact with the ledger sheet, backed by feed rollers 358, to feed the ledger sheet out of the recording station. A spring 623 extending between a stud 624 and the link 621 is provided to restore the mechanism when the magnet is deenergized. A stop stud 625 (Fig. 1) fastened to side plate 202 projects over the arms 345 and serves as a back stop when restoring the mechanism.

The drive is communicated to the feed rollers 358, 371 from the continuously running gear 539 (Fig. 5) through an idler gear 626 rotatable on a stub shaft fastened to side plate 202 and the gears 627, 628 fixed on the feed roll shafts 319 and 332, respectively.

As shown in Fig. 1, there is a control panel 629 fastened to the outside of side plate 202 for the purpose of facilitating the connection of wires to the recording coil terminals 566.

Stacker station

The ledger sheet is fed by the eject rollers 358, 371 into the feed rollers 359, 372 (Fig. 4) which in turn feed the

ledger sheet around the deflecting blades 308 and into the feed rollers 360, 373 for ejection into the stacker box 301.

The drive is communicated to the stacking station from the continuously running gear 627 (Fig. 5) through the idler gears 630, 631 and 632 rotatable on stub shafts 633, 634 and 635 fastened to the side plate 202. Gear 632 drives the gears 636, 637 on feed roll shafts 320 and 333 and also drives gear 638 fixed on the feed roll shaft 321.

Electrical connections

Referring to the wiring diagram (Figs. 25a-25t and 26a, 26b), the controls of the ledger posting machine are coordinated, in this illustrative machine, with the controls of an alphabet printing tabulator. The tabulator is of the type disclosed in United States Patents Nos. 2,079,418, 2,172,067 and 2,199,547 to which reference may be made for details of construction. Before describing the manner in which the posting machine is influenced by the ordinary tabulator controls and operations, and vice versa, it is believed well to outline the usual tabulator operations.

In such machines a motor TM (Fig. 25a) is connected to communicate a drive through two clutches which are selectively operated for card feeding and printing operations. A number of CF cam contacts operate only when the card feed clutch is engaged. Certain PM contacts operate only when the printer clutch is engaged. Other CB contacts operate all the time that the motor is active. A series of TS contacts are operated only when a total taking cycle is initiated.

After record cards, such as those shown in Fig. 23, are placed in the feed magazine, an initial feeding cycle is brought about by pressing a start key to connect the card feed clutch devices. The circuits pass from line 639 (Fig. 25a), wire 640, the stop key contacts SP, the start key contacts ST, pickup coil of R12, wire 641 and line 642. Relay 11 will now be picked up through a circuit from line 639, CB31, R61b, RC211-4, RC213-1, RC214-12, RC289B, RC270BL, RC275BL, RC280BU, R68AU, R12BU now closed, pickup coil of R11, wire 643 and line 642. When R11 is picked up the card feed clutch will be energized by a circuit from line 639, wire 644, R11b points now closed, wire 645, the card feed clutch magnet CFCM, wire 646 and line 642. The card feed clutch will engage at 330° in the cycle and start the cards through the feed rolls.

When the card feed clutch magnet CFCM is picked up, a parallel circuit is set up through R61a, the pickup coil of R15, wire 646 and line 642. Relay R15 picks up relay R16 which, in turn, closes contacts R16a to call in the print clutch magnet PCM.

As card feeding starts, a cam contact CF9 closes to call in a relay R1. The circuit passes through line 639, circuit breaker contacts CB1-4, wire 647, timer contacts CF17, CF18, contacts R2c, common brush 648, the upper brush contact roll 649, brush 650, wire 651, cam contacts CF9, the pickup coil of relay R1, wire 652 and line 642. Relay R1 is then held through contacts R1a and CF8 (top of Fig. 25a) until the first feed cycle is well advanced.

Relay R1 is effective to open contacts and de-energize the connections to the card feed clutch. Thus, the card feed mechanism is operated for one cycle and then stopped.

Under initial starting conditions it is necessary to depress the start key a second time to cause a continuous succession of card feed cycles. As soon as cards continue to feed and insulate the brush 650, relay R1 remains de-energized and certain of its contacts remain closed to maintain the holding circuit for the card feed clutch controls. Another relay R2 is connected with relay R1 to control contacts at various points in the machine in the nature of an upper card lever control.

The lower card lever relays R3 and R4 (Fig. 25a) are energized when the first card passes below the upper brushes UB and they remain energized until the last card

passes the lower brushes LB. The first card closes the lower card lever contacts LCLC after digit analysis under the upper brushes. The cam contacts CF6 also close to energize the relays by the circuit: Line 639, wire 653, cam contacts CF6, card lever contacts LCLC, relays R3 and R4, wire 652 and line 642.

On the second feeding cycle, relay R16 is energized by a circuit involving line 639, wire 654, R3b now closed, through S1, CB20, R15a now closed, the pickup coil of relay 16 and line 642.

As a result, the print clutch magnet PCM is picked up by a circuit involving line 639, wire 644, R11b now closed, R16a now closed, print clutch magnet PCM and wire 646 to line 642. The clutch is therefore unlatched and ready to engage at 330° and start the type bars up in synchronism with the movement of the first card passing the lower brushes.

In listing operations the record card passes the lower brushes LB in synchronism with the upward movement of the type bars. Magnets PM operate stop pawls to locate the type bars in positions corresponding to the data punched in the card and at a predetermined time, hammers are tripped to record the information on the record strip. Adjustment of the type bars is regulated by impulses carried to magnets PM from the lower brushes LB. An illustrative printing control circuit involves line 639, circuit breaker contacts CB1-4, wire 647, timer contact CF17 and CF18, wire 655, lower card lever relay contacts R4a, common brush 656, contact roller 657, through the perforation in the card by a lower brush LB, the brush socket, plug wire 658 to socket A1, normally closed contacts TSC, magnet PM, wire 659 and line 642.

Contacts TSC are shifted for total cycles so that printing is then controlled by impulses from an accumulator rather than from the lower brushes.

Group control devices are provided for separately considering different classes or groups of cards as distinguished by different group number perforations for different groups. Consecutive cards are compared, one card being read at the upper brushes while the preceding card is read at the lower brushes. As long as the card readings are alike, the card feed continues to function. When the machine senses that the two group readings are not alike, the feed unit stops, the machine prints the total, the accumulator is cleared to zero, and the machine automatically starts feeding the cards of the next group.

Preliminary to the establishment of group control circuits, a number of preparatory relays R169-R172 (Fig. 25b) are energized to close the circuits for the comparison relays. The preparatory circuit includes line 639, wire 660, cam contacts CF19, relays R169-R172 and line 642. As an example of the effect of these relays, it is seen that relay R169 serves to close contacts R169b in series with the group control pickup coils R129, R131 and R133.

The actual comparing circuits are connected by plug wiring between comparing relay pickup coils and certain upper and lower brushes devoted to sensing group numbers or special perforations. An example of the comparing circuits is as follows: Line 639 (Fig. 25a), contacts CB1-CB4, wire 647, timer contacts CF17 and CF18, contacts R2c, common brush 648, contact roll 649, through the perforation in the card sensed by the upper brush UB, plug wire 661 connected from a socket in line with the upper brush to a socket 662 in line with the pickup coil of relay R129, contacts R169b and wire 663 to line 642. As long as group numbers agree, a companion circuit to that already traced is set up at the same time through a pickup coil of a relay R130 as energized through the lower brushes by the following circuit: Line 639 (Fig. 25b), contacts CB1-CB4, wire 647, contacts CF17 and CF18, wire 655, relay contacts R4a, common brush 656, contact roller 657, through a perforation in the card sensed by the lower brush LB, a plug wire

664 connected to socket 665 (Fig. 25b), pickup coil of relay R130, contacts R172b, wire 663 and line 642.

Relays R129 and R130 have holding coils and contacts in series therewith for sustaining the comparing circuit connections. The holding circuit includes line 639, wire 660, CF21, contacts R129a, the holding coil of relay R129 and line 642. In a similar fashion the other pairs of holding coils, such as those of relays R133 and R134, are picked up and held as a part of the comparing control.

Referring to the upper left-hand corner of Fig. 25b, it is seen that the pairs of comparing relays are associated with pair of contacts so arranged that, when a related pair such as relays R129 and R130 are energized at the same time, they fail to provide a circuit path. However, should one or the other be energized alone, showing that there is a disagreement in the group control perforations, then a circuit is established for setting up a minor control operation: Line 639, cam contacts CB17, CB18, the left contacts R129a, the right contacts R130a, socket 666, plug wire to socket MI SHUNT, the pickup coil of relay R53 (Fig. 25a), wire 659 and line 642. A holding circuit is established through CB40 for relay R53 due to the closure of contact R53a in series with the holding coil. The holding coil of relay R53 operates other contacts R53b in series with the minor control pickup coils of relays R61, R66. The minor control circuit includes line 639, cam contacts CB19 (Fig. 25b), lower card lever relay contacts R3b, relay contacts R53b, switch S4, the pickup coils of relays R61, R66, wire 667 and line 642.

A holding circuit is established for relays R61, R66 by the closure of contacts R61a and connections which may be traced from line 639, wire 668, cam contacts PM15, contacts R61a, relays R61, R66, wire 669 and line 642. These relays have contacts throughout the machine for controlling the suspension of card feeding, the initiation of total taking, etc.

The foregoing description of the group control comparison and the resulting pickup of minor relays for control purposes is duplicated with respect to other columns or groups of columns on the record cards for intermediate and major control. The particular columns selected for control are made effective by plugging from various sockets, such as socket 666 to the sockets INT and MAJ.

The circuit arrangements mentioned hereinbefore deal mainly with the control of the tabulator, while those about to follow are concerned with the controls for the ledger posting carriage.

Assume the ledger hopper is filled with ledgers whose account numbers are in ascending numerical order, the lowest numbered ledger being at the bottom of the stack so that it will be the first to feed into the machine. Also that the card hopper of the tabulating machine is filled with transaction cards which have been so sorted that the account numbers punched therein are in ascending numerical order, the lowest numbered card to be fed first.

Assume as well that the main on-off switches are thrown to be on thus activating the drive motors of the carriage and the tabulator, the tabulator generator and the carriage power supplies. The tabulator drive motor TM in running causes continuous rotation of the various clutch shafts and the CB shafts as well as certain CBC circuit breaker shafts. The carriage drive motor CM in running causes continuous rotation of the various carriage clutch shafts, feed roll shafts, sensing drum and various emitter shafts.

Depression of the tabulator start key for an instant only causes a circuit as previously described to be established that will enable the tabulator to take one card feed cycle.

Depression by the operator of the carriage start key (Fig. 25b) causes a circuit to be established from line 639, continuous running carriage circuit breaker CBC13, carriage start key 670, the pickup coils of reset relay RC276, platen interlock relay RC290 and line 642. The platen interlock relay RC290 is provided to position the

platen in a detented position before the start of an operation so that the ledger may stop on a full line and energization of same causes contacts RC290A to be closed establishing a circuit from line 639, wire 671, contacts RC290A, coil of line space magnet control relay RC291 and line 642. The associated contacts RC291A and RC291B (Fig. 26b) are closed and transferred, respectively, establishing a circuit from line 672, wire 717, wire 673, transferred contacts RC291B, coils of the line space clutch magnet 499, voltage dropping resistor 674, contacts RC291A and line 675.

The line space clutch pawl 503 (Fig. 2) is engaged with the continuously running ratchet wheel 502 causing the printing platen 447 to take a number of full line spaces. The number taken will be determined by the length of time the operator holds the carriage start key closed. The purpose of this circuit is to make certain that the platen will take a full number of line spaces the next time it is moved.

Energization of the relay RC290 also closed contacts RC290B establishing a circuit from line 639, CBC13, wire 676 (Figs. 25b and 25c), wire 677, contacts RC290B, pickup coil of relay RC269, wire 678, and line 642. Relay RC269 is a double coil relay, its holding circuit being from line 639, through CBC12, the normally closed contact RC275BU, RC269AL, the hold coil of RC269, wire 678 and line 642.

Referring to Fig. 25a, contacts RC269AU bridging the tabulator start key are now closed causing the tabulator start circuit to be energized which in turn actuates the card feed clutch and the first transaction card thus passes through the upper or comparing brushes. Concurrently, the carriage hopper feed clutch (Fig. 2) is energized as follows: line 639 (Fig. 25d), contact RC269BU now closed, CBC10, coils of the hopper feed clutch magnet 238 and line 642.

By means of the ledger feeding mechanism the bottom ledger (lowest account number) is fed into the machine and into the sensing station. Between the first and second feed rolls, the ledger sheet closes the hopper card lever contact 1 completing a circuit from line 639 (Fig. 25c), through CBC12, wire 679, card lever contact 1, pickup coil of relay RC248 and line 642. Relay RC248 holds through a circuit from line 639, through contacts RC214-11, contacts RC213-6, contacts RC248-4, wire 679, hopper card lever contact 1, coil of relay RC248 and line 642. The RC248-4 contacts shunt CBC12 and provide a secondary branch to the hold circuit of RC269. Relay RC248 also has a hold coil which is energized through a circuit from line 639 (Fig. 25e), CB27, wire 680, contacts RC248AL now closed, the hold coil of relay RC248 and line 642, thereby holding the relay RC248 while the card lever contact 1 is open between ledger sheets.

The ledger sheet and the tabulating card feed simultaneously, the ledger stopping in the sensing station of the carriage while the card stops after passing through the comparing brushes. Normally there would be a minor control break due to the action of the tabulator comparing relays in comparing a card at the upper brushes with none at the lower brushes. However, in the present application the account number in the card is to be compared with the account number magnetically recorded in the ledger sheet and the circuits for accomplishing this will be described after the sensing circuits have been traced.

As was previously described the sensing drum 383 incorporates twenty coils, one for each column, distributed around its circumference. A developed picture of the locations of these coils is shown in Fig. 14. Referring to both Figs. 14 and 25h and assuming that sensing is started with coil 1 (representing as well column 1) then the sequence of sensing by columns is 1-12-2-13-3-14, etc., to blank-11-1. The sensing drum is continuously rotating and thus the coils have developed in them voltage pulses representing the recorded spots for each of 20 columns in each revolution.

The time relationship between the sensing drum, the 21 spot distributor 413 and the 3 spot commutator 412 is as follows: Referring to Fig. 25h, when the No. 1 coil core is so positioned that it is about to pass over the "a" code spot in column 1 of the ledger, then the "a" pair of brushes of the 3 spot commutator will be in a position to pass over one of the conducting inserts 415 and at the same time one set of the brushes 428 of the 21 spot distributor will be in position to contact the four segments 430 that relate to the No. 1 column or position. The "b," "c" and "d" brushes of the 3 spot commutator then pass over insert 415 in succession as the No. 1 coil core passes over the "b," "c" and "d" code spots in column 1 of the ledger while the said set of brushes 428 continue to contact the four segments 430 that relate to column 1. The groups of segments 430 are arranged in alternate positions around their respective rings and are distributed on the distributor mouldings with respect to the transist of the coils past the spot locations so that they read out the sensed information in a columnar sequence of 1—3—5—7—9—11—13—15—17—19—blank—2—4—6—8—10—12—14—16—18—20 and blank. The 3 spot commutator serves to distribute the bits of each code combination, while the 21 spot distributor serves to distribute the code combinations to their respective relay groups.

The sensing coils SC1 through SC20 are connected to a vacuum tube amplifier, indicated at 681 on Fig. 25h, through the sensing drum brush 405 and a cable 406a grounded to the amplifier chassis. Thus the voltage appearing between ground (chassis ground on the amplifier unit) and the other end of the sensing coils is impressed upon the grid of the vacuum tube amplifier. The amplifier may be of any well-known type such as a 6SF5 high gain pre-amplifier tube working into a base clipping amplifier tube which eliminates the majority of hash and other extraneous signals which may have been picked up. Due to the base clipping action of this tube the desired signal may still be very weak and if so a cascade voltage amplifier of two or more tubes may be used to secure a high voltage output.

The output of the pulse amplifier is fed to the 3 spot commutator and depending upon the time relationship of the pulse there is one of four possible paths through the commutator brushes a, b, c or d which correspond to elements of the binary code (Fig. 28). Each of these paths leads to two type 2050 thyratron tube grids 682 (Fig. 25i). There are four pairs or eight thyratron tubes 683 and members of each pair operate alternately as determined by the 21 spot distributor which impresses plate voltage on a set of four of said tubes to operate at any one time. A plurality of sensing code relays RC1, RC3, etc., are in series with the tube plates and the power supply so that when a tube is triggered to an on condition, plate current will flow and the relay will be energized. In view of the space requirement only a few of the sensing code relays have been shown in Fig. 25i. It will be understood that the remainder of these relays will be connected between the 21 spot emitter and the broken wires such as the one indicated at 684. Although not shown in the drawings, relays such as RC2, RC4, etc., are connected in parallel with the corresponding relays RC1, RC3, etc.

A typical sensing circuit would extend as follows: Sensing coil SC1 passing over the "a" spot in column 1 of the ledger sheet, brush 405, amplifier 681, the "a" upper brush, spot 415 and "a" lower brush of the 3 spot commutator, the "a" wire to the grid 682 of the left-hand tube 683 triggering said tube and setting up a circuit from line 685, through the left-hand tube, wire 686, the pickup coil of relay RC1, the 1 cable of the 21 spot distributor, segment 430, brush 428, wire 431, common brush 431a, common segment 421, wire 688 (Fig. 25i)

to a suitable source of +80 volts. The hold circuit for RC1 extends from line 639 (Fig. 25j), wire 689, cam contacts CBC1, wire 690, the RC1-12 contacts now closed, the hold coil of RC1, wire 691, wire 692 and line 642.

Referring to the chart shown in Fig. 29, it may be seen how the various sensing code relays are assigned to the binary code elements and to the columns of the ledger sheet. These relays have various contact points throughout the circuitry of the machine which are used for comparing the ledger sheet with the card, converting a binary number to a decimal number and for completing hold circuits to the relays themselves.

The comparing cycle is initiated upon the ledger sheet arriving at the sensing station and closing the card lever contact CLC2. Closure of CLC2 completes a circuit from line 639 (Fig. 25c), CBC12, wire 679, CLC2, the pickup coil of relay RC278 and line 642. The normally open contacts RC278A (Fig. 25j) now close to complete a circuit through the comparing mechanism (Fig. 20), which is operated by the tabulating card, to the comparing relays energizing them as follows: from line 639 (Fig. 25j), wire 693, contacts RC268BL, RC275AL, RC278A, RC281B, cam contacts CBC5, wire 694, the comparing mechanism, relay points of the sensing code relays through the group of comparing relays RC162 through RC181 (Figs. 25j and 25k) and line 642. Only the comparing circuits for the first and last positions (columns 1 and 10) are shown, the other eight positions being identical in arrangement to those shown.

As an example of comparing, column for column, the numbers recorded in the ledger and punched in the tabulating card assume that the tabulating card passing under the comparing brushes has a "7" hole punched in column 1 and that a magnetic recording consisting of the combination a, b, c, designating a "7" appears in column 1 of the ledger. This will complete a circuit from line 639 (Fig. 25a), circuit breaker contacts CB1-CB4, wire 647, timer contacts CF17 and CF18, contacts R2c, common brush 648, contact roll 649, through the "7" hole in the card, upper brushes UB, plug wire socket and plug wire connection to socket 694a (Fig. 25j), comparing magnet coil 36 for column 1 and line 642. The sector 35 (Fig. 20) driven in synchronism with the card will be stopped on the "7" tooth, thus completing a circuit from the common strip of the No. 1 comparing unit, readout pawls 51, 52, the "7" segment, wire 695, wire 696, contacts RC1-11 transferred, RC3-10 transferred, RC5-8 transferred, closed side of contacts RC7-3 and comparing relay RC162 to line 642. A parallel circuit is also completed from the "7" segment, wire 695, contacts RC1-7 transferred, contacts RC1-8 transferred or contacts RC7-8 closed, through contacts RC7-9 closed, the pickup coil of comparing relay RC163 and line 642. Contacts RC1-11, RC3-10 and RC5-8 are to be considered transferred due to sensing the binary code elements a, b, c in column 1 of the ledger sheet which caused the energization of relays RC1, RC3 and RC5. As will be understood shortly, the energization of relays RC162 and RC163 indicates an equal comparison between the information punched in column 1 of the tabulating card and the information recorded in column 1 of the ledger sheet. The corresponding two relays, such as 164, 165 for column 2, would be energized on an equal comparison in that column. The comparing sectors are restored by a circuit which extends from line 639 (Fig. 25g), CBC4, contacts R11BU closed, restoring magnet coils 57 and line 642.

In addition to comparing a ledger with a tabulating card to see if account numbers are equal to one another, it is necessary to the proper functioning of the machine to know also whether the ledger, if not equal, is either high or low with respect to the tabulating card. If the ledger is low it is presumed to be inactive and as such,

circuits to be described later, are set up to feed the low ledger through the machine without any alteration to its recordings or additions to its printed information.

However, if a ledger is high with respect to the tabulating card, then it is presumed that either one of two conditions exists. (1) The ledgers are in the wrong sequence or that an active ledger has been removed from the file. (2) The tabulating cards are in incorrect sequence.

The low, equal and high comparing circuitry is shown in Fig. 25*k* connected to the low, equal and high control relays RC285, RC284 and RC283. It is to be noted that, for simplicity, only the points of the comparing relays RC162, RC163, RC180 and RC181 for columns 1 and 10 are shown. The complete circuit would include the points of comparing relays RC164 through RC179 also, wired in the same fashion as the points of the comparing relays shown.

In order to understand how the machine functions are controlled by the low, equal and high comparing circuits several different conditions between the account number in the tabulating card and the account number in the ledger sheet will be assumed.

Assuming an equal comparison in columns 1 through 10 whereby relays RC162 through RC181 are energized, a circuit will be completed from line 639 (Fig. 25*j*), contacts RC268BL, RC275AL, RC278A, RC281B, CBC5, wire 694, CBC6 (Fig. 25*k*), contacts RC162-1 transferred, contacts RC163-2 transferred, contacts RC180-1 transferred, contacts RC181-2 transferred, pickup coil of equal control relay RC284 and line 642. The holding circuit for relay RC284 extends from line 639 (Fig. 25*g*), CBC8, closed side of contacts RC258-1, contacts RC284AU transferred, hold coil of relay RC284 and line 642. A parallel circuit is also completed from contacts RC284AU transferred, the pickup coil of relay RC252 and line 642, said relay RC252 holding along with RC284 through CBC8. A parallel circuit is also completed from contacts RC284AU, wire 697, wire 698, the pickup coil of relay RC213 and line 642. Now, contacts RC213-1 in the pick circuit of relay R11 (Fig. 25*a*) open to prevent a card feed operation after an equal reading. A total and an old balance cycle (circuits to be described) will always follow a cycle in which an equal reading appeared because the first equal reading is always accompanied by a control break in the tabulator.

In addition, the RC284AL contacts close to establish a circuit from line 639 (Fig. 25*f*), wire 699, contacts RC284AL, pickup coil of sensing control relay RC266 and line 642. Sensing control relay RC266 is used to control the test impulse through the comparing unit and the impulses to the various clutch magnets for feeding normal active ledger sheets which are ledger sheets on which equal comparisons are made. The holding circuit for relay RC266 extends from line 639, wire 700, CB38 and CB39, contacts RC266AL, the hold coil of relay RC266 and line 642.

With relay RC266 energized, the RC266BU contacts close to complete a circuit from line 639 (Fig. 25*b*), CBC13, wire 676, the RC266BU contacts (Fig. 25*c*), wire 701, the pickup coil of sensing control relay RC267 and line 642. A hold circuit for relay RC267 extends from line 639, CBC15 and the RC266AU contacts, wire 702, the hold coil of relay RC267, the RC267AL contacts, the pickup coil of sensing control relay RC268 and line 642. The RC268BL contacts in the circuit to the comparing units (Fig. 25*j*) open to prevent energization of the low, equal and high control relays through the comparing unit on total cycles, old balance cycles and the first idle cycle following a total cycle.

The circuits just described serve to control the operation of the carriage for a normal condition where there is an equal comparison between the card at the upper brushes and the ledger sheet at the sensing station with

an unequal comparison between the card at the upper brushes and the card at the lower brushes.

It will be remembered that an unequal comparison between cards causes the tabulator to go into a total cycle during which time amounts standing in the accumulators will be read out for total printing. In normal operation the amounts standing in the accumulators at this time will relate to the preceding ledger sheet which has been positioned at the printing platen and as a result these amounts are printed on that ledger sheet. It has been shown how an equal comparison between the ledger sheet and the card causes the energization of the equal control relay RC284 and the equal control relay RC252. The reason for energizing relay RC252 from an equal comparison is to open the RC252-1 contacts (Fig. 25*d*), in the pick circuit of the ledger feed control relay RC208 to prevent energizing this relay after an equal reading and a control break. As a result the feeding of the ledger sheet will be under control of the total cycle as will be described.

The accumulators are shown on Figs. 25*i* through 25*o* and are the well-known Mills type of accumulator shown and described in U.S. Patent No. 2,079,418. In the present embodiment of the invention there are four accumulator positions allotted for the line space control number, ten positions for the account number, eight positions for the balance amounts and eight positions for grand total amounts. Entries from the tabulating or transaction cards are made in the usual manner through plug wire connections to the entry hubs 730 of the accumulators. However, in the case of the ledger sheets the readings must be converted from the binary code to the decimal code before they are entered into the accumulators and as a result the ledger sheet readings are entered through an emitter EM and a network of code relay points.

Before tracing a typical adding circuit it should be pointed out that the circuitry for the line space accumulators and the grand total accumulators deviates from the normal arrangement in that contacts of relays RC201 and RC202 are arranged in individual shunt circuits around the PBCB contacts of these particular accumulators. Relay RC201 is a carry control relay and is energized every cycle during a carry period except on total cycles by a circuit which extends from line 639 (Fig. 25*e*), CB19, wire 743, total relay contacts RC207-5, the pickup coil of relay RC201 and line 642. The purpose of the RC201 contact points is to allow the normal carry circuits to the line space and grand total accumulator add magnets to be completed. The points shunt around the PBCB contacts of these accumulators because the PBCB contacts are only active on a card feeding cycle and hence are open at this time since the card feed circuits of the tabulator are still open due to the equal comparison. Relay RC202 is an adding control relay and is energized every cycle during the adding period except on total cycles by a circuit which extends from line 639 (Fig. 25*e*), CB27, minor total contacts RC286A, the pickup coil of relay RC202 and line 642. The RC202 contact points operate to allow the normal adding circuits to be completed to the line space and grand total accumulator add magnets as the PBCB contacts are inactive (open) at this time. The minor total contacts RC286A prevent RC202 from being energized on a total cycle and are controlled by relay RC286 which is energized during every total cycle by a circuit which extends from line 639 (Fig. 25*g*), minor total contacts R66BL, wire 744, the pickup coil of relay RC286 and line 642. The pickup coil of minor total relay RC300 which is wired in parallel with RC286 is also energized by this circuit to provide additional minor total contacts. RC286 and RC300 will hold until the minor total relay R66 drops at 210° of the total cycle.

To trace a typical adding circuit assume, for example, that the print line indication number recorded on the

ledger sheet is a "7" which would be in the form of spots "a," "b" and "c" in column 20 or the units position. The adding circuit would extend from line 639 (Fig. 25a), CB's 1 through 4, the upper control impulse hubs UCI, plug wire connection to hubs 745 (Fig. 25l), the equal relay contacts RC284BU which are now closed as a result of the equal comparison, contacts R66BU, emitter EM, emitter brush, the 7 segment, wire 7 through the RC232-2 contacts now transferred for the "a" spot, RC233-2 contacts transferred for the "b" spot, RC234-2 contacts transferred for the "c" spot, normally closed side of contacts RC235-2, closed contacts RC215-10, wire 746, contacts RC202-12 now closed, the normally closed side of the TSA contacts, the add magnet and line 642. Two accumulators each having two positions are used for the line indication number and so a parallel circuit extends from the RC215-10 contacts, wire 747, contacts RC202-10, the TSA contacts and the add magnet in the units position of the second accumulator to line 642.

In the case of the account number and balance accumulators the adding circuit would differ slightly due to the fact that these accumulators do not include contacts of relays RC201 and RC202. Assume, for example, that a 7 is recorded in column 11 to represent the old balance. The adding circuit extends through the emitter EM, as previously described, wire 7 transferred contacts RC71-2, RC72-2 and RC73-1 (Fig. 25m), normally closed contacts RC74-1, closed contacts RC215-1, wire 748, the add magnet and line 642. As balance readings are entered into the balance accumulator group they are also automatically entered into the grand total accumulators and so a parallel circuit extends from the RC74-1 contacts, through wire 749, contacts RC202-1 now closed, the closed side of contacts TSA, the add magnet of the grand total accumulator and line 642. The account number is entered into the account number accumulator group in the same manner as the balance readings are entered into the balance accumulator group except that the account number is confined to the account number accumulator group only and, of course, is not automatically entered into the grand total accumulator group.

The low control relay contacts RC215-1 through RC215-8 in the balance accumulator group will open on a low comparison to prevent entering a balance number from an inactive (low) ledger sheet. Similarly, contacts RC215-9 and RC215-10 in the print line indication accumulator group will prevent entering a print line indication number from an inactive ledger sheet. The low control relay contacts RC214-1 through RC214-10 in the account number accumulator group will open to prevent entering an account number from an inactive ledger sheet. The low control relay contacts RC285BU at the entry to emitter EM will close on a low comparison to allow the adding of all inactive ledger sheets into the grand total accumulator group.

The carry circuits for the accumulator groups are conventional carry circuits described in Patent 2,079,418 and it is not deemed necessary to describe them here.

Assuming, then, that entries have been made into the accumulators for the preceding ledger sheet and that the tabulator is going through a total cycle following the equal comparison, a circuit will be completed from line 639 (Fig. 25b), CB22 and CB23, minor total contacts R66AL now closed, the minor total control hubs, plug wire connection to the total control hub (Fig. 25o), wire 731, through the total switch plate contacts TSA now transferred and the add magnets of the accumulators to line 642. This impulse comes at 351° of the tabulator cycle and starts all of the adding wheels of the accumulators turning in synchronism with the upward movement of the type bars.

Parallel circuits are also completed at this time from line 639 (Fig. 25e), PMC3, total switch plate contacts TS-D5 now closed, the closed contacts RC212-9, RC287B and RC279BL, the pickup coils of progressive total relays

RC203, RC204 and RC249. Points of relays RC249, RC204 and RC203 in the line space number, account number and balance accumulators, respectively, transfer to complete circuits to the subtract or cancellation magnets on total cycles when the accumulators reach zero. These contacts replace the standard TSB total switch plate contacts and, as will be seen later, if desired they may be prevented from transferring to suppress the cancellation impulse allowing the accumulators to return to their original setting.

When the accumulator wheels reach zero the circuits for printing the totals are completed from line 639 (Fig. 25a), CB1 through CB4, wire 732, CB13 (Fig. 25l), wire 733, through the 10 side of the 9-10 contacts of the accumulators, the total exit hubs 734, plug wire connections to the total entry hubs 735 (Fig. 25a), transferred side of total switch plate contacts TSC, print magnets PM, wire 659 and line 642. The line indication number, account number, new balance and, if desired, a grand total amount will now be printed on the ledger sheet positioned at the platen. Parallel circuits are also completed from the 10 side of the 9-10 contacts, through the transferred contacts RC249-1 through RC249-4, RC204-1 through RC204-10, RC203-1 through RC203-8 and the TSB contacts of the accumulator groups, the subtract or cancellation magnets S and line 642. The energization of the subtract magnets at this time stops the accumulator add wheels at zero and thus the accumulators are ready to receive new entries from the equal ledger sheet at the sensing station.

As was previously explained the movement of the ledger sheet from the sensing station to the printing position is unique in that before the sheet begins to move, the line upon which printing is to be done will have been determined by entering a line indication number into an electronic counter during the sensing of the ledger sheet before the above-described total cycle. Assume, for example, that the ledger sheet at the sensing station has a line indication number of 40 recorded in columns 19 and 20 indicating that the sheet should be stopped at the platen on the 24th line from the top. The sensing of the "4" in the tens position (column 19) will energize sensing code relay RC230 corresponding to "C" of the binary code. A circuit will then be completed from line 639 (Fig. 25p), wire 736, CB26, the equal control contacts RC213-4 transferred on an equal comparison, wire 737, wire 738, contacts RC230-1, the pickup coil of electronic counter setup relay RC195 and line 642. The electronic counter setup relays RC193 through RC200 correspond to the binary code elements recorded in columns 19 and 20 and are used to enter the recorded line indication number into the counter. The energization of relay RC195 will condition the circuit which extends from the negative 100 volts grid bias supply (Fig. 26b), wire 739, wire 740 (Fig. 26a), wire 741, closed contacts RC192-3, contacts RC195-1 now open to the grid of trigger tube C10. Trigger tube C10 is normally in the "off" position but the interruption of the grid bias flips the trigger to the "on" position. Since trigger C10 corresponds to the "C" element of the binary code for column 19 (tens position) and all of the triggers A1 through D1 for column 20 (units position) are biased to the "off" condition, the counter now stands at 40.

Any total cycle except certain progressive total cycles will initiate a new ledger feed. Referring to Fig. 25g, cam contact PMC2 makes just prior to the start of the total cycle to establish a circuit from line 639, minor total contacts R66BL now closed, PMC2, wire 720, the pickup coil of total relay RC207 and line 642. Relay RC207 will hold through the total cycle by a circuit from line 639 (Fig. 25c), CBC14, wire 708, contacts RC207-6, the hold coil of relay RC207, wire 709 and line 642. Energization of relay RC207 will, at approximately 98° of the total cycle, complete a circuit from line 639 (Fig. 25d), the RC207-3 contacts, the RC280AL and RC212-3 con-

tacts in parallel, CBC10, the hopper feed clutch coils 238 and line 642.

As the new ledger sheet is fed from the hopper it becomes necessary to feed the ledger sheet at the sensing station to the printing station and also the ledger sheet at the print station should be moved to the erasing and recording stations. To accomplish this end, the platen clutch control relay RC282 is energized on the same cycle as the hopper feed clutch magnets. Referring to Fig. 25f, a circuit may now be completed from line 639, cam contacts PMC1, the now closed contacts RC207-2, contacts RC212-4 and RC280BL in parallel, wire 742, the pickup coil of relay RC272 and line 642. The holding circuit for RC272 extends from line 639, wire 700, CB38 and CB39, the RC272AL contacts, the hold coil of relay RC272 and line 642. Energization of relay RC272 completes a circuit from line 639, contacts RC272B, contacts RC300AL which will close when relay RC300 drops at 210° of the total cycle, the pickup coil of relay RC273 and line 642. The holding circuit for RC273 extends from line 639 (Fig. 25c), CBC's 14 and 15, wire 708, contacts RC273AL, the hold coil of RC273, wire 709 and line 642. The platen clutch control relay RC282 is now energized at approximately 310° of the total cycle by a circuit from line 639 (Fig. 25d), contacts RC207-3, contacts RC280AL and RC212-3 in parallel, wire 718, CBC9, contacts RC273BU, wire 710, the pickup coil of platen clutch relay RC282 and line 642. A hold circuit for RC282 extends from line 639 (Fig. 25c), wire 711, CBC17, wires 712 and 713, RC282AL contacts, the hold coil of RC282 and line 642. Referring now to Fig. 26b which shows a portion of the electronic counter, it will be seen that energization of the clutch relay RC282 will cause a circuit to be completed from the zero voltage terminal, wire 675, through control tubes 714 and 714a, wire 715, the high speed clutch solenoid 448, wire 716, contacts RC282B, wire 717, to the +250 volt terminal.

Soon after the time that the pick circuit for the hopper feed clutch coils 238 was completed, a parallel circuit is completed from line 639 (Fig. 25d), contacts RC207-3, contacts RC280AL and RC212-3 in parallel, CBC11, the pickup coil of recording stop control relay RC288 and line 642.

The energization of solenoid 448 operates the high speed clutch to feed the ledger sheet out of the sensing station. Energization of recording stop control relay RC288 completes a circuit from line 639 (Fig. 25d), contacts RC288B, the recording stop solenoid 613 and line 642. A holding circuit for relay RC288 extends from line 639, CB32, wire 719, the RC288A contacts, the hold coil of RC288 and line 642. Solenoid 613, it will be remembered, operates the stop fingers 550, 551 at the recording station and is energized on all ledger feeding cycles to allow ledger sheets to feed out of the recording station.

At this time the total cycle ends and the following cycle is called an old balance cycle during which time the printing line indication, the account number and the old balance recordings on the ledger sheet just leaving the sensing station are entered into the tabulator accumulators by the adding circuits previously described.

As the readings from the ledger sheet are entered into the accumulators the sheet is moving from the sensing station toward the printing station and this movement will be under control of the electronic counter so that the sheet will be positioned with the desired printing line at platen. When the sheet reaches a position which is the equivalent of 36 line spaces from the first print line position at the platen, the card lever contacts No. 3 are closed to complete a circuit from line 639 (Fig. 25c), CBC12, wire 679, CLC3, closed contacts RC277B, the pickup coil of relay RC206 and line 642. Relay RC206 holds through a circuit which extends from line 639, wire 711, CBC17, wire 712, the RC206-4 contacts, the hold coil of RC206 and line 642. When energized, relay RC206 al-

lows the count circuit from the count emitter 498a (Fig. 11) to pass to the electronic counter.

The electronic counter, the circuitry for which is shown on Figs. 26a, 26b, is a two position "scale of tens" counter employing for the main part a series of Eccles-Jordan trigger tubes and incorporating a locking tube and circuit to modify the cascade of Eccles-Jordan triggers so as to emit one output pulse for every ten pulses put in. The counter is basically a binary counter employing two groups of four stages each, the stages A1-A2 through D1-D2 relating to the binary code for the units position digit of the line indication number recorded in column 20 and the stages A10-A11 through D10-D11 relating to the tens position digit recorded in column 19. However, the binary arrangement is modified to count by the decimal system by the locking tubes B3 and B12 which function to allow a higher stage to control an intermediate stage to prevent response to certain impulses, thereby modifying the normal binary sequence. Such a modified binary counter is shown and described in U.S. Patent No. 2,536,955, issued to R. L. Palmer et al. on January 2, 1951, and hence, the description will be limited to only the details necessary for an understanding of the present invention.

The trigger circuit comprises two electronic tube elements, which may conveniently be the two halves of a twin tube, such as a 12SN7. The cathodes 750 are connected to a zero potential line 675, while the plates are connected to a +150 volt line 751 through equal resistances 752, 753 and 754. An output lead 755 is connected to an output terminal between the latter two resistances. The plate 756 of tube A2 is connected by a lead 757 to one end of a voltage divider composed of two resistances 758 and 759, the other end of the voltage divider being connected to a -100 volt bias line 739. The grid 760 of tube A1 is connected to the mid-point of the voltage divider 758, 759 and a condenser 761 is connected in parallel to the resistance 758. The plate 756 of tube A1 is connected in the same way by a lead 762 to one end of a voltage divider 763, 764 which is connected at its other end to another -100 volt bias line 765. The grid of tube A2 is connected to the mid-point of the voltage divider 763, 764 and a condenser 766 is connected in parallel to resistance 763. The grids of both tubes are further coupled by individual condensers 767 and a wire 768 to the output terminal 769 of a trigger tube 12 which serves to feed input pulses to the counter.

As is well known, the trigger circuit has two stable conditions. In one condition the tube A1 is conductive while in the other the tube A2 is conductive. When either tube is conductive, the other is biased below cut off. An impulse of the right characteristics out of the output terminal 769 will cause the circuit to reverse from either stable condition to the other. The small circle near the tube A2 indicates that this tube is conductive in the normal or 0 state of the counter. When the trigger circuit so reverses to the right, that is, the right-hand tube A2 becomes conductive, an effective impulse is transmitted to the next stage. For this reason the right-hand tube of each stage is called the transmitting tube while the left-hand one is called the counting tube. A single stage of the counter is said to be "off" when it is in normal condition, with the transmitting tube conducting, and "on" when reversed.

With relay RC206 energized, a circuit is completed from the -250 volt terminal (Fig. 26b), wire 770, closed RC206-2 contacts (Fig. 26a), brushes 520 and contact segment 519 of the 44 segment count emitter 498a, wire 771 to the grid of the normally conducting tube I1 of the input trigger cutting off tube I1 and reversing the trigger to the right. The current flow in tube 12 causes a drop in potential at the plate which results in a negative pulse being transmitted from the output terminal 769 and wire 768 to the grids of tubes A1 and A2 of the first

trigger stage. The normally conducting tube A2 will be cut off and the trigger reversed to the left or to the "on" position. The "on" condition of tube A1 indicates that a one has been entered into the counter. The second impulse from the count emitter occurs when the brushes 521 contact a segment 519 to complete a circuit from the -250 volt supply, wire 770, contacts RC206-2, brushes 521 and segment 519, wire 772, to the grid of tube I2. Tube I2 is cut off reversing the input trigger back to normal or the "off" position. The increase of potential on the plate of tube I2 will result in a positive pulse being transmitted from the output terminal 769 to the grids of tubes A1, A2. The positive pulse will tend to raise the potential on the grid of tube A2 in a positive direction but at the same time the potential on the plate of tube A1 drops, due to the rise in the grid potential of tube A1 and this drop of the plate potential of tube A1 holds the potential on the grid of tube A2 below the conducting point. Therefore, only the negative impulse from the output terminal 769 will reverse the trigger, there being one negative output pulse for every two pulses put into the input trigger by the count emitter.

The second negative impulse from terminal 769 will switch the first trigger "off" resulting in a negative pulse being transmitted from the plate of tube A2 and wire 755 to the grids of tubes B1 and B2 reversing the second trigger to the "on" position. The "on" condition of the second or "B" trigger indicates that a two is entered into the counter. The third negative pulse will switch the first trigger back to the "on" condition. The tubes A1 and B1 are now conducting to indicate that a three has been entered into the counter.

The second stage of each group has, in addition to the basic trigger circuit, a locking tube B3 and B12 respectively. The plate of B3 is connected directly to the plate of tube B2. The grid of B3 is connected through a resistor 773 to the mid-point of a voltage divider comprising resistances 774 and 775. One terminal of this voltage divider is connected by a wire 776 to the plate of tube D2, while the other terminal is connected to the -100 volt bias line 739. Since tube D2 is normally conducting the grid of tube B3 is biased below cut off and the tube is normally non-conducting.

The first eight impulses cause the counter circuit to pass through a normal series of changes, the eight impulse causing a carry impulse to be transmitted from the output of the tube C2 to the grid of the tube D2, which reverses the trigger circuit D. The rise in potential of the plate of tube D2 is transmitted through wire 776, tending to raise the potential of the grid of tube B3. A negative impulse transmitted from the plate of tube D1, which has now become conductive, through wire 777, and condenser 778, temporarily holds down the potential of the grid of tube B3, until the condenser 778 is discharged. The tube B3 then becomes conductive and locks stage B in its right-hand condition.

When two more impulses follow, the second of such impulses is transmitted from tube A2 to both tubes of stage B and also to the tube D1 only of trigger D. At this time the locking tube B3 is conductive and stage B cannot respond to the impulse and it remains in its normal state. The impulse transmitted to tube D1, on the other hand, reverses stage D to its normal state and causes an output impulse to be sent through the output wire 779 to the grid of tube A11 of the first stage of the "tens" position counter group switching the A stage to the "on" position which is indicative of the carry one. The "units" position counter group circuit is now in its normal state, with all the trigger circuits transferred to the right and the locking tube B3 non-conducting. The complete sequence of conditions of a counter group is shown in the following table, in which "X" indicates the conductive state.

	A1	B1	B3	C1	D1
0					
1	X				
2		X			
3	X	X			
4				X	
5	X			X	
6		X		X	
7	X	X		X	
8			X		X
9	X		X		X

Remembering that a 40 has already been forced into the counter as previously described, when 56 negative pulses have been counted the total resting in the counter will be 96 and the type bars will be opposite the 44th line of the ledger sheet (20th line from the top of the sheet). At this time the following tubes will be flipped to the "on" position; B1, C1 and A10, D10. The potential on their plates will be low due to the plate current flowing through the tubes and as a result the switch tubes S1, S2, S3 and S4 (Fig. 26b) will have their grids biased to cut off. The plates of tubes S1 and S2, S3 and S4, respectively, are wired together and a tap taken off therefrom. Each pair of tubes can be said to represent the word "and" as far as their common output is concerned. Thus, whenever the grids of S1 and S2 go from one bias state to another an output pulse will be emitted. But when only one grid of the pair changes its bias condition there will be no output. Similarly, the same condition holds with tubes S3 and S4 whose plates are also in parallel.

The output of the switch tube pair S3 and S4 is impressed upon the control grid 780 of a switch tube S5. The inputs to switch tubes S3 and S4 are connected to the plates of trigger tubes A10 and D10 and thus, this switch tube pair will sense the presence of a 90 in the counter. In the same manner the switch tubes S1 and S2 will sense the presence of a 6. The output of switch tubes S1 and S2 goes through wire 781 and the No. 4 contact of a dial switch 782 to the suppressor grid 783 of the switch tube S5. Switch tube S5 may also be thought of as an "and" switch because both the suppressor and control grids must be biased to zero volts concurrently in order for the tube to conduct current. Therefore, switch tube S5 will conduct every time the number 96 is present in the counter.

The output of switch tube S5 is a negative going pulse which is fed over wire 783 to the normally conducting or "off" side of trigger 784 causing said trigger to flip to the "on" condition. The right-hand plate of trigger 784 is now at a low potential due to the fact that this side of the trigger is now conducting. Since the right-hand plate of trigger 784 is connected by wire 785 to the control grids 786 of the high speed clutch control tubes 714, 714a, when the switch tube S5 is in the normal "off" condition, the positive potential on its right-hand plate is applied to said grids allowing the control tubes 714, 714a to conduct to energize the high speed clutch solenoid 448 as previously described. However, with S5 conducting the grids 786 will be biased below cut off and the control tubes 714, 714a turned off de-energizing the high speed clutch solenoid. The platen drive will now be transferred from the high speed drive gear train to the line space drive mechanism in the manner previously described. The clutch will also apply the brake disc 465 to the platen drive to quickly slow its rotation. The switch tube S5 may be controlled to operate at 4, 6, 8 or 10 spaces from the desired printing line by setting the dial switch 782.

The same trigger 784 also acts to start the line space mechanism in operation concurrently with the disengagement of the high speed platen drive by means of the following circuit: A negative pulse from the right-hand plate of switch tube S5 (now at low potential), wire 787,

to the control grid of a triode 788, biasing this triode to cut off. The other triode 789, of the pair 788 and 789, was biased to cut off by a negative pulse over wire 790 when trigger D10 was flipped "on" at a count of 80. Thus, the triodes 788, 789 now have a high potential at their plates which is transmitted over wire 791 to the control grid of the line space magnet control tube 792 placing the control grid of this tube at approximately zero volts and allowing the tube to conduct to energize the line space magnet 499. The platen drive will now be connected to the line space gear train.

As the platen and count emitter continue to rotate the electronic counter will continue to count. When it counts 99 line spaces triggers A1, D1 and A10, D10 will be flipped to the "on" condition. The 100th pulse from the input trigger will restore trigger A1 whose output pulse restores trigger D1. Trigger D1 in turn restores trigger A10 and trigger A10 completes the chain by restoring trigger D10. The plate of trigger tube D10 will now have a high potential which will cause the control grid of triode 789 to be biased to approximately zero volts and allowing this tube to conduct. As plate current flows in triode 789, the plate potential and in turn the control grid bias voltage on control tube 792 drops. The grid is biased to cut off and the circuit through tube 792 is interrupted deenergizing the line space magnet 499 and stopping the platen. The ledger is now stopped 40 lines from the bottom of the sheet with the desired line (24th line) now opposite the type bar heads.

Relays RC282 and RC206 which have been energized are now de-energized by CBC17 (Fig. 25c) opening. After CBC17 breaks and before it again is made, CBC4 makes for a duration of 14° to complete the following circuit: Line 639 (Fig. 25g), CBC4, wire 725a, closed contacts RC211-7 and RC250-4, closed contacts RC294BL, the pickup coil of cancellation relay RC205 and line 642. The function of relay RC205 is to restore or cancel all triggers which have been left in the operated condition at the conclusion of a ledger feeding operation. This is done by the RC205-1 contacts (Fig. 26b) which are now open to break the circuit from the -100 volt bias line 765 to the normal grids of all triggers. In effect this is a positive going pulse (-95 volts to zero volts) which initiates the trigger restoring action.

It should be pointed out that as long as a ledger is feeding the relays RC206 and RC282 had to be held energized and for this purpose there is provided a control relay RC294 which is energized from line 639 (Fig. 25f), contacts RC282AU whenever relay RC282 is energized, either contacts RC283BU on a high reading or contacts RC284BL for an equal reading, the pickup coil of control relay RC294 and line 642. Relay RC294 holds through a circuit which extends from line 639 (Fig. 25d), CB32, wire 719, the closed contacts RC294AL, the hold coil of relay RC294 and line 642. Referring now to Fig. 25c, it may be seen that the RC294AU contacts aid CBC17 to establish the hold circuit for relays RC206 and RC282. In connection with cancellation relay RC205 (Fig. 25f), the RC294BL contacts will open on a total cycle and the cycle following a total cycle to prevent the cancellation impulse to the electronic counter at times when ledger sheets might be moving.

In addition, there is provided an interlock relay RC277 which is used to prevent the operation of the count relay RC206 except for ledgers entering the printing position. This relay allows relay RC206 to be energized as the ledger actuates card lever No. 3 on approaching the printing position, and due to the fact that this card lever may still be made when the ledger stops in the printing position, it is necessary to prevent the operation of relay RC206 on this ledger when the next ledger feed cycle appears.

The pick circuit for interlock relay RC277 extends from line 639 (Fig. 25e), CB19, contacts RC206-3, the pickup coil of relay RC277 and line 642. The hold circuit ex-

tends from line 639 (Fig. 25c), CBC12, wire 679, CLC3, contacts RC277AU, the hold coil of relay RC277 and line 642. With the RC277 relay energized, the RC277B contacts open the pick circuit to relay RC206 and as a result relay 206 is only active for the ledger approaching the printing position.

In the case of inactive ledger sheets, there is provided a control relay RC192 which is used to enter the amount 64 into the electronic counter so that all inactive ledger sheets will stop on the first printing line. Although nothing is listed on these inactive ledgers, it is necessary to stop them on the first line to allow time for at least one line space to function when the brake is applied and before the next ledger movement. The pick circuit for relay RC192 extends from line 639 (Fig. 25p), wire 736, CB26, the contacts RC213-4 normally closed for inactive ledgers, closed contacts RC211-6, closed contacts RC212-12, the pickup coil of relay RC192 and line 642. Referring now to Fig. 26a, it may be seen that the RC192-1 contacts will open the grid bias circuit of trigger C1 flipping the trigger "on" and thereby entering a 4 into the units position counter group. Similarly, the opening up of contacts RC192-2 and RC192-3 will turn triggers B10 and C10 to the "on" position thereby entering a 6 in the tens position counter group.

The positioning of a ledger sheet at the printing platen and the feeding in of a new ledger sheet to the sensing station concludes the old balance cycle and the machine is ready to enter a card feeding cycle. The card feeding cycle is initiated by the dropping out of the equal relays RC284 and RC213. Then, the closure of the RC213-1 contacts (Fig. 25a) will complete the pick circuit to relay R11 to energize the card feed clutch. The card at the upper or comparing brushes will be fed to the lower brushes where the punched new items will be listed on the ledger sheet at the printing station through the conventional listing circuits previously described. At the same time, the new items will be entered into the balance and grand total accumulators and a new card will be fed to the upper brushes to be compared with the new ledger sheet at the sensing station.

Before discussing the circuits for adding the new items punched in the card into the accumulators it would be well to point out certain controls necessary to proper accumulator operation. Since the accumulators are capable of either adding or subtracting, accumulator plus and minus control relays are associated with all accumulators, and the accumulators are controlled for adding and subtracting by groups. The plus and minus relays R217-R256 are shown in Fig. 25b, the plus control relays being odd numbered and the minus control relays even numbered. When adding in an accumulator group the plus control relays must be energized. The plug to C impulse which is timed from 287° to 177° by CF10 and 11 is used to energize the control relays. The circuit extends from line 639 (Fig. 25a), to CF8, CF7 and through CF6, lower card lever contact, through CF10 and 11, plug to C hubs 793, plug wire connections to the sockets 794 (Fig. 25b), the coils of the desired control relays R217-R256 and line 642.

A typical adding circuit will now extend, for example, from line 639 (Fig. 25a), CB1-CB3, CF17 and 18, contacts R4a closed, common brush 656, contact roll 657, lower brush, plug wire connection to the counter entry hub 730 (Fig. 25n) for the balance accumulator group, the plus control relay contacts R241b transferred, the closed contacts RC260-6 and RC253-13, the left or add side of the PBCB contacts now transferred, the normally closed side of the TSA contacts, the add magnet and line 642.

The normally closed contacts of relays RC253, RC254, and RC260 shown in the adding circuits for the balance and grand total accumulators are provided to open the circuits from the accumulator entry hubs to the add magnets of these accumulators to prevent back circuits when

total printing. Referring to Fig. 25e, relays RC253 and RC260 are picked by a circuit which extends from line 639, CB19, wire 743, contacts RC207-7 which are closed during a total cycle, wire 795, equal control relay contacts RC213-7 closed for an equal reading, the pickup coils of relays RC253 and RC260 and line 642. A circuit is also completed during a total cycle which extends from line 639 (Fig. 25g), contacts RC207-1, closed side of contacts RC258-1, wire 703, equal control relay contacts RC213-3, the pickup coil of relay RC255 and line 642. Energization of relay RC255 allows a circuit to be completed from line 639 (Fig. 25e), CB27, wire 680, total relay contacts RC286AU closed on a total cycle, contacts RC255-3, the pickup coil of relay RC254 and line 642. A hold circuit for relay RC254 extends from line 639 (Fig. 25p), wire 707, PBCB contacts closed on the add side, the hold coil of relay RC254, the pickup coil of relay RC257 and line 642.

The data entered into the balance accumulators is also entered into the grand total accumulators in similar fashion by cross plugging between the entry hubs for these accumulators.

Each card at the lower brushes will operate a card count circuit which includes plug wire connections to the subtract magnets of the print line indication or line space accumulators. Thus, as each card is listed on the ledger sheet the total print line indication number in the accumulators is decreased by one. This insures that the print line indication number, later recorded on the ledger sheet in magnetic spot form, will correctly position the ledger sheet at the printing station the next time said sheet is run through the carriage. A typical card count circuit for one accumulator position would extend from line 639 (Fig. 25a), CB1-CB3, wire 732, contacts R4BU (Fig. 25l) which are closed with a card at the lower brushes, CF3 contacts, the card count exit hubs 796, plug wire connection to the accumulator entry hub 730 for units position of the first line space accumulator group, normally closed side of contacts R217A, normally closed side of contacts RC249-2, the subtract magnet and line 642. In the type of accumulators used in the present application, the subtraction operation is accomplished by starting the adding wheels turning to add the complement of the number that is to be subtracted and then stopping the adding wheels at the correct number by energizing the subtract magnets as previously described. As an example, the adding wheel for the units position of the first line space accumulator group would start turning as a circuit is completed from line 639 (Fig. 25a), CB1-CB3, wire 732, contacts R4BU (Fig. 25l), CF23 contacts, wire 796, contacts R218AL closed (minus control relays should be plugged for energization for the line space accumulator only), the left or add side of the PBCB contacts, normally closed side of the TSA contacts, the add magnet and line 642.

As was previously mentioned, during this card feed cycle the new card at the upper brushes is compared with the new ledger sheet at the sensing station. Assuming that the cards and ledgers are in the correct sequence, the new card and ledger will compare equally with the respect to account number but the account number on the new card will be unequal to the account number on the card at the lower brushes. Therefore, normal operating conditions will exist and the tabulator will go through a minor total cycle during which the new balance, the number of the last line used and the same account number will be printed upon the ledger sheet in the manner previously described.

It will be remembered that on a total cycle the adding wheels of the accumulators are turned until they all reach zero at which time the wheels are stopped and the accumulators are ready to receive new entries. However, before the accumulators are reset the information they hold must be read out, converted from decimal to binary code and put into storage relays to be stored until the

recording operation takes place to record the new information on the ledger sheet. The reading out of the amounts standing in the accumulators is done through individual top accumulator moulding assemblies (one for each accumulator position) each of which comprises an emitter ring and a pair of brushes. This type of accumulator readout mechanism is shown and described in U.S. Patent No. 1,965,979, issued to C. D. Lake et al. on July 10, 1934. It will suffice to say that as each accumulator wheel is turned to add, its related brush assembly will be driven in synchronism therewith. One brush will ride on a common strip while the other brush will wipe over ten segments on the emitter which correspond to the ten digital positions of the counter.

The accumulator readout circuits for the account number, balance and line indication accumulator groups are shown on Figs. 25p, 25q and 25r. It will be noted that in the present embodiment each accumulator position employs two readout emitters instead of the conventional one. Two emitters for each accumulator position are used to enable the decimal figure standing in the accumulator to be converted back to the binary code form during read out. The individual segments of the emitters are shown wired to the pickup coils of recording code relays RC81 through RC160. These recording code relays store in binary form the amounts standing in the accumulators and, as will be described later, serve to control the recording of magnetic spots on the ledger sheet when it arrives at the recording station. The wiring of the emitters in the ten columns allocated to the account number differs from that of the remaining ten columns. The reason for this is that the recording of a zero, if present, is necessary for the later comparison of account numbers. These ten columns are the only ones in which a zero (spots *bd*) is recorded.

As an example of a typical readout and conversion circuit, assume that an account number of 7 has been entered into the first account number accumulator position. Then, with a 7 standing in the accumulator the brushes 798 and 799 (Fig. 25p) will be resting on the upper and lower 7 segments respectively of the emitters. Also, brush 800 will be resting on the lower 9 segment. Circuits are then completed from line 639, wire 736, CB26, total contacts R66AL now closed, wire 797, the emitter commons 801, 802, through brushes 798, 799 and 800 which are electrically commoned, through the upper and lower 7 segments as well as the lower 9 segment, the pickup coils of relays RC81, RC82 and RC83 and line 642. The holding circuit for these relays extends from line 642, the RC81, RC82 and RC83 holding coils, contacts RC81-4, RC82-4 and RC83-4, wire 803, contacts RC266BL or CBC3, wire 736 and line 639. These relays will be held until 230° on the second cycle following a total cycle which is the cycle during which recording takes place. Relays RC81, RC82 and RC83 represent the *a*, *b* and *c* elements of the binary code and hence the figure 7 has been stored in the binary form.

Circuits similar to the one just described may be traced through the balance accumulator emitters for converting and storing the balance amounts.

In the case of the print line indication number, the number that is read out of the accumulators is always decreased by one during conversion. The reason for this is that the number recorded on the ledger should be one less than the number of the last line listed so that the next time the ledger sheet is run through the carriage it will automatically be positioned on the next line after the last listed line.

Assuming that we have a print line indication number of 7 standing in the accumulator, the brushes 804, 805 and 806 for the units accumulator emitters (Fig. 25r) will be resting on the upper and lower 7 and the lower 9 segments respectively. Circuits will then be completed from line 639 (Fig. 25p), wire 736, CB21, total contacts

R66AU now closed, wire 807, emitter commons 808, 809 (Fig. 25r), brushes 804, 805, upper and lower 7 segments, the pickup coils of relays RC158, RC159 and line 642. The lower 9 segment is not wired therefore there is no circuit completed through brush 806. The RC158 and RC159 coils represent the *b* and *c* elements of the binary code and the 7 in the units counter has been read out as a 6.

Whenever the last line used to print upon is a multiple of 10, that is 10, 20, 30, 40, 50 or 60, circuits are provided to store a 9 for the units accumulator readout and to decrease the tens accumulator readout by one. For example, assume a print line indication number of 40 in the accumulators. The brushes 810, 811 will be resting on upper and lower zero segments 812 and 813, respectively, while the brushes 804, 805 will be resting on the other set of zero segments. Circuits will then be completed through brushes 810, 811 and 805 to energize the pickup coils of carry relay RC161 and code relays RC157 and RC160. Relays RC157 and RC160 represent the *a* and *d* elements of the binary code and hence a 9 is stored. The carry relay RC161 has a group of contacts RC161-1 through RC161-8 wired in the tens accumulator readout and these contacts are now transferred due to the energization of RC161. The transfer of said contacts enables the tens accumulator to read out a number one less than was put in. With a 4 standing in the tens accumulator, the brushes 814, 815 will be resting on the upper and lower 4 segments respectively. Circuits will then be completed from the upper 4 segment, contacts RC161-3 transferred and the pickup coil of relay RC154 and from the lower 4 segment, contacts RC161-4 closed, and the pickup coil of relay RC153. Relays RC153 and RC154 represent the *a* and *b* elements and hence a 3 is read out of the tens accumulator.

At the conclusion of the total cycle all of the accumulators will be reset to zero and the hopper feed clutch coils 238 and the platen clutch relay RC282 will be energized to initiate a ledger feeding cycle in the manner previously described. The ledger sheet at the printing station will be sent to the erasing station, the ledger at the sensing station moves to the printing platen and a new ledger sheet moves into sensing position. As the ledger sheet approaches the erasing station it will close the card lever contacts CLC4 allowing a circuit to be completed from line 639 (Fig. 25s), CLC4, contacts RC273AU (closed at the end of a total cycle), the wipe out or erasing coil 527 and line 642. Energization of coil 527 saturates its pole pieces creating a magnetic flux which will erase all of the magnetic spots on the ledger sheet as it passes over.

The ledger sheet continues on into the recording station until it is stopped by the stop fingers 550 and 551 (Fig. 8), said stop fingers serving to position the sheet over the recording block 562 containing the recording coils AB and CD. It will be remembered that near the end of the total cycle the recording clutch control relays RC272 and RC273 were energized. Contacts of these relays act together to form a delay circuit to energize the recording clutch magnet coils 571 by a circuit which extends from line 639 (Fig. 25d), CB21, closed contacts RC273B, closed contacts RC272B, the recording clutch coils 571 and line 642. During a certain portion of the cycle the RC272B contacts are open while the RC273B contacts are closed but since relay RC272 is de-energized before relay RC273 the above traced circuit is made for a sufficient length of time to cause the unlatching of the recording clutch. The impulse from CB21 occurs at approximately 265° on the next cycle after a total cycle.

With the recording clutch unlatched the recording cam 570 will start turning along with the circuit breakers CC1 through CC7. At the beginning of the first 12° dwell of the recording cam at which time the "*b*" and "*d*" designated elements in the even columns are in position to

record, a circuit will be completed from line 639 (Fig. 25s), contacts CC1, the pressure plate solenoid 603 and line 642. The pressure plate 606 (Fig. 15) will now be operated to clamp the ledger sheet tight against the recording coils. CC1 will close for each 12° recording interval.

The recording operation is initiated by the making of cams CC2 and CC3 which complete circuits from line 639 (Fig. 25s), through the coils of interlock relays RC302 through RC309, to line 642. These interlock relays have contacts which control the energization of the recording coils AB and CD. The recording circuits shown in the drawings have been limited to the coils for columns 1, 2, 19 and 20, the circuits for the remaining columns being similar to those shown.

Assume that the recordings to be made are a 3 in column 1, a 5 in column 2 and an 8 in column 3. Then the following relay storage contacts in the recording circuits will be closed: column 1—RC81-2, RC82-2; column 2—RC85-2, RC87-2 and column 3 (not shown)—RC92-2. As previously described the even columns are the first to record and then the odd columns. With the "*b*" and "*d*" elements in the even columns in position to record, cams CC1 and CC2 will close to energize the interlock relays RC302 through RC309 and the BD circuit breaker CC5 will close in an effort to complete circuits to recording coils for the even columns. However, there have been no storage relay contacts relating to the "*b*" and "*d*" elements in the even columns closed and as a result no recording is done at this time.

On the second 30° dwell of the recording cam the "*a*" and "*c*" elements of the even columns are in position to be recorded. Contacts CC2 and CC3 again energize the interlocking relays and the AC circuit breaker CC4 will close in an effort to complete circuits to the recording coils for the even columns. A circuit will be completed at this time from line 639, CC4, contacts RC85-2 closed, contacts RC302-8 closed, resistor R1, recording coil AB and line 642. A parallel circuit will also be completed through the closed contacts RC87-2, contacts RC304-8, resistor R2, recording coil CD and line 642. As a result an "*a*" and "*c*" spot are recorded in their proper places in column 2 of the ledger sheet. Columns 1 and 3 are similarly recorded during the next two 30° dwells of the recording cycle through the closing of BD circuit breaker CC7 and AC circuit breaker CC6 which make for the odd columns.

In passing through the recording station the ledger sheet will engage a card lever 560 (Fig. 5) to close the card lever contacts CLC5. Contacts CLC5 operate in conjunction with the CBC12 contacts to provide a holding circuit for relay RC269 when running out ledgers. This circuit extends from line 639 (Fig. 25c), CLC5, wire 679, closed contacts RC275BU, RC269AL contacts, the holding coil of relay RC269, wire 678 and line 642. At the end of the recording cycle, a circuit will then be completed from line 639 (Fig. 25d), closed contacts RC269BU, CBC11, the pickup coil of relay RC288 and line 642. Relay RC288 holds through a circuit from line 639, CB32, the RC288A contacts, the holding coil of relay RC288 and line 642. During normal operation of the machine relay RC288 will be energized at approximately 261° of every total cycle by a circuit extending from line 639, contacts RC207-3, contacts RC280AL or RC212-3, CBC11, the pickup coil of relay RC288 and line 642.

The energization of relay RC288 will allow a circuit to be completed from line 639 (Fig. 25d), closed contacts RC288B, recording stop solenoid coils 613 and line 642. As previously explained, energization of the solenoid 613 will cause the stop fingers 550, 551 to pivot out of the path of the ledger sheet. As the stop fingers are pivoted out of the path of the ledger sheet, a pair of recording arm contacts 618 (Fig. 8) are closed

to energize the eject solenoid 619 (Fig. 15) by a circuit which extends from line 639 (Fig. 25d), recording arm contacts 618, the eject solenoid coils 619 and line 642. Energization of the eject solenoid 619 will cause the arms 345 and shaft 349 (Fig. 15) to pivot clockwise bringing the feed rollers 371 into contact with feed rollers 358 to feed the ledger sheet out of the recording station and into the stacker box 361.

During the operation of the machine if for any reason it becomes necessary to stop the machine the depression of the stop key will set up circuits for disabling the carriage as well as the tabulator. Depression of the stop key will complete a circuit from line 639 (Fig. 25b), CBC13, wire 676, stop key, the pickup coil of relay RC274 and line 642. The holding circuit for relay RC274 extends from line 639, normally closed contacts RC276A, contacts RC274A, the hold coil of relay RC274, the pickup coil of relay RC275 and line 642. The purpose of relay RC275 is to open various tabulator and carriage circuits so that both will idle and the relay will be held energized until the reset relay contacts RC276A are opened. The card feed clutch and print clutch of the tabulator are disabled by the RC275BL contacts opening the pick circuit of relay R11. The RC275AL contacts (Fig. 25j) will open to prevent any impulse from testing through the comparing unit and energizing the control relays. Also, the RC275BU contacts (Fig. 25c) will open to drop out relay RC269 should the carriage happen to be in a run-out cycle. To resume normal operation of the tabulator and carriage the start key is depressed energizing relay RC276 and opening the RC276A contacts to drop out the stop relays RC274 and RC275.

In connection with the starting and run-out relay RC269, the contacts RC248-4, which will be closed as a ledger sheet leaves the hopper, serve to prevent the start relay RC269 from dropping out between the second and third run-in cycles when CBC12 breaks by establishing a circuit from line 639 (Fig. 25c); closed contacts RC214-11, closed contacts RC213-6, contacts RC248-4, wire 679, closed contacts RC275BU, the RC269AL contacts, the holding coil of relay RC269, wire 678 and line 642. The equal control contacts RC213-6 will drop out relay RC269 on the third run-in cycle if the control was equal on the first ledger. The low control contacts RC214-11 will drop out relay RC269 on the third run-in cycle if the control was low on the first ledger.

Special control circuits will now be described which are effective to control the carriage during irregular operation due to certain conditions such as a ledger sheet comparing low with respect to a tabulating card, a ledger sheet comparing high with respect to a tabulating card, or when the ledger sheet being compared is void of any recordings.

Assuming now that an equal comparison had been made in columns 1 through 9 and a low comparison in column 10, a circuit will be completed from line 639 (Fig. 25j), wire 693, contacts RC268BL, contacts RC275AL, contacts RC278A, contacts RC281B, CBC5, wire 694, CBC6 (Fig. 25k), contacts RC162-1 transferred, contacts RC163-2 transferred, contacts RC180-1 not transferred, contacts RC181-1 transferred, through the normally closed blank relay contacts RC236-1 through RC245-1, the pickup coil of low control relay RC285 and line 642. The hold circuit for relay RC285 extends from line 639 (Fig. 25g) CBC8, closed side of contacts RC258-1, wire 703, contacts RC285AL, wire 704, the hold coil of relay RC285 and line 642. The energization of the low relay RC285 is an indication that the account number recorded in the ledger is lower in value than the account number punched in the card and as a result circuits are subsequently completed for automatically running out of the carriage the ledger lower in value than the card.

During the completion of the holding circuit for relay

RC285, parallel circuits are completed from the RC285AL contacts through wire 705, the pickup coil of relay RC214 and line 642; and, wire 706, the pickup coil of relay RC215 and line 642. The hold circuit for relays RC214 and RC215 extends from line 639 (Fig. 25p), wire 707, PBCB total switch plate contacts, the hold coils of relays RC214 and RC215, the pickup coil of progressive total relay RC257 and line 642. As is understood, relays RC214 and RC215 have contacts which are used to prevent entering account number and balance readings into the account number and balance accumulators for all inactive ledger sheets (ledgers having a low reading).

Referring to Fig. 25a, it will be seen that the RC214-12 contacts are now open to drop out relay R11 and suspend the card feed in the tabulator. The reason for this is that following a cycle in which a low reading appeared, either an idle cycle is taken to feed the ledger having a low reading out of the sensing station, or a total cycle is taken to print accumulator balances for the preceding ledger sheet at the printing station followed by idle cycles during which the low ledgers are merely run out without being subjected to printing, erasing or recording operations.

In the one case the low reading cycle is followed by an idle cycle for run-out purposes whenever the low reading occurs without a control break in the tabulator or in other words when the cards at the upper and lower brushes compare equally. Under this condition, the energization of the low control relay RC285 completes a circuit from line 639 (Fig. 25f), the RC285BL contacts, contacts RC246-11, contacts RC286AU, the pickup coil of clutch control relay RC209 and line 642. The hold circuit for relay RC209 extends from line 639 (Fig. 25c), CBC14, wire 708, contacts RC209-4, the hold coil of RC209, wire 709 and line 642. The energization of RC209 completes a circuit from line 639 (Fig. 25d) contacts RC268AL, the RC209-2 contacts, CBC9, RC278BU contacts which are closed whenever a ledger sheet is in the sensing station, wire 710, the pickup coil of platen clutch relay RC282 and line 642. A hold circuit for RC282 extends from line 639 (Fig. 25c), wire 711, CBC17, wires 712 and 713, RC282AL contacts, the hold coil of RC282 and line 642. Referring now to Fig. 26b which shows a portion of the electronic counter, it will be seen that energization of the clutch relay RC282 will cause a circuit to be completed from the zero voltage terminal, wire 675, through control tube 714 and 714a, wire 715, the high speed clutch solenoid 448, wire 716, contacts RC282B, wire 717, to the +250 volt terminal.

At the same time that the pick circuit for relay RC282 was completed, parallel circuits were completed from line 639, contacts RC268AL, the RC209-2 contacts, wire 718, CBC10 and CBC11, coils 238 of the hopper feed clutch and the pickup coil of recording stop control relay RC288 and line 642. Energization of relay coils RC238 causes the hopped feed clutch to operate which in turn operates the main cam shaft and hopper feeding mechanism to feed a new ledger to the sensing station. Also, solenoid 448 operates the high speed clutch to feed the low ledger out of the sensing station. Energization of recording stop control relay RC288 completes a circuit from line 639 (Fig. 25d), contacts RC288B, the recording stop solenoid 613 and line 642. A holding circuit for relay RC288 extends from line 639, CB32, wire 719, the RC288A contacts, the hold coil of RC288 and line 642. Solenoid 613, it will be remembered, operates the stop fingers 550, 551 at the recording station and is energized on all ledger feeding cycles to allow ledger sheets to feed out of the recording station.

The idle cycle continues until the ledger sheet at the sensing station compares either equally or high with the card at the upper brushes at which time the machine will

operate in the normal manner or be stopped depending on the comparison.

If the low reading should occur at the time when there is a control break in the tabulator then the low reading is followed by a total cycle so that balances accumulated in the accumulators may be printed for the preceding ledger sheet followed by two idle cycles during which the lower ledgers are run out. It has previously been shown how the minor, intermediate and major total control relays are energized from a control break in the tabulator to initiate a total cycle in the tabulator. Assuming then, that a total cycle was taken following the low reading a circuit will be completed from line 639 (Fig. 25g), contacts R66BL, cam contact PMC2 which makes on every total cycle at 342°, wire 720, the pickup coil of total relay RC207 and line 642. Relay RC207 will hold through the total cycle by the circuit from line 639 (Fig. 25c), CBC14, wire 708, contacts RC207-6, the hold coil of relay RC207, wire 709 and line 642.

Energization of relay RC207 will complete a circuit from line 639 (Fig. 25f), PMC1, contacts RC207-2, closed contacts RC212-4, contacts RC215-12 now closed, the pickup coil of relay RC266 and line 642. The hold circuit for relay RC266 extends from line 639, wire 700, CB29 and CB30, contacts RC266AL, the hold coil of RC266 and line 642. The RC266BU contacts are now closed to complete a circuit from line 639 (Fig. 25b), CBC13, wire 676, contacts RC266BU (Fig. 25c), wire 721, RC215-11 contacts now closed, the pickup coil of card feed clutch control relay RC289 and line 642. Relay RC289 holds through a circuit from line 639, CBC15, wire 702, wire 722, contacts RC289AU, the hold coil of relay RC289, wire 723 and line 642. Relay RC289 is always energized on a total cycle following a low reading and its purpose is to prevent the card feed clutch of the tabulator from receiving an impulse on the first idle cycle following a total cycle. This is accomplished by the RC289B contacts opening the circuit to relay R11 (Fig. 25a).

When relay RC289 was energized a parallel circuit was completed to pick relay RC267 through wire 701 and line 642. Relay RC267 holds through a circuit from line 639, CBC15, wire 702, the hold coil of RC267, contacts RC267AL, the pickup coil of RC268 and line 642. Referring to Fig. 25d, a circuit is now completed from line 639, CB7, the RC267BU contacts, closed contacts RC252-1, the pickup coil of relay RC208 and line 642. Relay RC208 functions to control the feeding of the ledger sheets on idle cycles and holds through a circuit which extends from line 639, CB32, the RC208-4 contacts, the hold coil of relay RC208 and line 642. The energization of relays RC267 and RC268 through contacts RC266BU and CBC13 took place approximately 10° after relay RC266 was energized. The purpose of delaying the energization of RC267 and RC268 is to prevent the RC268AL contacts from opening the circuit to the platen clutch and hopper clutch relays before they have been picked up and held. The platen clutch relay RC282, hopper feed clutch relay coils 238 and relay RC288 will be energized through the RC268AL and RC208-2 contacts to cause the ledgers to feed as previously described while the tabulator is taking two idle cycles. On the first idle cycle the lower ledger sheet will be fed to the printing station and a new ledger sheet will be fed to the sensing station. On the second idle cycle the new ledger sheet at the sensing station is compared with the card still at the upper brushes.

A third situation which may occur is where the ledger sheet being compared has no recordings at all for the account number which results in a low reading for all columns. In this situation none of the sensing code relays have been energized and as a result parallel circuits are completed from line 639 (Fig. 25j), wire 693, RC268BL contacts, RC275AL contacts, RC278A

contacts closed, RC281B contacts, CBC5, wire 694, CBC7 (Fig. 25k), RC269BL contacts, through the normally closed points of the sensing code relays, the pickup coils of blank relays RC236 through RC245 and line 642. Although a low reading exists, energization of the blank relays causes the RC236-1 through RC245-1 contacts in the pick circuit of the low control relay RC285 to open thus making it impossible to energize the low control relay. The reason for this circuit is that it is desired to stop the machine and remove a ledger sheet which is void of recording rather than run it through the machine.

Referring to Fig. 25g, a circuit may now be completed from line 639, CBC4, the RC236-2 through RC245-2 contacts, the pickup coil of relay RC281, wire 724 and line 642. Relay RC281 holds through a circuit which extends from line 639 (Fig. 25c), CBC12, wire 679, wire 725, the RC281AL contacts, the holding coil of relay RC281 and line 642. With relay RC281 energized a circuit is completed from line 639 (Fig. 25f), the RC281AU contacts, through the error light to line 642. The error light will light to indicate that the ledger sheet being compared is in error and should be removed. The RC281B contacts in the comparing circuit (Fig. 25j), now open to prevent any impulse from testing through the comparing unit and energizing the control relays.

Concurrently with the energization of the error light a circuit is also completed from line 639 (Fig. 25g), CBC4, wire 725a, the RC236-3 through RC245-3 contacts now closed, the lower pickup coil of error relay RC270 and line 642. The hold circuit for relay RC270 extends from line 639 (Fig. 25d), CBC16 or the RC213-2 contacts, wire 726, contacts RC270AL, the hold coil of relay RC270 and line 642. Once energized this coil will hold until CBC16 breaks at 310° after an equal reading has occurred. The RC213-2 contacts are provided to drop out relay RC270 on the read-in cycle whenever an equal reading occurs. The RC270BL contacts in the pick circuit of relay R11 will now open to prevent card feed operation until the ledger in error has been removed and the correct ledger has been sensed.

A fourth situation which should be considered is where there is an equal comparison in column 1 through 9 and a high comparison in column 10. The comparing circuit now extends from line 639 (Fig. 25j), RC268BL contacts, RC275AL contacts, contacts RC278A closed, RC281B contacts, CBC5, wire 694, CBC6 (Fig. 25k), RC162-1 contacts transferred, RC163-2 contacts transferred, RC180-1 contacts transferred, RC181-2 contacts not transferred, the pickup coil of high control relay RC283 and line 642. The hold circuit for relay RC283 extends from line 639 (Fig. 25g), CBC8, the closed side of contacts RC258-1, wire 703, contacts RC283AL, wire 727, the hold coil of relay RC283 and line 642. A parallel circuit is also completed from the RC283AL contacts, wire 728, the pickup coil of high control relay RC212 and line 642.

The energization of the high control relay RC283 when accompanied by a control break denotes that either the cards or the ledgers are in wrong sequence and consequently the error light should be energized and the machine stopped. Referring to Fig. 25g, under these conditions a circuit will be completed from line 639, CB10, minor total contacts R61h, the RC211-5 contacts, the pickup coil of relay RC210, and line 642. The hold circuit for relay RC210 extends from line 639 (Fig. 25c), CBC15, wire 702, wire 728, the RC210-4 contacts, the hold coil of relay RC210 and line 642. Now a circuit may be completed from line 639 (Fig. 25d), CB21, the RC283BU contacts, contacts RC210-2, the upper pickup coil of error relay RC270 and line 642. The holding circuit for relay RC270 is again through the RC270AL contacts as previously described. The RC270BL contacts in the pick circuit for relay R11 now open to prevent card

feed operation until the wrong ledger has been removed and the correct ledger has been sensed. Also a circuit will be completed from line 639 (Fig. 25g), CBC4, the RC270AU contacts, RC283BL contacts, the lower pickup coil of error control relay RC281 and line 642. The RC281AU contacts now close to energize the error light as previously described.

To remove a high ledger sheet it is necessary to clear the machine by removing all of the ledgers from the hopper and depressing the run-out key three times to run the ledgers out of the machine. With the ledgers removed from the hopper depression of the run-out key will complete a circuit from line 639 (Fig. 25b), CBC13, wire 676, run-out key (Fig. 25c), hopper contact, the pickup coil of relay RC295 and line 642. Relay RC295 holds through a circuit which extends from line 639, CBC12, contacts RC275BU, the RC295AU contacts, the hold coil of relay RC295 and line 642. Energization of relay RC295 causes a circuit to be completed from line 639 (Fig. 25b), CBC13, wire 676, line 677 (Fig. 25c), the RC295AL contacts, the pickup coil of relay RC269 and line 642. The energization of relay RC269 completes a circuit from line 639 (Fig. 25d), contacts RC269BU, wire 718, CBC9, card lever No. 2 contacts RC278BU, wire 710, the pickup coil of platen clutch relay RC282 and line 642 actuating the feed clutch to run the ledgers out of the machine. Relay RC269 holds through CBC12 which drops out at 330° of the cycle so consequently one depression of the run-out key will cause the platen clutch to take one revolution only.

The first depression of the key will cause the sheet at the recording station, which has been wiped out and had new recordings put on it, to be ejected to the stacker. The high sheet which is at the printing station and which did not enter any readings into the accumulators due to the high comparison will move through the erasing station and into the recording station. However, since the erasing coil is activated from a total cycle and since there is no total cycle for the high sheet it will pass through the erasing station without being erased. Also since the high sheet did not enter any readings into the accumulators, there will be no recording done on it. The sheet at the sensing station did not compare due to the error relay contacts RC281B opening the circuit to the comparing unit and this sheet will move to the print station without having any other effect on the machine. The second depression of the key will eject the high sheet from the recording station and will move the ledger sheet at the printing station to the erasing and recording stations with no erasing or recording being done. The third depression of the key will eject said latter sheet from the recording station and the carriage will be cleared of ledger sheets.

The cards in the tabulator hopper are lifted out and the card at the comparing station run-out into the stacker. After the cards are checked they are put back in the hopper and one tabulator feed cycle is taken by momentarily depressing the tabulator feed key. Depression of the carriage start key then synchronizes the two feeds so that both a card and ledger will arrive at the comparing and sensing station at the same time.

A high sheet comparison accompanied by an equal comparison between the cards at the upper and lower brushes indicates that there is more than one card to be listed on the sheet that is positioned at the printing station. In this case the ledger sheet feeding clutches will remain inoperative and the tabulator card feed will continue to operate to accumulate and list the equal cards until an equal comparison is reached between the card at the upper brushes and the ledger sheet held at the sensing station.

Circuits will now be described for controlling the carriage operations for an overflow condition which exists when a ledger sheet becomes filled up and there are still more entries to be made for that particular account. In

such a case, whenever the last printing line of a ledger is reached the machine is caused to go through a progressive total cycle during which progressive totals are printed at the bottom of the ledger sheet. The ledger is then removed from the machine and a new ledger sheet is run-in. Another progressive total cycle occurs and the same progressive totals are printed at the top of the new sheet after which the carriage returns to normal operation.

Referring to Fig. 23, assume that card 123 has listed a 75 on line 3 of ledger A, as shown. Assume also that five more cards all bearing the same account number 123 as ledger A are to come but as there is only sufficient space on the ledger sheet to list two of them, the last three will have to be held for a new ledger sheet. In addition, assume that a ledger B (not shown) having an account number of 124 is at the sensing station and that it compares high with the card at the upper brushes. Since the cards at the upper and lower brushes compare equally there is no control break in the tabulator. When the listing has been made on line 2, it will be remembered that the card count circuit will decrease the amount in the line space counter group by one so that at this time the counter will stand at 01 indicating that there is one more printing line. The 01 standing in the counter will initiate circuits for taking the machine through a progressive total cycle to print progressive totals on line 1 along with the usual listing of the card.

Referring now to Fig. 25r, the top accumulator moulding of line space accumulator group No. 2 is used for the progressive total operation. With a "0" in the tens accumulator and a "1" in the units accumulator brush 816 will be resting on the 0 segment of the tens accumulator and brush 817 will be resting on the 1 segment of the units accumulator. A circuit will then be completed from line 639, CF52, emitter common 818, brush 819, common wire 820, brush 816, the 0 segment of the tens accumulator, switch SC1 shown in the closed position for an 8½ inch ledger sheet, the 1 segment of the units accumulator, common wire 821, brush 822, emitter common 823, wire 824, the pickup coil of progressive total relay RC279 and the upper pickup coil of relay RC281 to line 642. The SC2 switch shown open would be similarly used to complete a circuit to these relays in cases where ledger sheets having a length of only 5 inches are used. Relay RC279 holds through a circuit which extends from line 639 (Fig. 25e), PMC3, wire 825, contacts RC279AL (Fig. 25f), the hold coil of relay RC279 and line 642. Relay RC281 holds by a circuit previously traced through CBC12 and contacts RC281AL (Fig. 25c).

The energization of relay RC281 will cause the RC281AU contacts (Fig. 25f) to close to complete the circuit for energizing the error light to indicate that the last printing line has been reached. At the same time the energization of relay RC279 allows a circuit to be completed from line 639 (Fig. 25b), wire 826, the RC279BU contacts, switch S4, minor total relays R61 and R66, wire 667 and line 642 causing the tabulator to take a minor progressive total. The total print circuits previously described will now become effective to print the line indication number, the account number and the balance standing in the balance accumulator group on line 1.

The energization of relay RC 279 also completes circuits to energize other progressive total relays RC280, RC246, RC211 and RC258 which have contacts throughout the circuitry of the machine for controlling various phases of the progressive total operation. These circuits extend from line 639 (Fig. 25e), PMC3, wire 825, contacts RC279AU, the pickup coil of relay RC280 and line 642. Parallel circuits are also completed from the RC279AU contacts through wire 827 and the pickup coils of relays RC246, RC211 and RC258 to line 642. Relays RC211, RC246 and RC258 will be held energized until

the ledger sheet is removed and a new one run into the sensing station by a circuit which extends from line 639 (Fig. 25e), wire 828, PMC4 and or contacts RC213-5 and contacts RC212-2, wire 829, contacts RC211-12, RC246-12 and RC258-6 (Fig. 25f), the hold coils of relays RC211, RC246 and RC258 to line 642. Relay RC280 holds through a circuit which extends from line 639 (Fig. 25c), CBC14, wire 708, contacts RC280AU, the hold coil of relay RC280, wire 709 and line 642. A parallel circuit is also completed from the RC280AU contacts, the pickup coil of progressive relay RC287, wire 709 and line 642. Relay RC287 holds through CBC14, wire 708, the RC287AL contacts, wire 709 and line 642.

Energization of relay RC211 causes the contacts RC211-4 (Fig. 25a) to open the pick circuit of relay R11 to suspend card feed operation during the progressive total cycle. Also, contacts RC211-5 (Fig. 25g) open the pick circuit of control change relay RC210 which in turn prevents the error relay RC270 from being energized. Contacts RC211-6 (Fig. 25p) open the pick circuit of the electronic counter setup relay RC192. Relay RC192 is used to set the first printing line for inactive ledger sheets only. In addition, referring to Fig. 25g, the RC211-11 contacts open a circuit which would extend from line 639, PMCS, contacts RC211-11, contacts RC287AU and RC287AL, the lower pick coil of platen clutch relay RC282 and the pickup coil of count relay RC271 and line 642. As a result the high speed clutch which initiates feeding of the ledger sheet and the count emitter are prevented from operating until after the progressive total has been printed at the bottom of the ledger sheet.

Since on a progressive total operation it is desired to hold the amounts standing in the accumulators so that the progressive totals may be printed at the top of a new sheet, provisions are made to prevent the accumulators from resetting. Referring to Fig. 25e, the progressive total relay contacts RC279BL, and RC287B are now open to prevent a circuit from line 639, wire 828 and total switch plate contacts TS-D5 (closed on a total cycle) from energizing relays RC203 and RC204. As a result the RC203 and RC204 contacts in the account number and balance accumulator groups will not be transferred and the total print circuit to the total exit hubs 734 will not be able to get through to the subtract magnets to reset these accumulators. Although the high comparison of ledger sheet B energized the high control relay RC212 to open contacts RC212-9, relay RC212 will have dropped out by this time and contacts RC212-9 will be closed to allow relay RC249 to become energized and the contacts RC249-1 through RC249-4 will transfer to allow the line space accumulators to be reset. Since the progressive total is to be printed on a new line at the top of a new sheet, a new print line indication number will have to be entered into the line space accumulators as will be described.

It will be remembered that near the end of a normal minor total cycle circuits were automatically completed to initiate a ledger feeding cycle. However, in a progressive total cycle the situation is changed because due to the opening of the progressive total relay contacts RC280AL and the high comparison relay contacts RC212-3 (Fig. 25d) a circuit cannot be completed to energize the upper pickup coil of platen clutch relay RC282. Also, the RC211-11 contacts (Fig. 25g) are open to prevent the energization of the lower pickup coil of relay RC282. Since it is necessary to clear the machine so that a new ledger sheet may be run-in to take care of the overflow listings, the hopper is cleared of ledger sheets and the run-out key is depressed three times energizing relays RC269 and RC282 each time, as previously described in connection with a high comparison, to feed the ledger sheets out of the carriage. On the first depression of the key the filled ledger A will move through the erasing station where its recordings are erased and

into the recording station for new recordings. Ledger sheet B at the sensing station will not compare due to the error relay contacts RC281B opening the circuit to the comparing unit and this sheet will move to the print station without having any other effect on the machine. The second depression of the run-out key will eject ledger sheet A from the recording station and feed ledger B to the recording station with no erasing or recording taking place. The third depression of the key will clear the carriage by ejecting ledger sheet B from the recording station.

A new ledger sheet C (Fig. 24) having no previous recordings made in it and the ledger sheet B are placed at the bottom of the deck of ledger sheets with the new ledger sheet being the bottom sheet. The sheets are put back in the hopper and the start key is then depressed to complete circuits previously described for energizing relay RC269 and initiating a run-in cycle to feed the new ledger sheet to the sensing station. The card feed is inoperative due to the open RC211-4 contacts. The ledger sheet moves out of the hopper near the end of the first run-in cycle and in so doing operates the No. 1 card lever contact to effect the energization of relay RC248 (Fig. 25c) as previously described. Relay RC248 will remain energized until approximately 168° of the next or second run-in cycle and its purpose on an overflow operation is to control the operation of a pair of dial switches such as are shown in Fig. 25f.

The dial switches are manually settable and are shown connected to the code relays associated with columns 19 and 20 which are allotted to the print line indication number. On an overflow operation it is necessary to position the new sheet that has no recordings on it at the platen to receive the overflow data and this is done by manually setting the dial switches to a desired position and the switches in turn will condition the electronic counter to stop the ledger sheet with the desired line at the platen. Switch No. 1 is used to position the progressive total at the top of the new sheet such as is shown on line 64 of the ledger sheet shown in Fig. 24, and switch No. 2 is used to position the first listed line after the progressive total such as is shown on line 62 of said sheet.

Assuming that it is desired to position the progressive total on line 64 of the new sheet, line 64 being the first printing line, dial switch No. 1 would be set with its emitter arm resting on the 1 spot as shown in Fig. 25f. With relay RC248 energized a circuit will be completed at approximately 335° of the first run-in cycle from line 639, CBC19, the RC211-10 contacts closed, closed contacts RC248-3, the normally closed side of contacts RC250-2, wire 830, the emitter arm 831, the first 1 spot, wire 832, wire 833, normally closed contacts RC247-1, progressive total relay contacts RC246-7 transferred, the pickup coil of code relay RC230, contacts RC246-15 transferred, wire 834, and line 642. The three 1 spots of the switch are electrically commoned and similar circuits may be traced through wires 835 and 836 to energize the pickup coils of code relays RC229 and RC234. Code relays RC229 and RC230 correspond to the "b" and "c" code elements for column 19 or the decimal number 6. Relay RC234 corresponds to the "c" code element for column 20 or the decimal number 4. The energization of code relays RC229, RC230 and RC234 will effect the energization of the electronic counter setup relays RC194, RC195, and RC199 by a circuit through CBC2 (Fig. 25p), closed contacts RC248-1, closed contacts RC211-1, normally closed contacts RC250-3, through wire 737 as previously described and the figure 64 is entered into the electronic counter. The electronic counter had been reset to zero by the energization of cancellation relay RC205 (Fig. 25f) at approximately 280° of the first run-in cycle through CBC4.

At approximately 374° of the second run-in cycle CBC5 closes to send a test shot through the comparing unit (Fig. 25j) and since the new sheet is void of recordings none

of the code relays will be energized and the sheet must of necessity compare low. As a result, taking column 1 for example, comparing relay RC163 only would be energized and a circuit would be completed from CBC6 (Fig. 25k), closed contacts RC162-1, contacts RC163-1 transferred, closed blanking relay contacts RC236 through RC245, the low control relay RC285 and line 642. In the example previously described for comparing a sheet that is void of recordings it will be remembered that CBC7 closed to complete a circuit to energize the pickup coils of the blank relays RC236 through RC245 (Fig. 25k) to denote that the sheet was in error. However, on a run-in operation, such as after an overflow, the run-in relay RC269 is energized and this relay will hold through CBC12 until 330° of the second run-in cycle and as a result the RC269BL contacts in the pick circuit of the blanking relays will be open to prevent these relays from being energized and allowing the low control relay RC285 to be energized as described.

With the low control relay RC285 energized a circuit will now be completed from line 639 (Fig. 25g), CBC8, overflow relay contacts RC258-1 transferred, normally closed contacts RC300AL, wire 703, contacts RC285AL, wire 837, the pickup coil of low control relay RC250 and line 642. Then, at approximately 290° of the second cycle a circuit will be completed from line 639 (Fig. 25e), CB27, wire 680, the overflow contacts RC211-9 closed, contacts RC250-1 now closed, the pickup coil of head space control relay RC247 and line 642. As will be presently seen, relay RC247 is used to transfer the control of the line space code relays from dial switch No. 1 to dial switch No. 2 to control the position of the first listing line on the new sheet. Also at this time the figure 64 that was entered into the electronic counter by the setting of dial switch No. 1 is entered into the line space accumulators. The closed RC248-2 and RC211-8 contacts (Fig. 25l) allow the digit emitter impulses to pass through the code relays that were energized by the setting of dial switch No. 1 and the now closed contacts RC247-9 and RC247-10 allow the line space accumulators to operate. It should be pointed out that with low control relay RC250 now energized both the contacts RC250-4 and RC211-7 are now open to prevent energizing the cancellation relay RC205 (Fig. 25f) on this second run-in cycle. The electronic counter should not be cleared on this cycle.

The new sheet has now been compared and is ready to be moved to the printing station. At 310° of the second run-in cycle a circuit will be completed from line 639 (Fig. 25d), contacts RC269BU now closed, wire 718, CBC9, contacts RC278BU which are closed whenever a sheet is in the sensing station, the pickup coil of platen clutch relay RC 282 and line 642. The ledger sheet will now move toward the printing station under control of the electronic counter as previously described. When the sheet is 36 line spaces from the first printing line position at the platen it will close card lever contact No. 3 to energize the count relay RC206 and close the RC206-2 contacts (Fig. 26a) to allow the count emitter to enter pulses into the electronic counter. Since the Figure 64 has been entered into the electronic counter through the dial switch No. 1, after 36 pulses the electronic counter will stand at 100 at which time the line space magnet 499 will be deenergized and the platen stopped. The ledger sheet will be then positioned with the first printing line (line 64) opposite the type bars ready to receive the progressive total.

At approximately 99° of the second run-in cycle and prior to the movement of the blank sheet toward the printing station, a circuit is completed from line 639 (Fig. 25d), contacts RC269BU, CBC10, the pickup coils 238 of the hopper feed clutch and line 642 to start feeding ledger sheet B having the account number of 124 out of the hopper and toward the sensing station. Ledger sheet B will reach the sensing station during the third run-in cycle and at 274° of this cycle the sheet will com-

pare high against the card having an account number of 123 which is being held at the upper brushes. It will be noted that with the progressive total contacts RC258-1 transferred the total relay RC300BL contacts (Fig. 25g) will open at 210° of the third run-in cycle to drop the comparing control relays so that they may be again energized by this high comparison. The high comparison will cause the high control relays RC283 and RC212 to become energized by circuits previously traced. Also at this time the cancellation relay RC205 will be energized through CBC4 and the closed RC211-7 contacts to reset the electronic counter and the head space control relay RC247 which had been picked on a low reading but which dropped out at 210° through CB27 is again energized by a circuit which extends from line 639 (Fig. 25e), CB27, wire 680, closed contacts RC211-9, contacts RC212-6 now closed, the pickup coil of relay RC247 and line 642.

With the new sheet positioned at the platen it is necessary to cause the machine to go through a total cycle in order to print the progressive total at the top. The total cycle is initiated by either or both of two circuits. On the third run-in cycle when the low control relay RC285 was energized a circuit was completed from line 639 (Fig. 25b), wire 826, the RC211-3 contacts closed, closed contacts RC285AU, switch S4, minor total relays R61 and R66, wire 667 and line 642. The cycle following the third run-in cycle, then, is a total cycle during which the progressive total retained in the accumulators is printed on line 64 of the new ledger sheet as shown in Fig. 24.

This same total cycle is also initiated as a result of the high comparison of ledger sheet B. Energization of the high control relay RC212 will allow a circuit to be completed from line 639 (Fig. 25f), now closed contacts RC212-1, closed contacts RC211-2, the lower pickup coil of relay RC279 and line 642. The energization of relay RC279 will allow a circuit to be completed from line 639 (Fig. 25b), wire 826, now closed RC279BU contacts, switch S4, minor total relays R61 and R66, wire 667 and line 642. The energization of relay RC279 closes the contacts RC279BU to again energize the progressive total control relay RC280 (Fig. 25e) while relays RC211, RC246 and RC258 are still being held energized through the combination of contacts RC213-5, RC212-2 and PMC4. The hold circuit for relay RC280 (Fig. 25c) will again energize the progressive total control relay RC287. The purpose of energizing relay RC280 at this time is to open the RC280AL contacts in the pick circuit for the upper pickup coil of the platen clutch relay RC282 (Fig. 25d) to prevent any impulse to the carriage feed clutches because it is desired to have the new ledger sheet remain in the printing position for additional listings. Although the total relay contacts RC207-3 are closed at this time, contacts RC212-3 are open due to the high comparison, contacts RC269BU are open because relay RC269 drops out at 330° of the second run-in cycle, and the RC208-2 contacts are open so the platen clutch relay cannot be energized at this time.

Once again the RC279BL and RC287B contacts (Fig. 25e) will be open to prevent relays RC203 and RC204 from being energized and the account number and balance accumulators will not be reset. Also, since a high comparison immediately preceded the start of this total cycle the RC212-9 contacts will be open through the total cycle and consequently relay RC249 will not be energized and the contacts RC249-1 through RC249-4 in the line space accumulators will prevent the accumulators from being reset. Referring to Fig. 25f, it will be noted that both the RC212-4 and RC280BL contacts are now open to prevent the energization of the recording clutch control relays RC272 and RC273. Since the new ledger sheet will remain at the printing station for additional listings it is not necessary on this total cycle to initiate circuits for activating the recording clutch.

As was previously mentioned the position of the first listing after the progressive total may be controlled by setting the dial switch No. 2. For example, referring to Fig. 24, assume that it is desired to have the first listing on line 62 as shown. In such a case, then, dial switch No. 2 would be set to space the ledger sheet to line 63 because in normal tabulator operation the sheet will be moved one line space during the upward movement of the type bars on a listing operation.

Referring to Fig. 25*t*, the dial switch No. 2 is set with its emitter arm 838 resting on spot 2 which corresponds to the second line from the top of the sheet or line 63. Then, at approximately 335° of the third run-in cycle when the high comparison is made and after the electronic counter has been reset, a circuit is completed from line 639, CBC19, the closed contacts RC211-10, high control contacts RC212-5 now closed, the emitter arm 838, the first 2 spot, wire 839, the pickup coil of relay RC293 and line 642. The energization of relay RC293 allows parallel circuits to be completed from the emitter arm 838, wire 840, contacts RC293B, contacts RC247-8 now closed, contacts RC246-8 transferred, the pickup coil of code relay RC231, contacts RC246-16 transferred, wire 834 to line 642 and also from the emitter arm 838, wire 840, contacts RC293A, contacts RC247-5 transferred, contacts RC246-5 transferred, the pickup coil of code relay RC228, contacts RC246-13 transferred, wire 834 and line 642. A circuit is also completed from the second 2 spot, wire 841, contacts RC247-4 transferred, contacts RC246-4 transferred, the pickup coil of code relay RC235, contacts RC246-12 transferred, wire 834 to line 642. A circuit is also completed from the third 2 spot, wire 842, contacts RC247-1 transferred, contacts RC246-1 transferred, the pickup coil of code relay RC232, contacts RC246-9 transferred, wire 834 and line 642. The function of relay RC293 is merely to provide additional contacts to take the place of additional spots which are needed on dial switch No. 2 but for which there is no room. Relay RC292 and its associated contacts provide the same function for dial switch No. 1.

The code relays RC228 and RC231 correspond to the "a" and "d" code elements for column 19 or the decimal figure 9. The code relays RC232 and RC235 correspond to the "a" and "d" code elements for column 20 or the decimal figure 9. The energization of these relays will effect the energization of the electronic counter setup relays RC193, RC196, RC197 and RC200 by a circuit through CBC2 (Fig. 25*p*), closed contacts RC212-8, closed contacts RC211-1, normally closed RC250-3 contacts, through wire 737 as previously described and the figure 99 is entered into the electronic counter.

The progressive total relays RC211, RC246 and RC258 are dropped out at approximately 178° of the total cycle by PMC4 and the total is printed at approximately 196°. Then, at about 232° of the total cycle a circuit is completed from line 639 (Fig. 25*g*), PMC5, contacts RC211-11 now closed, contacts RC287AU and RC287AL now closed, the lower pickup coil of platen clutch relay RC282 and the pickup coil of count control relay RC271 to line 642. The hold circuit for relay RC271 extends from line 639 (Fig. 25*c*), wire 711, CBC17, wire 712, the RC271A contacts, the hold coil of relay RC271 and line 642. The ledger sheet at the platen will begin to move and at the same time the RC271B contacts (Fig. 26*a*) will close to allow the count emitter to enter pulses into the electronic counter. Since the figure 99 had been entered into the counter through the dial switch No. 2, after 1 pulse the electronic counter will stand at 100 at which time the line space magnet 499 will be de-energized and the platen stopped. The ledger sheet will now be positioned with the second printing line (line 63) opposite the type bars ready to receive the first listing.

The cycles following the progressive total cycle will be card feed cycles during which the third, fourth and

fifth cards bearing the account number 123 will list below the progressive total as shown in Fig. 24. Assuming that the next card to come along does not compare equally with the fifth card which will be at the lower brushes after having listed, a control break is effected and the following cycle will be an ordinary total cycle. The machine will then continue to operate in a normal manner.

If it is desired to print a grand total at the end of a sheet such as is shown in Fig. 24, the standard tabulator circuits may be conditioned, in a manner known in the art, so that the TSB contacts of the grand total counter will suppress the resetting of this counter until a final total key is depressed to cause the machine to take a total cycle. Then, with the grand total counter wired to a class of total hub which is under control of the final total key, a depression of said key will effect a total cycle and the printing of the amount standing in the grand total counter only.

While there have 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 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:

1. In a record controlled machine for operating on ledger sheets bearing magnetic recorded indicia, means for feeding groups of record cards, means for sensing said record cards, means for feeding said ledger sheets, means for sensing magnetic recorded indicia on said ledger sheets, group control means under control of said card sensing means for determining changes in card groups, amount entering means under control of said sheet sensing means, accumulating devices adjusted under control of said amount entering means and said card sensing means for accumulating data recorded on a ledger sheet and a related group of cards, total taking devices cooperating with said accumulating devices to read out totals, means under control of said group control means for initiating operation of said total taking devices, printing means adjusted under control of said card sensing means and operable to record on said ledger sheet data from said related group of cards, means under control of said accumulating devices for adjusting said printing means, means under control of said total taking devices for initiating operation of said printing means to record on said ledger sheet the data accumulated, wipe out means for wiping out the magnetic recorded indicia on the ledger sheets, means under control of said sheet feeding means for initiating operation of said wipe out means after total printing, magnetic recording means adjusted by said accumulating devices, and cyclically operable means for initiating operation of said recording means to record in magnetic form on each sheet related accumulated data.

2. In a record controlled machine for operating on ledger sheets bearing recorded indicia, said records bearing indicia for controlling said operation, means for feeding record cards, means for sensing said record cards, means for feeding ledger sheets, means for sensing said ledger sheets, a comparing device, means under control of said record card sensing means for entering indicia from a pair of successive record cards into said comparing device, a second comparing device, means under control of said record card sensing means for entering indicia from one of said pair of record cards into said second comparing device, means under control of said ledger sheet sensing means for entering indicia from a ledger sheet into said second comparing device, amount entering means cooperating with said ledger sheet sensing means, accumulating devices adjusted under control of said enter-

ing means and said record card sensing means, total taking devices cooperating with said accumulating devices to read out totals, means under control of said second comparing device for causing operation of said amount entering means, and means under control of said first comparing device for causing operation of said total taking devices to read out totals.

3. In a record controlled machine for operating on ledger sheets bearing recorded indicia, said records bearing indicia for controlling said operation, means for feeding record cards, means for sensing said record cards, means for feeding ledger sheets, means for sensing said ledger sheets, printing mechanism, means under control of said record card sensing means for adjusting said printing mechanism to record items of data on said sheets, a comparing unit comprising two sets of settable devices, means under control of said record card sensing means for adjusting said settable devices to represent account number indicia from a pair of successive record cards, a second comparing unit comprising two sets of settable devices, means under control of said record card sensing means for adjusting one of said latter sets of settable devices to represent account number indicia from one of said pair of record cards, means under control of said ledger sheet sensing means for adjusting the other of said latter settable devices to represent account number indicia from a ledger sheet, comparing instrumentalities cooperating with said latter settable devices and adjusted thereby into one of three positions according to the comparison of account numbers of the cards and the ledger sheets, the first of said positions representing a low ledger sheet condition, the second position indicating an equal condition, the third position indicating a high ledger sheet, and means for causing the operation of said printing mechanism to record data on a ledger sheet when said comparing instrumentalities are in said third position and said first comparing unit indicates an equal comparison between the account numbers from said pair of record cards.

4. The combination set forth in claim 3 further characterized by means for adjusting said comparing instrumentalities into a fourth position indicating a low comparison due to a void ledger sheet, error indicating means, means for suppressing the operation of said machine, and means for causing the operation of said error indicating means and said suppression means whenever said comparing instrumentalities are in said fourth position.

5. In a record controlled machine for operating on ledger sheets bearing recorded indicia, said records bearing indicia for controlling said operation, means for feeding record cards, means for sensing said record cards, means for feeding ledger sheets, means for sensing said ledger sheets, amount entering means cooperating with said ledger sheet sensing means, accumulating devices adjusted under control of said entering means and said record card sensing means, total taking devices cooperating with said accumulating devices to read out totals, printing mechanism, means under control of said total taking devices for adjusting said printing mechanism to record data totals on said sheets, a comparing unit comprising two sets of settable devices, means under control of said record card sensing means for adjusting said settable devices to represent account number indicia from a pair of successive record cards, a second comparing unit comprising two sets of settable devices, means under control of said record card sensing means for adjusting one of said latter sets of settable devices to represent account number indicia from one of said pair of records, means under control of said ledger sheet sensing means for adjusting the other of said latter settable devices to represent account number indicia from a ledger sheet, comparing instrumentalities cooperating with said latter settable devices and adjusted thereby into one of three positions according to the comparison between the account numbers of the cards and the ledger sheets, the first of said

positions representing a low ledger sheet condition, the second position indicating an equal condition, the third position indicating a high ledger sheet, means under control of said comparing instrumentalities for causing operation of said amount entering means, and means for operating said total taking devices to effect the operation of said printing mechanism to record total data on a ledger sheet whenever said comparing instrumentalities are in said second position and said first comparing unit indicates an unequal comparison between the account numbers from said pair of record cards.

6. The combination set forth in claim 5 further characterized by means for suppressing further operation of said amount entering means and means for causing operation of said total taking devices to effect the operation of said printing mechanism to record total data whenever said comparing instrumentalities are in said first position and said first comparing unit indicates an unequal comparison between the account numbers from said pair of record cards.

7. In a record controlled machine for recording on ledger sheets bearing magnetic recorded indicia, means for feeding record cards, means for sensing indicia on said record cards, means for feeding ledger sheets, means for sensing indicia on said ledger sheets, means for comparing indicia from a pair of successive record cards, means for comparing indicia from one of said pair of record cards with indicia from a ledger sheet, amount entering means cooperating with said ledger sheet sensing means, accumulating devices adjusted under control of said entering means and said card sensing means, total taking devices cooperating with said accumulating devices to read out totals, means under control of both said comparing means for initiating operation of said total taking devices, wipe out mechanism, means effective upon the operation of said total taking devices for conditioning said wipe out mechanism for operation, means effective upon operation of said total taking devices for causing said ledger feeding means to initiate a ledger feeding cycle, and means actuated by a ledger sheet during said feeding cycle for causing the operation of said wipe out mechanism to wipe out the magnetic indicia on said latter ledger sheet.

8. In a record controlled machine for recording on ledger sheets bearing magnetic recorded indicia, means for feeding record cards, means for sensing indicia on said record cards, means for feeding ledger sheets, means for sensing indicia on said ledger sheets, means for comparing indicia from a pair of successive record cards, means for comparing indicia from one of said pair of record cards with indicia from a ledger sheet, amount entering means cooperating with said ledger sheet sensing means, accumulating devices adjusted under control of said entering means and said card sensing means, total taking devices cooperating with said accumulating devices to read out totals, means under control of both said comparing means for initiating operation of said total taking devices, readout means for said accumulating devices and operated by said total taking devices, storage means settable by said readout means, magnetic recording means adjusted under control of said storage means, and cyclically operable means for causing the operation of said magnetic recording means to record data on said ledger sheets.

9. In a record controlled machine for operating on ledger sheets bearing magnetic recorded indicia, said records bearing indicia for controlling said operation, means for feeding record cards, means for sensing said record cards, means for feeding ledger sheets, means for sensing said ledger sheets, amount entering means cooperating with said ledger sheet sensing means, accumulating device adjusted under control of said entering means to represent a line indication number, other accumulating devices adjusted under control of said amount enter-

ing means and said card sensing means to represent balance data, total taking devices cooperating with said accumulating devices to read out totals, card counting means cyclically operable as each record card feeds through the machine, means effective upon each operation of said card counting means for decreasing the line indication number in said line indication accumulating devices, readout means cooperating with said line indication accumulators, and means controlled by said readout means when said line indication accumulators reach a predetermined number representing the last line on a sheet for causing the operation of said total taking devices.

10. The combination set forth in claim 9 further characterized by a printing mechanism adjusted by said total taking devices to print data totals on the last printing line of a ledger sheet to indicate a sheet overflow.

11. The combination set forth in claim 9 further characterized by resetting means under control of said total taking devices for resetting said accumulators, and means associated with said balance accumulating devices and rendered effective upon operation of said readout controlled means when said line indication accumulators reach said predetermined number representing the last line on a sheet for preventing said resetting means from resetting said balance accumulating devices.

12. In a machine for recording on ledger sheets bearing magnetic recorded indicia, control indicia on said sheets for controlling the positioning of the sheets, sheet sensing means for sensing said control indicia, a control device adjusted by said sensing means in accordance with said control indicia, means for feeding a ledger sheet at high speed, means controlled by the movement of said sheet for causing an operating cycle of said control device, line spacing means for line spacing said sheet, means controlled by the operation of said control device for disabling said high speed feeding means and for operating said line space means, and means controlled by the termination of the operating cycle of said control device for stopping said line spacing means to position said sheet.

13. In a machine for recording on ledger sheets bearing magnetic recorded indicia, control indicia on said sheets for controlling the positioning of the sheets, sheet sensing means for sensing said control indicia, a printing platen, an electronic counting device, means controlled by said sensing means for setting said electronic counting device in accordance with said control indicia, high speed feeding means, means for operating said high speed feeding means to feed a sheet from said sensing means toward said platen, means controlled by the movement of said ledger sheet for pulsing said counting device as said sheet moves toward said platen, line space feeding means, control means cooperating with said counting device, suitable means connected between said counting device and said control means for causing said control means to disable said high speed feeding means and to call said line space feeding means into operation when the desired printing line on the sheet is a predetermined distance from said platen, and means associated with said control means for stopping said line spacing means when said counting device reaches counting capacity to position the sheet with the desired printing line at the platen.

14. The combination set forth in claim 13 further characterized by a manually settable device for setting said electronic counting device setting means to accordingly set said counting device at a predetermined value for controlling the positioning of a sheet which is void of control indicia.

15. In a machine for recording on ledger sheets bearing magnetic recorded indicia, control indicia on said sheets for controlling the positioning of the sheets, sheet sensing means for sensing said control indicia, a printing platen, an electronic counter comprising a chain of electronic trigger circuits, each trigger operable to either

of two stable electrical conditions, means controlled by said sensing means for setting said triggers to permutations of either of said stable conditions, said permutations being indicative of the value of said control indicia, high speed feeding means, means for operating said high speed feeding means to feed a sheet from said sensing means toward said platen, means controlled by the movement of said ledger sheet for pulsing said electronic counter as said sheet moves toward the platen, line space feeding means, means settable to different positions representing different line space distances from the platen, electron discharge devices under control of said settable means for controlling the operation of said high speed feeding means and said line space feeding means, means associated with said settable means and rendered effective upon said counter assuming a permutation of settings corresponding to a selected line space distance for effecting the operation of said discharge devices to disable said high speed feeding means and to call said line spacing means into operation, and means rendered effective upon said counter assuming a permutation of settings corresponding to the capacity of the counter for effecting the operation of said discharge devices to stop said line spacing means.

16. The combination of a record controlled machine and a sheet feeding carriage for feeding ledger sheets bearing magnetic recorded indicia which comprises, means for feeding groups of record cards, means for sensing said record cards, group control means for finding changes in said card groups, a ledger sheet sensing device, main operating means for said carriage, a sheet feeding device, means for connecting said sheet feeding device with said main operating means to feed a ledger sheet to said sheet sensing device, cyclically operable means for stopping said ledger sheet at said sensing device, comparing instrumentalities under control of said card sensing means and sheet sensing device for determining whether said ledger sheet compares low, equal or high with respect to said record cards, a second sheet feeding device for feeding said ledger sheet away from said sensing device, means for connecting said second sheet feeding device with said main operating means, and means effective upon a high comparison with no change in card groups for rendering both of said connecting means inoperable and said card feeding means operable until an equal or low comparison is encountered.

17. The combination set forth in claim 16 further characterized by means effective upon a low comparison with no change in card groups for rendering both of said connecting means operable and said card feeding means inoperable until an equal or high comparison is encountered.

18. The combination of a record controlled machine and a sheet feeding carriage for feeding ledger sheets bearing magnetic recorded indicia which comprises, means for feeding groups of record cards, means for sensing said record cards, group control means for finding changes in said card groups, a ledger sheet sensing device, main operating means for said carriage, a sheet feeding device, means for connecting said sheet feeding device with said main operating means to feed a ledger sheet to said sheet sensing device, cyclically operable means for stopping said ledger sheet at said sensing device, comparing instrumentalities under control of said card sensing means and sheet sensing device for determining whether said ledger sheet compares low, equal or high with respect to said record cards, a second sheet feeding device for feeding said ledger sheet away from said sensing device, means for connecting said second sheet feeding device with said main operating means, amount entering means, accumulating devices adjusted under control of said entering means, total taking devices cooperating with said accumulating devices to read out totals, means under control of said group control means

for initiating operation of said total taking devices when card changes are encountered, and means effective upon the operation of said total taking devices for rendering both of said connecting means operable to initiate a ledger feeding cycle.

19. In the combination of a record controlled machine and a sheet feeding carriage for feeding ledger sheets bearing recorded indicia, means for sensing the recorded indicia on said ledger sheets, sheet feeding means comprising a platen, a counter, means controlled by said sensing means for entering a predetermined number in said counter identifying a predetermined printing line on a sheet, means for operating said sheet feeding means to feed a sheet to said platen, means for rotating said platen, means operated in dependence upon the rotation of said platen for stepping said counter, for each line space travel of said sheet, from its condition corresponding to said predetermined count toward a stop signal condition, and means controlled by said counter on reaching said stop signal condition for stopping said platen rotating means to register said sheet with the predetermined printing line at the platen.

20. The combination as in claim 19, wherein the stepping of the counter in dependence upon rotation of the platen begins when the leading edge of the paper trips a card lever positioned between said sensing means and said platen.

21. The combination as in claim 19, wherein the predetermined number is recorded on the sheet in the form of magnetic indicia, the means for entering said predetermined number including means for sensing said magnetic indicia, means for erasing said magnetic indicia, and means for recording magnetic indicia representing a new predetermined number on the area erased.

22. The combination as in claim 21, wherein means are provided to print in successive lines on the sheet, said means for recording magnetic indicia representing a new predetermined number including a counter and means to advance the same once for each line printed.

23. In a record controlled machine for operating on ledger sheets, a printing platen, driving means for said platen, sheet feeding means, a clutch device comprising a driven member and a driving member, said driving member being in engagement with said sheet feeding means and said platen driving means, main operating means for operating said driven member at high speed, a braking device normally in engagement with said driving member, a solenoid, means for energizing said solenoid, mechanism effective upon energization of said solenoid for disengaging said braking device from said driving member and engaging said driving member with said driven member whereby said platen driving means and sheet feeding means will operate at high speed, said mechanism also being effective upon deenergization of said solenoid to disengage said driven member from said driving member and to bring said braking device into engagement with said driving member to slow same below line spaced speed, a line spacing device driven by said main operating means, and means effective upon deenergization of said solenoid and the engagement of said braking device for connecting said line spacing device with said driving member whereby said platen driving means and sheet feeding means will operate at line space speed.

24. In the combination of a record controlled machine and a sheet feeding carriage for feeding ledger sheets, sheet feeding means comprising a clutch shaft rotatable in a pair of support plates, said clutch shaft having a first threaded portion, a second threaded portion, and a non-threaded portion between said threaded portions, a driving gear, a threaded nut integral with said gear and mounted on said first threaded portion of said shaft, said driving gear also having a pair of collars fastened thereto, one on each side, a free turning gear

mounted on the non-threaded portion of said shaft and fixed axially thereon by a collar and a bushing, said free turning gear having a pair of collars fastened thereto, one on each side, a pair of friction discs each one of which is fastened to one of said last mentioned collars, one of said friction discs being adjacent to and normally out of engagement with one of said first mentioned pair of collars, said other friction disc being adjacent to and normally in engagement with a braking disc, said braking disc having a threaded bushing integral therewith and mounted on the second threaded portion of said shaft, and means to rotate said shaft slightly to impart a horizontal movement to said last mentioned threaded bushing through said threaded nut whereby said one of said first mentioned collars is moved into engagement with the said adjacent friction disc and said braking disc is moved out of engagement with said other friction disc allowing said free turning gear to be driven by said driving gear.

25. In a record controlled machine for recording on ledger sheets bearing magnetic recorded indicia, means for feeding record cards, means for sensing indicia on said record cards, means for feeding ledger sheets, means for sensing indicia on said ledger sheets, means for comparing indicia from a pair of successive record cards, means for comparing indicia from one of said pair of record cards with indicia from a ledger sheet, amount entering means cooperating with said ledger sheet sensing means, accumulating devices adjusted under control of said entering means and said card sensing means, total taking devices cooperating with said accumulating devices to read out totals, means under control of both said comparing means for initiating operation of said total taking devices, readout means for said accumulating devices and operated by said total taking devices, storage means settable by said readout means, a recording device having a plurality of recording coils under control of said storage means for recording vertically disposed code elements into a plurality of horizontally disposed columnar positions on said ledger sheet, said recording coils being arranged with a row of coils for each even numbered columnar position and a row of coils for each odd numbered columnar position, said rows of coils for the even columns being vertically disposed with respect to said rows of coils for the odd columns, means for positioning a ledger sheet at said recording device with the horizontally disposed columns of the sheet in alignment with said rows of coils, cam controlled means operable to move said recording device at intervals to position said device for recording in said columnar positions, said cam controlled means being effective to restore said recording device back to its original position at the end of the recording cycle, and cyclically operable means for energizing said recording coils between the intervals of movement of said recording device.

26. The combination set forth in claim 25 further characterized by a pressure plate for pressing a ledger sheet against said recording coils, a solenoid for operating said pressure plate, and cyclically operable means for energizing said solenoid between the intervals of movement of said recording device.

27. In a record controlled machine for operating on ledger sheets bearing magnetic recorded indicia, said indicia being arranged in the form of vertically disposed code elements in a plurality of horizontally disposed columnar positions, means for feeding groups of record cards, means for sensing said record cards, a ledger sheet sensing drum having a plurality of sensing coils spacedly disposed about its periphery in the manner of a helix, means for feeding said ledger sheets, cyclically operable means for stopping a ledger sheet at said sensing drum, means for continuously rotating said drum with said coils developing voltage pulses corresponding to

the recorded indicia on said sheet, an emitter device, said emitter device serving to distribute the pulses representing said code elements, a plurality of code relays electrically connected to said emitter device, a second emitter device electrically connected to said code relays, said second emitter device serving to distribute the pulse representing said code elements to their respective code relay groups, and comparing instrumentalities under control of said card sensing means and said code relays for comparing data on said ledger sheet with data on said record cards.

28. The combination set forth in claim 27 wherein said sensing coils are arranged to scan the ledger sheet in a predetermined columnar sequence and said emitter

devices are connected to read out the sensed data in a different columnar sequence.

References Cited in the file of this patent

UNITED STATES PATENTS

1,183,529	Brasseur	May 16, 1916
2,000,218	Carroll	May 7, 1935
2,138,646	Scharr	Nov. 29, 1938
2,357,455	Bryce	Sept. 5, 1944
2,359,617	Bryce	Oct. 3, 1944
2,435,725	Paris	Feb. 10, 1948
2,496,579	Cheney et al.	Feb. 7, 1950
2,551,088	Beattie et al.	May 1, 1951
2,672,395	Lewis	Mar. 16, 1954