MACHINE METHODS OF ACCOUNTING

AUTOMATIC SUMMARY PUNCHES

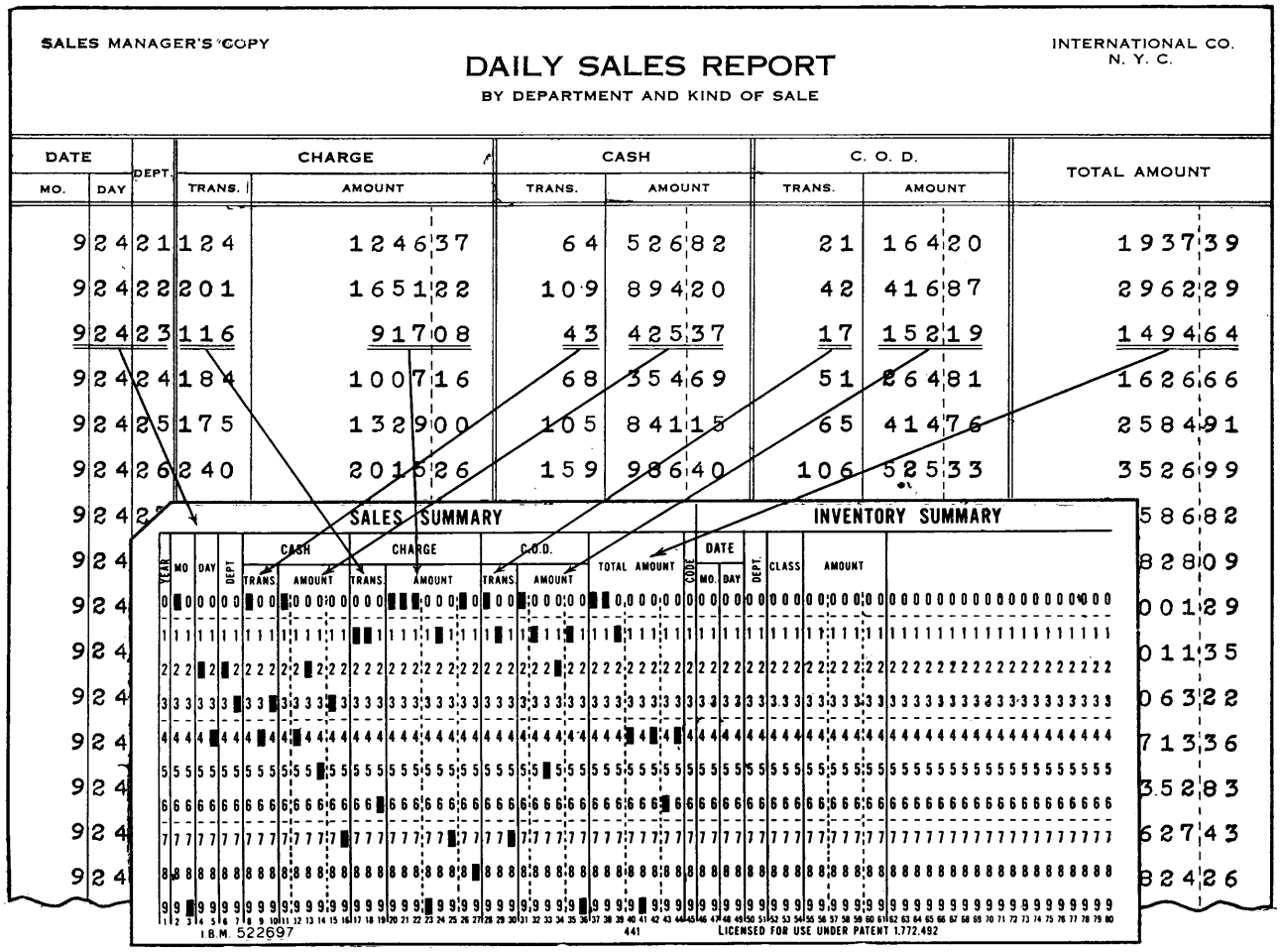
For use with the Numerical Accounting Machines (Type 285-297)

EACH step in the development of Electric Accounting Machines is characterized by the more automatic performance of various record-keeping operations. The manual punching of total cards from data appearing on tabulated reports was one of the time-consuming routines formerly encountered in the Electric Accounting Machine Method. Summary punches, built in two different models, now accomplish the automatic preparation of total or new-balance cards simultaneously with the accumulation of totals and the printing of reports. These cards may be prepared as a by-product of any tabulation—daily, weekly, or monthly.

Such summary cards and new-balance cards are utilized to reduce the volume of cards in the current file and to speed up the compilation of accounting and statistical analyses.

Properly planned summary-punching at periodic intervals, such as daily or weekly, as shown in the illustration below, can be used to reduce markedly the time required for the preparation of month-end reports.

The automatic summary punches also possess recording possibilities that are unique. One example of this feature is the punching of a total card for the debit entry to Accounts Receivable simultaneously with preparation of the bill on an Invoicing Tabulator. Another common use is the preparation of a tabulating card payroll check as a by-product of the payroll tabulation.

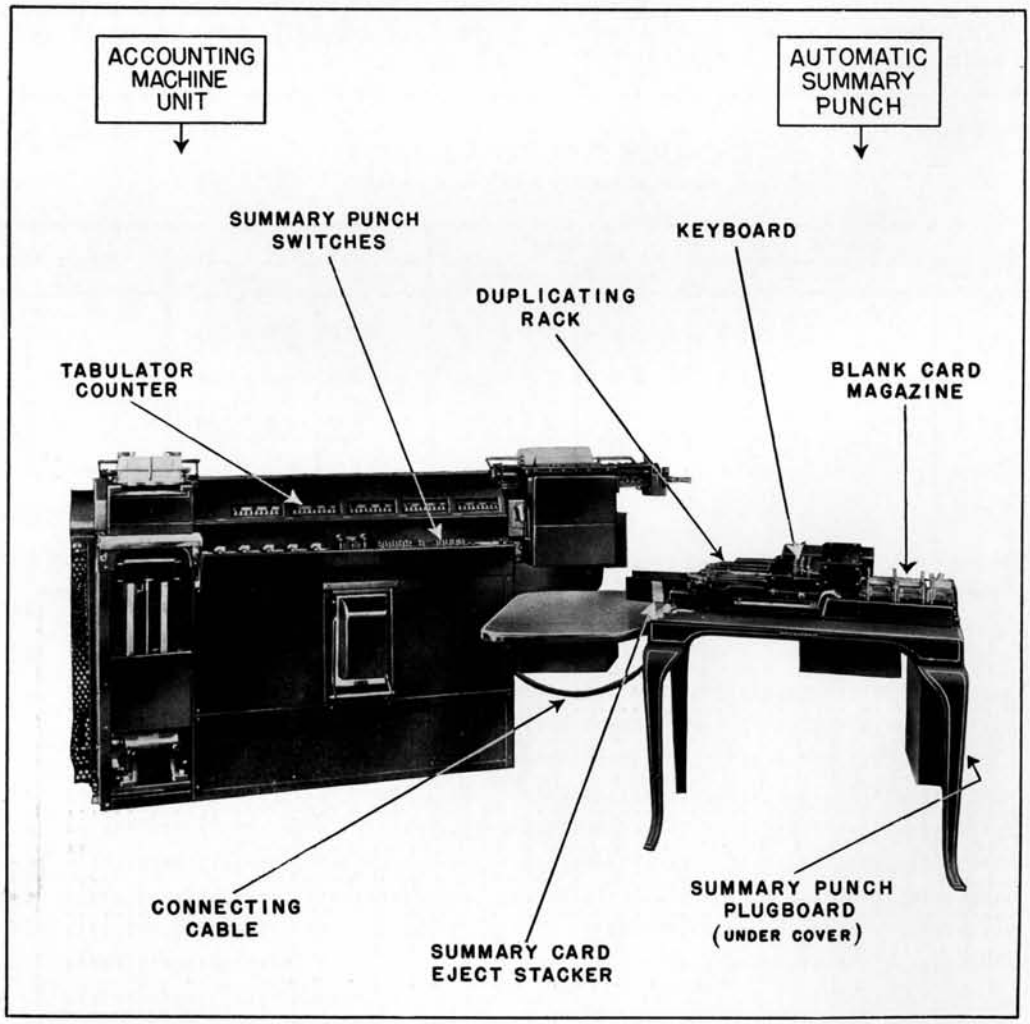


Duplicator Summary Punch (Type 516)

THE Duplicator Summary Punch is designed for the automatic preparation of total cards or new-balance cards simultaneously with the tabulating operation. The indications and accumulations in the counters of an Electric Accounting Machine, at any desired control change, are recorded in punched-hole form in summary cards as shown previously. These cards, therefore, are punched transcriptions of the printed results shown on any tabulation, and may be used for further analyses of such data or for other specific purposes.

The machine consists of a Motor Drive Duplicating Key Punch connected to the counter wheels of the Accounting Machine by means of a flexible, multiple-wire cable. With the exception of this cable and a plugboard which permits flexibility in plugging the data to be punched, the punching unit is identical in appearance and mechanical operation with the standard punch. The punch may be actuated in three different ways—by manual key depression (key-punching), by a master card in the duplicating rack (duplicating), and by the counter wheels of the Accounting Machine (summary-punching). All three methods of punch actuation may be used in the punching of a single total card.

The punching mechanism may be attached to any numerical Accounting Machine equipped with commutator-type top counters and impulse emitters. The Accounting Machine may be of either the single-reset or the successive-reset type.



Operation

The tabulating, printing, and punching operations are fully automatic, the cycle of operation being as follows:

The Accounting Machine tabulates as usual until a change occurs in the control for which totals are to be punched. The Accounting Machine stops but does not reset until all punching in the summary card has been completed. The punch magnets are actuated through the medium of an emitter which reads the amounts standing in each counter and transmits the impulses to the punch magnets in a sequence determined by the plugging arrangement. For key-punching and duplicating, the punch magnets are actuated in the normal manner.

The reset circuit on the Accounting Machine is made operative at the moment the summary card is ejected from the punch. At this time the machine resets, prints the totals, and starts tabulating the next control group in the normal manner. Simultaneously with the reset of the Accounting Machine, a new card is fed automatically into the Summary Punch. This card positions itself (either by punching or skipping, as described later) at the first field to be punched from the counter totals and remains stationary until the control change.

Punching may be duplicated from master cards if desired. In this operation the master card is placed in the duplicating rack of the punch in the usual manner. If the duplicated information is punched in card fields to the left of the first total-punched field, the duplicating operation is performed while the Accounting Machine is accumulating the particular group of detail cards. If the duplicated information is punched to the right of the first total-punched field, the duplicating operation is not performed until the control change. Thus, to obtain maximum operating speed, the fields to be duplicated must appear to the left of the fields to be total-punched. Special skip bars and cut-out bars for this use are discussed later.

Data may be manually key-punched if desired. In this case also, the key-punched fields must appear to the left of the fields to be total-punched if a maximum operating speed is to be obtained.

Operation of the Accounting Machine is normal on any control change at which totals are not to be punched; that is, if only major totals are to be punched, the machine resets and starts as usual following a change in intermediate or minor control.

When punching summary cards, each machine is under electrical control of the other. When desired, however, each machine may be operated independently and simultaneously. The current supply for both Accounting Machine and Summary Punch is obtained from a single outlet, each machine having an individual switch.

Accounting Machine Features

The information appearing in any normal adding or balance counter can be transferred to summary cards. It is not possible to transfer information from the list banks. Such information can, however, be summary-punched if there are sufficient unused counter positions in which it may be group-indicated but not printed. This operation is illustrated later.

The attachment of the punching mechanism to the Accounting Machine does not change the normal listing and tabulating speed of the machine. It does, however, increase the reset time because the punching occurs before the totals are printed. The time required for punching is governed by the amount of punching to be done.

The plugboard of the Accounting Machine is standard except that provision is made for group indication on those machines which normally do not have this feature. Twenty positions of group indication are provided on all machines. Additional positions may be supplied at a slight additional charge.

If any indicated information appearing in a counter is to be punched, it must be plugged through the Group Indicator hubs.

The Accounting Machine is equipped with several switches which are used in summary-punching operations. These are as follows:

The "Summary Punch" switch when ON, makes both units (Accounting Machine and Punch) function synchronously. It should be OFF when the Accounting Machine and the Punch are to be used independently of each other.

The "Major," "Intermediate," and "Minor" switches, located near the Summary Punch switch, govern the totals to be transferred to cards. The machine may be made operative for the major, the intermediate, or the minor totals, but never for more than one class of total in any one tabulation. When the tabulating and punching units are to be used independently, these switches should be OFF.

Summary Punch Features

The keys and operating switches on the Automatic Summary Punch perform the same functions as those on the Motor Drive Duplicating Key Punch.

High skip bars are provided to skip automatically those fields in which no punching is desired. (Regulations regarding automatic skip bars are applicable.)

A card lever in the punching unit prevents operation of the punch should a card fail to feed or the card magazine become exhausted while the Accounting Machine is in operation.

Common information not appearing in any counter of the Accounting Machine may be transcribed to the summary cards from master cards which are placed in the duplicating rack of the punch. This information may appear in any position of the new card provided the proper skip bar and cut-out bar are used.

For maximum operating speed, the duplicated or key-punched data must be punched to the left of total-punched fields. (See section on skip bars.)

A plugboard mounted on the punch base permits plugging from any top counter positions to any card columns desired. The arrangement of the data in the counter wheels places no restriction as to the positions on the card in which these same data can be punched. Complete flexibility in the transposition of data is afforded through the plugboard.

Zeros will be punched automatically to the left of figures when digits in the total are fewer than the wired columns of the field. For example, if eight columns are plugged to punch and the amount is $42.45, the card is punched 00004245.

Credit amounts in balance counters may be summary-punched in true or in complement figures, as desired. X-punching of summary cards to designate various types of balances may be accomplished with complete flexibility. X-punching is controlled by a switch unit for each balance counter, as described and illustrated later.

General Features

If, on the Summary Punch plugboard, the counter hub positions are plugged to the "Punch Columns" hubs, the figures in the respective counter positions are transcribed during the reset for which the punch is set, regardless of whether the counter resets or not. By means of this feature it is possible to punch progressive totals in summary cards.

The punch is equipped with a cable approximately six feet long. Where it is necessary to have a punch at a greater distance than six feet, an extra length of cable, not exceeding fifty feet, can be furnished at a nominal installation charge.

The transfer of information from the Accounting Machine to the summary card is accomplished at the speed of about ten holes a second. Since the feeding and the ejecting of summary cards are simultaneous with the printing of the report, the actual punching time is the only additional time required for producing summary cards. The duplication or the manual punching of additional information in the summary cards can be performed while the tabulator is running. No additional time need be allowed for these operations unless the tabulating time of the group is less than the time required for recording the additional information. If summary-punching and additional punching are interspersed, it becomes necessary to add the additional punching time to the summary-punching time.

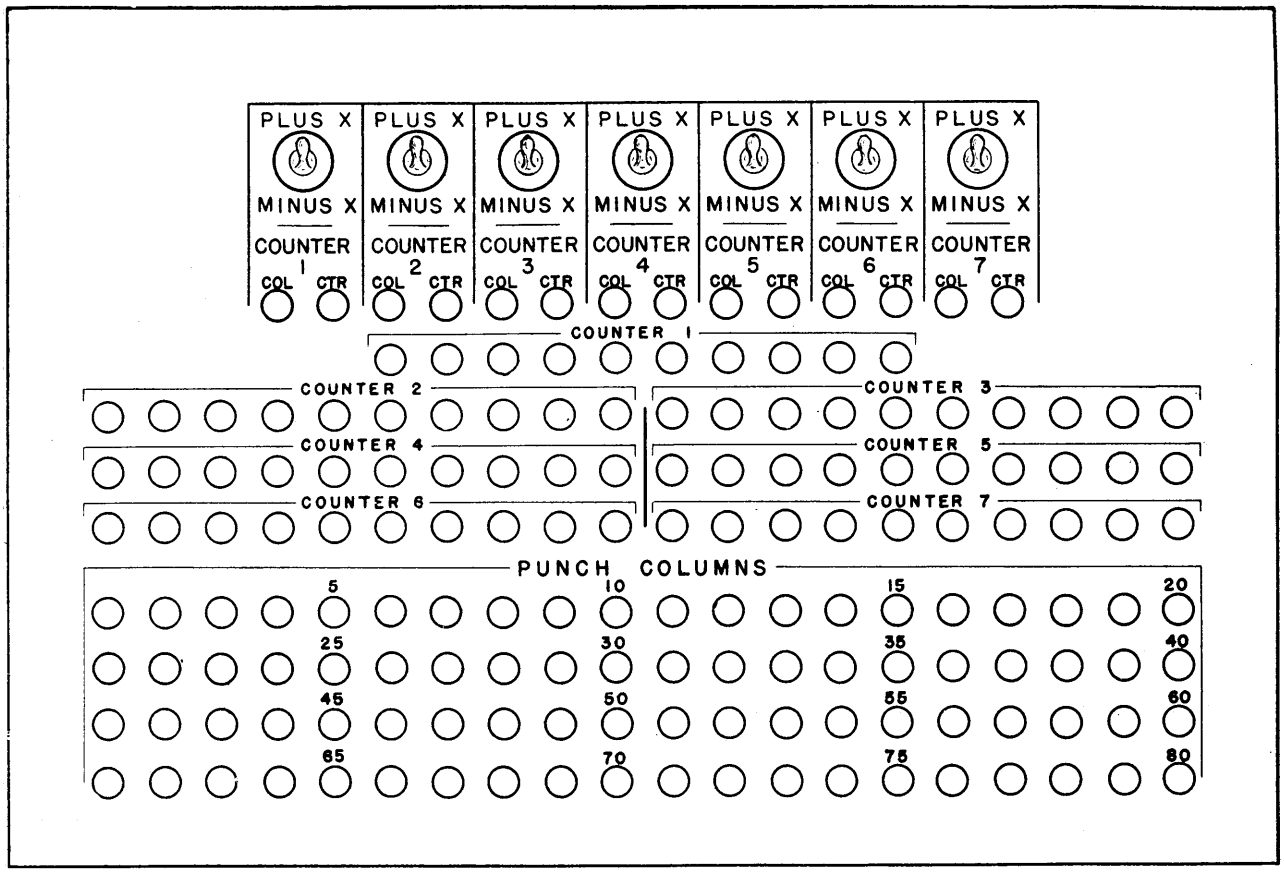
Plugboard

The diagram shows the Summary Punch plugboard for an Accounting Machine of maximum capacity—that is, an 80-column machine with seven balance counters. Machines of less capacity have plugboards arranged similar to the above except that positions which are not applicable to the particular machine are not wired.

The plugboard is mounted at the right-hand end of the punch base, as noted on the machine illustration.

Counter

A row of ten (or nine on Type 285 machines) hubs is supplied for each counter of the Accounting Machine. Each hub represents the outlet



Plugboard of Duplicator Summary Punch

for the corresponding wheel of the particular counter. These hubs may be plugged to the punch columns and to the counter hubs of the X-punch switches.

Punch Columns

A single hub is provided for each column of the summary card. Each hub represents the inlet for the corresponding column of the card to be punched. These hubs are plugged to the counter positions and to the column hubs of the X-punch switches.

X-Punch Switches

An X-punch switch is provided for each balance counter of the Direct Subtraction Accounting Machine. The switch assembly consists of a toggle switch and two hubs—a column hub and a counter hub. The toggle switch is thrown up if it is desired to punch an X in the summary card when the amount in the balance counter is plus; and down when the X is to be punched for minus amounts. Further details on the operation of this unit are presented later.

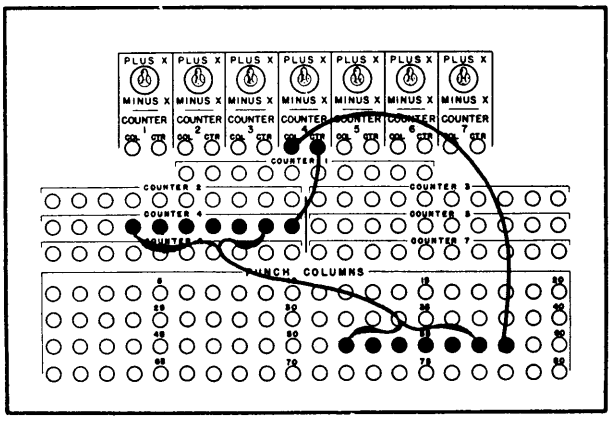
Summary Card X-Punching

All Summary Punches are arranged to permit complete flexibility for X-punching summary cards to designate either plus or minus amounts being punched from balance counters. The X's may be punched over any column of the field corresponding to the particular balance counter, or over any other summary-punched column of the card.

When summary-punching from a balance counter, the entire counter is plugged in the usual manner. For punching an X over any summary-punched column, the particular position in which the X is to appear is plugged as follows—the punch column hub is plugged to the "COL" hub of the switch corresponding to the governing counter; the "CTR" hub is plugged to the corresponding counter hub position. This plugging is illustrated in the following diagram.

Thus, to punch an X in any summary-punched column, the switch unit of the governing bal-

ance counter is injected between the counter and punch column hubs selected.



Wiring for X-Punching of Selected Balances

The switch is thrown up if it is desired to punch an X when the amount standing in the counter is positive, and down if an X is to be punched for a negative amount.

General

The examples shown in the following sections serve to illustrate the various operations and plugging arrangements referred to in previous sections.

Each example is outlined to bring out a specific point. The plugging diagrams, therefore, are not complete for an entire case, but illustrate only the point being discussed. In some cases, more than one point is illustrated on the one diagram. The reports and cards show the complete flexibility of the machine for printing and punching.

Examples of Plugging and Operation

The exhibit shows a Daily Sales Report prepared on a Type 285 Direct Subtraction Accounting Machine. In order to convey most clearly the points to be illustrated by this report, a short description of its contents precedes the detailed description of the separate points to be discussed.

Daily detail cards are sorted by department and tabulated with a minor control on department number. The horizontal distribution of "Kind of Sale" is obtained through the use of the X-distributor. Date and department number are group-indicated in the left side of counter No. 1. The right-hand positions of counter No. 1 are used to accumulate a card count of charge transactions. The amounts for charge transactions are accumulated in counter No. 2, and corresponding amounts for cash and C. O. D. transactions in counters No. 3 and No. 4, respectively. The total amount of departmental sales is accumulated in counter No. 5.

The Summary Punch is set to punch a card at each minor total, as shown in the illustration.

Standard Plugging

Standard plugging of the Summary Punch is from counter hubs to punch columns, as shown in section A of the illustration. The C. O. D. transactions and amounts, as illustrated in the printed report, are plugged to be punched directly from the counter to columns 28 to 36 of the summary card.

To print the transactions and amounts totals as shown, one special point regarding the Accounting Machine plugging should be observed. The report, as arranged, calls for the accumulation of a transaction card-count in the left side of a counter, and an accumulation of amounts in the right side of the same counter. Normally, a zero would be printed between these two sides, but the zero is prevented from printing, and the two separate items are printed with an intervening space as shown, by means of locking the hammer of the type bar separating the two accumulations.

It should be noted also that even though no symbol is printed from this type bar, nevertheless this blank column on the report is represented on the summary-punched card by a punched zero. The reason for this is that, as previously stated, zeros are punched automatically in the summary card for every punch column wired, even though the corresponding counter position does not register a significant digit.

Non-Sequence Plugging

Section B of the exhibit opposite illustrates the flexibility of the Summary Punch, in that information may be punched in the summary card in a sequence which is different from that of the same information as printed on the tabulated report. For example, note that month, day, department, and transaction, printed in sequence on the report, are split for punching as follows: month, day, and department in columns 2 through 7, and transaction in columns 17 through 19.

SALES MANAGER'S COPY

INTERNATIONAL CO.
N. Y. C.

DAILY SALES REPORT

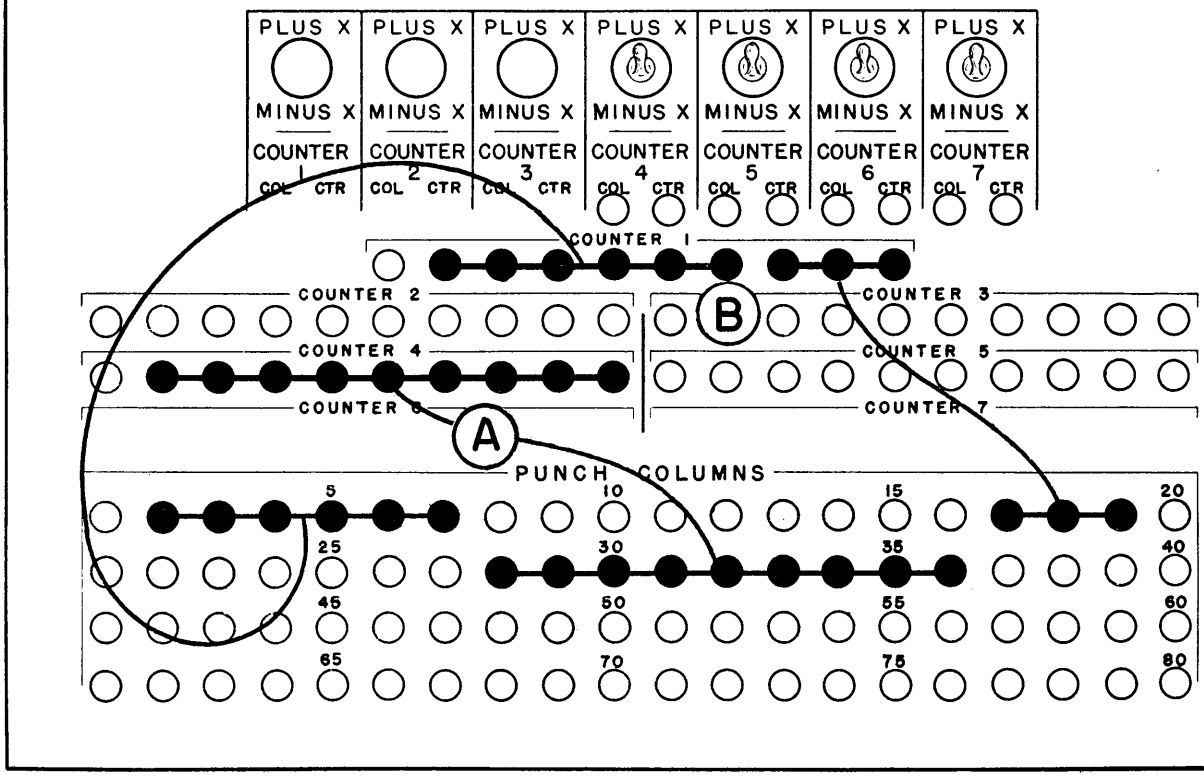
BY DEPARTMENT AND KIND OF SALE

DATE MO.	DATE DAY	DEPT	CHARGE TRANS	CHARGE AMOUNT	CASH TRANS.	CASH AMOUNT	C. O. D. TRANS.	C. O. D. AMOUNT	TOTAL AMOUNT
7	21	50	240	201526	159	98640	106	52533	352699
7	21	51	175	132900	105	84115	65	41476	258491
7	21	52							68346
7	21	5							86542
7	21	5							23531
7	21	5							45328
7	21	5							58774
7	21	5							56432
7	21	5							59874
7	21	5							32434
7	21	6							86538

SALES SUMMARY

INVENTORY SUMMARY

I.B.M. 522697 441 LICENSED FOR USE UNDER PATENT 1,772,492



It should be noted also that counter No. 1 is split for simultaneous group-indicating and adding. Month, day, and department must be plugged (in the Accounting Machine) through the group indicator, while the plugging of transaction is direct from add brushes to the counter. The Summary Punch wiring is as illustrated.

In accordance with the requirements governing the skipping of those columns in the summary card which are to remain unpunched, an automatic (high) bar is used in the case of the card illustrated, to skip column 1 and columns 45 through 80, in order to bring the card into the eject position.

Summary-Punching of Data in List Banks

To obtain the stock report illustrated on the opposite page, a Type 297 Direct Subtraction Accounting Machine is used. The cards employed are the previous stock-balance cards and all subsequent detail cards affecting those balances. The cards for each zone and division are sorted by commodity number and tabulated with a minor control on commodity.

The Summary Punch is set to punch a card at each minor total, as shown in the illustration.

In this example, it is desired to summary-punch zone and division, which, being registered in a list bank, cannot be summary-punched except by special provision for such punching. This special provision is as follows:

The detail-card columns which contain this information are wired, for printing, to the list bank. In addition they are also wired (for subsequent punching) to the unused left-hand positions of counter No. 1 (which also contains old balance in its right-hand side). The printing of zone and division in counter No. 1 is suppressed by locking the hammers of the corresponding type bars. The summary-punching of zone and division is effected by plugging these three counter hubs on the Summary Punch plugboard to the proper hubs of the punch columns. The other information in counter No. 1 (old balance) is not summary-punched in this example.

Thus, data printing from list banks may be summary-punched by plugging this information to unused counter positions and locking out the corresponding type bars to prevent printing. All data plugged in this manner must be plugged through the group-indicator hubs on the Accounting Machine.

Summary-Punching of X

This exhibit illustrates also the summary-punching of X's for subsequent use in designating the particular types of cards, and for class selection or X-distribution of the data as required. In this case, the X is plugged to be punched in column 60 whenever the balance in counter No. 7 is a negative one. The X-switch for counter No. 7 is thrown down, thus making the X-punch operative only for a negative balance.

Note that the wiring for the entire counter is normal, with the exception of column 60. This column is to be punched with the left-hand digit of "balance" (printed from counter No. 7), and is also to be X-punched on negative cards. This one hub of counter No. 7, instead of being wired directly to its punch-column hub, is first plugged through the X-switch unit of counter No. 7—the counter hub to the "CTR" hub of the switch unit, and the "COL" hub of the unit to punch column hub 60. The switch unit is thus injected between the counter hub and the punch-column hub for this one position.

The plugging through the X-switch does not in any way affect the punching of any significant information from the counter position involved.

Skip Bars and Duplicating Cut-Out Bars

In summary-punching, the entire card is seldom punched completely because of the limited number of counter hubs (ranging from 27 to 70) which may be plugged. All other columns must be either key-punched, duplicated from a master card, or skipped in order to position the card properly for punching and also to bring the card to the last column for ejection.

Skipping is accomplished either automatically, by the use of an automatic (high) skip bar, or by the low bar governed by a hole punched in the X-position of the master card. The customary rules governing the design of skip bars are applicable in all cases.

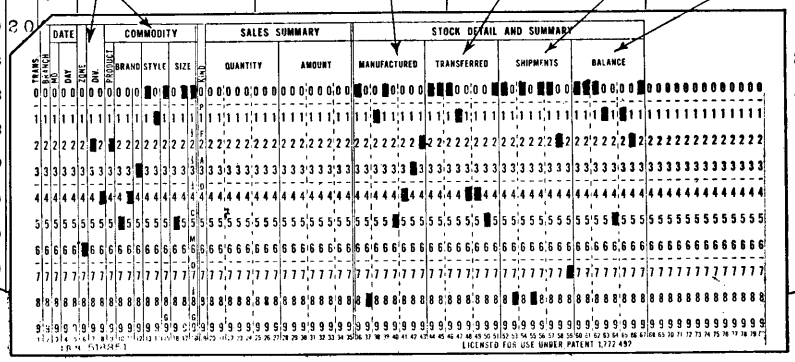
For most efficient operation and increase of speed, information to be duplicated from a mas-

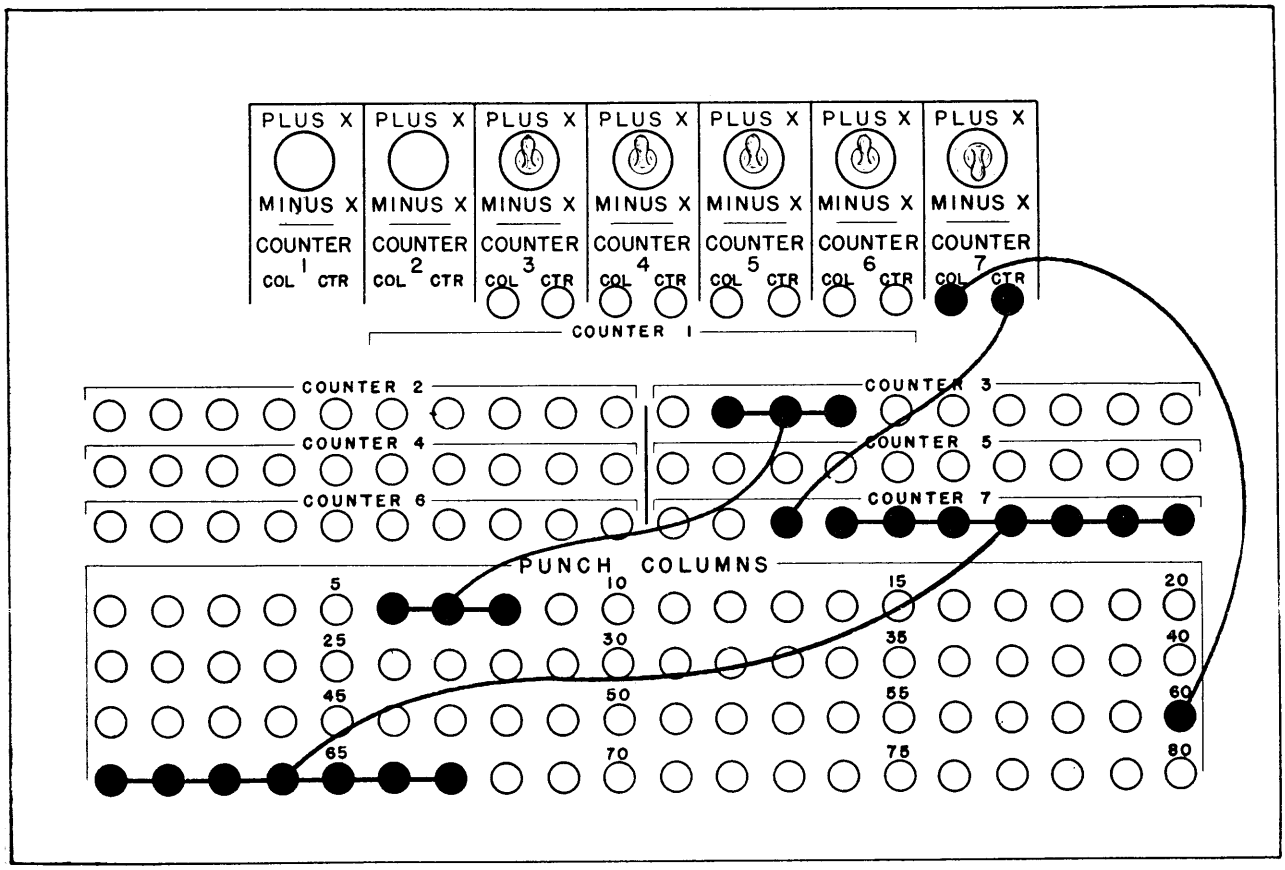
STOCK REPORT

TOBACCO COMPANY

COPY TO DATE

ZONE	DIVISION	COMMODITY PROD	BRAND	STYLE	SIZE	OLD BALANCE	MANUFACTURED	TRANSFERRED	SHIPMENTS (INCLUDING ORDERS)	NEW BALANCE
6	24	25	43	01	025 0	3250	743209	15000	725061	6398
6	24	25	43	01	050 0	4165	8105432	14450	8080027	15120
6	24	26	77	27	025½	9450	410055		435805	16300-
6	24	26	77	27	050 0	0025	76529	1200	75098	256
6	24	26	77	27	075½	1625	15000	1000	11525	4100
6	24	27	44	33	010½	5051	2840		496	7395
6	24	27	44	33	020				39	2705-
6	24	27	89	00	8				29	15634
6	24	27	89	00	8				64	7539
6	24	27	89	00	8				66	54985-
6	24	27	98	99	9				91	5629
6	24	29	98	40	0				99	16764
6	24	29	98	40	0				82	895
6	24	29	98	40	0				09	86736-

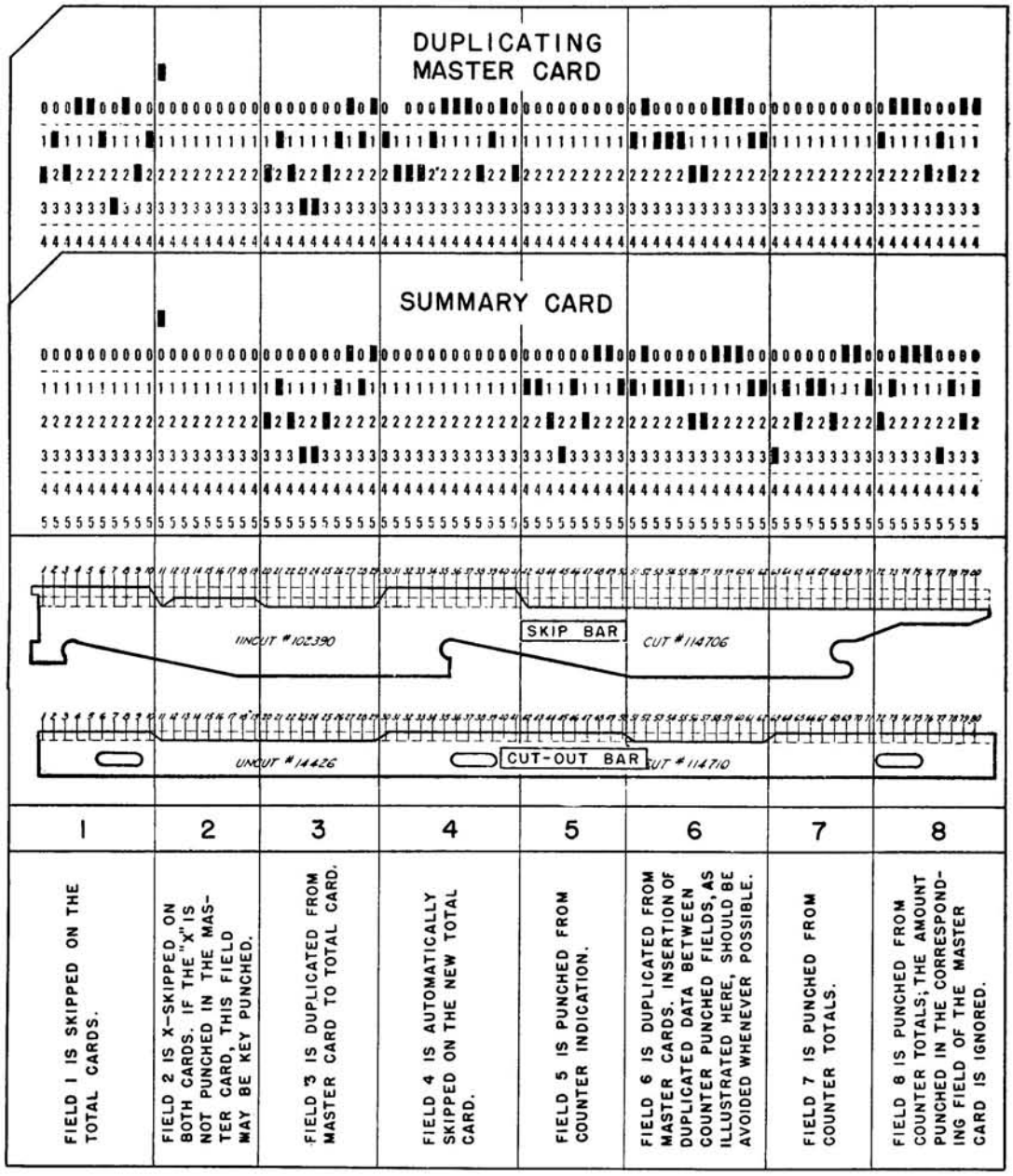




ter card or manually punched must appear at the left end of the card. The reasons for this requirement have already been explained fully.

Predetermined cut-out bars are used when a punched master card appears in the master rack, and only selected information is transcribed to the total card. The cut-out bar is merely a mechanical device for raising or lowering the duplicating circuit cut-out rod on the punch carriage. When the duplicating cut-out rod is raised, the circuits between the master card reading brushes and the punch magnets are broken. When it is lowered these circuits are complete. Thus, the cut-out bar must be high for those positions which are to be punched from the counters.

The illustration appearing below shows the method of specifying skip bars and cut-out bars for various functions.

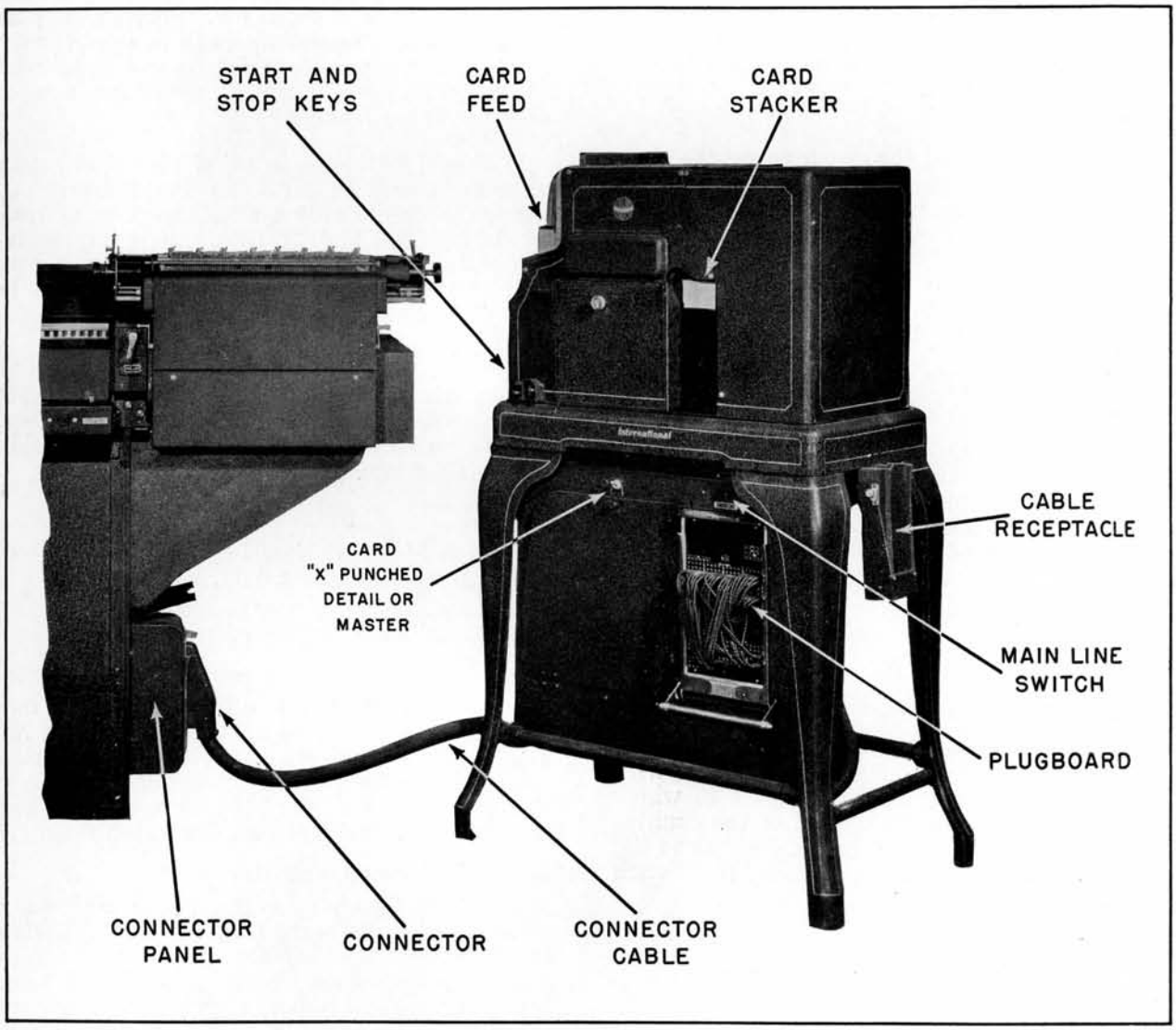


Gang Summary Punch (Type 518)

The Gang Summary Punch is a dual-function machine. Although it is designed primarily as a fast summary punch, it is capable also of performing gang-punching operations independently.

For summary-punching it performs the same functions as the Duplicator Summary Punch (Type 516) in the preparation of total or new balance cards. It may be attached, by means of a flexible connector cable, to any numerical Accounting Machine which is arranged for summary-punching.

For gang-punching operations the machine functions entirely independently of the Accounting Machine to which it is attached. The operating principles of the Type 518 Gang Summary Punch are identical with those of the Type 512 Automatic Reproducing Punch, except that the Summary Punch magnets are capable of receiving impulses not only from punched cards passing the punch brushes, but also from the counters of the Accounting Machine. This permits both summary-punching and gang-punching operations, either independently or in combination.



Features

The operation of the Accounting Machine to which the Gang Summary Punch is attached is not materially altered by the addition of this unit. The Accounting Machine has the same general features as one to which a Duplicator Summary Punch is attached.

Type of Punching

In summary-punching operations, only numerical data may be punched from the tabulator counters, but duplicated (gang-punched) data may be either numerical or alphabetic.

In gang-punching operations, both alphabetic and numerical data may be punched.

Class of Summary Cards

The machine may be made operative for summary-punching major, intermediate, or minor totals, but never for more than one class of total in any one tabulation.

Card Feed

The card feed is of the continuous type similar to that used on the Reproducer. The capacity of the feed hopper is 800 cards; that of the card stacker, 1,000 cards. If the supply of cards in the feed hopper becomes exhausted, or if a card should fail to feed, the machine stops automatically, thus enabling the operator to correct the condition. Suitable interlocking circuits between the Punch and the Accounting Machine are provided.

Speed

For summary-punching operations the speed is .8 *seconds per summary card,* regardless of the number of columns simultaneously gang-punched from a master set-up card or the number of columns of group indication or totals punched.

For gang-punching operations the speed is 100 cards a minute, regardless of the number of columns gang-punched into each card, or the number of holes punched in any column of a card.

NOTE: Eight-tenths (.8) seconds for a summary card represents the additional time required at each tabulator reset cycle for accomplishing summary-punching. This *may or may not* be less than the time required with the Duplicator Summary Punch, depending entirely upon the character of the particular summary-punching to be done. Therefore, a careful study should be made in every case to determine accurately which type of Summary Punch will be best for any given job. For this purpose a chart appears later which can be used for determining the time required by the Duplicator Summary Punch to punch summary cards under varying circumstances.

It should be borne in mind also that actual summary-punching time, in the majority of cases, represents only a minor portion of total tabulating time and, therefore, it is imperative to determine the difference in overall time as well as the difference in time required by the respective Summary Punches.

Automatic Plugboard

All wiring is accomplished through the use of an automatic plugboard. One manual set-up slide is furnished with each machine, but additional slides can be furnished.

Current

The machine is designed to operate on 110- or 220-volts direct current only.

Plugboard

Counters

The double rows of hubs located at the bottom of the automatic plugboard, labelled with the numbers of the respective banks to which they correspond, are the outlets of the counter impulses. They may be connected either to the punch magnets or to the hubs marked "Punch 0 to 9."

Punch X

A single + hub and a single — hub are provided for each balance counter of the Accounting Machine for control X punching. These hubs are located directly above the counter outlets for No. 1 Bank and are labelled "Punch X". They may be connected with the hubs marked "Punch 11 and 12" for X-punching a column of the card under control of the corresponding balance counter, or directly to the punch magnets.

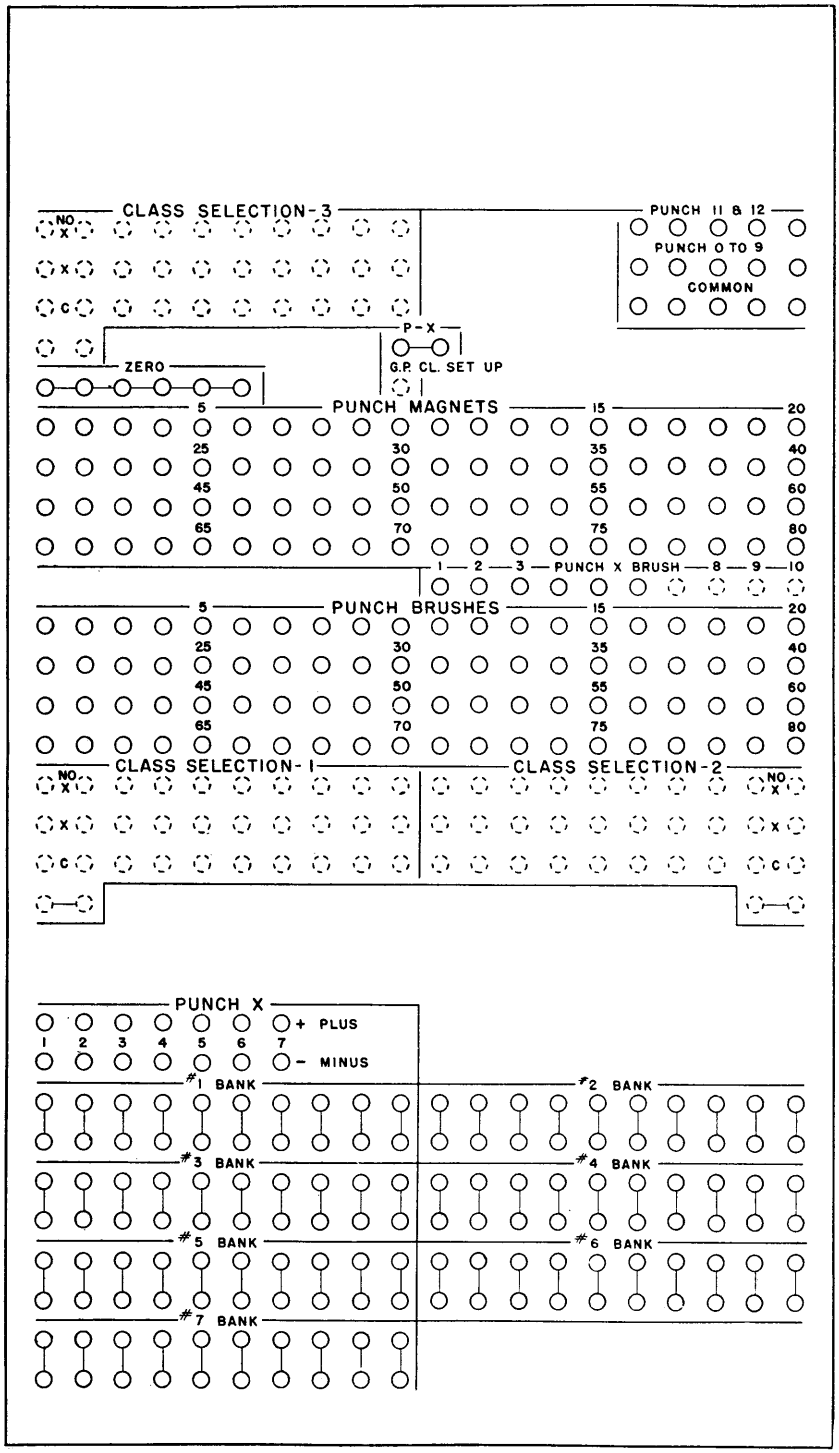
X-Eliminator and Transfer

The hubs located on the upper right-hand corner of the plugboard have a double function. In gang-punching they serve the same purpose as on the Automatic Reproducing Punch plugboard for X-elimination or transfer. For summary-punching operations they provide a means

of collecting the X punch designating selected balances and the digit of a counter total which are to appear in a single column of the summary card. The method of wiring is described in the paragraphs concerning Plugging and Operation.

Other Hubs

The other hubs pertain only to gang-punching operations and perform the functions described in the Automatic Reproducing Punch booklet.



Plugboard of Gang Summary Punch

Plugging and Operation

The Gang Summary Punch is attached to the Accounting Machine by inserting the end of the flexible connector-cable into the receptacle on the Accounting Machine. The Summary-Punch switches on the latter must be set for the class of total to be summarized.

The wiring of the automatic plugboard for each of the special uses for which the machine may be employed is illustrated in the following examples:

Regular Summary Punching

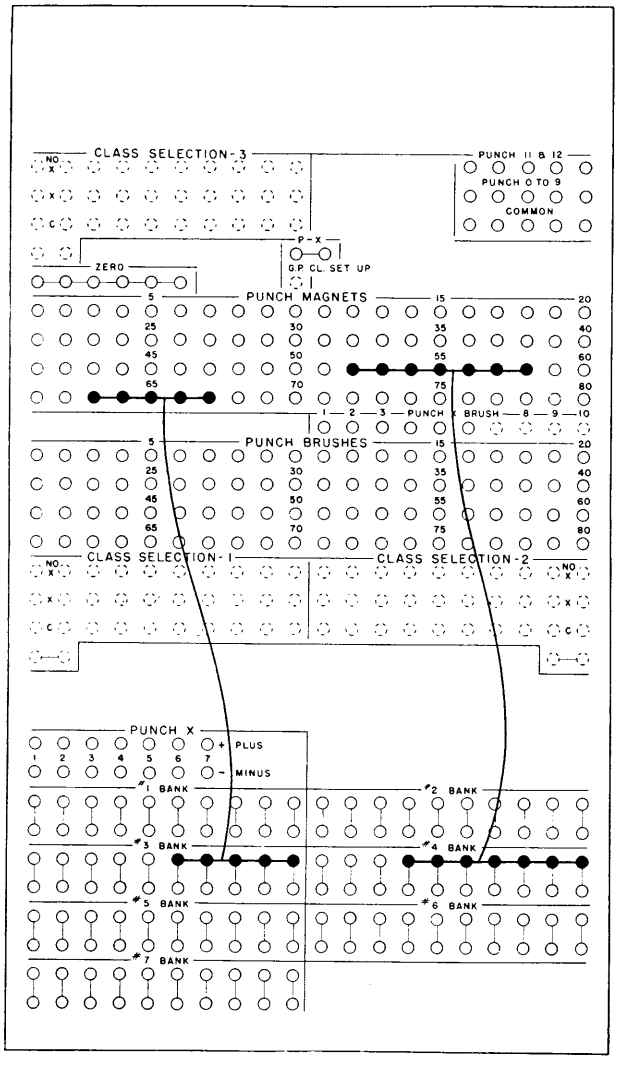
The setting up of the Gang Summary Punch is effected by wiring from the counter outlet hubs to the punch magnet hubs in the same manner as on the Duplicator Summary Punch. This plugging is entirely flexible so that any counter positions may be plugged to any columns of the summary card.

Summary Punching of Control X

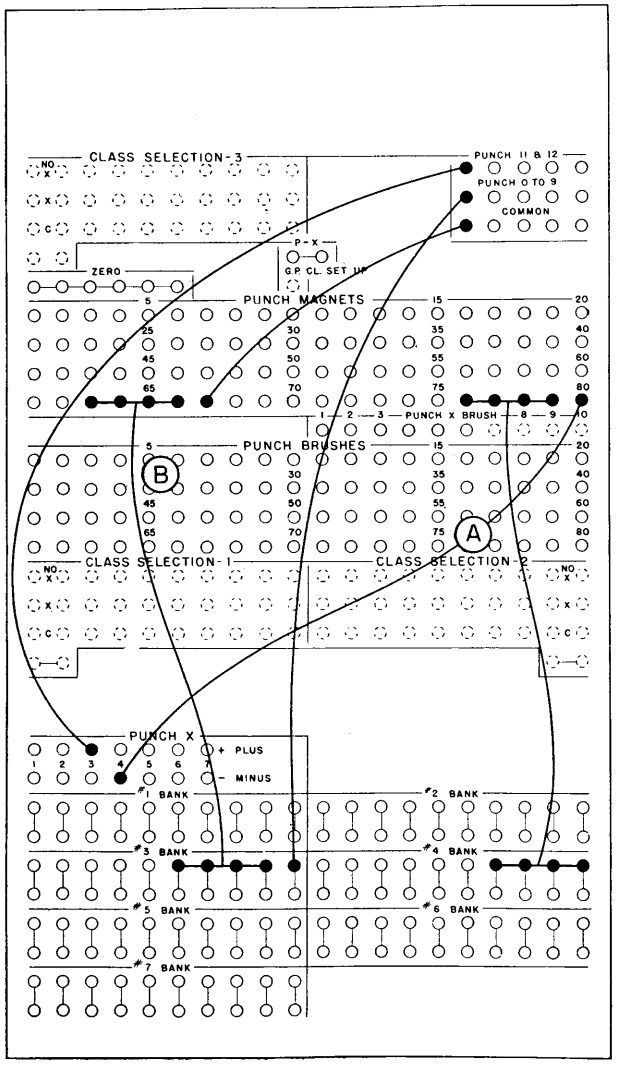
The wiring to accomplish X-punching under the control of a particular counter is as follows:

When the X is to be punched over a card column which is not being summary punched, the + (or —) hub is wired directly to the punch magnet as shown in Section A.

When the X is to be punched over a column which is to contain summary-punched numerical data, it is necessary to wire from the + (or



Regular Summary-Punching



Punching of Control X

—) hub of the wired balance counter to the Punch 11 & 12 row of the X-eliminator. The counter total hub is wired to the Punch 0 to 9 row; and the Common hub is connected to the desired Punch Magnets position as shown in Section B.

Summary Punching and Duplicating

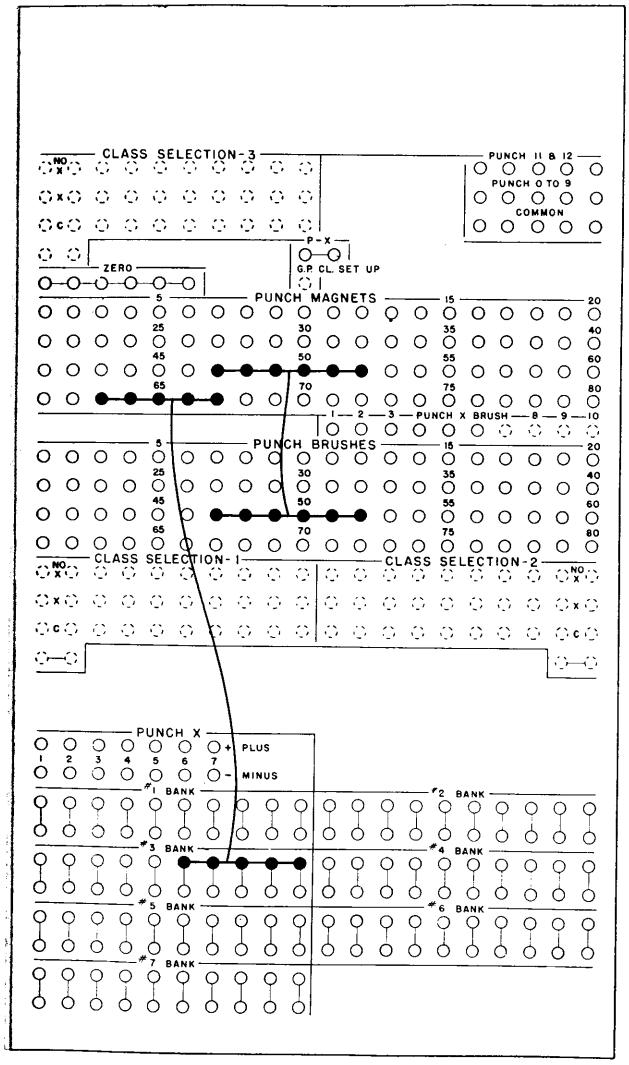
If it is desired to duplicate common information (either alphabetic or numerical) into the summary-punched cards, it is only necessary to supplement the wiring already described with the wiring to effect the gang-punching.

The information appearing on master cards must be in the same columns as in the total cards to be prepared. Wiring must be column for column between the Punch Brushes and Punch Magnets.

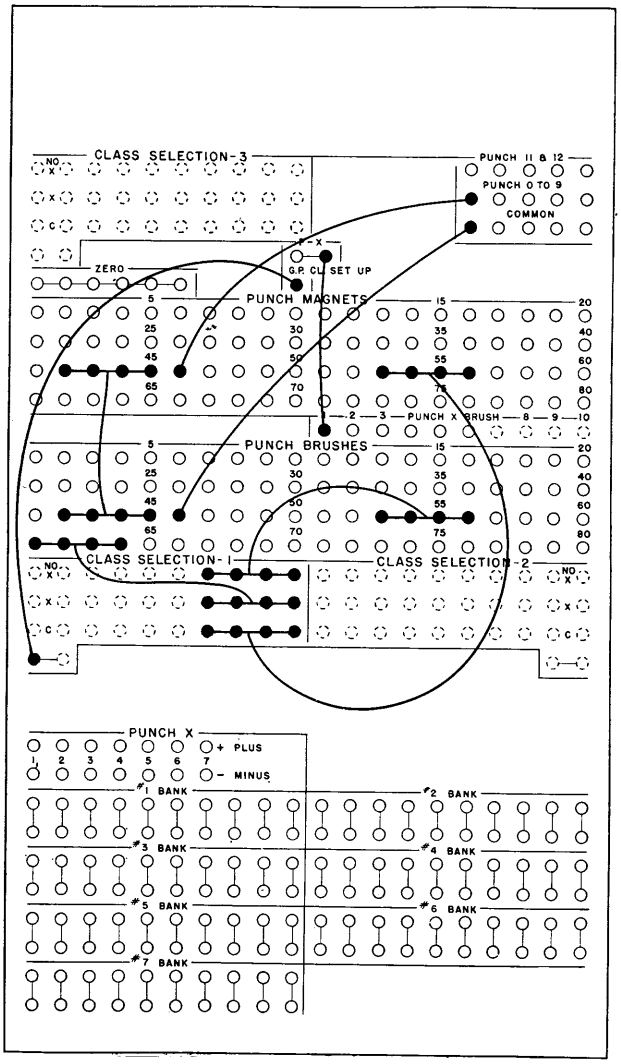
Gang-Punching

For gang-punching operations the machine operates entirely independently of the Accounting Machine. The end of the flexible connector-cable must be placed in the receptacle provided on the punch itself.

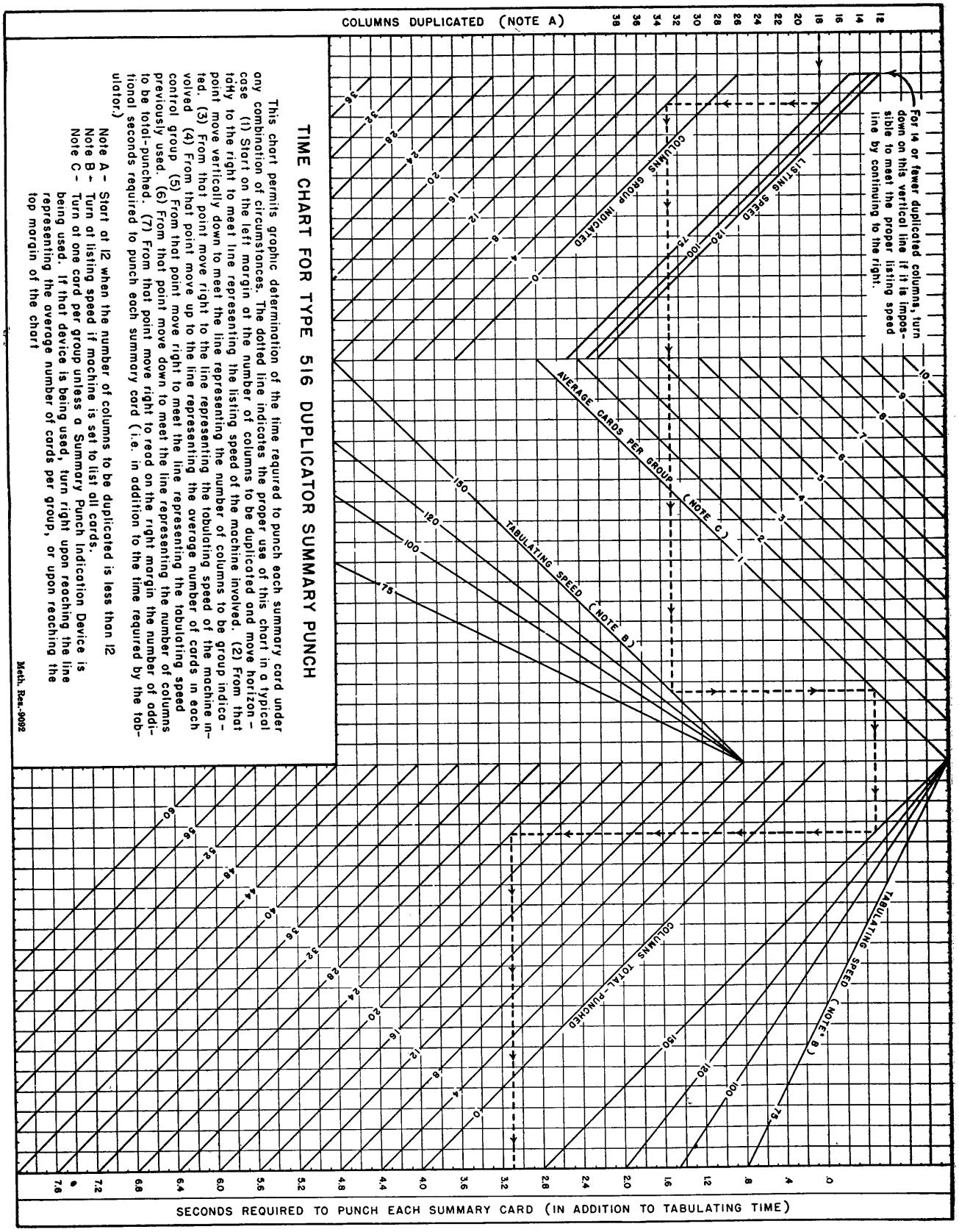
The plugging and operation of the machine for gang-punching is exactly the same as that for the similar operations on the Automatic Reproducing Punch. The unit is capable of performing straight gang-punching, off-set gang-punching, X-elimination or -transfer, and O-punching; but it cannot perform the operation of gang-punch checking.



Summary-Punching and Duplicating



Gang-Punching



TIME CHART FOR TYPE 516 DUPLICATOR SUMMARY PUNCH

This chart permits graphic determination of the time required to punch each summary card under any combination of circumstances. The dotted line indicates the proper use of this chart in a typical case. (1) Start on the left margin at the number of columns to be duplicated and move horizontally to the right to meet line representing the listing speed of the machine involved. (2) From that point move vertically down to meet the line representing the number of columns to be group indicated. (3) From that point move right to the line representing the tabulating speed of the machine involved. (4) From that point move up to the line representing the average number of cards in each control group. (5) From that point move right to meet the line representing the tabulating speed previously used. (6) From that point move down to meet the line representing the number of columns to be total-punched. (7) From that point move right to read on the right margin the number of additional seconds required to punch each summary card (i.e. in addition to the time required by the tabulator.)

Note A - Start at 12 when the number of columns to be duplicated is less than 12
Note B - Turn at listing speed if machine is set to list all cards.
Note C - Turn at one card per group unless a Summary Punch Indication Device is being used. If that device is being used, turn right upon reaching the line representing the average number of cards per group, or upon reaching the top margin of the chart

Mech. Res.-9092

MACHINE METHODS OF ACCOUNTING

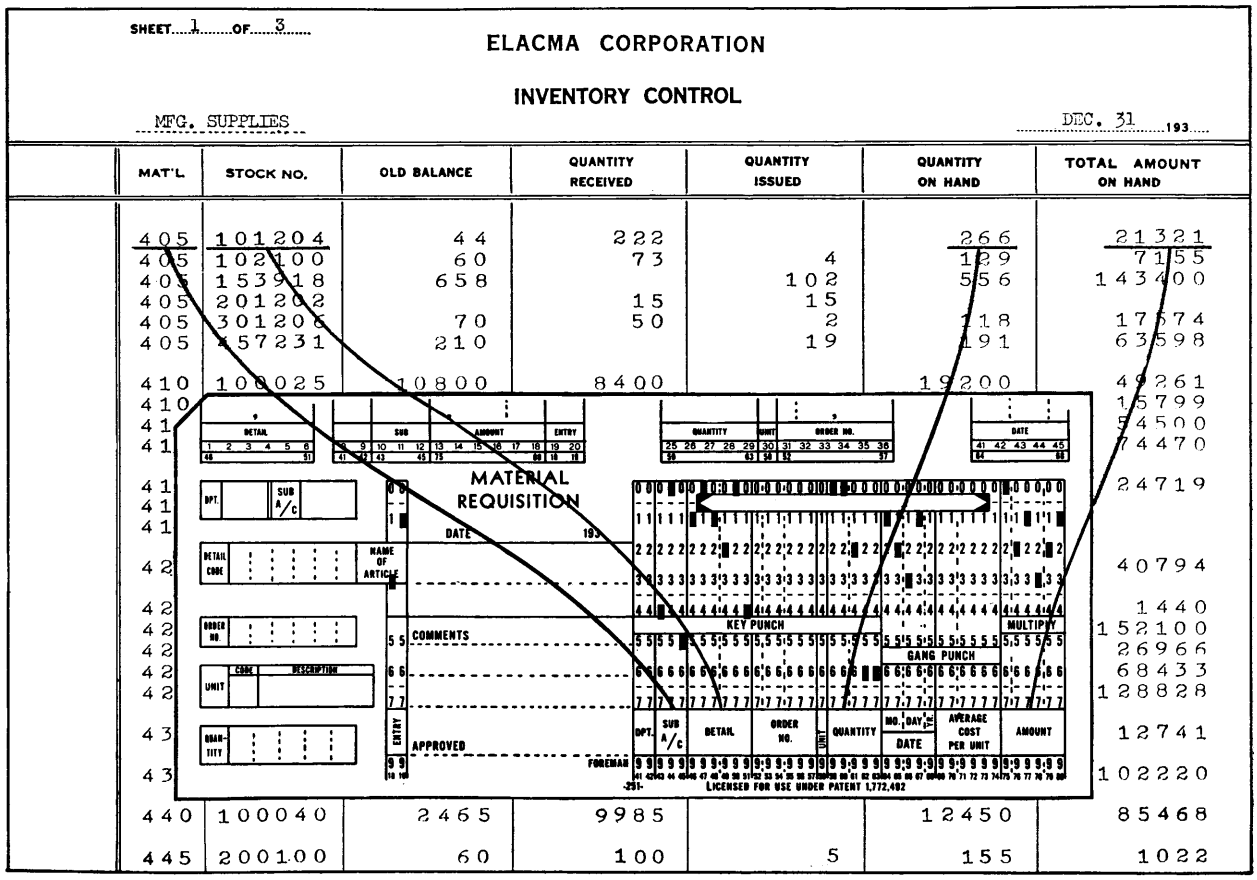
AUTOMATIC SUMMARY PUNCHES

For use with the Alphabetic Accounting Machines (Type 405)

THE usefulness of the Type 405 Alphabetic Accounting Machine in many applications has been substantially increased by the addition of an automatic means of punching summarized data. Summarizing data from many cards into a single card and thereby reducing the volume of cards to be handled daily, weekly, or monthly affords an effective method of speeding up accounting and statistical analyses. As additional applications are handled by the punched-card method, it becomes necessary to have some means of automatically preparing punched-card records for associated routines.

In the application of Electric Accounting Machines to accounting for material, balance-forward cards are important factors. These may be prepared automatically by means of the Automatic Summary Punch simultaneously with the preparation of the Inventory Control Report, as illustrated. At the time of remittance statement preparation in an Accounts Payable routine, tabulating card checks become an automatic by-product if a Summary Punch is operated in conjunction with the Accounting Machine. Similarly, Summary Earnings Cards for payroll, Accounts Receivable entries from customer invoicing, and data for many other important records may be obtained automatically.

The Alphabetic Summary Punches are presented in two models discussed in detail in this booklet as the Duplicator Summary Punch (Type 522), and the Gang Summary Punch (Type 517).



Duplicator Summary Punch (Type 522)

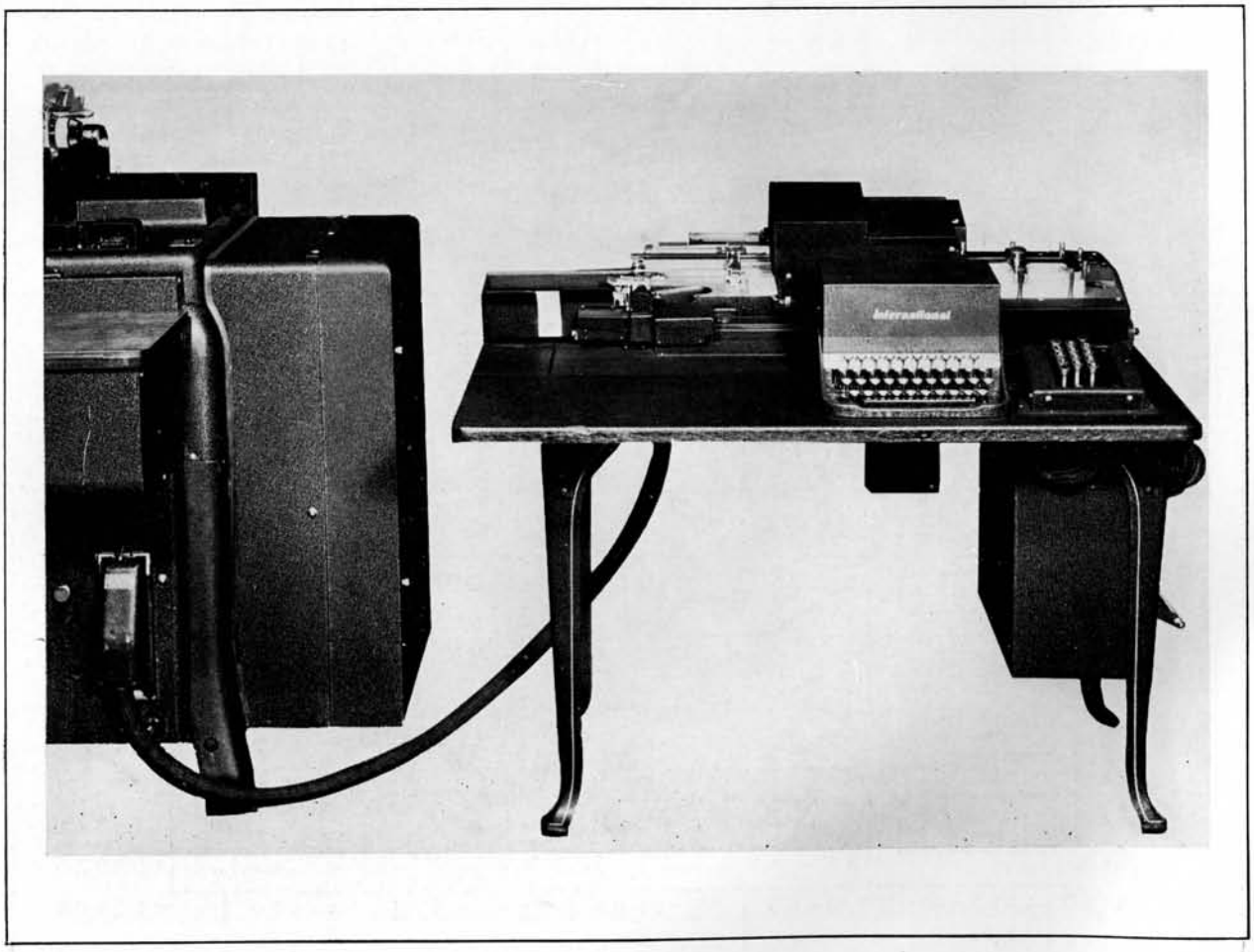
The Type 522 Duplicator Summary Punch is a combination Summary Punch and Duplicating Key Punch especially designed for operation in conjunction with the Alphabetic Accounting Machine. Used as a summary punch, it records in summary cards the numerical indications and totals contained in the counters of the accounting machine, for any card groups desired. In addition, it may be operated independently as a duplicating key punch.

Its general appearance is similar to that of any duplicating key punch, except in the matter of keyboards. The numerical keyboard is located at the right end of the reading board, in front of the punch base. The alphabetic keyboard, supplied only when specifically ordered, is located at the left of the numerical keyboard.

The machine has a summary-punch cable permanently attached to it. The other end of the cable is equipped with a multiple-contact plug unit similar in construction to an automatic plugboard, but much smaller. The Accounting Machine to be used with this Summary Punch must be equipped with a summary-punch stationary plugboard unit and receptacle. The cable unit must be inserted into this receptacle whenever the punch is being used either for summary-punching or as a Duplicating Key Punch.

When the summary-punch cable unit is not inserted in its receptacle on the Accounting Machine, it should be placed in its holding guides on the back of the punch to prevent damaging the plug unit contacts.

The Type 522 Punch is equipped with an automatic plugboard, located between the two right legs of the base. When using the punch as a standard duplicator, it is necessary either to remove the automatic plugboard from the machine or to remove its plugwires. The independent operation of the machine as a key punch does not interfere with the simultaneous use of the Accounting Machine for other work.



Features

Keyboards

The machine is equipped with a numerical keyboard as standard equipment, and with an alphabetic keyboard which is optional. The numerical keyboard is the same as on all standard key punches, and is used for performing the same functions.

The auxiliary alphabetic keyboard is similar to a typewriter keyboard and is used for punching alphabetic information. It may also be used for punching numerical information.

The action of all keys is extremely light since they serve merely to close their individual contacts to perform their particular functions. Interlock assemblies are provided on both boards to prevent any possibility of the operator's depressing more than one key at a time.

The various standard typewriter keys for punctuation, fractions, etc., are dummy keys and perform no function other than to facilitate touch-system operation.

The "Skip" key, located to the right of the "L" key, is used in conjunction with a skip bar when it is desired to skip over portions of a card. This operation is similar to "X" skipping from the numerical keyboard except that here no hole is punched in the eleventh position. It is more like the tabular spacing of a typewriter or the Alphabetic Printing Punch. This function is used most often to skip to the end of an alphabetic field after punching a short name.

In the lower row, second from the right end, is the "Release" key, which releases the rack from any punching position as does the release key on all numerical punches.

To the right of the release key is the "Stacker" key which is used to eject cards after multiple-punching the 80th column (Auto Release and Auto Eject switches in their "OFF" positions).

The space bar advances the rack one column for each depression, thus performing the same function as the space key on any numerical punch.

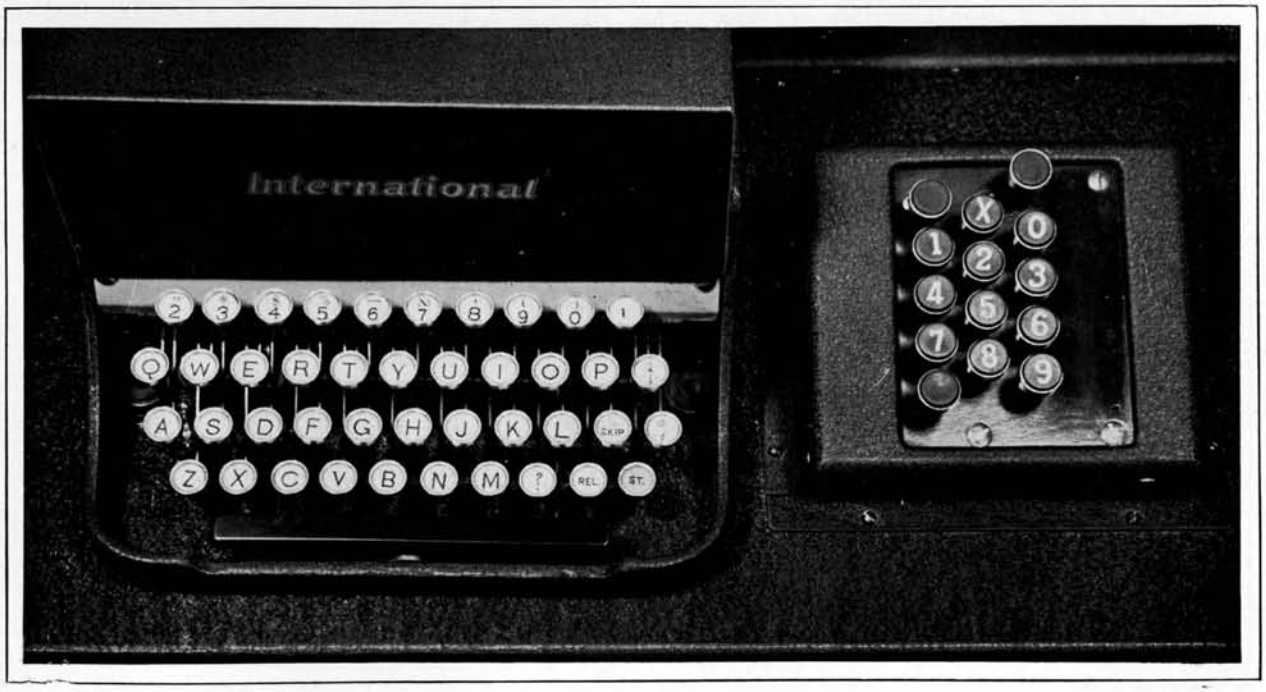
Card Feed-and-Eject

The card feed-and-eject is the same as that used on all standard motor-driven punches.

When summary-punching, there are interlocking circuits between the punch and the Accounting Machine which prevent the machines from operating in case cards either run out of the punch or fail to feed into punching position.

Plugboard

All wiring is accomplished through the use of a quick-setup, single-panel, automatic plugboard. One manual set-up slide is furnished with each machine, and additional slides may be ordered.



Group Indication

The immediate punching of group indication is a standard feature of this machine. It provides for the punching of indicated information immediately following the counter registration of this information from the first card of a control group.

Balance Selectors

If balance-selected totals are to be summary-punched, it is necessary to install balance-selection relays on the summary punch. Balance selectors must be specified, when desired, as they are special equipment.

Skip Bars and Duplicating Cut Out Bars

The entire card is seldom summary-punched completely. It is necessary, therefore, in most cases to skip over unpunched columns to position for punching or to bring the card to the 80th column for ejection.

Skipping is accomplished either automatically, by the use of an automatic (high) skip bar, or by the low bar governed by a hole punched in the X-position of the master card. Rules governing the design of skip bars for this machine are the same as those for skip bars for use on the Motor Drive Duplicating Punches.

Predetermined duplicating cut-out bars are used when a punched master card is placed in the master card rack, and only selected information is transcribed to the total card. The cut-out bar can be eliminated for most operations if the summary card and master card are properly designed.

Auto Eject Switch

The automatic eject switch provides for automatic ejection of the card after the 80th column has been punched.

Release Key Eject Switch

This switch when ON ejects the card from a release-key depression, from a skip to the 80th column or after punching the 79th column. When it is OFF and the Auto Eject Switch ON, it allows the punching of the 80th column before ejecting.

When it is desired to punch more than one hole in the 80th column, both switches must be in their OFF position. After the last hole is punched in the 80th column, the card can be ejected by depressing either the space key on the numerical keyboard, or the space bar or the stacker key on the alphabetic keyboard.

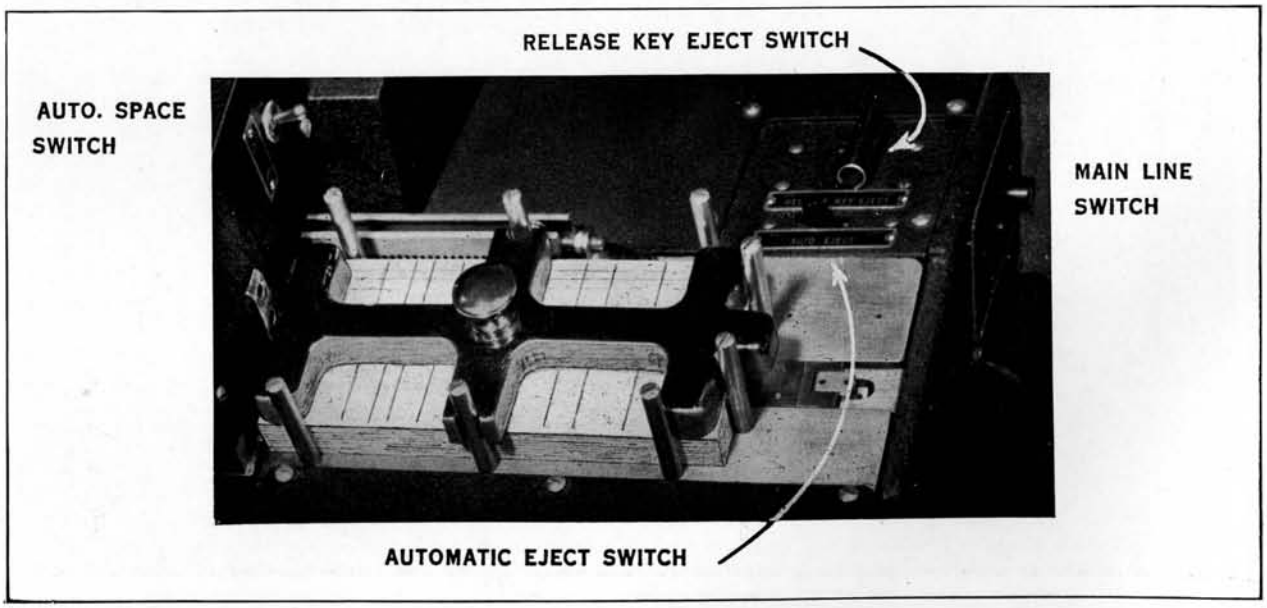
Auto Space Switch

In duplicating, when this switch is ON the machine automatically spaces over any blank column of the master card up to a point where the duplicating column cutout stop may be set.

Speed

The summary-punching operation is accomplished at a speed of 10 card columns a second. Duplication of master-card data and group-indication punching are also accomplished at the rate of 10 card columns a second.

The time required for summary-punching is governed by the number of card columns total-punched, since the punching of duplicated and indicated information usually is completed be-



fore a control change or during the feeding of cards for each control group.

Current

The reason for having the summary-punch cable unit inserted in its receptacle on the Accounting Machine for all operations is that the punch magnets operate on 40 volts direct current and must receive their current from the Accounting Machine. The drive motor on the punch is designed to operate from an individual source of either 110 or 220 volt direct or alternating current, preferably from the same source used to operate the Accounting Machine.

Operation

Summary Punching

With the plugboard wiring made, the switches properly set, cards in the Accounting Machine and Summary Punch feed hoppers, and a card fed into punching position in the Summary Punch, the tabulating, printing, and summary-punching operations are ready to be performed automatically. The start key on the Accounting Machine is depressed and the first control group feeds through. After the first card of the control group has read past the add brushes, the Summary Punch starts to operate. The indication information is punched; then the Summary Punch stops at the first column encountered for total-punching and holds there until all the cards have fed through the Accounting Machine for that control group. When a control change is recognized, the Accounting Machine stops without actuation of the print unit. The punch magnets are then actuated for total-punching, through the connector cable, from the counter positions that are wired for summary-punching. After the punching has been completed, the card is ejected, at which time the Accounting Machine operates to print the totals that have just been punched and carry on with another series of operations the same as those just described.

For key-punching and duplicating, the punch magnets are actuated in the same manner as on a Duplicating Key Punch.

In any summary-punching operation, to obtain maximum speed the fields to be duplicated, key-punched, or indicated, should appear to the left of the first total-punch field. This allows the manual key-punching, duplication, or group indication to be performed while the Accounting Machine is accumulating a particular group of detail cards.

Operation of the Accounting Machine is normal for any control changes other than the class of total being summary-punched.

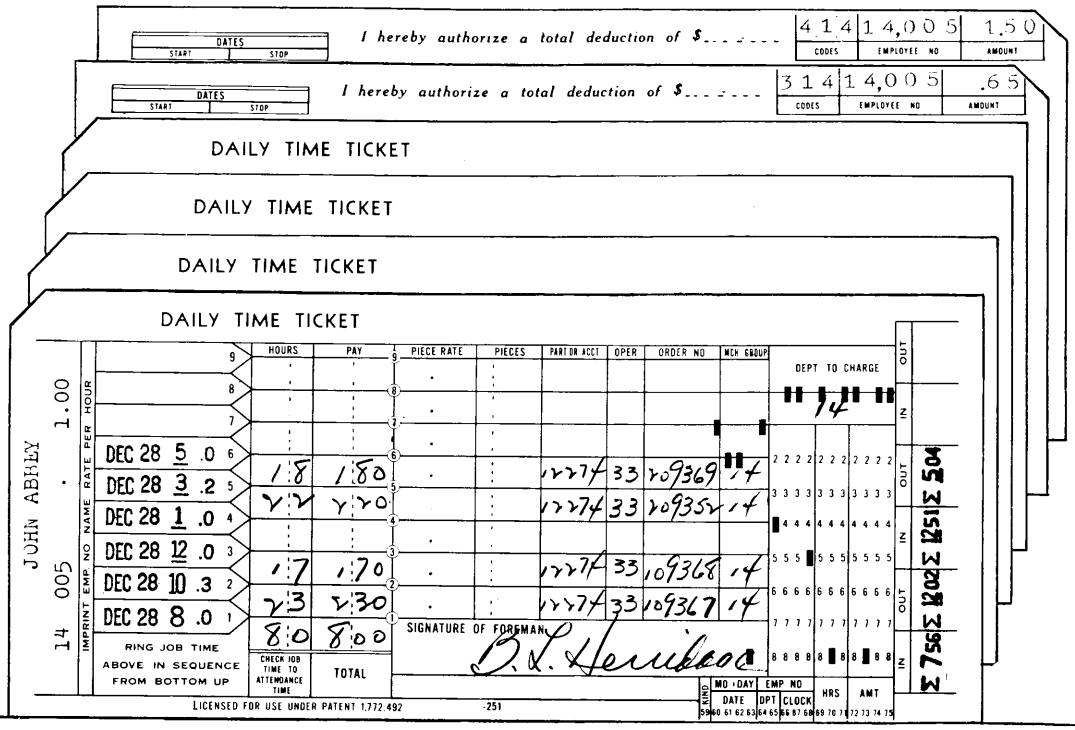
When summary cards are being punched, each machine is under electrical control of the other. Card levers in the punching unit prevent continuous operation of both machines should a summary card fail to feed, or the summary punch card magazine become exhausted.

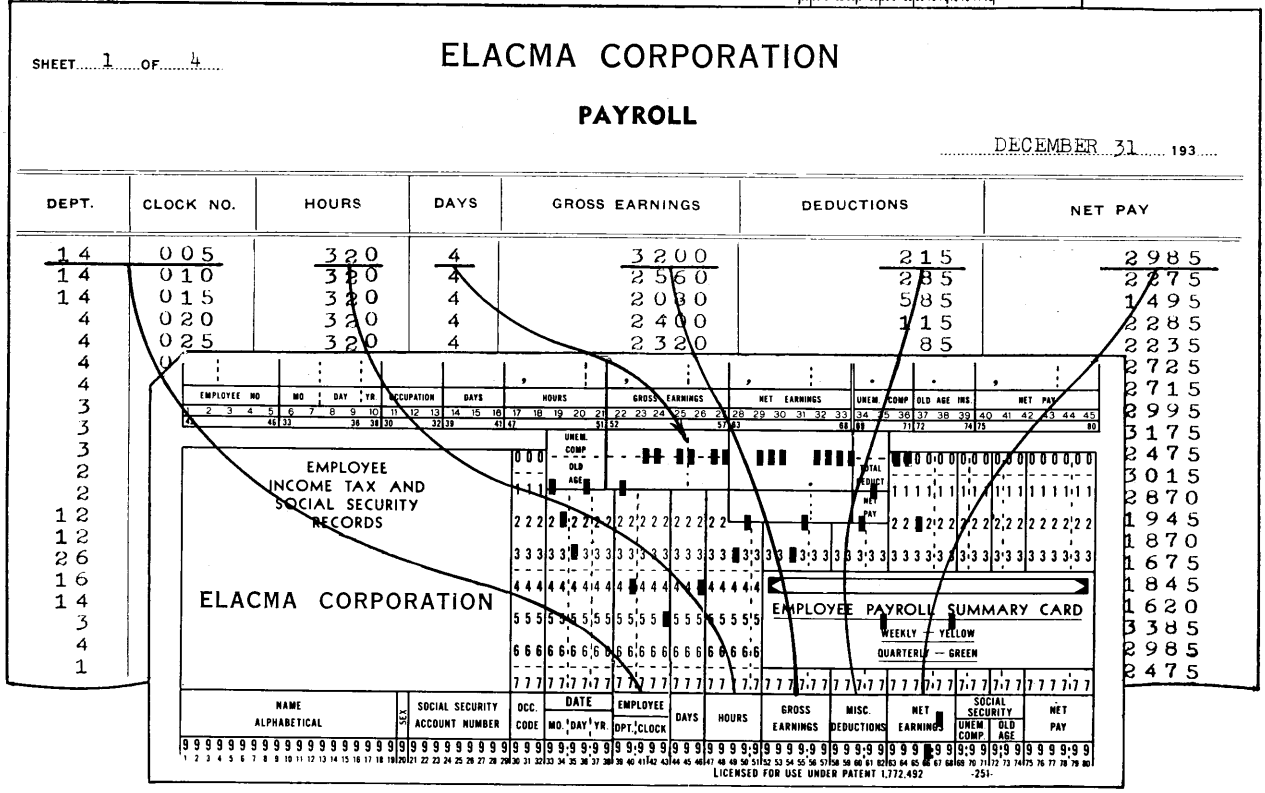
The information appearing in any counter can be transferred to summary cards. The attachment of the punching mechanism to the Accounting Machines does not change the normal listing and tabulating speed of the machine. It does, however, delay the total printing because punching occurs before the machine prints totals on the report. The time required for punching is governed by the amount of punching to be done.

The plugging of the Accounting Machine without net balance counters is standard and no special wiring is necessary for summary-punching. The Alphabetic Accounting Machine with net balance counters requires additional plugging on the Accounting Machine plugboard for summary-punching. This is illustrated in a later section. One requirement that must be observed in any summary-punching operation is that any information to be summary-punched must be read into a counter. Identification to be punched must therefore be group-indicated into a counter.

The Accounting Machine is equipped with several switches which are used in summary-punching operations. The "Summary Punch Switch" must be ON for all summary-punching operations. This switch makes both units (Accounting Machine and Punch) function synchronously. This switch is the only summary-punch switch that should be ON when summary-punching minor totals. When intermediate or major totals are to be summary-punched, the "Intermediate" or "Major" summary-punch switch must *also* be ON. These switches govern the totals to be transferred to cards. The machine may be made operative for the major, the intermediate, or the minor totals, but never for more than one class of total in any one tabulation. When the tabulating and punching units are to be used independently, these switches should be OFF.

Reference to the accompanying payroll illustration enables one better to visualize the above operations. The cards in the Accounting Machine are the Daily Time Tickets and the Deduction cards in employee sequence, with minor control on Employee Number. The Employee Payroll Summary cards are placed in the Summary Punch. The Date is automatically punched into the summary card from a master duplicating card in the duplicating rack of the Punch.





The Employee Number is punched into the summary cards from counter positions in the Accounting Machine immediately after the first card of a control group has passed the adding brushes. The next information, Days Worked, should not be punched until all the cards for a single employee have passed the adding brushes.

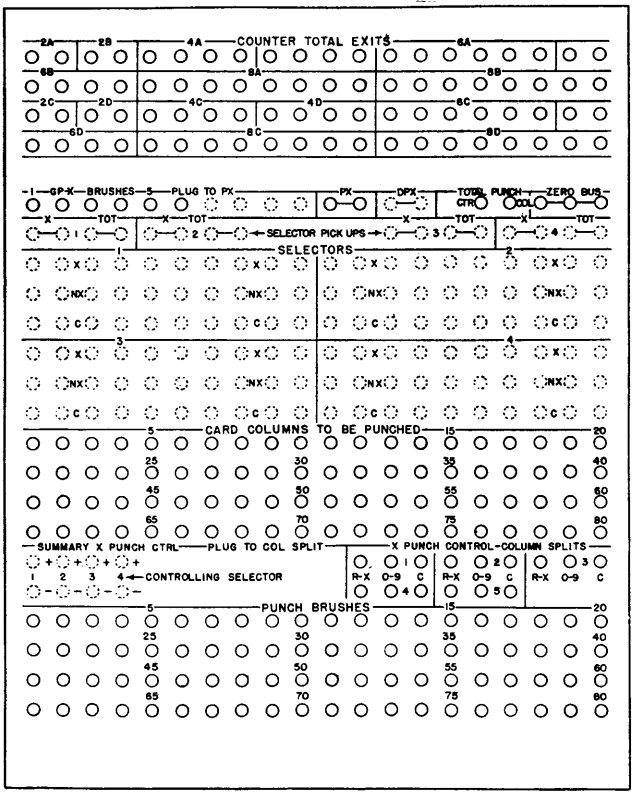
The summary-punching must therefore be stopped after punching Employee Number until a control change is recognized. This is accomplished by wiring the first or left-hand column of Days Worked indirectly to the card column to be punched through the Total Punch Control hubs, which hold up the punching of that column and all columns to the right of that point until the employee number changes. When the control change is recognized, the Accounting Machine stops and the punching circuit is completed through the Total Punch Control hubs, thereby allowing the rest of the punching to take place in the summary cards.

After Net Earnings have been punched, the rack skips out and ejects the card, which action automatically causes the Accounting Machine to print on the report all the information that was summary-punched. After total printing, the series of actions which follow are the same for each employee as those described above.

Plugboard and Plugboard Setups

Plugboard

The diagram shows the Summary Punch plugboard for use on the Type 522 Duplicator Summary Punch. The top group of hubs, labelled "Counter Total Exits," are outlet hubs from counter positions in the Accounting Machine. The lower group of hubs labelled "Card Columns To Be Punched" are inlet hubs to the Summary Punch for punching the desired information into the columns of the summary card. The purpose of the two hubs below the counter total hubs, labelled TOTAL PUNCH, is to prevent a punching circuit from getting through to a card column to be punched until the desired control change is encountered. These hubs speed the punching operation by allowing the indications to be punched while cards are feeding, but holding up the total punching until the control group has passed the adding brushes. The hubs labelled "Selectors," "Selector Pickups," "Summary X Punch Control" and "X Punch Control" are active only when balance selectors are installed on the Summary Punch. The other hubs; namely, GP-X Brushes, Plug To PX, PX, DPX and Zero Bus Hubs are for use with the Type 517 Gang Summary Punch.

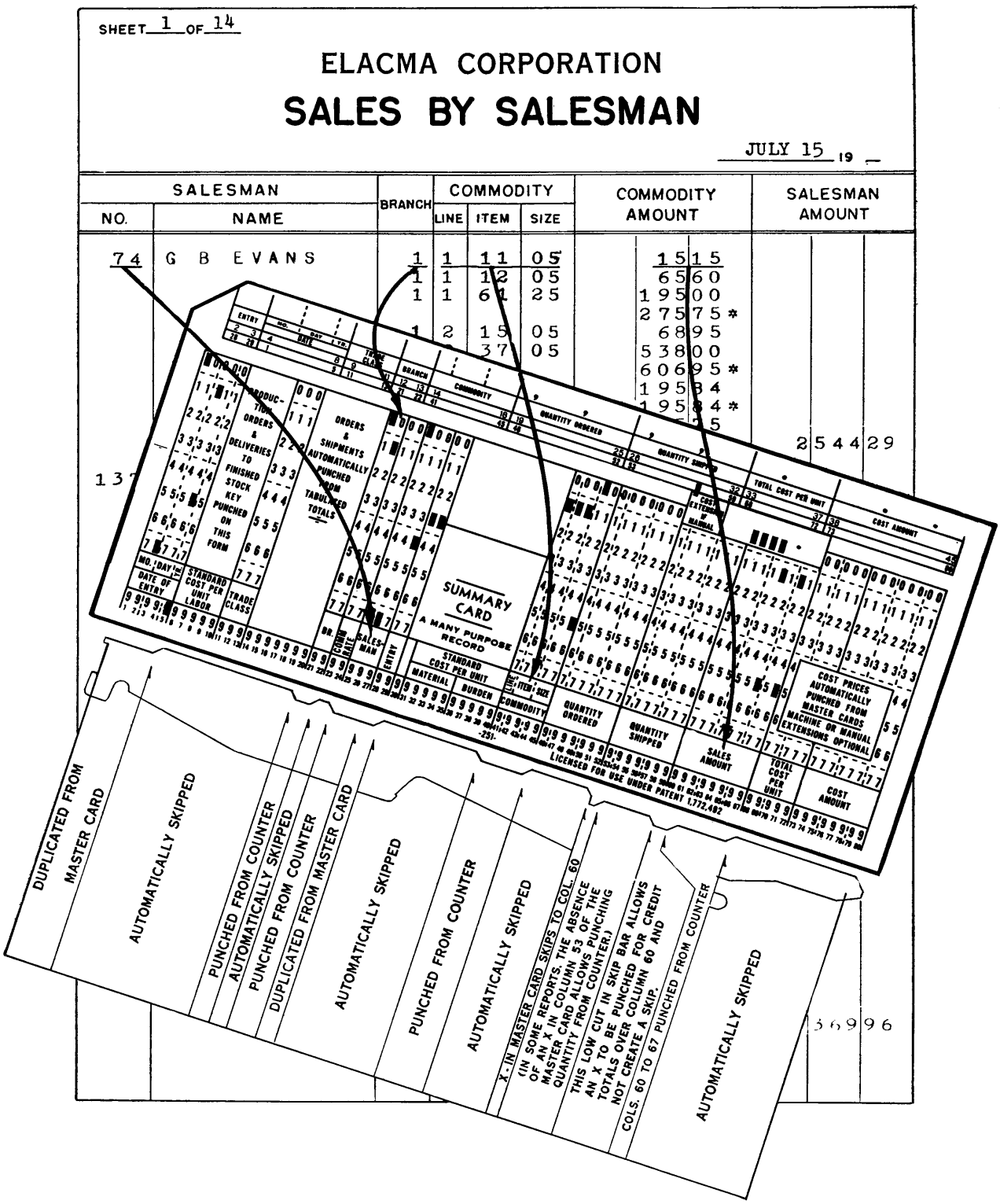


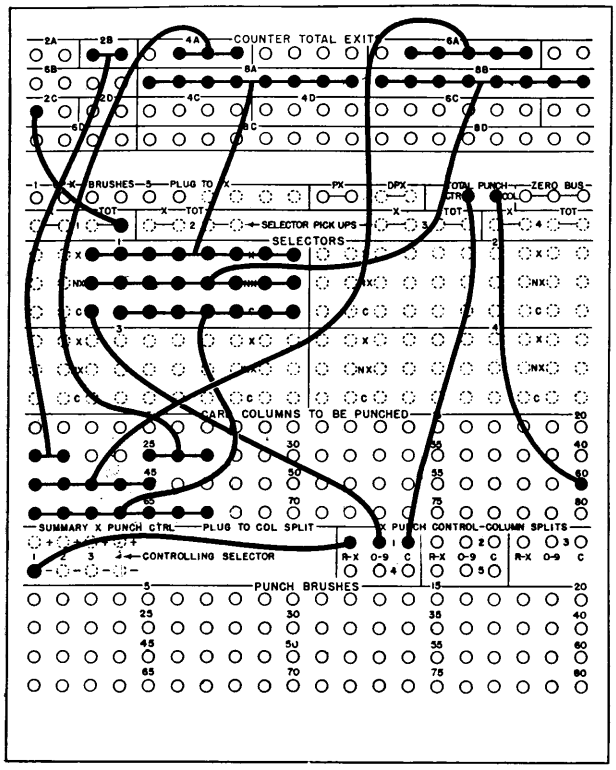
In summary-punching, the entire card is seldom summary-punched completely. All other columns must be either key-punched, duplicated from a master card, or skipped in order to position the card properly for punching or to carry it to the last column for ejecting.

Skipping is accomplished either automatically, by the use of an automatic (high) skip bar, or by the low bar governed by a hole punched in the X position of a master card. The customary rules governing the design of skip bars are applicable in all cases.

For most efficient operation and increase of speed, information to be either duplicated from a master card or manually punched must appear at the left end of the card. The reasons for this requirement have already been explained fully.

Predetermined cut-out bars are used when a punched master card appears in the master


SHEET 1 OF 14
ELACMA CORPORATION
SALES BY SALESMAN
JULY 15 19 —
SALESMAN NO.
SALESMAN NAME
BRANCH
COMMODITY LINE
COMMODITY ITEM
COMMODITY SIZE
COMMODITY AMOUNT
SALESMAN AMOUNT
74 G B EVANS
1 1 11 05 1515
1 1 12 05 6560
1 1 61 25 19500
2 75 75 *
1 2 15 05 6895
37 05 53800
60695 *
19534
19534 *
25429
SUMMARY CARD
A MANY PURPOSE RECORD
DUPLICATED FROM MASTER CARD
AUTOMATICALLY SKIPPED
PUNCHED FROM COUNTER
AUTOMATICALLY SKIPPED
PUNCHED FROM COUNTER
DUPLICATED FROM MASTER CARD
AUTOMATICALLY SKIPPED
PUNCHED FROM COUNTER
AUTOMATICALLY SKIPPED
X: IN MASTER CARD SKIPS TO COL. 60 (IN SOME REPORTS, THE ABSENCE OF AN X IN COLUMN 53 OF THE MASTER CARD ALLOWS PUNCHING QUANTITY FROM COUNTER.)
THIS LOW CUT IN SKIP BAR ALLOWS AN X TO BE PUNCHED FOR CREDIT TOTALS OVER COLUMN 60 AND NOT CREATE A SKIP.
COLS. 60 TO 67 PUNCHED FROM COUNTER
AUTOMATICALLY SKIPPED
LICENSED FOR USE UNDER PATENT 1,772,482



rack, and only selected information is transcribed to the total cards. A cut-out bar is merely a mechanical device for raising or lowering the duplicating circuit cut-out rod on the punch carriage. When the duplicating cut-out rod is raised, the circuits between the master-card reading brushes and the punch magnets are broken. When it is lowered, these circuits are completed. Thus, the cut-out bar must be high for those positions which are to be punched from the counter.

The report "Sales by Salesman," shown with its related summary card on the opposite page, illustrates summary-punch wiring. Since Date is duplicated from a master card in the master rack, no wiring is required for this punching. Branch, Salesman Number, Class, and Product are indication information and are punched immediately following the passage of the first card of each minor group through the adding brushes. The summary-punch wiring for this punching is directly from the proper counter-total hubs to the proper card columns to be punched. Minor totals for Sales Amount cannot be punched until all the cards of the group have passed the adding brushes. This necessitates the holding up of the punching circuit for the total information until a control change has been recognized. This delay is effected by wiring the first total column to be punched through the total-punch hubs as illustrated. As previously described, this prevents the total being punched until after the proper control change has taken place.

If balance-selected totals are to be summary-punched, it is necessary to install balance-selection relays on the Summary Punch and to plug them as illustrated in the diagram. When balance-selecting, two counter groups are used, which necessitates the selection of the counter group containing the true figure. The counter group that will normally carry most true figure totals is usually wired to the NX hubs of the selector. The other counter group is wired through the X hubs of the selector. The wiring from the selector is completed by plugging from the common hubs to the card columns to be punched. One unused counter position must be allowed on the left side of the counter group wired to the NX hubs of the selector. Counter group 2C is coupled to 8B, in this illustration, to obtain an unused counter position. This position is wired to the selector pick-up so that when a complement total appears in that counter group, the 9 standing in that position will actuate the selector so that punching will take place from the other counter group.

When balance-selecting, the first total-punch column would normally be plugged through the total-punch hubs from the common of the selector to the card column to be punched. To punch negative balances in true figures, it is necessary to identify them as such by means of an X-punch in some column. In this example an X is desired over the regular total position in column 60. This is effected by using the X-punch control and wiring from the common of the selector, into 0-9 of the X-Punch Control 1 which carries the figures 0 to 9 for punching. The X is picked up from the Summary X-Punch Control hubs, in this case 1 minus, and wired to R-X of the X-Punch Control 1. The wire from C of X-Punch Control 1 then carries the 0 to 9 punching, and the X whenever the selector is actuated, through the Total Punch hubs to column 60 for punching.

The illustration on the opposite page shows the first summary card punched from this operation. It will be noted that Date and Entry are duplicated from a master card which also contains an X in column 53. This X when read from the master card and punched in each summary card, in conjunction with the skip bar illustrated, causes the Quantity Shipped field to be skipped. The skip bar is so designed that it may be used for other operations where Quantity Shipped is punched.

Gang Summary Punch (Type 517)

The Gang Summary Punch for use with the Type 405 Alphabetic Accounting Machine is similar in appearance and operation to the punching unit of the Reproducing Punches. It is a double-function machine, a fast Summary Punch and a Gang Punch. The main point of difference between the Numerical and Alphabetic Gang Summary Punch is the fact that the Alphabetic Punch must be connected to the Accounting Machine for all operations. It is necessary that it receive the 40-volt current from the Accounting Machine and also be plugged into an outlet. This is required both for summary-punching and for gang-punching operations. The machine cannot be operated independently as a Gang Punch simultaneously with the operation of the Accounting Machine unless a motor-generator set is specified for installation on the Summary Punch.

Features

Type of Punching

In summary-punching operations, only numerical data may be punched from the Accounting Machine, but gang-punched data may be either numerical or alphabetic. Gang punching may take place with the Summary Punch operation to place in the summary cards any common numerical or alphabetic information desired. Interspersed master cards for gang-punch actuation may be used.

Gang-punching operations, with or without summary-punching, are identical with those on the Reproducing Punches.

Class of Summary Cards

The machine may be made operative for summary-punching major, intermediate, or minor totals, but never for more than one class of total in any one tabulation. This is controlled by switch settings on the Accounting Machine.

Card Feed

The card feed is of the continuous horizontal type similar to that used on the Reproducing Punches. The card-feed hopper has a capacity of 800 cards; the card stacker, 1000 cards. If the supply of cards in the feed hopper becomes exhausted, if a card should fail to feed, or if the stacker becomes full, the machine stops automatically, thus enabling the operator to correct the condition.

Cards are fed into this machine face down 12's first.

Speed

For summary-punching operations, the speed is 1.5 seconds for a summary card, regardless of the number of columns simultaneously gang-punched from a master setup card, or the number of columns of group indication, or totals punched.

For gang-punching operations, the speed is 100 cards a minute, the same as that of the Reproducing Punch.

Automatic Plugboard

All setups are made through the use of an automatic plugboard. One manual setup slide is furnished with each machine, and additional slides can be ordered.

Current

The Type 517 Summary Punch draws from the Accounting Machine to which it must be attached the 40-volt direct current necessary to operate the punch magnets and control relays. The drive motor is designed to operate from an individual source of either 110 or 220-volt direct or alternating current, preferably from the same source as is used to operate the Accounting Machine.

Because the 40-volt current must come from the Accounting Machine and because the supply is not sufficient to care for the simultaneous

operation of both machines, gang-punching cannot be performed at the same time that an operation is taking place on the Accounting Machine.

If it is necessary to use the two machines simultaneously for their separate functions, a motor-generator set can be specified for installation on the punch. This allows the punch to operate entirely independently of the Accounting Machine.

Operation and Plugging

The Gang Summary Punch is attached to the Accounting Machine by inserting the end of the flexible connector-cable into the receptacle on the Accounting Machine. The separate cord must be plugged to its proper source of current, the main line switch turned ON, and the Accounting Machine running. This applies for all operations.

When summary-punching, the card levers in the summary punch and interlocking circuits between the punch and the Accounting Machine prevent the machines from operating if the supply of cards in the summary-punch feed magazine becomes exhausted or if cards fail to feed into punching position.

Operation

The operation of this machine for summary-punching is similar to that of the Type 522 Summary Punch with a few exceptions which are explained here.

Before starting the summary-punching operation, two cards must be fed into the summary punch feed. This allows the first card placed in the Gang Summary Punch to advance to the punch brush station so that if it is a master card, it will be in position to be read into the first summary card. This first card is never summary-punched.

The Accounting Machine begins to operate after the depression of its start key for the first control group as described in the previous section. However, no summary-punching takes place until the end of a control group is reached, at which time both indication and summarized data are punched. The punching is performed in twelve fast motions as the card passes under the cutters. At the completion of the punching, a start impulse is passed automatically to the Accounting Machine, which goes through the same operation for each successive control group.

Data common to all summary cards may be gang-punched during the summary-punching operation with no loss of time. This common information is prepunched on the first card placed in the feed hopper and by properly wiring for gang-punching, these data will be punched in each summary card as it passes through the machine.

It is not necessary, when designing summary cards for use on the Gang Summary Punches, to have the indication information located in any specific portion of the card. All punching is performed in one operation at the end of each control group, which allows complete flexibility in locating the fields to be punched.

The attachment of a Gang Summary Punch to the Alphabetic Accounting Machine does not change the normal listing and tabulating speed of the machine. The added time factor that is necessary is that total printing is delayed until after summary-punching is completed.

The delay due to summary-punching is usually less on the Gang Summary Punch than on the Duplicator Type. If 20 columns are to be summary-punched on the Duplicator Summary Punch, at the end of a control change, it would require 2 seconds (punching speed 10 columns a second) for the punching only, as against 1.5 seconds on the Gang Summary Punch for a complete summary-card operation. As the number of total columns to be punched increases, the time for punching them increases on the Duplicator Summary Punch. This is not true on the Gang Summary Punch, because each summary card is punched in twelve fast motions of the machine, which makes the time a constant factor. It follows from the above statement that as the number of total columns to be punched increases, and as the volume of summary-punching increases, it becomes advantageous to use the Gang Summary Punch because of the saving in time effected.

When using the Gang Summary Punch with an Alphabetic Accounting Machine without Net Balance Counters, no extra wiring is necessary on the Accounting Machine plugboard. The wiring on the Summary Punch plugboard is similar to that for the Duplicator Type Summary Punch with two exceptions. No wiring is necessary for total-punch control, but wiring is necessary for the gang-punched data.

The Summary Punch switches on the Accounting Machine are set, for summary-punching, as described under "Operations" for the 522 Duplicator Summary Punch. When using the Gang Summary Punch for a separate operation

of gang-punching, the "Gang Punch" Switch is turned ON. This switch when ON, disengages the drive clutch of the Accounting Machine which allows the motor and generator to run, but removes the load of turning over all the other mechanisms in the Accounting Machine. This action, as stated before, prevents the Accounting Machine from being used independently and simultaneously with a gang-punching operation.

Plugboard

Counter Total Exits

The Counter Total Exit hubs are outlet hubs for impulses from the counters of the Accounting Machine for summary punching.

GP-X Brushes

Six Gang Punch X Brushes, which may be set to read any columns of the card, are located under the joggle plate just inside the feed. In order to dispense with the necessity of raising this cover and manually setting an X brush on the desired column for each operation involving X-control, six outlets for the X brushes have been brought to the plugboard and labelled "GP-X Brushes." After it has been determined which card columns are to contain the most frequently used control X's (as many as six of them), the six punch X brushes under the cover are set on these columns. (Any six columns may be selected for X-controlling, provided that at least two columns intervene between any two consecutive X-punched columns.) Thereafter, in order to make operative any one of these six punch X brushes, it is necessary only to plug from the corresponding hub of the GP-X Brush on the plugboard. This hub is plugged to one of the PX hubs.

PX Hubs

These two hubs are common, and one is plugged from the proper GP-X brush for all operations requiring an X-control impulse. They are inlets to prevent punching the gang-punched information from a last detail card into the following master card.

The PX hubs serve also, in the case of offset gang-punching, as inlets for an internal mechanism necessary to delay the action of a class selector for one card cycle after the X-punching has been sensed by the GP-X brushes.

DPX Hubs

The Delay Punch X hubs are the plugboard outlets for the internal delay mechanism mentioned in the preceding paragraph. For offset gang-punching, the delayed action of a class selector is necessary. One of the two common DPX hubs is connected to the X pickup hub of the selector used. The X for controlling this operation is wired from a GP-X brush to a PX hub.

Total Punch Hubs

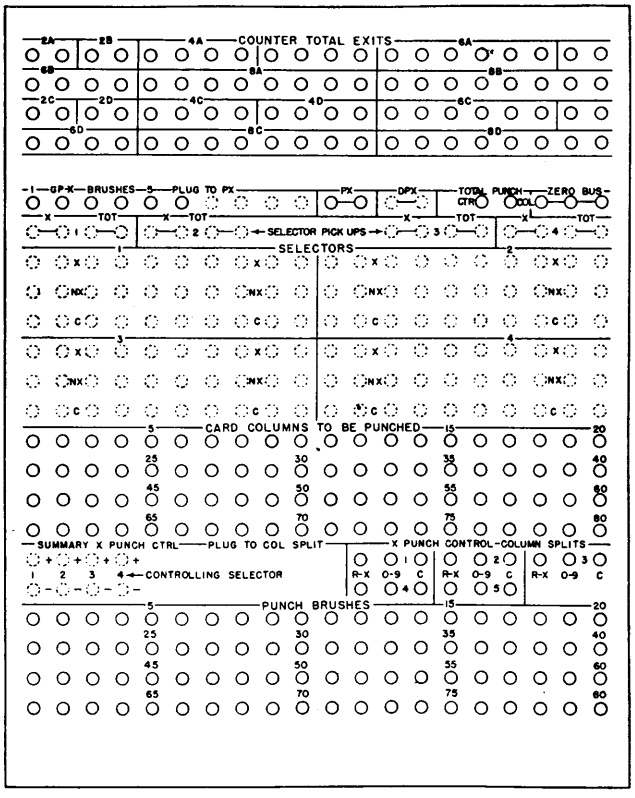
These hubs, for use on the duplicating type summary punch only, have been explained in the previous section.

Zero Bus Hubs

A row of three common hubs supplies zeros for increasing automatically the size of summary-punched or gang-punched fields. The required number of these hubs are wired directly to the desired card columns to be punched. Zeros are then punched automatically in these positions of every card (except X-punched master cards) passing through the machine.

Selector Pick Up Hubs

A maximum of four class selectors can be installed on this machine for the purpose of balance selection or offset gang punching. The selector pickup hubs, X and Total, are wired from the PX or DPX hubs for actuation from an X, or from a counter position of highest order for total actuation.



Selectors

These hubs and all other dotted hubs are not active unless class selectors are installed. As stated above, from one to four class selectors may be installed on this machine for the purpose of balance selection or offset gang punching.

Card Columns to be Punched

Eighty hubs serve as the plugboard inlets which actuate the punches for summary punching and gang-punching. These hubs are plugged from the Counter Total Exits for summary punching and from the Punch Brushes for gang punching. When selectors, column splits, or automatic zeros are to be used, the card columns to be punched are plugged from these positions of the plugboard respectively.

Summary X Punch Control Hubs

Two hubs for each selector, one labelled plus and one labelled minus, are outlet hubs for X punch impulses to designate credit or debit balances when summary punching. These hubs are wired through the Column Split hubs to Card Columns To Be Punched.

X Punch Control—Column Split Hubs

These are five three-position permanent selectors which are actuated every machine cycle. As the 12 and 11 punching positions pass the punch station, the R-X and common hubs are connected. As the 0 through 9 positions pass the punch station, the 0 - 9 hubs are connected to common. This allows an X from a Summary X-Punch Control hub to read in through the R - X hub of a column split and out the common to punch, immediately followed by an impulse from a counter into the 0 - 9 hub and out the common to punch in the same column.

These hubs can be used in gang-punching operations to transfer the control punching into a column other than the one from which it is read, or to eliminate it altogether—at the same time permitting all other holes in both columns to be copied exactly.

Each column split group is a separate unit, therefore it is possible to perform as many as five operations at one time.

Punch Brushes

Eighty hubs serve as the plugboard outlets for the punch brushes which are plugged to the card columns to be punched for all gang-punching operations. This plugging must be direct column for column. Gang-punched information can be offset only by directing it through a class selector.

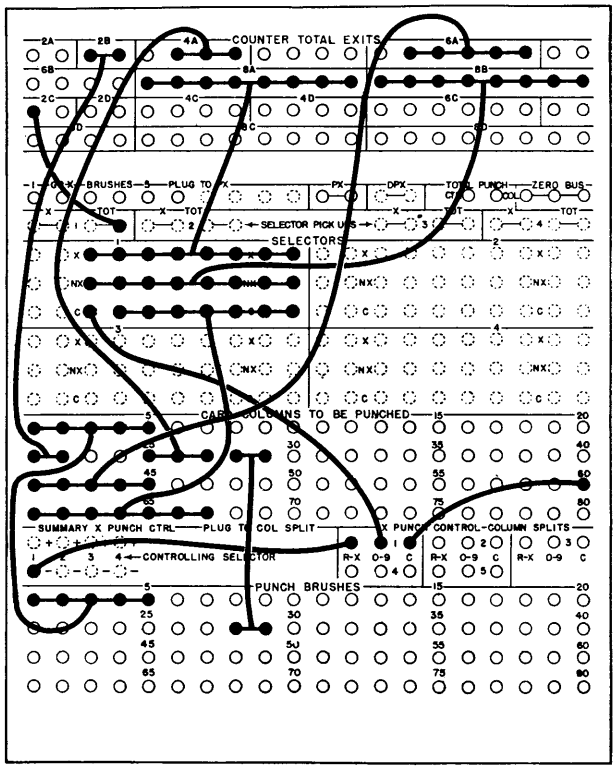
Summary Punching

The Punch is attached to the Accounting Machine by inserting the end of the flexible connector cable into the receptacle on the right end of the Accounting Machine. The summary-punch switches on the latter are set for the particular class of total to be summarized.

The plugging for straight summary-punching of indication information and totals is from the counter total hubs to the card columns to be punched.

If balance-selected totals are to be summary-punched, it is necessary to install balance-selection relays on the Summary Punch and to plug them as illustrated. When balance selectors are installed, all circuits necessary for control X-punching are also provided in order that selected totals may be suitably designated by X's on the summary cards.

The plugboard diagram illustrated shows the Gang Summary Punch wiring for the Sales by Salesman report on Page 8. All summary punch wiring is from Counter Total Exits to Card Columns To Be Punched. Gang-punched information, which was duplicated from a master card on the Type 517 Summary Punch, is wired from Punch Brushes to Card Columns To Be Punched. Because of the method of punching, no Total Punch Control wiring is necessary.

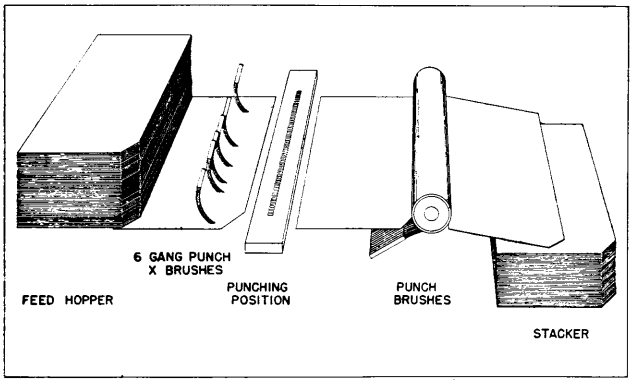


When gang-punching during a summary-punching operation, additional wiring is required from the punch brushes to the card columns to be punched. In this operation a card containing the information to be gang-punched must be placed ahead of all the summary cards in the Gang Summary Punch.

Gang Punching

For gang-punching operations, the connections must be made as for summary-punching, and the Accounting Machine must be running, but not in use. A motor-generator set may be specified for installation on the Summary Punch, which will allow the Accounting Machine and Gang Summary Punch to operate as separate machine units simultaneously.

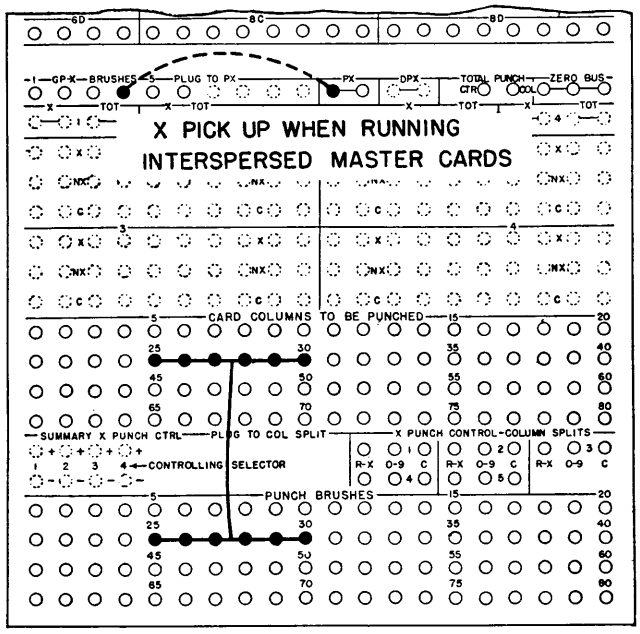
Gang-punching requires the use of one or more master setup cards. The master card is the first card fed. When this card has reached the punch brushes, the blank card following it is at the punching position. The master card



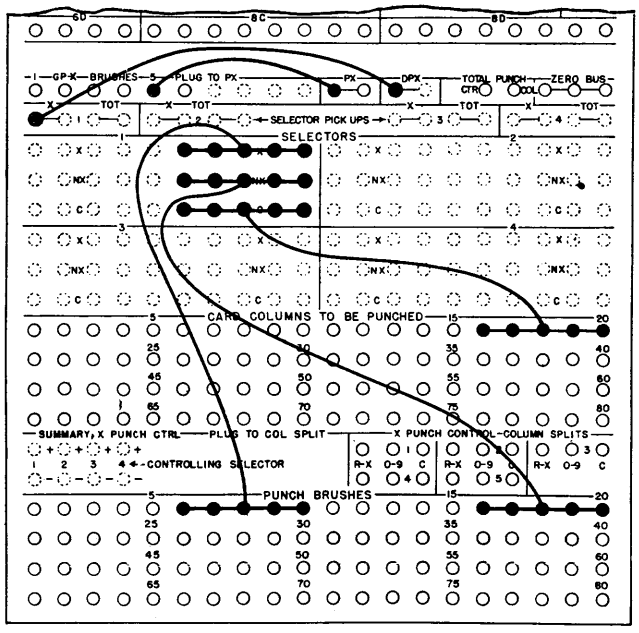
is read by the punch brushes and the impulses are transmitted to the punch magnets, which cause the detail card following the master card to be punched. The next card cycle then advances the punched detail card to the punch brushes where it in turn is read and serves as the setup card for the following detail card.

When it is desired to intersperse master cards with detail cards (each master card to bring about a new setup), it is necessary only to prevent the last detail card of a group from punching the incoming master card. For this purpose, the master cards must be punched with a control X so that one of the GP-X brushes may be wired to one of the PX hubs.

As a new master card approaches, the X-punching is sensed by the GP-X brush which is operative. This impulse wired into a PX hub causes the circuit between the punch brushes and card columns to be punched, to be broken. This allows the master card to pass the punching position without being punched from the preceding detail card. Since, however, the following detail card contains no X-punching, the circuit is re-made as this card reaches the GP-X brushes, and when it has advanced to the punching position it is punched with the information contained in the master card, then at the punch brushes.



When a single master setup card is used for an entire gang-punching run, it is not necessary that the master card contain a control X.



Offset Gang-Punching

The Detail-Master switch allows the detail cards to be X-punched and the master cards to have no control X-punching. This performs a similar operation with interspersed master cards as that explained above.

Offset Gang-Punching

The accompanying diagram illustrates the plugging arrangement for gang-punching information contained in a particular field of the master card into a different field of the detail cards.

Columns 6 to 10 of the master card are to be gang-punched into columns 16 to 20 of the detail cards.

Connections are made with the Accounting Machine as for any gang-punching operation. The Detail-Master switch is set to Master if the master cards contain the control X-punching. The proper GP-X Brush hub is plugged to the PX hub to read the control X. The DPX hub, which emits a one-cycle delayed impulse, is wired to the X pick-up of the class selector. This is necessary because the operation of the class selector, in this case, must be delayed one card cycle after the reading of the control X; that is, actuation must be held up until the master card is in position to be read by the punch brushes.

SUMMARY PUNCHES FOR USE ON THE NET BALANCE ALPHABETIC ACCOUNTING MACHINE

Standard Type 517 and Type 522 Summary Punches will be arranged for use with Alphabetic Accounting Machines equipped with Net Balance Counters, as well as with existing Direct Subtraction Machines. The foregoing discussion applies to summary-punching on the Net Balance Alphabetic Accounting Machine with a few additional operations which will be discussed in this section. The greatest difference appears in the plugboard of the Net Balance Alphabetic Accounting Machine and not in the Summary Punch. The Summary Punch plugboards are the same as those illustrated and described in the previous section, being interchangeable between the Type 517 and Type 522 Summary Punches, whether used with the Direct Subtraction Alphabetic Accounting Machines or machines equipped with Net Balance Counters.

It is necessary to plug a Summary Punch for Balance Selection (as illustrated in the previous section) when it is to be used interchangeably with both Net Balance Machines and Direct Subtraction Machines. However, when a Summary Punch is used only with a Net Balance Machine, Class Selectors are not necessary if the counters involved are plugged for Balance Conversion. In this case, counter balances are plugged directly from the Counter Total Exit hubs to the card columns to be punched, except for columns which are to be over-punched with X's to distinguish Debit and Credit balances. In such cases, the Counter Total Exit hubs must be plugged first to the 0 - 9 hub of a Column Split position, and then from the C hub of the same group to the proper card column to be punched, as illustrated.

The plugging for X-punching under Net Balance Counter Control is completed on the plugboard of the Accounting Machine as well as on the Summary Punch Plugboard. The five Column Split hubs on this Accounting Machine Plugboard are connected, through the Summary Punch Cable, to the R - X hubs of the correspondingly numbered Column Split positions on the Summary Punch Plugboard. To punch an X in the card column plugged through Column Split Position No. 1, it is necessary only to plug the Column Split No. 1 hub on the Accounting Machine Plugboard from the proper Summary X-punch Control hub on that board. The principle is the same as in the case of Total Symbol Control, except that the Plus or Minus hub is plugged to the proper Column Split hub instead of to the proper Numerical Type Bar hub. An example of this is illustrated.

Five column-split circuits are supplied as standard. If necessary, five additional column-split circuits can be installed.

Net Balance Counters are individually capable of converting complement balances into true figure balances, as well as performing all other functions of adding and direct subtraction counters. It is therefore unnecessary to use Net Balance Counters in pairs, or to use Class Selectors for Balance Selection either on the Accounting Machine or for summary-punching.

Summary Punching Complements

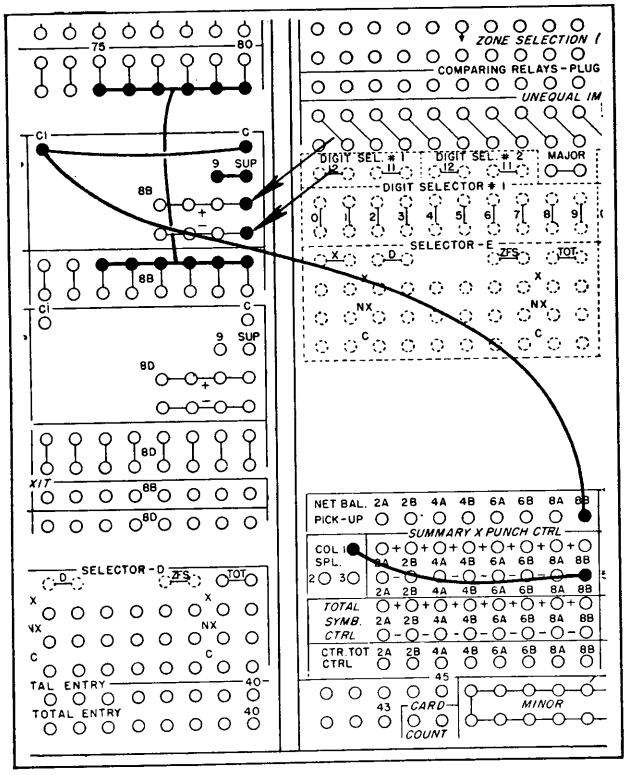
In some cases, involving the summary-punching of spread-field cards containing two or more net balances, it is desirable to punch complement balances as they occur, while printing these balances in true figures. This can be accomplished by turning the Complement Summary Punching Switch ON, which delays the conversion cycle until the summary cards have been punched.

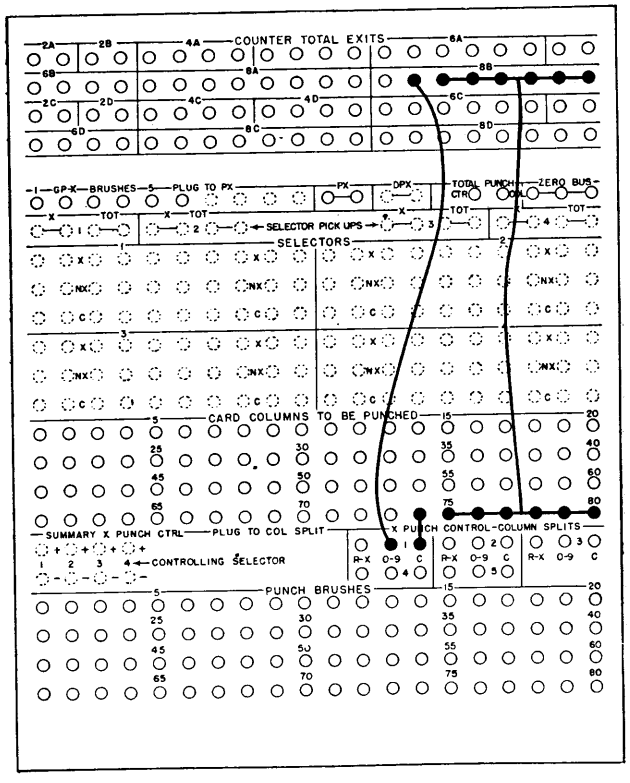
It is important to note, when summary

punching complements from a net balance machine, that they will not be actual complements but *Nine Complements*. This means, then, that card fields punched with *Nine Complements* should not be added in counters plugged for direct subtraction. Likewise, card fields punched with actual complements should not be added in counters plugged for net balance. This limitation should not prove serious except where large files of cards have been set up with many cards carrying complement balances. It would not be possible to use these actual complement cards in their present form with *Nine Complement* cards prepared on a Net Balance Machine.

Example of Plugging

In the following illustration, Counter 8-B is used to accumulate a Net Balance in a Net Balance Machine. It is required to summary punch an X over Column 74 when this total is Negative. The summary X-punch Control hub 8-B Minus contains this X impulse when 8-B is Negative. It is necessary to wire this X impulse from summary X-punch Control 8-B Minus to one of the column-split hubs which carries the X impulse through the summary-punch cable to the summary-punch plugboard (Summary X-punch Control 8-B Minus to Column Split One). The X will then be available, when it appears, out of the C hub of the corresponding Column Split hub on the summary-punch board (No. 1 in the illustration). This common hub is wired to column 74. Any numerical punching that appears in the counters for column 74 will be introduced by wiring from counter 8-B on the summary-punch board to the 0-9 hub of this same column-split group as illustrated on the diagram. Other wiring is the same as that covered in the previous section.





Alphabetic Summary Punching

Eight positions of Alphabetic Summary Punching are available as a special device on the Type 405 Alphabetic Accounting Machine.

For alphabetic summary-punching, it is necessary to specify the type of summary punch to be used, as the Type 517 and Type 522 punches are not interchangeable for this particular work. The summary punches are interchangeable for other than alphabetic summary-punching.

No special plugging on the Summary Punch plugboard is necessary, other than to plug from the outlet hubs of the specified eight-counter group, to the desired card-column hubs.