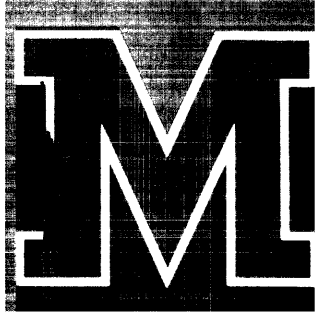
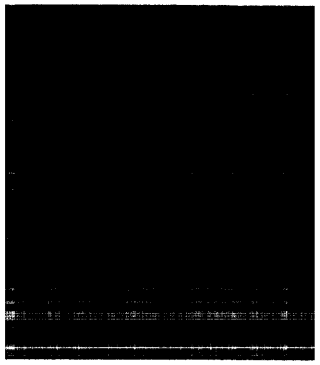
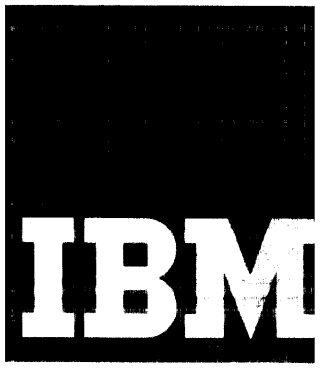






Reference Manual

IBM 513, 514 Reproducing Punches

IBM®

Reference Manual

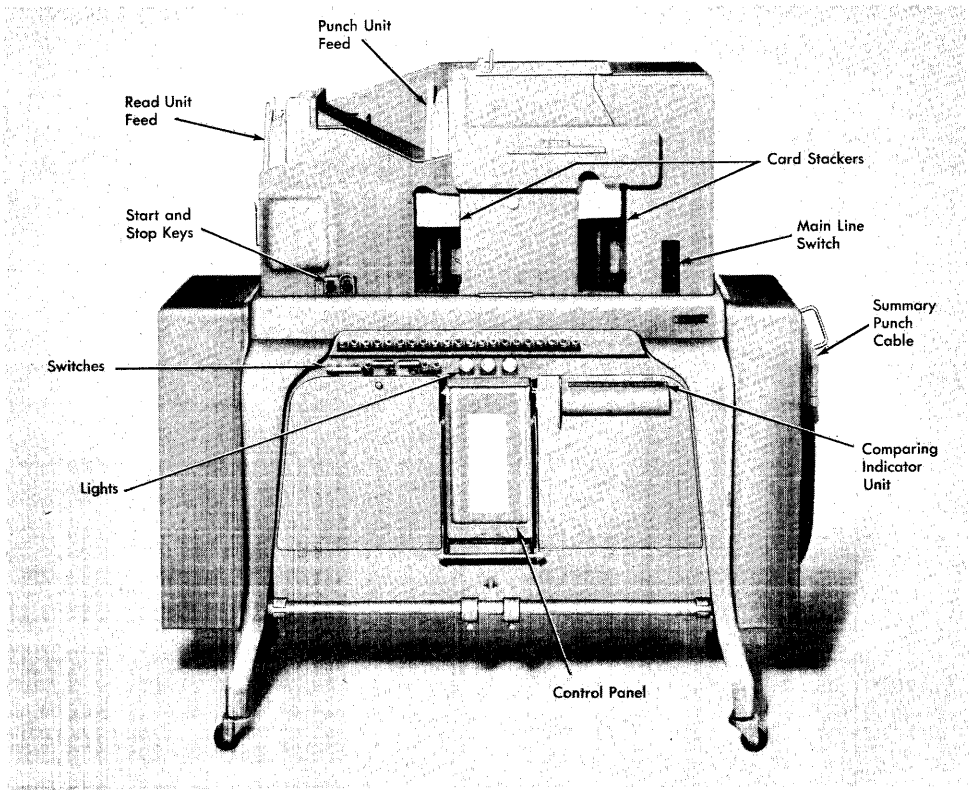
IBM 513, 514 Reproducing Punches

MINOR REVISION (October 1959)

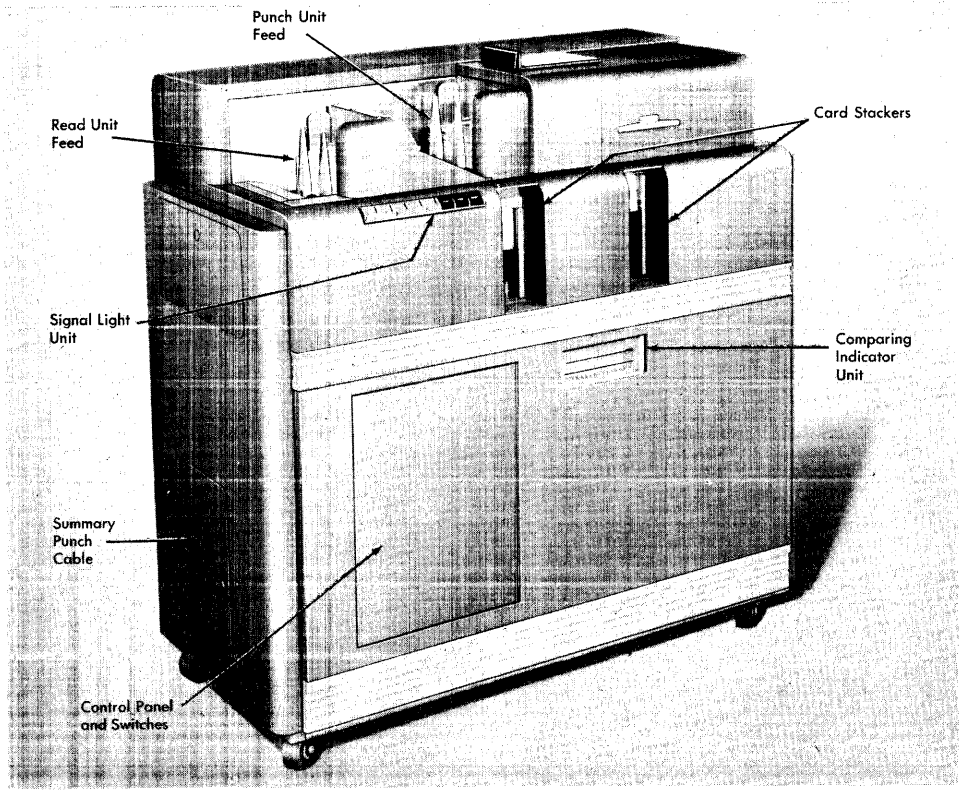
This edition, A24-1002-2, is a minor revision of the preceding edition but does not obsolete A24-1002-1. Principal changes in this edition are:

PAGE	SUBJECT
10	RX and RD hubs
11	Double-Punch and Blank-Column Detection
16	Offset Gangpunching

Contents



IBM 513 Reproducing Punch



IBM 514 Reproducing Punch

IBM 513, 514 Reproducing Punches

IN THE IBM DATA PROCESSING METHOD, an important function is the automatic preparation of IBM cards. This is accomplished by IBM machines, including the Reproducing Punches. They perform the following functions:

Reproducing: in which all or any part of the information punched in one set of cards is punched into another set of cards. At the same time, the comparing feature of the machine can verify the accuracy of the punching operation.

Gangpunching: punching information from a master card into detail cards.

Summary Punching: punching a total card or new balance card with amounts that have been accumulated in the accounting machine.

Mark sensing: information recorded in the form of pencil marks on IBM cards is automatically transformed into punched holes in those cards.

The IBM 513 and 514 Reproducing Punches are similar in function and operation. The 514 can be used with the IBM 402, 403, 407 and 408 Accounting Machines. The 513 can be used with all accounting machines except the 407 and 408. If the 513 is modified for use with the 407 or 408, certain operational limitations occur. Each machine can be equipped with 45 or 80 columns of comparing, with summary punching, and with 10, 20, or 27 positions of mark sensing. Cards feed at the rate of 100 per minute except when summary punching; summary punching requires 1.2 seconds per card.

FEATURES

The location of the following features of the reproducing punch is shown in the frontispiece:

Control Panel

This mechanism controls reading of information from the cards and punching of the information in the desired columns.

Card Feeds

Before they pass through the machine, cards are placed in two hoppers, one each for the reading and punching units. If either hopper empties, the machine automatically stops.

Start and Stop Keys

These two keys are used to start and stop feeding cards in the reading and punching units.

Card Stackers

After they pass through the machine, the cards are deposited in stackers. Each stacker has a capacity of approximately 1,000 cards; if either is filled to capacity, the machine automatically stops.

Main Line Switch

This switch controls the power, and must be ON for all machine operations. A red signal light indicates that the switch is turned on.

Comparing Indicator Unit

When the comparing light signals an error in verifying, the machine automatically stops and the indicator points out the comparing position in which the error occurred.

Summary-Punch Cable

This cable permits the combined operation of a reproducing punch and an accounting machine. This operation prepares, automatically and simultaneously, total or new balance cards and reports. When the reproducer is not being used in a summary-punch operation, the cable must be disconnected and returned to the receptacle.

Machine Operation

THERE are two feed units in the reproducing punch, the reading unit and the punching unit. Cards can be fed in either or both of the units according to the operation being performed. For normal operations, the cards are fed face down, 12-edge first. Each feed hopper holds about 800 cards; feeding is continuous, and if either hopper becomes empty, or if a card fails to feed, the machine automatically stops.

The relation of the two units to each other, and the sequence in which the cards pass the operating stations in the two units, are shown in the schematic diagram (Figure 1).

NOTE: The positions of the cards shown in the feed schematic are not literal representations. If the machine stops at any point during card feeding, the cards do *not* appear in these positions. Figure 1 is a functional representation of the card feed process. For example: during one card cycle in the read feed, a card is read by the RX and reproducing brushes; during a second card cycle, the card is read by the comparing brushes; during a third, it is ejected into the stacker and so on.

Punching Unit

Cards fed in the punching unit first pass the six punch X-brushes, which can be set to read any six columns of the card. They read X-punches which identify master cards, to control the punching and feeding operations. If a mark-sensing device is installed in the machine, the mark-sensing brushes are the next station in the punching unit. These brushes read marks on a card, and punch the corresponding positions in the same card. The following station is the punching mechanism which consists of 80 punches and dies corresponding to the 80 card columns. Because there is a separate punch for each column of the card, and each card passes the punch dies with its top edge first, the 12-position is the first punched. All 12 positions are punched at one time; the 11 positions are punched next, etc., through the last or 9 positions. Thus, the card is punched completely in twelve steps of the card cycle. A card passes these three stations during one card cycle in the punching unit.

The 80 punch brushes represent the last station in the punching unit. A card passes the punch brushes during the 2nd card cycle. When the 5-position of the first card in the punching unit is being read by the punch brushes, the 5-position of the card immediately following it is at the punch dies; and as the 9-position of the first card is passing over the punch brushes, the 9-position of the following card is at the punch dies.

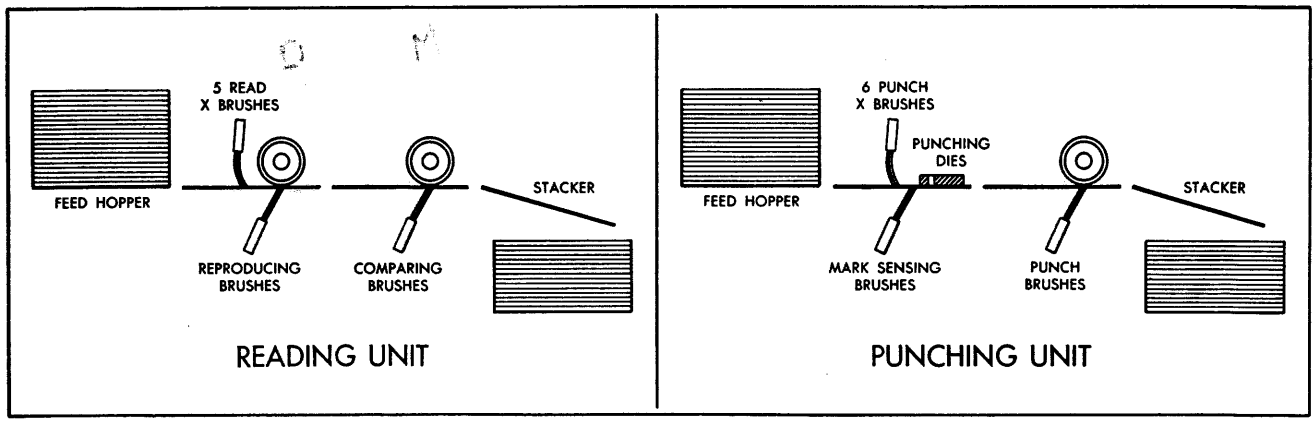


FIGURE 1. SCHEMATIC DIAGRAM OF CARD FEED AND CARD CYCLES

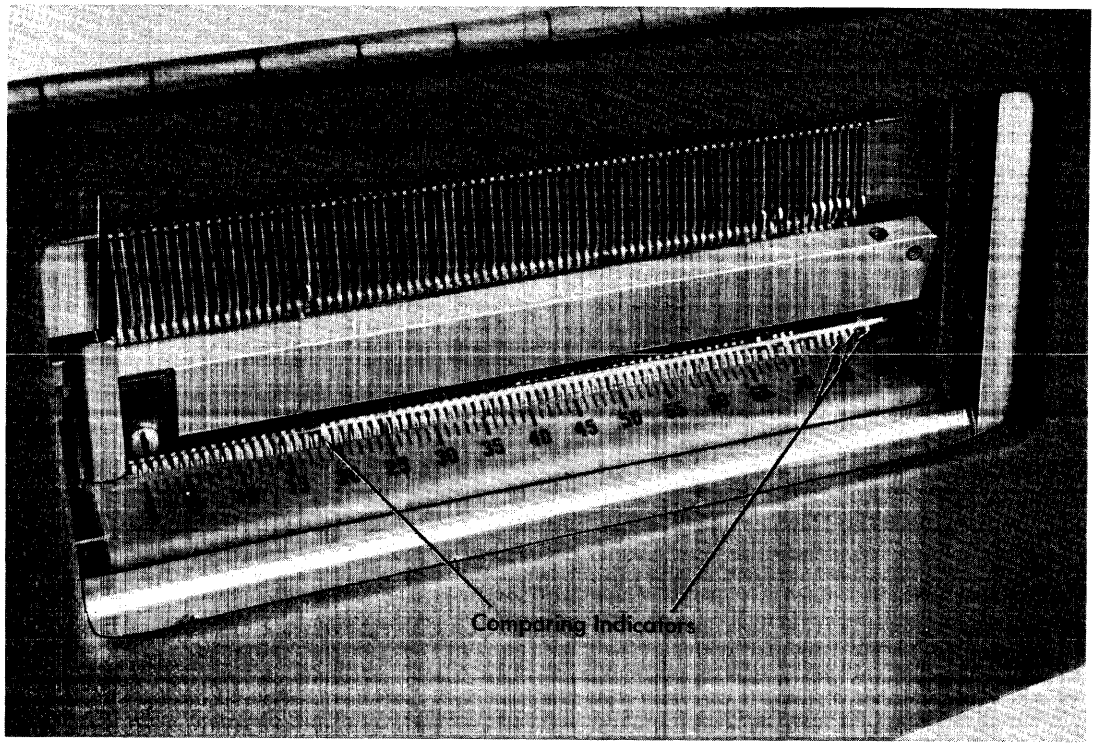


FIGURE 2. 514 COMPARING INDICATOR UNIT

Reading Unit

Cards fed in the reading unit first pass the five read X-brushes, which can be set to read any five columns of the card. The purpose of these brushes is to read X-punches to control the reading of other information from the card. At the following station are the 80 reproducing brushes, that correspond to the 80 card columns. A card passes these two stations on one card cycle as it passes through the reading unit.

The next station is the set of 80 comparing brushes, one for each column of the card. (Comparing, in the 513 and 514, is an optional feature.) The cards pass the comparing brushes on the next card cycle as they pass through the reading unit. Thus, when the 5-position of the first card in the reading unit is passing over the comparing brushes, the 5-position of the card immediately following it is being read by the reproducing brushes.

Combined Operation

When both units are being used, the cards feed simultaneously through both units. At the time that the X-position of a card in the reading unit is being read by the read X-brushes, the X-position of the card in the punching unit is being read by the punch X-brushes. At the time the 5-position of a card in the reading unit is being read by the reproducing brushes, the 5-position of a card in the punching unit is at the punch position. As the card in the reading unit passes on to the comparing brushes, the card in the punch unit passes on to the punch brushes; and at the time a 5-hole in a card in the reading unit is being read by the comparing brushes, the 5-position of a card in the punching unit is being read by the punch brushes.

Comparing Magnets

The comparing feature of the machine makes it possible to compare punching in two cards for purposes of verification and control. The comparison may occur between one card in the reading unit and one in the punching unit, or between cards at the two stations in the reading unit. When the punching in the two cards is different, a signal light indicates the error, the machine stops, and a comparing indicator (Figure 2) points out the comparing position in which the error occurred. The comparing indicator unit is reset and the signal light is turned off by operating the lever to the left of the indicator unit. (See *Comparing Error Procedure.*)

Control Panel

AUTOMATIC OPERATION of the reproducing punch is achieved by control-panel wiring and switch settings. The control panel fits into a rack on the front of the machine (Figure 3). The various groups of hubs (Figure 4) are explained below.

Reproducing Brushes: A-D, 1-20

The 80 REPRODUCING BRUSHES hubs are exits for the reproducing brushes. They are wired to the PUNCH MAGNETS for straight reproducing, to a class selector for selected reproducing, or to a column split for X-elimination or transfer. For verification of gangpunching, they are connected to COMP. MAG. FROM PUNCH BRUSHES.

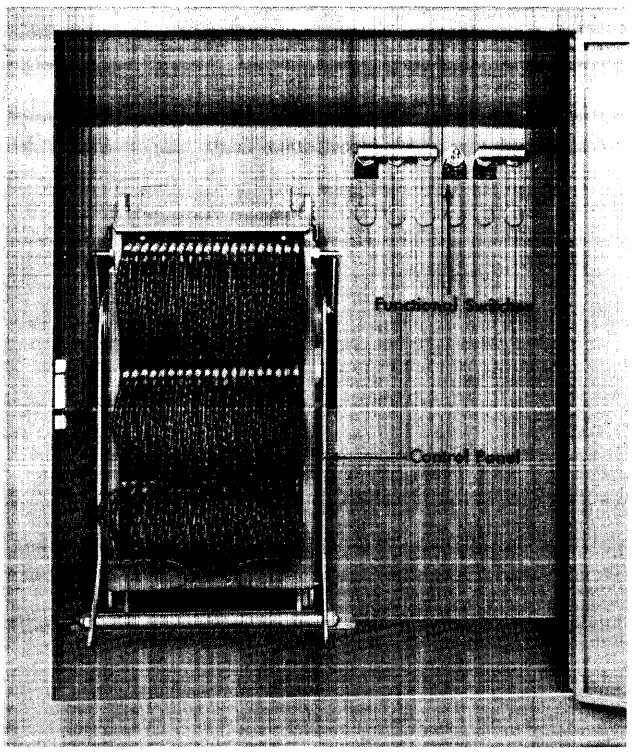


FIGURE 3. 514 CONTROL PANEL AND SWITCHES

Punch Magnets: K-N, 1-20

The 80 PUNCH MAGNETS hubs are entries for the punch magnets, which actuate the punching mechanism. The punch magnets are wired from REPRODUCING BRUSHES for reproducing, from the PUNCH BRUSHES for gangpunching, from CTR. TOT. EXIT hubs for summary punching, and from the M.S. OUT hubs for mark-sense punching from pencil marks.

Punch Brushes: Q-T, 1-20

There are 80 exit hubs for the punch brushes. These hubs are connected to PUNCH MAGNETS for gangpunching, to a class selector for offset gangpunching, and to a column split for X-elimination or transfer. The punch brushes are connected to the COMP. MAG. FROM PUNCH BRUSHES hubs to verify reproducing.

Comparing Magnets: Y-AB, 1-20; AC-AF, 1-20

There are two sets of hubs that are entries to the comparing magnets: one set is wired from PUNCH BRUSHES, and a second set is wired from COMPARING BRUSHES. The reproducing punch may have either 45 or 80 columns of comparing. The full complement of comparing magnets can be used except when summary punching or mark sensing. When the connector cable is attached to the accounting machine for summary punching, the two sets of hubs for the last 40 comparing positions become exits from the counters. As a result, only 40 comparing units can be used for verification of punching. This is one reason the cable is attached to the accounting machine for summary punching but returned to the punch receptacle for other operations. When mark sensing is being done, the last 20 hubs in the comparing-magnet sections become mark-sensing IN and OUT hubs.

Comparing Brushes: AG-AK, 1-20

The comparing brushes are effective only in a machine equipped with the comparing feature. The 80 outlet hubs for the brushes are connected to the comparing magnets for verification of reproducing or gangpunching.

Punch X-Brushes: P, 1-6

The six punch X-brushes in the machine may be located on any six columns, provided that two columns intervene between any two consecutive X-punched columns. On the control panel there are six outlets for the brushes (P.X. BR.) which may be connected to the PX hub or directly to a PX pickup hub of a selector.

Read X-Brushes: J, 5-9

There are five outlets for the five read X-brushes READ X BR. Any of the five outlets may be wired to the RX hub, the PX hub, or directly to the RX pickup hub of a class selector. The five read X-brushes may be placed on any five columns, provided that two columns intervene between any two consecutive X-punched columns.

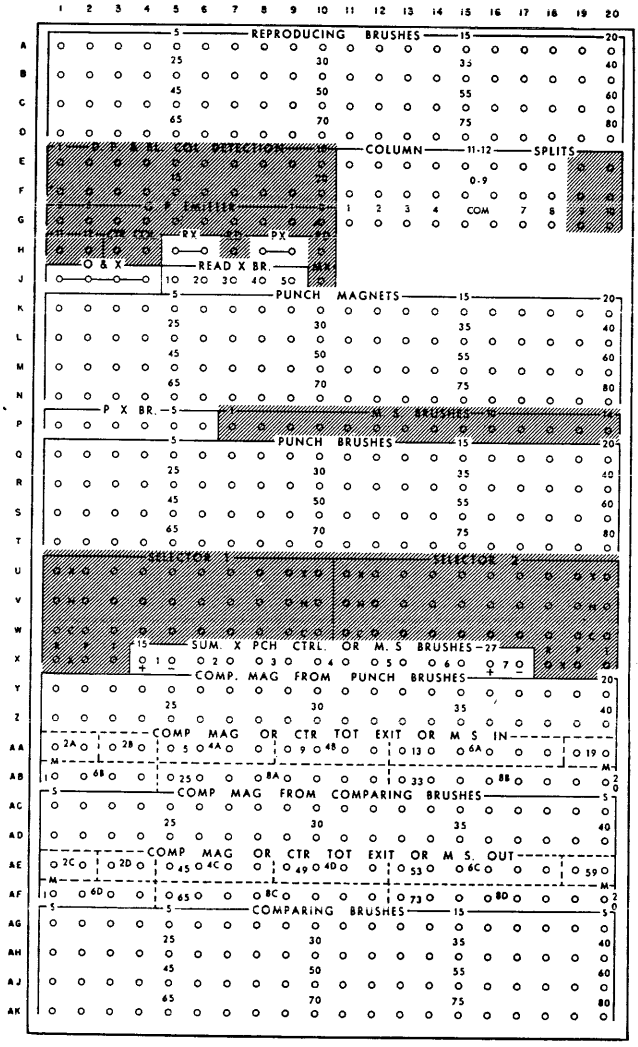


FIGURE 4. CONTROL PANEL DIAGRAM
IBM 513-514 REPRODUCING PUNCHES
(Form X24-9188)

PX and PD Hubs: H, 8-10

The two PX hubs are common, and may be wired from either a punch X- or read X-brush. If the X-punch is in the master cards (and the detail or master switch is at MASTER), the PX is effective for an X-master card. If the X-punch is in the detail cards (and the detail or master switch is at DETAIL), the PX is effective for an NX master card. With the PX effective, machine operation is affected in three ways:

1. The punch magnets are inoperative for one card cycle. If the detail or master switch is set at MASTER, the punch magnets are inoperative when the PX hubs receive an X-impulse—that is, when X-cards are under the punching dies or the reproducing brushes. If the switch is set on DETAIL, the punch magnets are inoperative when the PX hubs do *not* receive an X-impulse—that is, when NX cards are under the punching dies or the reproducing brushes. In an interspersed-master gangpunch operation, therefore, the master card would not be punched with information picked up from the last detail card of the preceding group.

2. Feeding in the reading unit is stopped for one card cycle if the selective-reproducing and gangpunch-compare switch is OFF. If the detail or master switch is set on MASTER, feeding in the reading unit stops when the PX hubs receive an X-impulse—that is, when X-cards are under the punching dies or reproducing brushes. If the switch is set on DETAIL, feeding in the reading unit stops when the PX hubs do *not* receive an X-impulse—that is, when NX cards are under the punching dies or the reproducing brushes. In an operation combining master-card gangpunching and reproducing, therefore, a source card in the reading unit will not feed under the reproducing brushes while a master gangpunch card is passing under the punch magnets.

3. Comparing circuitry is inoperative for one card cycle if the reproducing switch is ON. If the detail or master switch is set on MASTER, comparing is inoperative for each card cycle following the card cycle during which the PX hubs receive an X-impulse—that is, when the X-cards are under the comparing brushes or the punch brushes. If the detail or master switch is set on DETAIL, comparing is inoperative for each card cycle following the card cycle during which the PX hubs do *not* receive an X-impulse—that is, when NX cards are under the comparing brushes

or the punch brushes. In a selective reproduce operation with comparing, an NX source card that is *not* reproduced will *not* be compared with a blank card.

In addition to these three results, the wiring of the PX also affects the PD hub. Whenever an X reaches the PX in any given card cycle, this impulse is available from the PD hub one card cycle later. The PD can be used to control a class selector when the X-punched card is at the punch brushes. The PD is not affected by the position of the detail or master switch; it is the X-punched card that causes the PD to be operative on the following card cycle, when the X-card is at the punch brushes. It does not matter, in this operation, which card—master or detail—contains the X-punch.

RX and RD Hubs: H, 5-7

The two RX hubs are common and may be wired from a read X-brush. If the X-punch is in the master cards (and the detail or master switch is at MASTER), the RX is effective for an X-master card. If the X-punch is in the detail cards (and the detail or master switch is at DETAIL), the RX is effective for an NX-master card.

With RX effective, the comparing unit is inoperative for the same card cycle if the reproducing switch is OFF. In other words, comparing is inoperative when the master card (X or NX) is at reproducing brushes and the preceding card is at the comparing brushes. In verifying an interspersed-master gangpunching operation, therefore, a master card would not be compared with the last detail card of the preceding group.

When an X is wired to the RX, the other RX hub may be wired to the pickup of a selector to control the selector as the X-card is passing the reproducing brushes.

In addition to these results, the wiring of the RX also affects the RD hub. Whenever an X reaches the RX hub on any given card cycle, this impulse is available from the RD hub one card cycle later. The RD can be used to control a class selector when the X-punched card is at the comparing brushes. The RD is not affected by the position of the detail or master switch; it is the X-punched card that causes the RD to be operative on the following card cycle, when the X-card is at the comparing brushes. It does not matter, in this operation, which card — master or detail — contains the X-punch.

Column Splits: E-G, 11-20

Each one of the 8 COLUMN SPLITS can be used to transfer or eliminate X- or 12-punches. Control and digit punches in the same column can be directed to different destinations.

0 and X Hubs: J, 1-4

These four hubs are a source of both X and 0 impulses. These hubs may be used to add control X-punches, or for increasing the size of a field by adding 0's. To punch a single X or 0, a column split must be used.

Summary X-Punch Control: X, 4-17

A group of + and – summary X-punch hubs (SUM. X PCH. CTRL.) are provided to summary punch a distinguishing X for either debit or credit totals. For use with a non-net balance alphabetic accounting machine, the + and – hubs are paired and numbered 1, 2, 3, etc., to correspond with the number of the class selector used for balance selecting of totals. For use with the numerical accounting machine, the hubs are paired and labeled 1, 2, 3, etc., to correspond with the number of the balance counter used on the accounting machine. The SUM. X PCH. CTRL. hubs are not needed in operations involving a net balance alphabetic accounting machine.

These same hubs serve also as the outlets for mark-sensing brushes 15-27.

Class Selectors: U-W, 1-20; X, 1-3 and 18-20

The 10-position class selectors may be installed as extra features. Each selector has three pickup hubs, the PX, RX, and total (R; P; T).

The PX pickup hub should be used if the selector must hold for a punching-unit card cycle. This hub may be impulsed from the PX, PD, or directly from a punch X-brush (the last to control a selector without affecting the regular PX circuit).

The RX pickup hub should be used if the selector must hold for a reading-unit card cycle. This hub may be impulsed from the RX, RD, or directly from a read X-brush (the last to control a selector without affecting the regular RX circuit).

The total pickup hub is used in balance-selecting with the non-net balance alphabetic accounting machine. It is impulsed from the left-hand position of one of the balance counters.

Mark-Sensing Brushes: P, 7-20; X, 4-17

These hubs are outlets for the 27 mark-sensing brushes and are separated on the control panel; brushes 1-14 are to the right of the punch X-brush outlets, and brushes 15-27 are the same hubs used for summary X-punch control when summary punching.

Mark-Sensing IN and OUT: AB, 1-20; AF, 1-20

These hubs are entries and exits for the amplifying unit. They are the same hubs used for comparing magnet positions 61-80, or for counter exits in summary punching. The mark-sensing brush outlets are wired to the mark-sensing IN hubs, and from the mark-sensing OUT hubs to the punch magnets. A 12-mark, sensed in the first MS IN position, will punch as an X and cause the MX hub to emit. If all 27 positions are installed, the last seven entries are located at AA, 11-17; the last seven exits are located at AE, 11-17.

Double-Punch and Blank-Column Detection: E-F, 1-10

These are entry hubs to the unit that detects double-punched or blank columns. They are wired from the punch brushes. On machines equipped with mark sensing, DPBC is standard. The number of positions supplied is the same as the number of mark-sensing positions installed, except that 30 DPBC positions are furnished with either 26 or 27 mark-sensing positions.

MX Hub: J, 10

This hub is used when gangpunching from mark-sensed master cards that must have a control 12-mark or an X-punch. The MX hub is connected to the PX pickup hub of a selector.

A control X-impulse is available from the MX hub when a 12-mark is read by a brush connected to the first mark-sense IN position.

Switches and Lights

Reproducing Switch

This switch ON synchronizes the reading and punching feeds. When a card is fed in the reading unit, one is fed in the punching unit. If either hopper empties, the machine automatically stops. The reproducing switch must be ON when the two feeds are used to perform a single operation. It is turned OFF when the two feeds operate independently to perform separate operations, or when only one feed is used. If the switch is ON and the PX hub receives an impulse, comparing will be inoperative during the following cycle. If the switch is OFF and the RX hubs receive an impulse, comparing is inoperative during the following cycle.

Selective Reproduce and Gangpunch Compare Switch

This switch ON allows continuous feeding in the reading unit. The switch should be ON only when a selective reproducing *or* a gangpunch and comparing operation is being run. If the switch is OFF, an impulse to the PX hub causes the feeding in the reading unit to stop for the following card cycle, while a card is fed in the punching unit.

Detail or Master Switch

This switch controls the handling of two types of cards distinguished by X-punching. In gangpunching it should be set to MASTER when the master cards have the control X-punch, or in reproducing from NX source cards. It should be set to DETAIL when the detail cards have the control punch for gangpunching, or when the X-source-cards are to be reproduced.

Mark-Sensing Switch

The mark-sensing switch must be ON for any mark-sensing operation. When the switch is on, the last 20 comparing positions on the control panel become mark-sensing IN and OUT hubs, and the summary X-punch control hubs become outlets for mark-sensing brushes 15-27.

Master-Card-Punching Switch

This switch ON allows mark-sensed information to be punched into a card regardless of the operation of the PX hub. It is turned on only for a combination reproducing and gangpunching operation with mark-sensed master cards. It should be OFF for all other operations. This switch is operative only if mark sensing is installed in the machine.

Blank-Column Detection Switches

For each position of blank-column and double-punch detection, there is a blank-column check switch. To verify blank columns or double punches, the punch brushes are wired to the detection unit and the corresponding blank-column check switches must be ON. If the punch brushes are wired and the blank

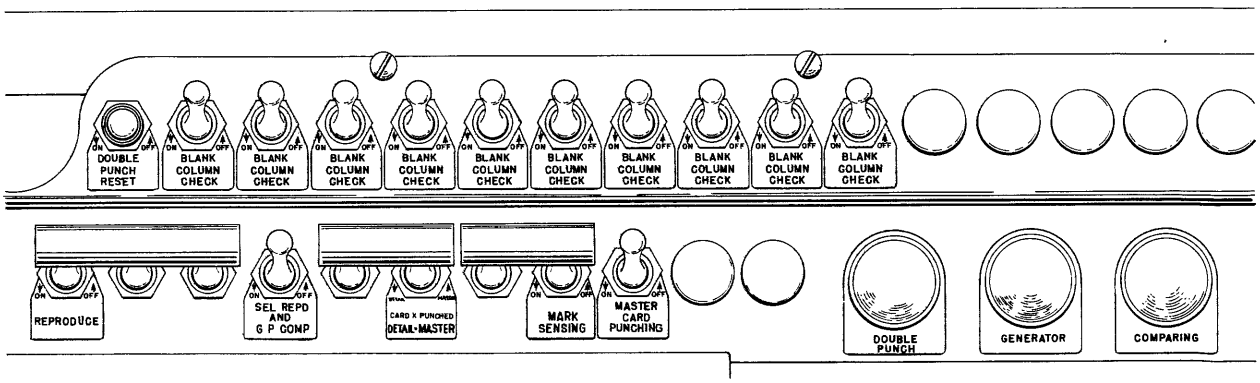


FIGURE 5A. IBM 513 SWITCHES AND LIGHTS

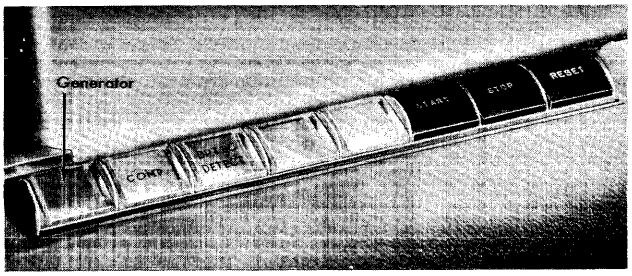


FIGURE 5B. IBM 514 SIGNAL LIGHT UNIT

column switches are OFF, only double punching will cause the machine to stop. (See *Double-Punch and Blank-Column Detection Device,* and *Double-Punch or Blank-Column Error Procedure.*)

Double Punch Reset Key

This key resets the machine after a double-punch or blank-column error has been recognized. The start key must be pressed to resume machine operation. Double punch reset key is operative only if double punch and blank column detection special device has been installed. (See *Double-Punch and Blank-Column Detection Device* and *Double Punch or Blank Column Error Procedure.*)

Double Punch Light (DP & BC Detect)

If the machine recognizes a double punch or blank column condition, this light comes on. The light is put out and the machine is reset by pressing the double punch reset key. (See *Double Punch or Blank Column Error Procedure.*)

Generator Light

This light comes on when the main line switch is turned on. The generator light goes out when cards feed in either the punch or read units; when the hopper in either unit empties, the light comes on again.

Comparing Light

This light comes on to indicate a comparing error; the light is turned off and the machine is reset by pressing the restoring lever in the indicator unit (Figure 2). (See *Comparing Error Procedure* and *Comparing Magnets.*)

Gangpunching and Verifying

THE PUNCHING UNIT is used in gangpunching operations. The master setup cards must precede the detail cards to be punched. When the first master card has reached the punch brushes, the blank card following it is at the punch magnets. The master card is read by the punch brushes and the impulses are transmitted to the punch magnets. This results in the punching of the first detail card.

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. Thus, every card passing through the machine serves in its turn as the setup card for the card directly behind it.

For machine verification of gangpunching, the cards are taken from the punching-unit stacker and placed in the reading-unit feed. Verification is made by comparing the punched holes of the card at the comparing brush station with those of the card at the reproducing brush station.

The relationship of cards for verification is similar to that of gangpunching: the master card is compared with the first detail card, and each subsequent detail card in that group is compared with the card that immediately precedes it.

When a discrepancy occurs, the machine stops, and the signal light flashes on. The operator should remove the cards in the stacker and the feed hopper, reset the indicator, and depress the start key. The second card entering the stacker is the error card.

One Master Card — Column-for-Column Gangpunching

If only one master card is to be used, this card is placed in front of the detail cards and all cards are placed in the feed hopper of the punching unit. In this case, X-control of the master card is not needed.

SWITCHES				
ON	OFF	X	REPRODUCE
ON	OFF	X	SEL REPD AND GP COMP
DET	MSTR	X	CARD X PUNCHED
ON	OFF	X	MARK SENSING
ON	OFF	X	MASTER CARD PUNCHING

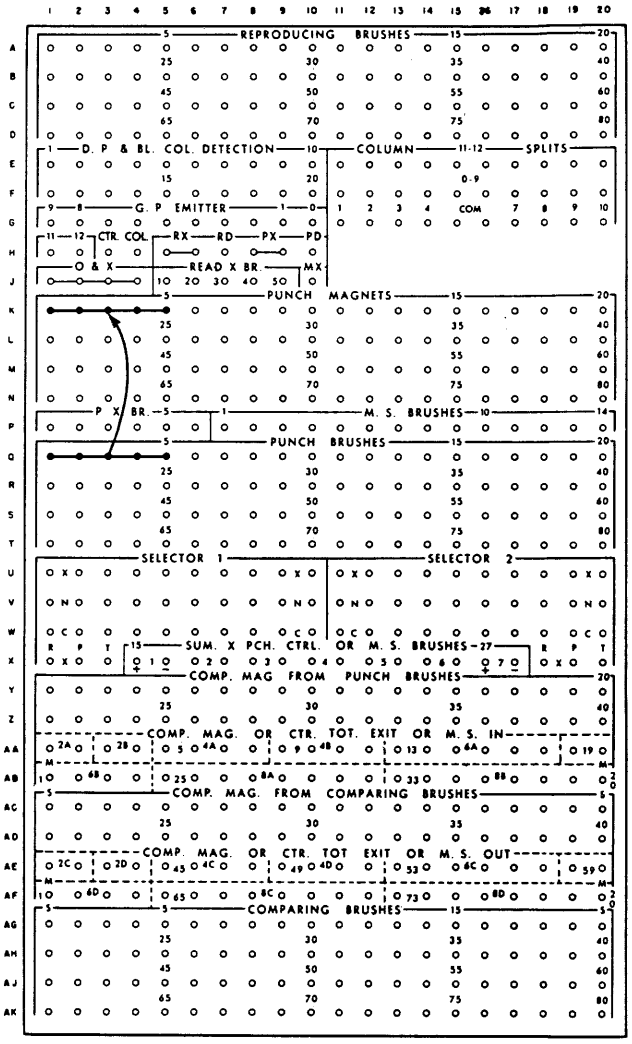


FIGURE 6. SINGLE MASTER-CARD GANGPUNCHING

Columns 1-5 into columns 1-5.

The only wiring required is from PUNCH BRUSHES to PUNCH MAGNETS (Figure 6).

The quickest method of verification for this type of gangpunching is to visually compare the master card with the last card punched.

Interspersed Master Cards — Column-for-Column Gangpunching

The master cards are inserted in front of the detail cards that are to be gangpunched. Either the master or the detail cards must have a distinguishing X-punch. In addition to the wiring from PUNCH BRUSHES to PUNCH MAGNETS, there must be a wire

from the P.X. BR. hub for the punch X-brush which is placed on the column in which the control X is punched, to the PX hub, as shown in Figure 7. This allows the master cards to pass the punch magnets without being punched with information picked up from the preceding detail card.

The punching can be verified in the reading unit by wiring the REPRODUCING BRUSHES and COMPARING BRUSHES to the comparing magnets, and the proper read X-brush to the RX hub, to prevent a comparison between the master card of one group and the last detail card of the preceding group. The verifying can begin as soon as a batch of cards has been punched, and while the remaining cards are being gangpunched.

It is often desirable to have the distinguishing X-punch in the detail cards rather than the master cards, for interspersed master-gangpunching operations.

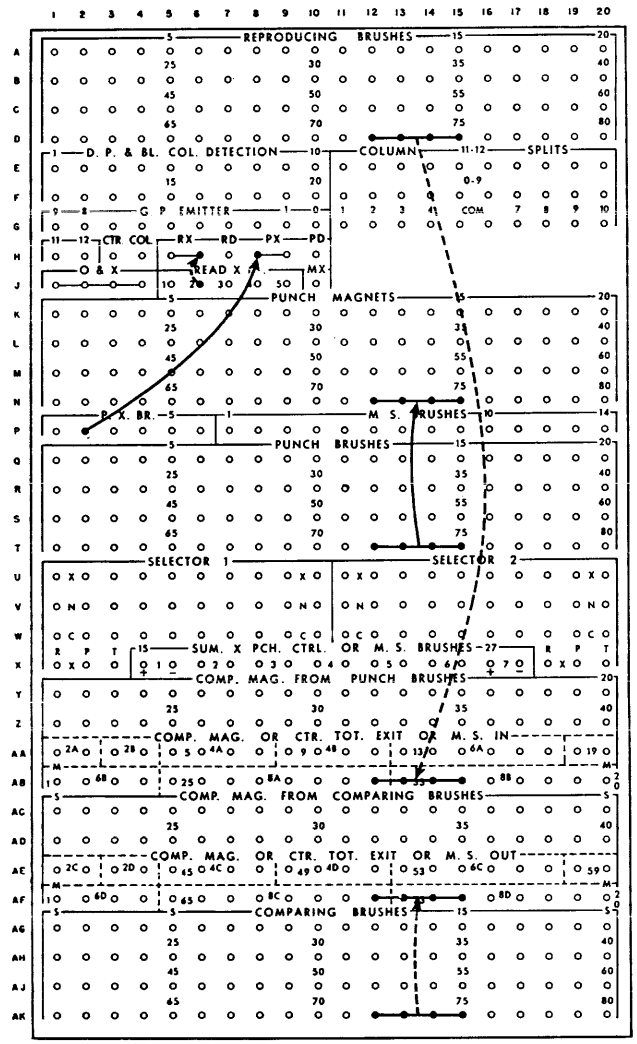


FIGURE 7. INTERSPERSED MASTER GANGPUNCHING

Columns 72-75 into columns 72-75; X column 16 in master card; 2nd PX and RX brushes are set on column 16.

If master punching is read from an NX master card and an error occurs in sensing the X-punch in the detail card, the series of cards will not be punched. If master-card punching is read from an X-punched master card and an error occurs in sensing the X-punch in the master card, master-card information will be accumulated from each X-card and punched in subsequent master and detail cards.

SWITCHES					
	ON		OFF	X	REPRODUCE
	ON	X	OFF		SEL REPD AND GP COMP
	DET		MSTR		CARD X PUNCHED
	ON		OFF	X	MARK SENSING
	ON		OFF	X	MASTER CARD PUNCHING

If verifying is being done, the selective-reproduce and gangpunch-compare switch should be ON; otherwise it should be OFF. The detail-master switch is set to whichever card is X-punched.

Testing the PX Function in Gangpunching Operations

In gangpunching operations with interspersed master cards, punching is suspended when master cards pass the punching station. This is accomplished by wiring a PX brush to the PX hub. Obviously, if a PX brush is not properly set or is wired erroneously on the control panel, punching is not suspended for master cards, thus causing *lace punching*. Normally, the erroneous punching is not detected until the cards are verified later through the reading unit.

A method of immediately detecting lace punching is illustrated in Figure 8. The RX hub is wired from the PD hub. The X-punch in the master card is wired to the comparing unit through a column split. If the PX feature functions correctly, comparing is suspended as the master card passes the punch brushes, and the operation continues without interruption. If the PX feature fails, comparing is not suspended, and the X-impulse from the master card causes the machine to stop. Cards should be removed from the hopper and those in the machine run out. If the control panel is removed before the cards in the machine are run out, one master card and only one detail card behind it need to be made over. Gangpunch comparing in the read feed is *not* possible during this operation.

The PD hub appears only on machines which have selectors.

PX brush 5 is set on column 75. If the PX feature fails, the machine stops. *The Sel Repd and GP Comp switch must be turned* ON.

1. PX brush 5 impulses PX to suspend punching when master cards pass the punching station.
2. PD to RX suspends comparing one cycle later.
3. X in column 75 of the master card is wired through a column split to a comparing position.

NOTE: This wiring may be used for either X-master or X-detail gangpunching operations. *When used with X-detail operations, remove the bar connecting the two switches and set the switch on the left to X-detail and the switch on the right to X-master.*

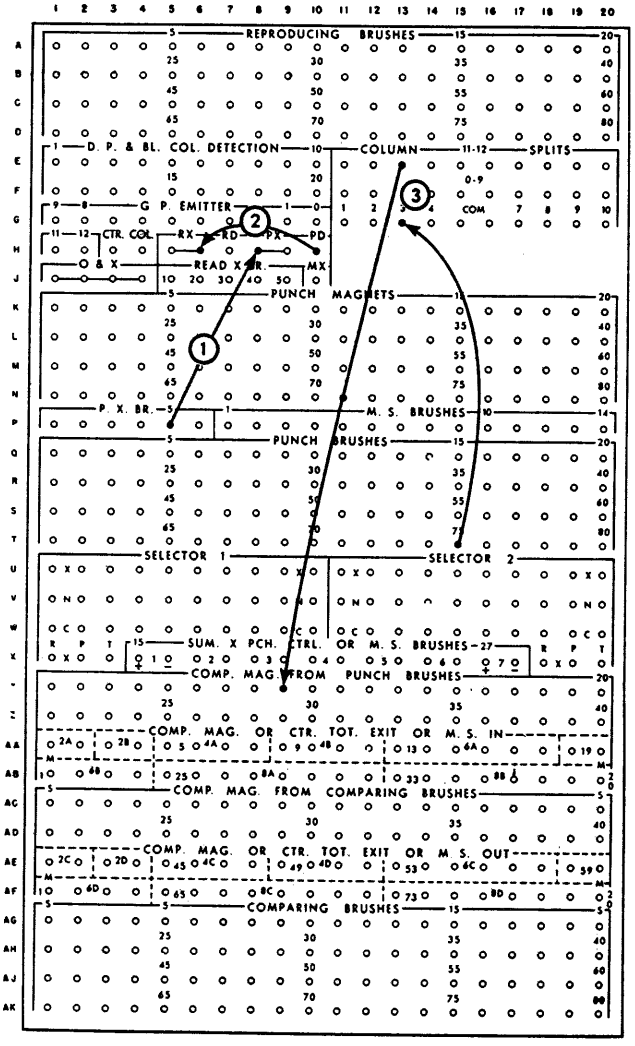


FIGURE 8. TESTING THE PX FUNCTION

Offset Gangpunching

In order to gangpunch information into columns other than those punched in the master card, a class selector must be used (Figure 9). A punch X-brush is placed in the proper column to pick up master X-punches, and the corresponding outlet hub is wired to the PX hub, to prevent master cards from being punched from the last detail card of the preceding group. With the X in master cards, the punch brushes corresponding to the columns punched in the master

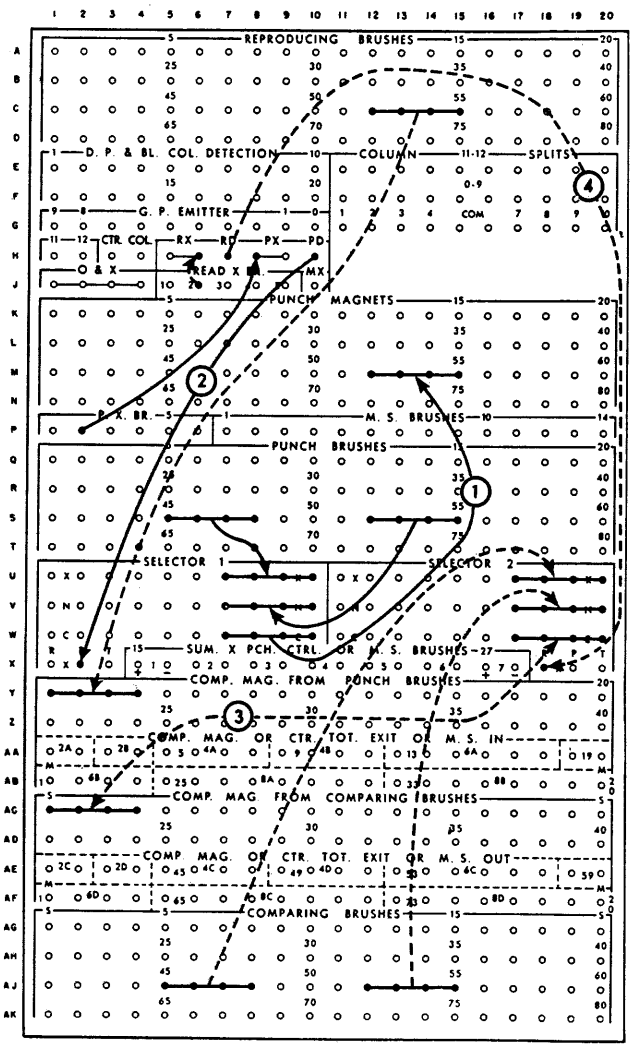


FIGURE 9. OFFSET GANGPUNCHING

1. *Detail cards are to be punched columns 52-55 from a master card punched columns 45-48.*
2. *Selector is controlled on a PD; there is a connection between C and X when the X-punched master is at the punch brushes.*
3. *The comparing brushes read columns 45-48 in the master cards and columns 52-55 on the detail cards and are connected to the comparing magnets.*
4. *Selector is controlled on an RD; there is a connection between C and X when the X-punched master is at the comparing brushes.*

cards are wired to the controlled (X) hubs of a class selector; the punch brushes corresponding to the columns to be punched in the detail cards are wired to the normal (N) hubs of the selector; and the common (C) hubs of the selector are wired to the punch magnets corresponding to the columns to be punched in the detail cards. The PD hub is wired to the pickup hub of the selector to control the selector when the X-punched master card is at the punch brushes.

Verification of offset gangpunching requires another class selector, as shown by the dotted wiring in Figure 9. A read X-brush is placed on the proper column to read the master X-punch, and the brush outlet is wired to the RX hub. The comparing brushes corresponding to the columns punched in the master card are entered in the controlled hubs of the selector; the comparing brush outlets corresponding to the columns punched in the detail cards are connected to the normal hubs; and the common hubs of the selector are wired to the comparing magnets to compare with the field punched in the detail cards, as read by the reproducing brushes. The selector is controlled by an RD impulse, and will be operative when the X-punched card is at the comparing brushes.

If the detail cards, rather than the master cards, contain the X-punch, the wiring to the selectors is reversed; that is, the columns of the master card are wired to the *normal* hubs of the selector, and the columns to be punched in the detail cards are wired to the *controlled* hubs of the selector.

SWITCHES					
	ON		OFF	X	REPRODUCE
	ON	X	OFF		SEL REPD AND GP COMP
	DET		MSTR		CARD X PUNCHED
	ON		OFF	X	MARK SENSING
	ON		OFF	X	MASTER CARD PUNCHING

If verifying is being done, the selective-reproduce and gangpunch-compare switch should be ON; otherwise, OFF. The detail-master switch is set to whichever card is X-punched.

Reproducing

IN REPRODUCING operations, the reading and punching units are synchronized. The original cards (the source cards), are placed in the reading unit. The cards to be punched (the reproduced cards), are placed in the punching unit. As each card feeds in the reading unit, a corresponding card feeds in the punching unit. As the card in the reading unit passes under the reproducing brushes, the punched information is picked up and transmitted to the punch magnets, and the corresponding card under the punch magnets at this time is punched.

Verification of the punching can be done one card cycle later, during the same operation. As the source card passes under the comparing brushes, the corresponding reproduced card passes under the punch brushes. If the punching sensed by the two sets of brushes is alike, the machine continues in operation. If there is any discrepancy, the machine automatically stops and the red signal light goes on. The cards in error are those about to enter the stackers. The cards in the feed hoppers and the correct cards already in the stackers should be removed, the signal light reset, and the machine started. The error cards can then be removed.

Straight Reproducing

The source cards are placed in the reading unit and the blank cards to be reproduced are placed in the punching unit. The REPRODUCING BRUSHES are wired to PUNCH MAGNETS (Figure 10). To verify the reproduced data, the proper columns of the source and reproduced cards are wired from COMPARING BRUSHES and PUNCH BRUSHES, respectively, to the comparing magnets.

SWITCHES					
	ON	X	OFF		REPRODUCE
	ON		OFF	X	SEL REPD AND GP COMP
	DET		MSTR	X	CARD X PUNCHED
	ON		OFF	X	MARK SENSING
	ON		OFF	X	MASTER CARD PUNCHING

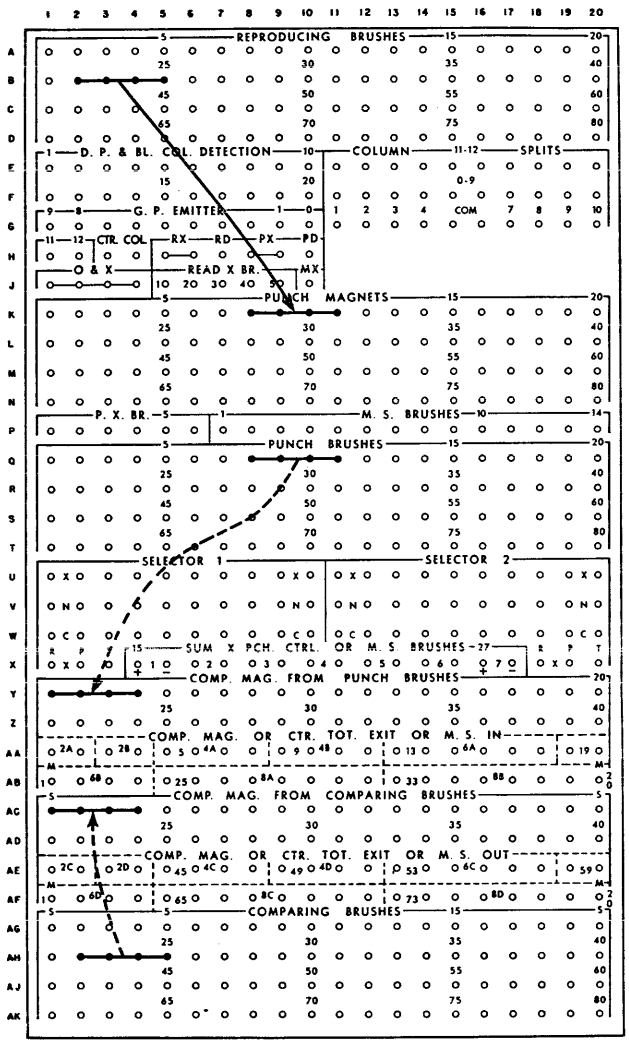


FIGURE 10. REPRODUCING
Columns 22-25 into columns 8-11.

Field Selected Reproducing

To select information from one of two punched fields in the source cards and reproduce it into a single field in the reproduced cards, a class selector must be used (Figure 11). The field to be selected from the X-punched cards is entered in the controlled x-row, the field from the NX-cards is entered in the normal N-row, and the common C-row of hubs is connected to the desired punch magnets. A read X-brush must be placed on the proper control column of the source cards, and the corresponding outlet must be connected to the RX hub. The class selector

pickup is then wired from the second RX hub, so that the selector will be controlled when the X-punched source card is at the reproducing brushes.

SWITCHES				
ON	X	OFF		REPRODUCE
ON		OFF	X	SEL REPD AND GP COMP
DET		MSTR	X	CARD X PUNCHED
ON		OFF	X	MARK SENSING
ON		OFF	X	MASTER CARD PUNCHING

If this punching is to be verified, a second selector must be used, as indicated by the dotted lines in Figure 11. The field of the X-punched card from the comparing brushes is entered in the X hubs of the selector, the NX-card field picked up by the comparing brushes is entered in the N hubs of the selector, and the C hubs of the selector are wired to the comparing magnets. The selector is impulsed from the RD hub, in order that it may be controlled when the X-punched card is at the comparing brushes.

Selective Reproducing

Selective reproducing is the operation by which only one type of card (X or NX) will be reproduced. For each source card not reproduced, there will be a blank card in the reproduced deck. As in normal reproducing, the proper reproducing brushes are connected to the punch magnets as shown in Figure 12. In addition, a read X-brush must be placed in the X-punched column, and the READ X-BR hub must be connected to the PX hub, which prevents the punch magnets from operating for the following card cycle.

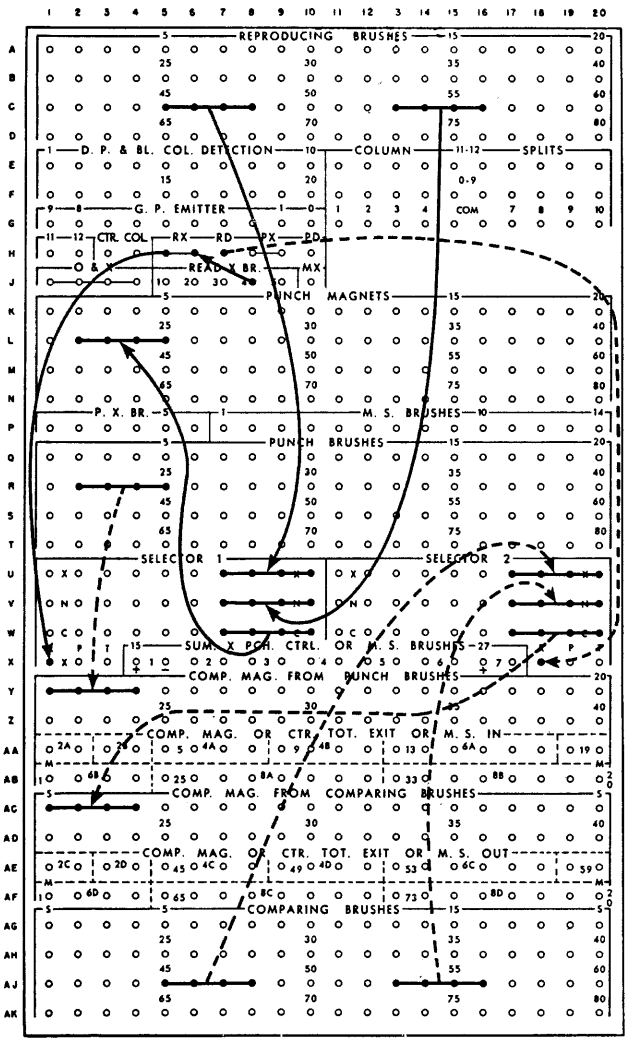


FIGURE 11. FIELD SELECTED REPRODUCING

X source cards are punched in columns 45-48; NX source cards are punched in columns 53-56; reproduced cards are to be punched in columns 22-25.

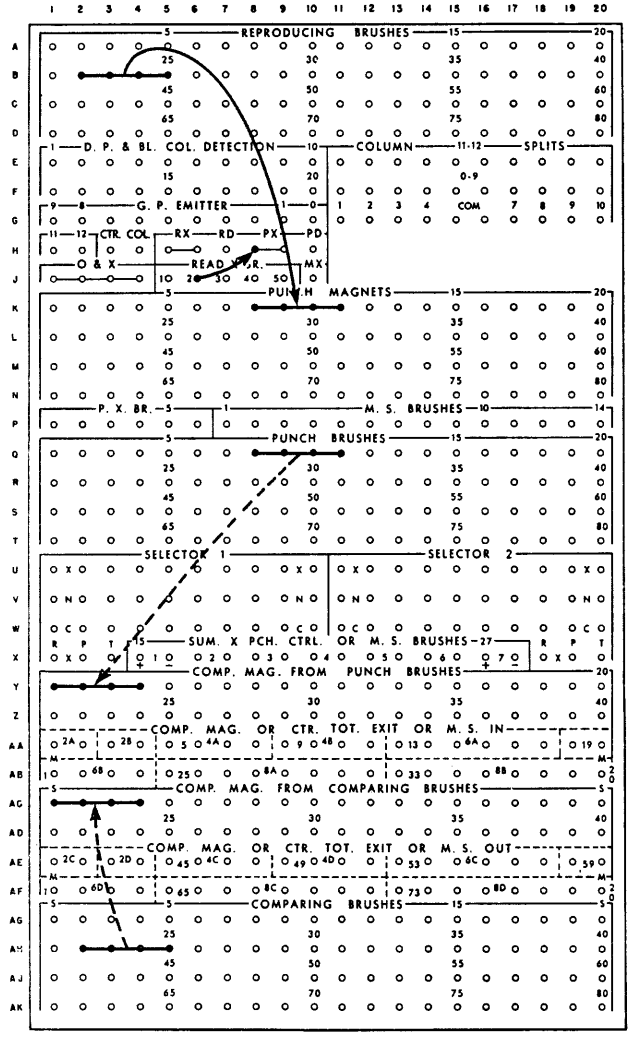


FIGURE 12. SELECTIVE REPRODUCING

Columns 22-25 into columns 8-11.

Verification of selective reproducing is the same as for straight reproducing, as shown by the dotted lines in Figure 12.

The detail or master switch should be turned to MASTER if the NX cards are to be reproduced, or to DETAIL if the X-cards are to be reproduced.

SWITCHES					
	ON	X	OFF		REPRODUCE
	ON	X	OFF		SEL REPD AND GP COMP
	DET		MSTR		CARD X PUNCHED
	ON		OFF	X	MARK SENSING
	ON		OFF	X	MASTER CARD PUNCHING

Combined Reproducing and Gangpunching

For all combined operations, the separate reading and punching units operate together as already described. If, however, the gangpunching is to be performed from a single master card, and the master card is not X-punched and wired for control to the PX hub, a blank card must precede the detail cards in the reading unit. This is necessary because the master gangpunch card must be one card cycle in advance of the first source card in the reading unit, to avoid reproducing the first source-card data into the master setup card. The reproduced data can be verified in this same operation. Control-panel wiring is shown in Figure 13.

SWITCHES					
	ON	X	OFF		REPRODUCE
	ON		OFF	X	SEL REPD AND GP COMP
	DET		MSTR		CARD X PUNCHED
	ON		OFF	X	MARK SENSING
	ON		OFF	X	MASTER CARD PUNCHING

The detail-master switch should be turned to MASTER if the master gangpunching cards are X-punched or to DETAIL if the detail cards contain the X-punch. The Sel Repd and GP Comp switch is turned OFF because the machine is not performing either of these operations.

X-Elimination or Transfer

When a brush outlet is wired to the COM hub of a column split, the 0-9 punches of that column can be wired from the 0-9 hub to a punch magnet, and the X- or 12-punch of that column can be eliminated entirely, or wired from the 11-12 hub to a different punch magnet, as shown in Figure 13. A column split must also be used to punch a single 0 or X from the 0 and X hubs.

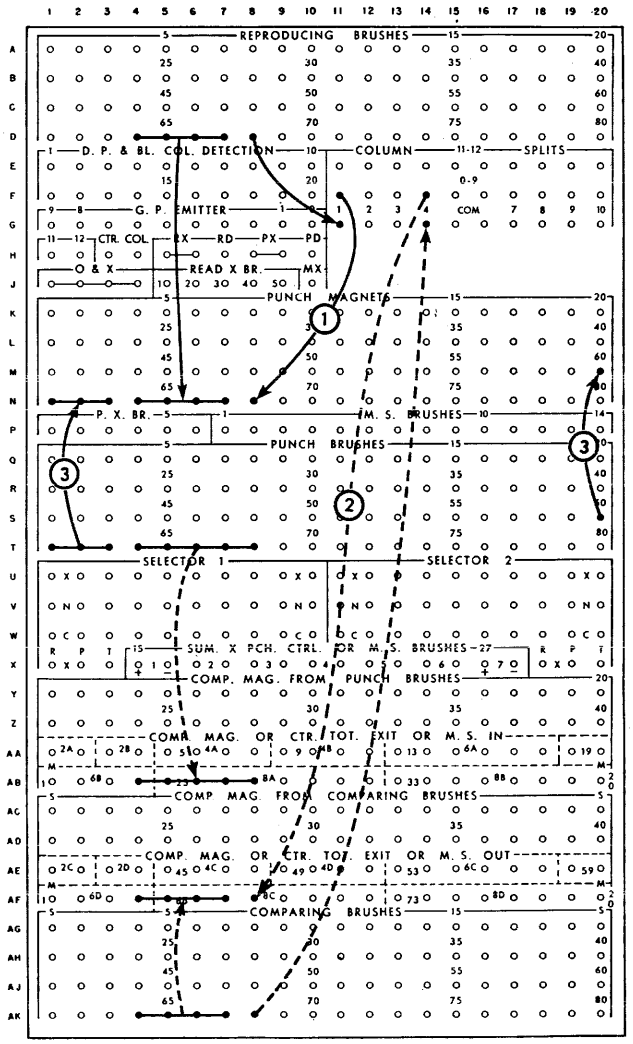


FIGURE 13. REPRODUCING WITH X-ELIMINATION AND GANGPUNCHING

1. *X-column 68 eliminated in reproducing columns 64-68.*
2. *X-column 68 eliminated in verification of columns 64-68 punching.*
3. *Gangpunching columns 60-63 into columns 60-63.*

IN SUMMARY-PUNCHING operations, the reproducing punch is connected to the accounting machine by the connector cable. The accounting machine operates as usual until a change occurs in the control for which the summary totals are to be punched. It then stops, and does not print or reset until the punching of the summary card has been completed.

The reset circuit of the accounting machine is made operative when the punching of the summary card has been completed. At this time the accounting machine prints the total, resets, and starts accumulating the next control group in the normal manner. Before any summary punching can start, a card must be fed under the punch magnets of the reproducing punch. One depression of the start key will automatically feed cards to this position.

Summary Punching with Net-Balance Alphabetic Accounting Machine

The wiring for summary punching is shown in Figure 14. The proper CTR. TOT. EXIT hubs are wired to the punch magnets. An X-punch to identify a credit (or debit) total may be obtained by wiring

SWITCHES				
ON	OFF	X	REPRODUCE
ON	OFF	X	SEL REPD AND GP COMP
DET	MSTR	X	CARD X PUNCHED
ON	OFF	X	MARK SENSING
ON	OFF	X	MASTER CARD PUNCHING

the proper summary X-punch control – or + hub to a column-split hub in the accounting machine control panel. This column-split hub is internally connected

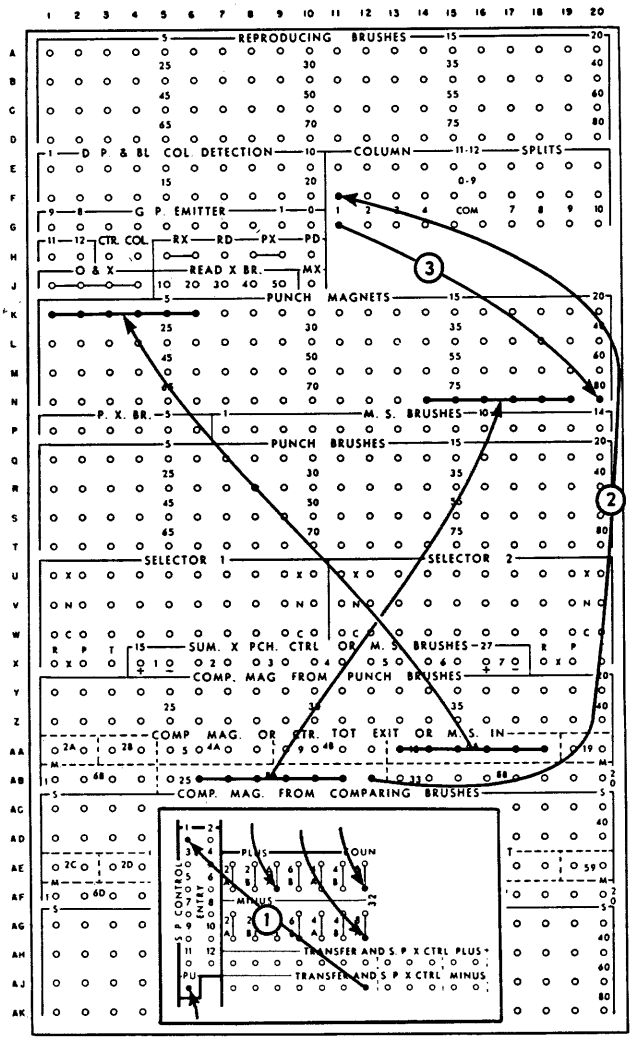


FIGURE 14. SUMMARY PUNCHING WITH 402 OR 403 ALPHABETIC NET-BALANCE ACCOUNTING MACHINE

1. *If counter 8A has gone through a conversion cycle indicating a credit balance, an X-impulse is brought to column split.*
2. *Units position of amount field is brought to same column split.*
3. *Units position of amount field is punched and if field is a credit amount, an X is also punched.*

to the corresponding column split in the reproducing-punch control panel. By wiring the COM hub of the column split to a punch magnet, an X will be punched. If a numerical punch is to be in the same column as the X, the numerical impulse must be brought to the 0-9 hub of the column split, in which case the COM hub carries both punches.

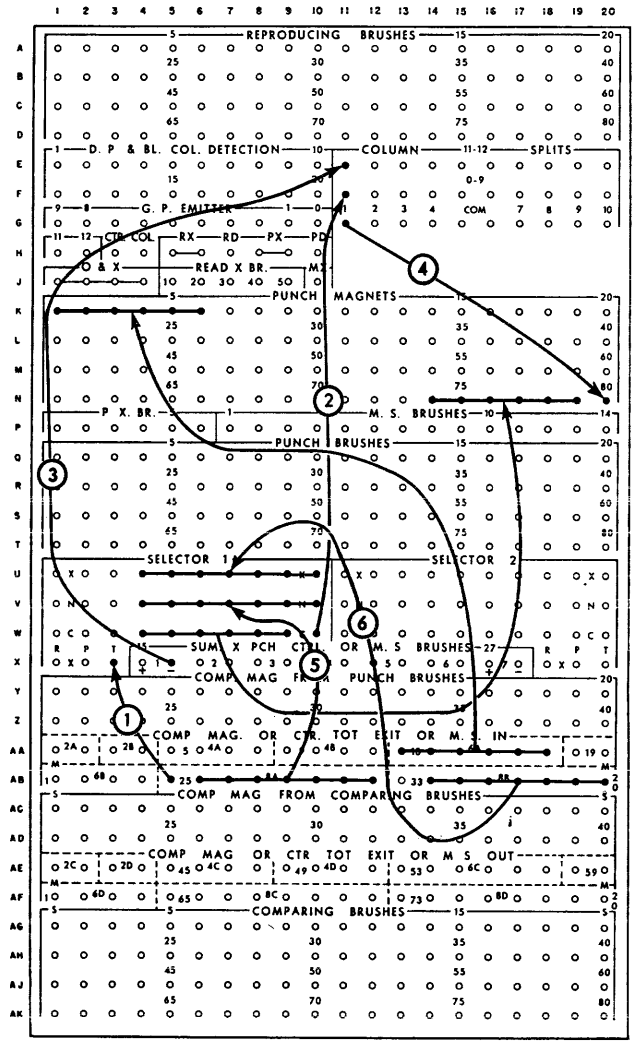


FIGURE 15. SUMMARY PUNCHING WITH ALPHABETIC NON-NET-BALANCE ACCOUNTING MACHINE

1. *Selector is controlled by complement 9 of left-hand position of normal counter.*
2. *Units position of field is brought to 0-9 of column split.*
3. *Credit X impulse corresponding to selector used is wired to same column split.*
4. *Units position of amount field is punched and if field is a zero or a credit amount, an X is also punched.*
5. *Counter normally impulsed is connected to normal hub of selector.*
6. *Counter impulsed in reversed manner is connected to controlled hubs of selector.*

Summary Punching with Non-Net-Balance Alphabetic Accounting Machine

The wiring for summary punching is shown in Figure 15. The proper CTR. TOT. EXIT hubs are wired to PUNCH MAGNETS. If balance selection has been performed in the accounting machine, it must be repeated in the reproducing punch in order to punch a true figure. The counter-total exit hubs representing the counter normally impulsed to add and subtract are wired to the N hubs of a class selector. The counter-total exit hubs for the counter that was impulsed in the reverse manner are wired to the X hubs of the selector. The C hubs of the selector are connected to the PUNCH MAGNETS. The selector is controlled by the extreme left position of the counter-total exit hubs of the normal counter. Whenever a complement occurs in this position, the selector is controlled and a true credit figure will be punched, rather than a complement.

SWITCHES				
ON		OFF	X	REPRODUCE
ON		OFF	X	SEL REPD AND GP COMP
DET		MSTR	X	CARD X PUNCHED
ON		OFF	X	MARK SENSING
ON		OFF	X	MASTER CARD PUNCHING

If an X is to identify a credit (or debit) total, the proper SUM. X PCH CTRL – or + hub to be wired to the punch magnet is determined according to the class selector used in the reproducing punch. If selector 1 is used for balance selecting, summary X-punch control 1 must be used. If the X is to be punched into the same column as a numerical punch, a column split should be used.

Combined Reproducing, Gangpunching, and Summary Punching

All three operations of reproducing, gangpunching (one master card only), and summary punching can

SWITCHES					
ON	X	OFF			REPRODUCE
ON		OFF	X		SEL REPD AND GP COMP
DET		MSTR	X		CARD X PUNCHED
ON		OFF	X		MARK SENSING
ON		OFF	X		MASTER CARD PUNCHING

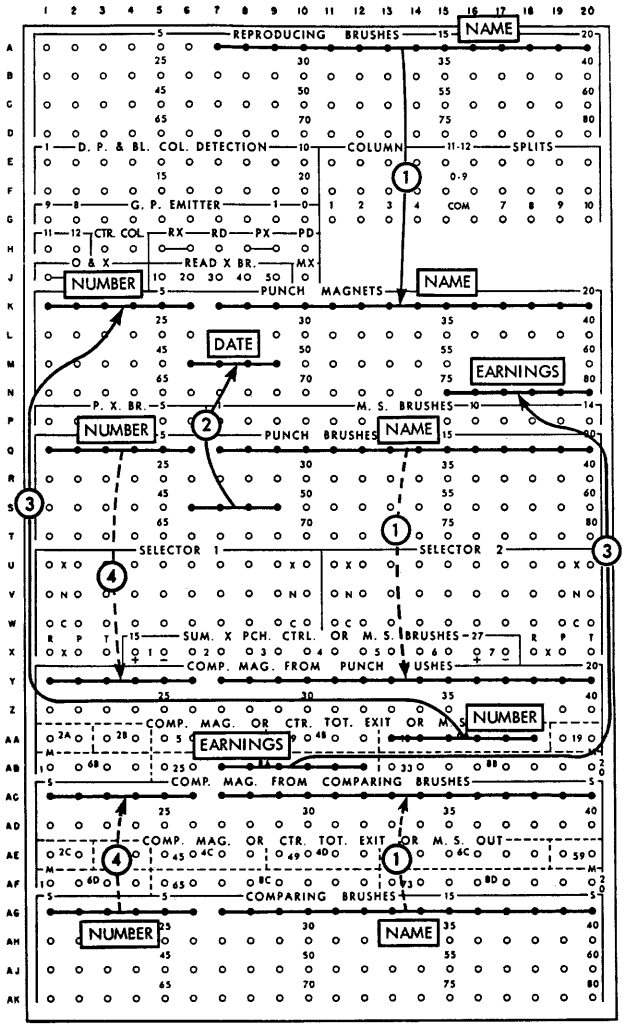


FIGURE 16. SUMMARY PUNCHING WITH REPRODUCING AND GANGPUNCHING

1. *Name is reproduced; punching is verified.*
2. *Date is gangpunched.*
3. *Earnings and Employee Number are summary punched.*
4. *Employee Number on summary card is compared with Employee Number in corresponding master source card.*

be performed at one time. The wiring for each operation is done in the normal manner (Figure 16). In this kind of combined operation, one depression of the start key will feed cards in both reading and punching units so that the cards are in proper position for the combined operation. A control to make sure that the reproduced information has been punched in the right summary card can be obtained by wiring to the comparing magnets the PUNCH BRUSHES and COMPARING BRUSHES corresponding to a control field in the summary and source cards.

A blank card must precede the detail cards in the reading unit because the master gangpunch card must be one cycle in advance of the first source card in the reading unit to avoid reproducing the first source card data into the master setup card. A comparing error between the master gangpunch card and the master name-and-address card is also prevented by inserting a blank card in the read feed.

Card Comparing and Setup Change

Card Comparing

Two sets of punched cards can be checked with each other for agreement of the data punched, and agreement in sequence. One set of cards is placed in the reading unit feed, and the other set is placed in the punching unit feed. The fields to be compared are connected from the punch brushes and comparing brushes to the comparing magnets (Figure 17). When a discrepancy is detected between any two cards, the machine stops and the signal light flashes on. The cards in error are those about to enter the stackers. The cards in the feed hoppers and the correct cards already in the stackers should be removed; the signal light should be reset; and the machine restarted.

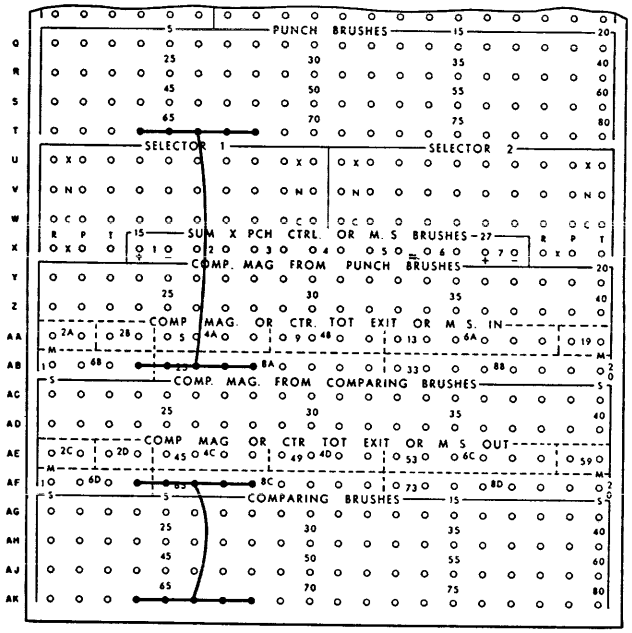


FIGURE 17. CARD COMPARING

Columns 64-68 of corresponding cards in each set are compared.

Setup Change

When a control panel is wired for two different jobs, variations in setup between one job and another are wired through selectors that are always normal for one job but always transferred for the other.

In IBM 402, 403, 407 and 408 Accounting Machines, the selectors are normally transferred by a setup change circuit that is effective when a toggle switch is turned ON. Obviously, when the switch is turned OFF, the selectors remain normal.

In the absence of a setup change switch, selectors can be transferred by an X-punched leader card preceding the file to be processed, and held transferred for the rest of the run by control-panel wiring (Figure 18).

In IBM 513 and 514 Reproducing Punches, a selector can be transferred and held transferred for the entire run by wiring shown in the diagram. When the leader card precedes the file to be processed, both R pickup of the selector and RX are impulsed as the leader card passes the read X-brush station. When RX is impulsed, RD emits on the next cycle. Because RD is connected to RX, RD will emit for every cycle, thus causing the selector to remain transferred for the entire run. When the file is not preceded by a leader card, the wiring shown is ineffective; therefore the selector remains normal.

Variations in control-panel wiring between one job and another may then be handled through the normal side of the selector when the leader card is not used and through the transferred side when the leader card is used. To drop the selector back to normal, it is necessary to turn off the main line switch, or else remove the control panel and depress the start key for one cycle.

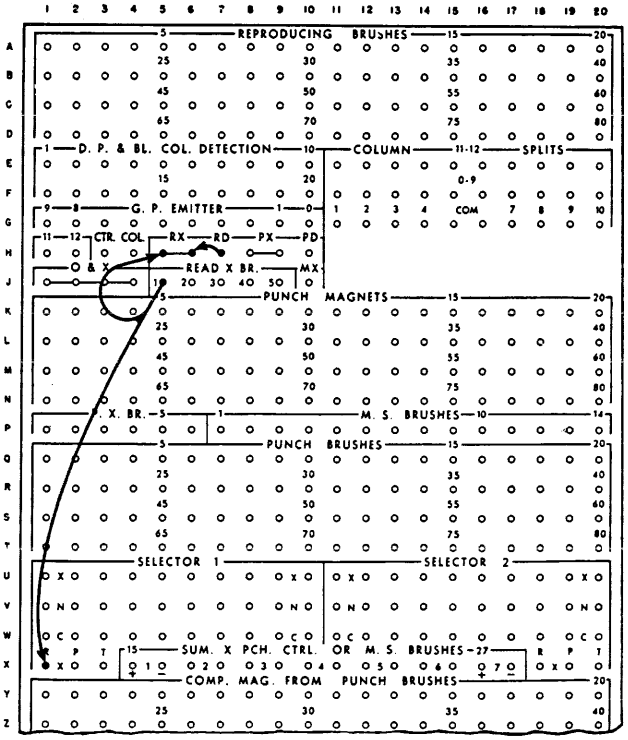


FIGURE 18. SETUP CHANGE

MARK SENSING is automatic conversion of pencil marks on a card into punched holes in the same card. To function properly, the mark must be electrically conductive. This necessitates the use of a special lead with a high graphite content.

Each face of the card has a total capacity of 27 mark-sense columns. The mark-sense field may also be used as a punch field; and the mark-sense field can be punched anywhere on the card.

Some important things to remember about mark-sensing are:

1. Marks should be made by a single, strong stroke of the pencil;
2. Marks should fill, but not extend beyond, the marking position;
3. Marks can be erased, carefully;
4. No writing should be done in a mark-sense field;
5. In general, only one mark should be made in each column, so double-punch and blank-column detection can be used for verification.

Straight Mark Sensing

Control-panel wiring for straight mark sensing is shown in Figure 19. Because marks are not sufficiently conductive to permit direct operation of the punch magnets, an amplifying unit is supplied. The mark-sensing brushes corresponding to the positions marked are wired to the M.S. IN hubs, representing the entrance to the amplifying unit, and the M.S. OUT hubs are then wired to PUNCH MAGNETS. Any number of marks can be sensed in any one column, except when using the first M.S. IN position. A 12-mark entered in this position will punch as an X and cause MX to emit an X-control impulse.

SWITCHES					
ON		OFF	X	REPRODUCE
ON		OFF	X	SEL REPD AND GP COMP
DET		MSTR	X	CARD X PUNCHED
ON	X	OFF		MARK SENSING
ON		OFF	X	MASTER CARD PUNCHING

To verify the mark-sensing operation, PUNCH BRUSHES are wired to the D.P. & BL. COL. DETECTION hubs, as shown by the dotted line in Figure 19. If a column is double-punched, the machine automatically stops and the double-punch signal light flashes on. The signal light can be turned off by pressing the error reset button. If verification for blank columns is also desired, the blank-column switches corresponding to the positions of the unit that are being used should be turned ON. Blank-column detection must be accompanied by double-punch detection.

Reproducing and Gangpunching with Mark-Sensed Master Cards

It is possible to use mark-sensed cards as master cards for gangpunching. The master cards must have a control 12-mark or an X-punch.

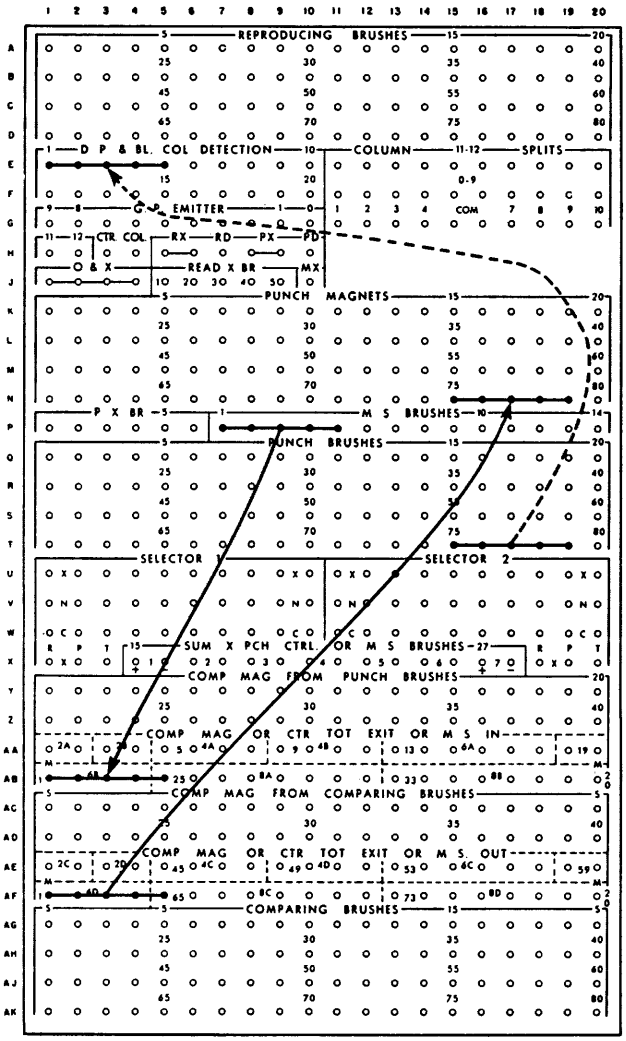


FIGURE 19. MARK SENSING

Marked columns 1-5 punched into columns 75-79.

The control-panel wiring is shown in Figure 20. The mark-sensing brush reading the 12-control-mark column is connected to the first M.S. IN position, which allows an X-impulse to be emitted from the MX hub. The mark-sensing brushes are wired to the M.S. IN hubs and the M.S. OUT hubs are wired to the controlled row of a selector. The punch brushes corresponding to the columns to be gangpunched are taken to the normal row of the selector. The common hubs of the selector are then connected to the punch magnets. The MX is used to control the selector. To punch a control X in the master cards, the first mark-sensing OUT position is connected to a punch magnet.

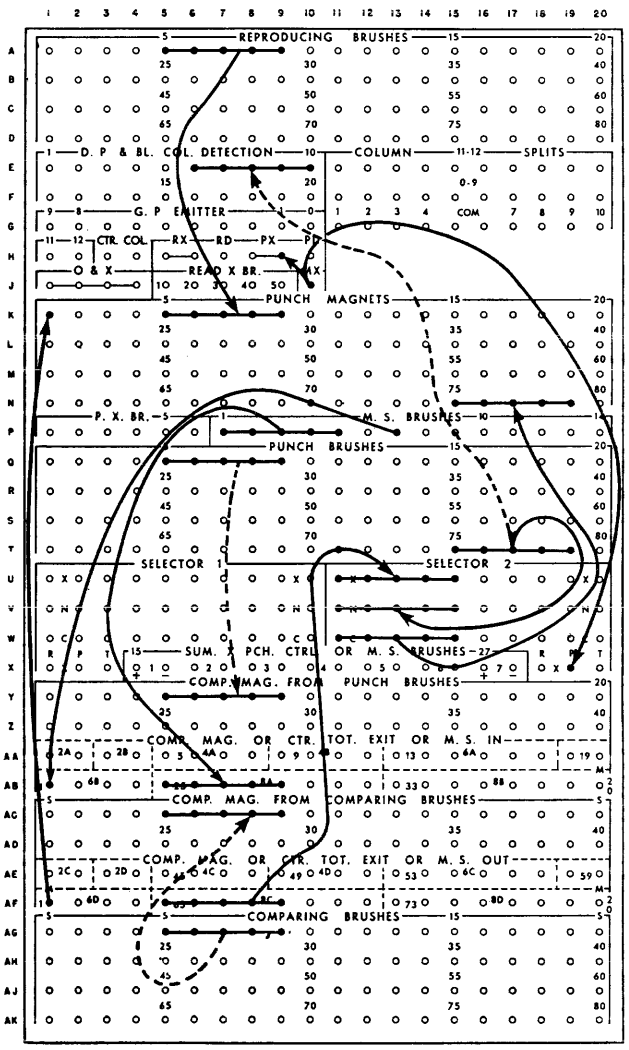


FIGURE 20. REPRODUCING AND GANGPUNCHING FROM A MARKED CARD

1. *Marked columns 1-5, on master cards with a 12-mark in column 7, are punched into the master cards, then gangpunched into detail cards (col. 75-79).*
2. *Col. 5-9 in Master cards are reproduced into col. 5-9 of detail cards and compared.*
3. *Master cards are X-punched from a 12-mark sensed on master cards.*

SWITCHES					
	ON	X	OFF		REPRODUCE
	ON		OFF	X	SEL REPD AND GP COMP
	DET		MSTR	X	CARD X PUNCHED
	ON	X	OFF		MARK SENSING
	ON	X	OFF		MASTER CARD PUNCHING

The MX hub impulses the PX hub because the control X is mark-sensed. Read feed is suspended for the cycle during which the mark-sense master card is passing the punch station. Comparing will be inoperative during the following cycle because the reproduce switch is turned ON. To allow punching mark-sensed information into master cards, the master card punching switch is turned ON.

Electronic Mark-Sense Delay Unit

Mark-sense units have a built-in delay system. In the 513 they are mechanical; in the 514, some are mechanical and some are electronic. A customer engineer can easily identify the type of system in any machine.

If the delay unit is electronic, the following precautions are necessary to prevent damage to the machine:

1. The mark-sensing switch must be OFF for any operation involving use of the comparing unit.
2. The mark-sensing switch must be OFF whenever M.S. OUT hubs are wired in the control panel and the hand crank is used (e. g., to feed a card or to move a card jam). The switch may be left ON if the control panel is removed from the machine.
3. Interspersed gangpunching using mark-sensed master cards requires wiring from an M.S. OUT and a PUNCH BRUSH (or emitter) to a PUNCH MAGNET hub. Do not split-wire read hubs to PUNCH MAGNET hubs. Always wire them through a properly controlled selector.
4. Never wire one M.S. OUT to more than one PUNCH MAGNET.

Read Feed Mark Sensing

A maximum of 26 positions of mark sensing can be installed in the read feed. If the installation is made, control-panel wiring is identical to the example shown in Figure 19. Mark-sensed cards are placed in the read feed, and cards to be punched are placed in the punch feed. The mark-sense brushes in the read feed are located between the reproducing brushes and the 5 read X-brushes (Figure 1).

Error Procedures

Comparing Error

If a comparing error is recognized by the machine:

1. the machine stops
2. the comparing light comes on
3. a comparing indicator points out the comparing position in which the error occurred.

The error card or cards can then be removed in the following manner:

1. Reset the indicator unit and turn off the comparing light by operating the restoring lever to the left of the indicator unit (Figure 2).
2. Remove cards from the feed hoppers and stackers.
3. Press the start key and empty the machine.
4. Three cards should move into the stacker from *each* feed that is being used.
5. If a gangpunching operation is being verified, the error card is the second card that moves into the reading unit stacker. It should be compared against the first card that moves into the reading unit stacker.
6. If a reproducing operation is being verified, the error card is the first card that moves into the punching unit stacker. It should be compared against the first card that moves into the reading unit stacker. (See *Comparing Magnets* and *Comparing Light.*)

Double-Punch or Blank-Column Error

(See *Blank-Column Detection Switches, Double-Punch and Blank-Column Detection Device.*)

If a double-punch or blank-column error is recognized by the machine:

1. The machine stops
2. The double-punch light comes on (Figure 5)

The error card or cards should then be removed in the following manner:

1. Reset the machine by pressing the double-punch reset key.
2. Remove cards from the feed hoppers and stackers.
3. Press the start key for one cycle *only;* until one card passes into the stacker.
4. If the double-punch unit has been wired from the punch brushes, the error card is the first card into the punching unit stacker.
5. If a gangpunch operation is being checked for double punches and blank columns, and an error is recognized by the machine:
   a. remove the control panel,
   b. the start key should be pressed for three cycles until all three cards in the punching unit have moved into the stacker,
   c. all three cards should then be checked for errors.

Special Devices

Gangpunch Emitter

The gangpunch emitter is an attachment for the reproducing punch. It provides a means of gangpunching common information without the use of prepunched master setup cards. The emitter supplies punching impulses that are identical to those obtained from punched cards passing the reproducing or punch brushes. Such impulses, when wired to the punch magnets, cause punching of predetermined data in every card. The emitter does not in any way affect the normal punching operation of the machine.

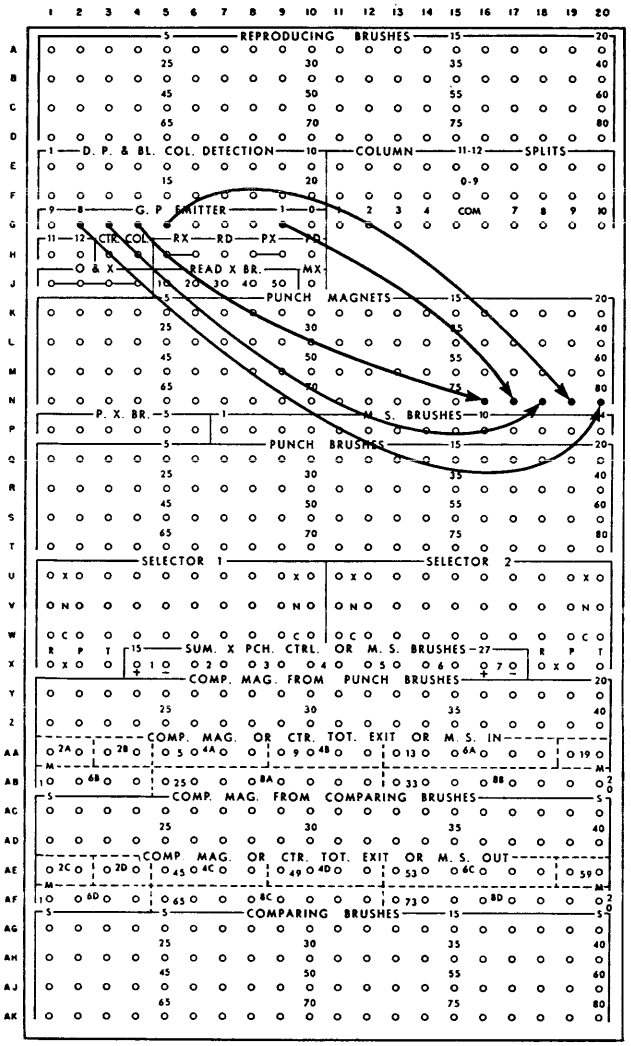


FIGURE 21. THE USE OF THE GANGPUNCH EMITTER

The date (6-17-58) is punched in col. 76-80.

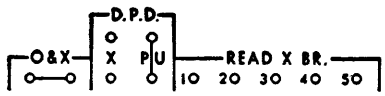
The control-panel arrangement for the emitter consists of one hub for each of the twelve punching positions of a card (Figure 21). The wiring is from the G.P. EMITTER hubs to PUNCH MAGNETS. The emitted impulses can be class- or field-selected, or wired for multiple punching. Split wires can be used from the emitter, and therefore its capacity for gangpunching is not limited.

Before a gangpunch emitter can start to operate, a card must be at the punch brushes. When the emitter is being used, therefore, a blank card should be fed ahead of the detail cards to be punched.

Double-Punch and Blank-Column Detection Device

This device is standard on a machine equipped for mark sensing, but it can be installed as a special device in other machines. For each column of mark sensing there is a corresponding D.P. & BL. COL. DETECTION hub. It can be used to verify summary punching or gangpunching operations, to determine that all columns have been punched, and that there are no double punches. Its operation and control-panel wiring are the same as shown in connection with the straight mark-sensing operation.

On all IBM 514 Reproducing Punches that are equipped with the double-punch and blank-column detection device, two special sets of hubs are provided on the control panel for X- or NX-control of double-punch and blank-column detection. The hubs are labeled D.P.D. (X and PU) and are located on the control panel as shown below:



The D.P.D. PU hubs can be impulsed from an X read by either an RX-brush or a PX-brush. When the two hubs labeled X are connected, only X-punched cards will be checked for double punches and blank columns. When the two hubs labeled X are not connected, only NX-cards will be checked for double punches and blank columns. If the D.P.D. PU hubs are

not wired from an RX or PX brush, all cards are checked for double-punch and blank-column detection. This check occurs only in those columns that are wired into the double-punch and blank-column detection unit, and for which the blank column switches are ON. (See *Blank-Column Detection Switch* and *Double Punch or Blank Column Error Procedure.*)

Offset Stacker Device

The offset stacker device is designed for use with the double-punch and blank-column detection device. It can be installed in the punch unit stacker. Without any special wiring of the control panel, an error card having either a blank or double-punched column will be offset ⅜ inch forward in the stacker. This device may be specified as standard for any machine equipped with the mark-sensing feature. An offset stacker switch is provided on the switch panel with this device.

If continuous machine operation is desired, the offset stacker switch should be turned to OFFSET. If the operator wants the machine to stop whenever an error card is detected, the switch should be turned to OFFSET STOP. In either case, the error card will be offset in the stacker.

Consecutive-Number Gangpunching and Checking Device

A consecutive-numbering and gangpunching device is available for factory or field installation in the 514, and for field installation only in the 513 Reproducing Punch.

The device can be used to punch consecutive numbers, one to five digits in length, into individual cards or groups of cards. The gangpunch master card must be prepunched in as many columns as will be required for the highest number in the field. For instance, if a field has a consecutive range of 1 to 6000, the master card must be punched 0001.

Cards may be punched by any one of three options:

Option 1: Punch consecutive numbers starting from any desired number in a single master card. Each card following the master card is numbered consecutively up to 99,999. The master card must not have a *9* punched in the units position.

Example: Master 00001
1st Detail 00002
2nd Detail 00003

Option 2: Gangpunch a starting number from a master card into the first detail card of a group and punch consecutive numbers in all subsequent detail cards in that group. Master cards may contain a *9* in the units position.

Example: Master 00001
1st Detail 00001
2nd Detail 00002

Option 3: Gangpunch the same number from a master card into all subsequent cards in a group; the number can be raised under control of an X- or NX-detail card. When a new master card is read, a new starting number is punched. By pre-arranging cards into sets, cards can be numbered and punched in duplicate and triplicate, etc. Master cards may contain a *9* in the units position.

Raise on X-Detail	*Raise on NX-Detail*
Master 00001	Master 00001
NX-Detail 00001	NX-Detail 00001
NX-Detail 00001	NX-Detail 00002
X-Detail 00002	X-Detail 00002
NX-Detail 00002	NX-Detail 00003
*Master 00100	Master 00100

Comparing must be done in a separate operation. It cannot be done simultaneously with punching.

Figure 22 illustrates the wiring for punching and comparing the three options. Wires numbered 1 are necessary for options 1, 2, and 3. Wires numbered 2 are necessary for options 2 and 3. Wires numbered 3 are necessary for option 3. Wiring for comparing is shown in broken lines.

Special hubs for the device and their normal locations are:

To Punch Brushes (H-11-15): Five hubs wired from the punch brushes. They are lettered TT (ten thousand); TH (thousand); H (hundred); T (tens); and U (units). The full field must be wired.

To Punch Magnets (J-11-15): Five hubs wired to the punch magnets. They are labeled the same as the TO PUNCH BRUSHES hubs.

ST-X (H-16): Start X-hub, usually wired to a PX or RX brush to initiate numbering or comparing of a new group in option 2 or 3.

RA-X (J-16): Raise X-hub, usually wired from a PX or RX brush to raise the number being punched or compared in option 3.

Two Switches: A start switch and a raise switch, each with an X- or NX-setting, are provided on the switch panel.

Wiring for the Three Options (Figure 22)

OPTION 1

Consecutive numbers with a single master card.

	Switch Settings *Punching*	*Comparing*
Reproduce	OFF	OFF
Sel. Repd. G. P. Comp.	OFF	ON
Mark Sensing	OFF	OFF
Master-Card Punching	OFF	OFF
X-Master X-Detail	X-Master	X-Master
Start Switch	X	X
Raise Switch	NX	NX

Wiring for Punching: The first card must be a master card. The starting number is prepunched in the master card columns 1 to 5. This number will be raised one for each subsequent card and punched in columns 1 to 5.

The number is read into the punch device from the master card at the punch brushes. Because the start X-switch is set to X and the raise X-switch is set to NX, and their respective hubs are not wired, the number will advance one, and punch into the first detail card (wire from TO PUNCH MAGNETS to the PUNCH MAGNETS). This operation will be repeated for each subsequent card.

Wiring for Comparing: Comparing is done in a separate operation. All the switch settings are the same except the selective-reproduce and gangpunch-compare switch is wired on.

The number punched is read from the master card into the punch device from the comparing brushes; it is raised one and then wired out to the comparing magnets, and compared with the following detail card (wire from REPRODUCING BRUSHES to COMP. MAG. FROM PUNCH BRUSHES). This operation is repeated for each subsequent card.

OPTION 2

Gangpunch a starting number from a master card into the first detail, and punch consecutive numbers in all detail cards in the group.

	Switch Settings *Punching*	*Comparing*
Reproduce	OFF	OFF
Sel. Rep. G. P. Comp.	OFF	ON
Mark Sensing	OFF	OFF
Master-Card Punching	OFF	OFF
X-Master X-Detail	X-Master or Detail	X-Master or Detail
Start Switch	X or NX	X or NX
Raise Switch	NX	NX

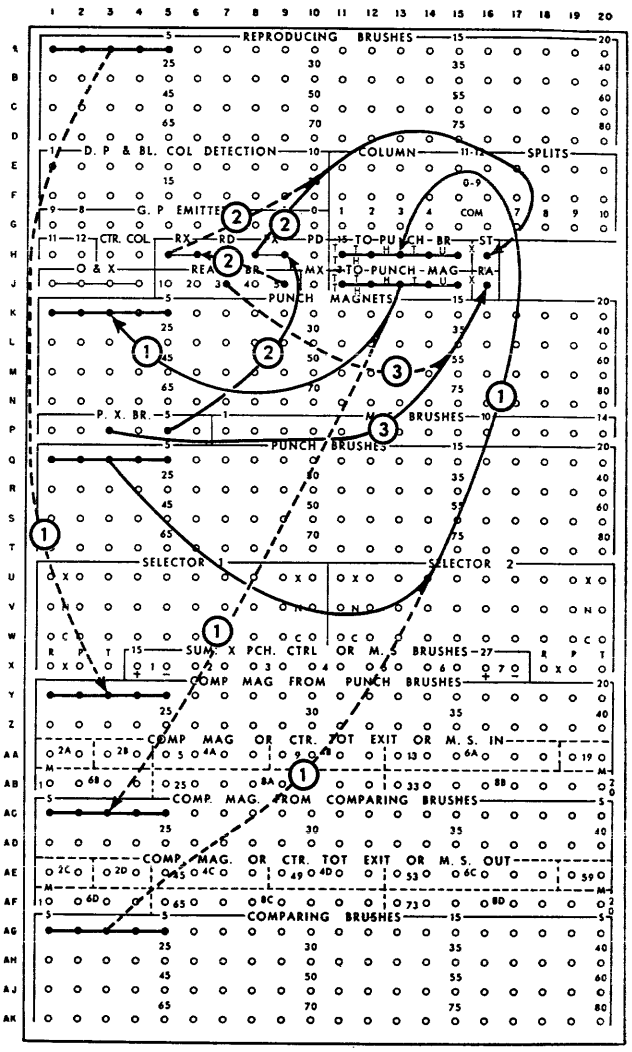


FIGURE 22. CONSECUTIVE-NUMBER GANGPUNCHING AND CHECKING DEVICE

Wiring for Punching: Assume the first card will be a prepunched X-master card. The master card is gangpunched into the first detail card, and subsequent detail cards are read and punched as in option 1. When the PX hub is impulsed from PX brush 5 by a new pre-punched X-master card, punching is suspended. By wiring from the PX brush to the X-ST hub, a new consecutive number series is started for the new set of detail cards and continues until another master card is read.

The raise switch must be set on NX. The X-RA hub must not be wired. The start X-switch and master-detail switch must agree depending on whether master or detail cards are X-punched.

Wiring for Comparing: Comparing is done in a separate operation. The switch settings are the same as those for punching except the selective-reproduce and gangpunch-compare switch must be ON.

Comparing is the same as in Option 1 except for the additional wiring from RX brush 5 to the RX hub, which suspends comparing between the last detail card of one group and the new master card of the next. Wiring from RX brush 5 to X-ST hub begins a new consecutive-number series for comparing when a new master card is read at the read X-brushes.

OPTION 3

Gangpunch the same number from a master card into subsequent detail cards until the number is raised under the control of an X or NX detail card.

	Switch Settings	
	Punching	*Comparing*
Reproduce	OFF	OFF
Sel. Rep. G. P. Comp.	OFF	ON
Mark Sensing	OFF	OFF
Master-Card Punching	OFF	OFF
X-Master X-Detail	X-Master or Detail	X-Master or Detail
Start Switch	X or NX	X or NX
Raise Switch	X or NX, whichever is the first detail card of the group being raised.	

Wiring for Punching: Assume that master cards and raise-detail cards are both X-punched. Wiring from PX brush 5 to the PX hub and to X-ST suspends punching on each master card and commences punching on subsequent detail cards. Wiring from PX brush 3 to the X-RA hub raises the number one, and punches the *same* number in the first card and all subsequent cards of the numbering group until a new raise detail card is read by PX brush 3.

Start X-switch and master-detail switch must agree, depending on whether master or detail cards are X-punched. The raise card is always a detail card. It can be either X or NX and the raise switch must be set accordingly.

Wiring for Comparing: Comparing is done in a separate operation. Switch settings are the same as for punching, except that the selective-reproduce and gangpunch-compare switch must be on. Wiring from RX brush 3 to the X-RA hub performs the same function in comparing as wiring from PX brush 3 to the X-RA hub did in punching. Otherwise the wiring is the same as for Options 1 and 2.

The control-panel location of the hubs for the consecutive number gangpunching and checking device may vary depending upon the location of other special features that are installed on the machine.

513, 514 Timing Chart

THE 513-514 TIMING CHART is shown in digit time and covers 360 degrees of the machine cycle. The times when exit hubs emit impulses and entry hubs receive impulses are illustrated in the chart.

The references in the *Location* columns show the location of the hubs on the control panel (Figure 4). The references in the *Notes* column of the chart refer to information listed below.

The timing applies to all 513 and 514 machines that are internally wired to wiring diagram number 223601T.

Notes on Timing Chart

1. D—the time at which the clutch latches and the machine cycle begins.

2. The 11-12 hub of column splits emits an X during summary-punch cycles for credit-X punching from 11 to 11.3 time.

3. Hubs are used as counter total exits only during summary punching.

4. MX emits only during mark-sense operations when a 12-mark is read by an MS brush connected to the first mark-sense IN position.

5. The control factor for these exits and entries is an X-type impulse which occurs *before* 12, 11, or digit time.

6. Emits one machine cycle after PX is impulsed.

7. When this hub is impulsed:

   a. Punch magnets are inoperative for one cycle;

   b. Feeding in the reading unit is stopped for one cycle if the selective reproduce and gang-punch compare switch is off;

   c. The PD hub emits one cycle later;

   d. Comparing will be inoperative one cycle later if the reproduce switch is on.

8. Emits one machine cycle after RX is impulsed.

9. When this hub is impulsed:

   a. The comparing unit is inoperative for one cycle if the reproduce switch is off.

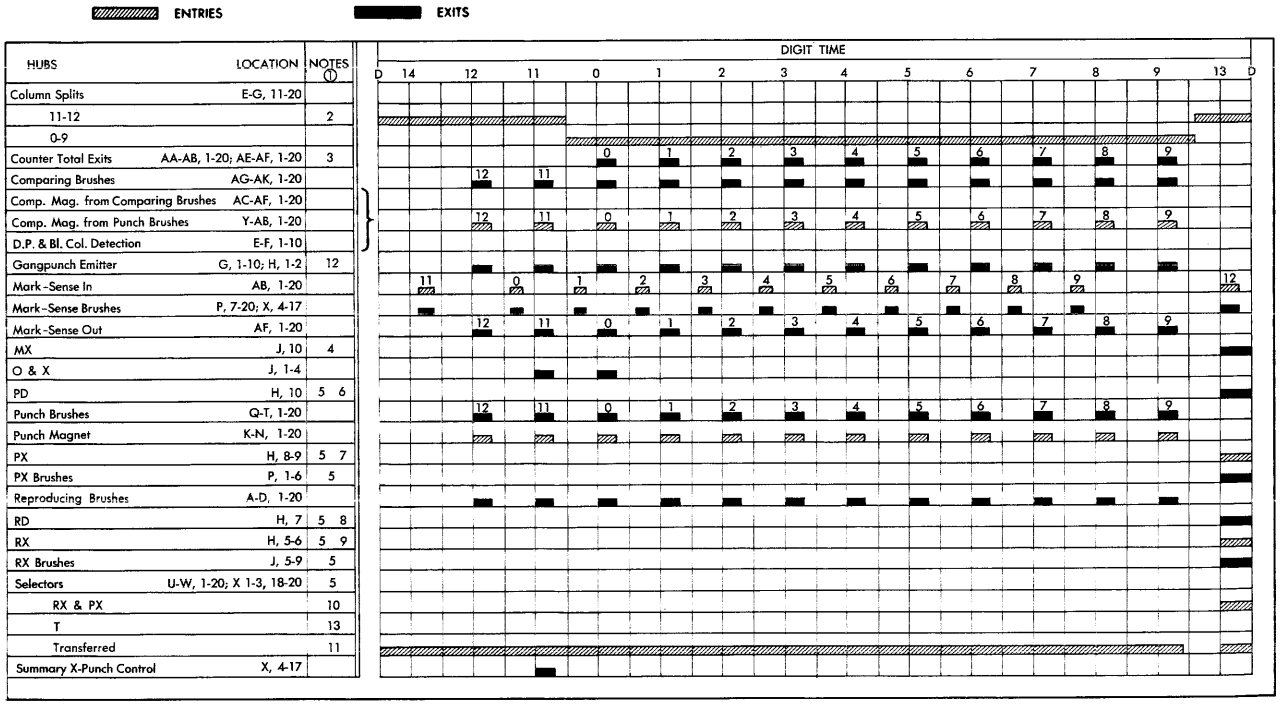
   b. RD emits one cycle later.

10. Selectors transfer immediately for the entire cycle when impulsed at RX or PX.

11. Selectors are transferred by an X-type impulse at *13 time*. They are transferred immediately for the entire cycle.

12. Emits on each machine cycle when a card is at the punch brushes.

13. *T-pickup* is used for selection during summary-punch time; the impulse used to pick up the selector comes from the accounting machine before the punch starts its summary cycle.



HUBS	LOCATION	NOTES ①
Column Splits	E-G, 11-20	
11-12		2
0-9		
Counter Total Exits	AA-AB, 1-20; AE-AF, 1-20	3
Comparing Brushes	AG-AK, 1-20	
Comp. Mag. from Comparing Brushes	AC-AF, 1-20	
Comp. Mag. from Punch Brushes	Y-AB, 1-20	
D.P. & Bl. Col. Detection	E-F, 1-10	
Gangpunch Emitter	G, 1-10; H, 1-2	12
Mark-Sense In	AB, 1-20	
Mark-Sense Brushes	P, 7-20; X, 4-17	
Mark-Sense Out	AF, 1-20	
MX	J, 10	4
O & X	J, 1-4	
PD	H, 10	5 6
Punch Brushes	Q-T, 1-20	
Punch Magnet	K-N, 1-20	
PX	H, 8-9	5 7
PX Brushes	P, 1-6	5
Reproducing Brushes	A-D, 1-20	
RD	H, 7	5 8
RX	H, 5-6	5 9
RX Brushes	J, 5-9	5
Selectors	U-W, 1-20; X 1-3, 18-20	5
RX & PX		10
T		13
Transferred		11
Summary X-Punch Control	X, 4-17	

FIGURE 23. 513, 514 TIMING CHART

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