IBM

Reference Manual

88 Collator

IBM Reference Manual

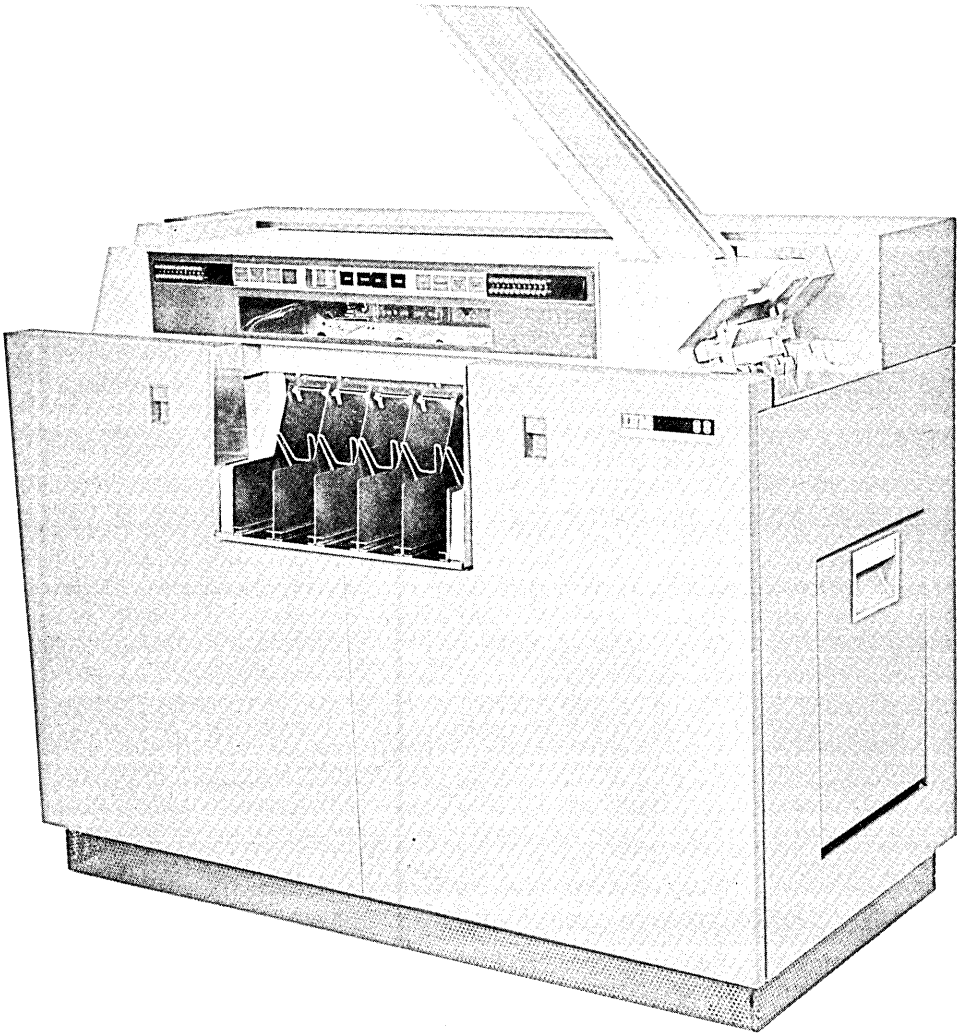
88 Collator

MAJOR REVISION (November, 1960)

This edition, A24-1013-2, obsoletes the Machine Bulletin *Interchangeable 51-Column Feed* (G24-1026). Significant changes and additions in this revision are:

PAGE	SUBJECT
13	Secondary collating sequence
30	Sequence Checking — Selecting All Low Cards (Both Feeds)
31	Conditions controlling card feeding for matching
40	Sequence Checking — Up to 66 Columns
50	Merging, Selecting Low-Primary-Sequence Cards
51	Merging Primary Cards behind Secondary Cards (with Selection)
52	Merging One Secondary behind Two Primary Cards
53	Merging Master and Trailer Cards with Transaction Cards
56	Rapid Merging with Selection
61	Double-Punch and Blank-Column Detection (Digits 9-12)
73	Merging by Major and Minor Control; Selecting Unmatched Majors
87, 94	Interchangeable 51-Column Secondary Feed
94	ALPHA CONTROL

Contents



IBM 88 Collator

IBM 88 Collator

The IBM 88 Collator is a high-speed filing machine that arranges cards in the pattern desired for subsequent operations. After the cards are arranged, they are either processed through another machine (such as an accounting machine to prepare a printed report), or they are filed for future reference.

The principal function of the collator is to feed and compare two files of punched cards simultaneously in order to match them, or to combine them into one file. At the same time, cards in each file that do not match those in the other, or cards that correspond to a predetermined pattern, can be separated automatically from the rest of the file. Concurrent with other operations, each file can be checked for proper sequence and punching.

Two hoppers and two feed units are provided to accommodate the two files of cards, and five pockets are provided to stack the cards in the desired groupings. When cards are fed from the hoppers, the numerical punching in them is compared. This comparison controls card feeding and stacking according to conditions set up on the control panel.

Each feed operates at 650 cards per minute. With both feeds in use, up to 1300 cards per minute (78,000 cards per hour) can be collated. The rate depends on the operation performed, and varies from a minimum of 650 to a maximum of 1300 cards per minute.

The IBM 88 Collator is available in three models of different control-unit capacity:

Model 1 — 22 positions
Model 2 — 16 positions
Model 3 — 10 positions

Functions

The functions of the IBM 88 Collator fall into five general classifications:

Card Selecting. A particular card can be selected from a file of cards. The type of card to be selected may be an X-card, an NX-card, the first card of a group, the last card of a group, a single-card group, a zero-balance card, a card with a particular number, a card out of sequence, or any other card conforming to a pattern set up by control-panel wiring.

Sequence Checking. The collator checks a file of cards to determine whether or not they are in order. As the file passes through the machine, each card is compared with the one ahead; and, if it is out of numerical sequence, card feeding can be stopped.

Merging. The collator combines two files of cards (already in sequence) into a single file. The cards in one file are compared with those in the other, to determine which card should precede the other into the merge pocket. Card feeding from the two files is thereby controlled so that the combined file is in numerical sequence.

Matching. The collator compares two files of cards to determine that there is a card or group of cards in one file to match each card or group of cards in the other file. Unmatched cards in either or both files are selected. When the operation is completed, there may be four groups of cards: two groups that match, and two groups of unmatched selected cards.

Editing. Cards in both feeds can be checked for accuracy of numerical punching. Whenever a double punch or blank column is detected, card feeding can be stopped.

Machine Features

Machine Controls (Figure 1)

Master Switch

The master switch controls the power to the machine and must be ON before the machine can operate. (A machine having a serial number below 15,000 requires a warm-up period of approximately one-half minute.) The green ready light indicates the machine is ready to operate.

This switch should not be turned OFF while cards are being fed. Press the stop key first.

Turning off the master switch resets all error circuits and restores all control units.

Start Key

Pressing the start key starts card feeding. When the primary hopper is empty, a 3-second delay occurs to allow the hopper to fill from the file feed. This delay is in effect whenever cards are removed from the primary hopper. The start key need not be held for automatic card feeding to occur.

No card feeding occurs when:

1. both hoppers are empty
2. one hopper has just emptied
3. a red signal light is ON.

The start key cannot be used to run cards out of the machine.

Stop Key

Pressing the stop key stops all card feeding before the next card is fed. Three cards remain in the machine in their relative position in any feed used (Figure 2). This key is raised for easy identification.

Runout Key

When the last card is fed from either hopper, card feeding stops with three cards still in the feed. If these cards are to be run out, the runout key must be pressed until the feed with the empty hopper takes one cycle. Normal comparing and functional operations occur. The opposite feed then continues feeding cards automatically until that hopper is empty. The runout key must be pressed again, and held until the cards in this feed run out.

The runout key is also used whenever card feeding stops with a check light or control stop light. Cards must be removed from the corresponding hopper before that feed can be run out.

Reset Key

The reset key is used to reset the error circuits and to turn off any error, check, or stop light. Pressing the reset key permits card feeding to begin under control of the start key.

If a visual check is to be made of an error condition in the cards, or if a check light is ON, the cards should be run out before pressing the reset key.

Indicating Lights (Figure 1)

Ready Light

The ready light indicates the machine is ready to feed cards. The green light is not lit while cards are being fed, but goes on whenever card feeding stops because of an empty hopper.

The machine cannot start unless the ready light is ON. Pressing the start key extinguishes this light.

The ready light does not come ON if:

1. the joggler is open
2. a stacker is full
3. the top cover is open
4. the transport light is ON
5. a main-line fuse is burned out.

Fuse Light

The fuse light glows to indicate card feeding has stopped because an indicating fuse has burned out.

Transport Light

The transport light glows to indicate card feeding has stopped because of a card jam in the continuously-running rollers of the card transport area over the stackers. Pushing back the cover between the hoppers

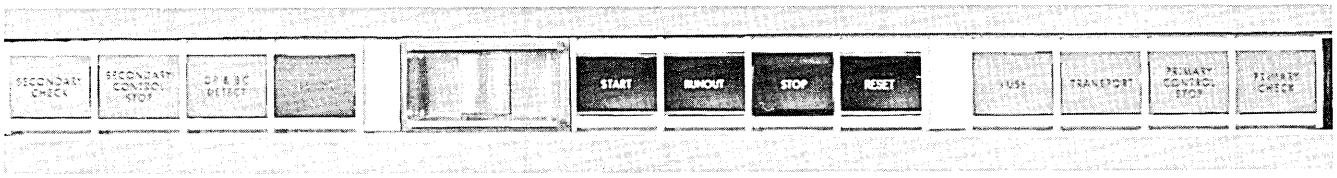


Figure 1. Machine Controls

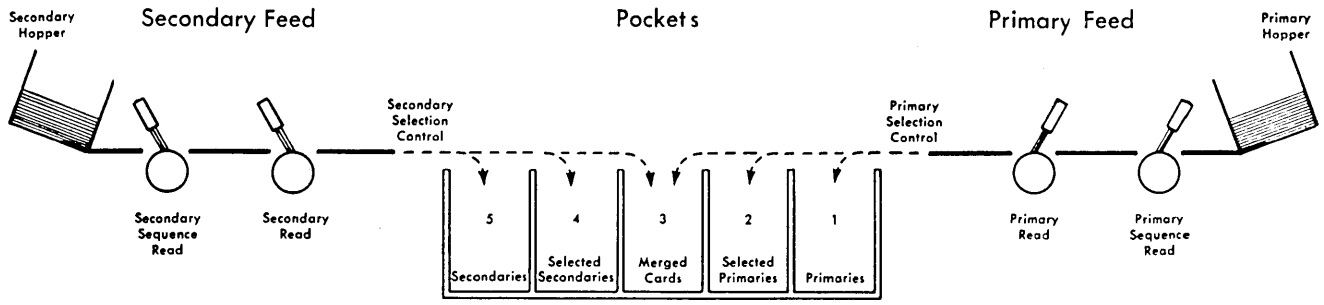


Figure 2. Card-Feed Schematic

permits access to the card transport area. (All comparing is lost when this cover is opened.) Card jams should be removed with care not to damage the chute blades and deflectors.

When the transport light goes out, pressing the start key restarts card feeding.

Primary Check Light

The primary check light glows and card feeding stops for a card-feed failure in the primary feed, such as:

1. failure to feed from the hopper
2. failure to feed from a reading station
3. card jam at a reading station
4. clutch malfunction.

This light also turns ON, together with the DP&BC DETECT light, to indicate a double-punch or blank-column error detected in the primary feed.

The reset key extinguishes this light and permits card feeding to be restarted. Cards should be run out before pressing the reset key.

Primary Control Stop Light

Card feeding stops and the primary control stop light turns ON whenever an error condition in the primary is recognized by a basic-setup configuration (sequence error – low primary sequence) or by control-panel wiring (an open circuit to the primary SEQ ON or OFF switch).

If an error occurs in the comparing circuitry, this signal light turns ON, together with the secondary control stop light, and card feeding stops. This check circuit assures valid comparing – one and only one result for each comparison: low, equal, or high.

Pressing the reset key turns out this light and permits card feeding to be restarted.

To check the cards visually, remove cards from the primary hopper, and press the runout key to run out the cards into pocket 1. Correct the error, press the reset key, and rerun the cards. (If no error has been found, and rerunning the cards results in a recurring control stop signal, this indicates a control-panel error or a machine failure.)

Secondary Check Light

The secondary check light turns ON and card feeding stops for one of these card-feed failures in the secondary feed:

1. failure to feed from the hopper
2. failure to feed from a reading station
3. card jam at a reading station
4. clutch malfunction.

This light also turns ON, together with the DP&BC DETECT light, to indicate a double-punch or blank-column error detected in the secondary feed.

The reset key extinguishes this light and permits card feeding to be restarted. Cards should be run out before pressing the reset key.

Secondary Control Stop Light

Card feeding stops and the secondary control stop light glows whenever an error condition in the secondary is recognized by a basic-setup configuration (sequence error – low secondary sequence) or by control-panel wiring (an open circuit to the secondary SEQ ON or OFF switch).

If an error occurs in the comparing circuitry, this signal light turns ON, together with the primary control stop light, and card feeding stops. This check circuit assures valid comparing – one and only one result for each comparison: low, equal, or high.

Pressing the reset key turns out this light and permits card feeding to be restarted.

To check the cards visually, remove the cards from the secondary hopper and press the runout key to run out the cards into pocket 5. Correct the error, press the reset key, and rerun the cards. (If no error has been found, and rerunning the cards results in a recurring control stop signal, this indicates a control-panel error or a machine failure.)

DP&BC Detect Light

Card feeding stops and the DP&BC DETECT light turns ON when a double punch or blank column is recognized in the positions wired for detection. Because the

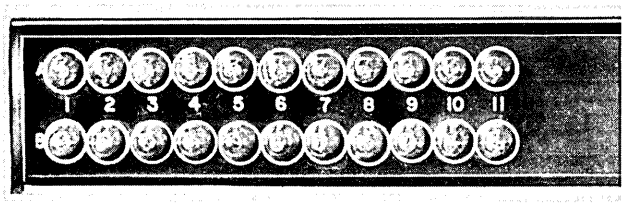


Figure 3. Indicator Lights

comparing unit does not recognize X and 12 punches, only the digit (0-9) portion of a column is checked.

The feed containing the error card is indicated by either the primary or secondary check light. Pressing the reset key extinguishes the signal lights and permits card feeding to be restarted.

The comparing position in which the blank column is detected is indicated by the continuous glow of a lamp in the blank-position indicating panel. A double punch causes only a flash on the lamp panel as the second punch is detected.

With the corresponding DPBC switch wired, the machine detects double punches automatically for all positions wired to the comparing unit. Control punches (X's or 12's) over a column are not recognized as double-punch errors.

The switch corresponding to each position to be checked for blank columns must be wired on the control panel.

Blank-Position Indicating Lights

A bank of small lamps (Figure 3) is associated with each feed. A lamp (labeled A or B, 1-11) glows steadily to indicate the COMPARING AND DPBC ENTRY position in which a blank column has been detected. To be operative, a switch for each position on the control panel must be wired ON, and the comparing unit must be wired to read in.

An indicating lamp flashes the instant a double punch is detected in a COMPARING AND DPBC ENTRY position.

Pressing the reset key extinguishes the indicating lamp and permits card feeding to be restarted.

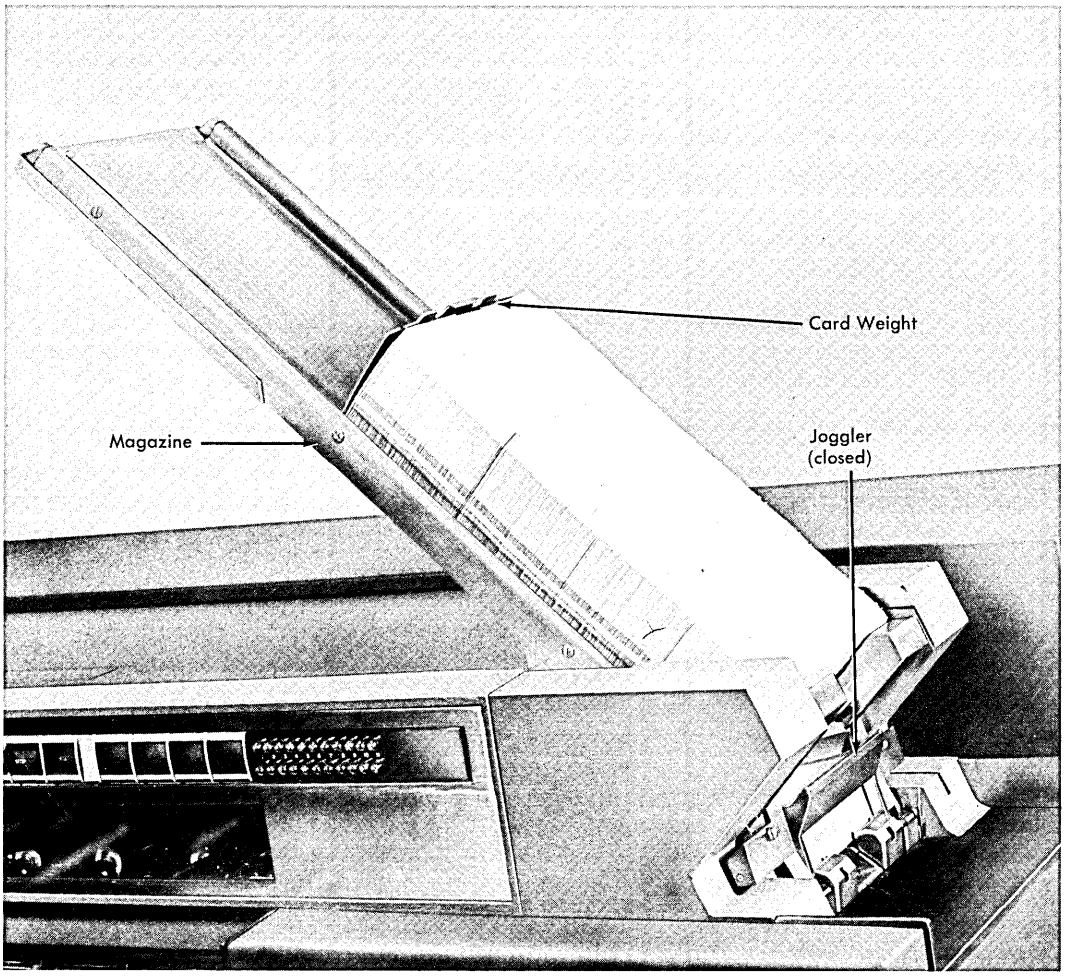


Figure 4. File Feed

Hoppers

The collator has two separate feed units — primary and secondary. The primary is located at the right end of the machine; the secondary is at the left. Cards placed in the primary hopper are called *primary cards;* those placed in the secondary hopper are *secondary cards.*

Because cards are fed from opposite directions, they must be placed in the hoppers differently. In the primary hopper, cards are placed face down, *9-edge first.* In the secondary, they are placed face down, *12-edge first.*

Each hopper is equipped with a hopper contact to stop card feeding when the last card leaves the hopper. Adding more cards and pressing the start key resumes card feeding.

Primary File Feed

The primary feed is equipped with a file feed (Figure 4). The magazine holds approximately 3600 cards. This allows at least 5½ minutes of continuous running time without reloading the primary hopper.

Cards are loaded on the magazine with the 9-edge down and the column-1 end toward the front of the machine. Usually, it is not necessary for the operator to fan and joggle the cards, because this is done automatically by card jogglers on the 12-edge and column-1 end, as the cards enter the hopper from the magazine. A modified card weight, designed to pass from the magazine into the hopper, must be removed from the hopper and should be placed behind the cards in the magazine before starting an operation. This card weight must be used to feed the last cards.

Small groups of cards can be placed either directly in the hopper or in the file-feed magazine.

Pressing the start key fills the hopper with about 300 cards from the file feed during the 3-second delay before card feeding begins. When the hopper is full, feeding from the file feed stops.

Card feeding from the magazine is controlled by the level of cards in the hopper. A clutch lever operated by the front joggler maintains a volume of about 300 cards in the hopper, except on runout.

The front joggler is hinged and can be opened to insert or remove cards or the card weight (Figure 5). An interlock prevents machine operation when this joggler is fully open.

The file-feed magazine is hinged so that it can be locked in an upright position, 12 degrees from the vertical (Figure 6). This allows access to the primary reading stations. Removing cards from the file feed is not necessary. To lower the magazine, raise the magazine slightly and pull up the latch on the back.

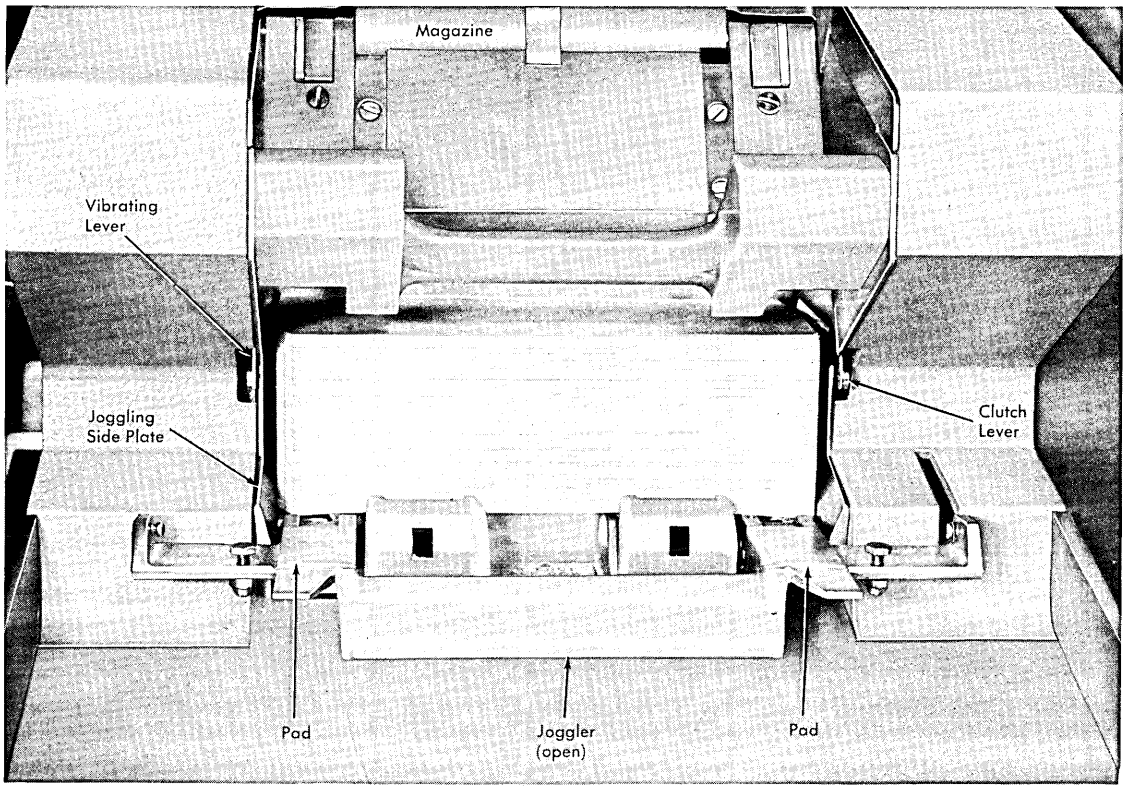


Figure 5. File Feed Joggler

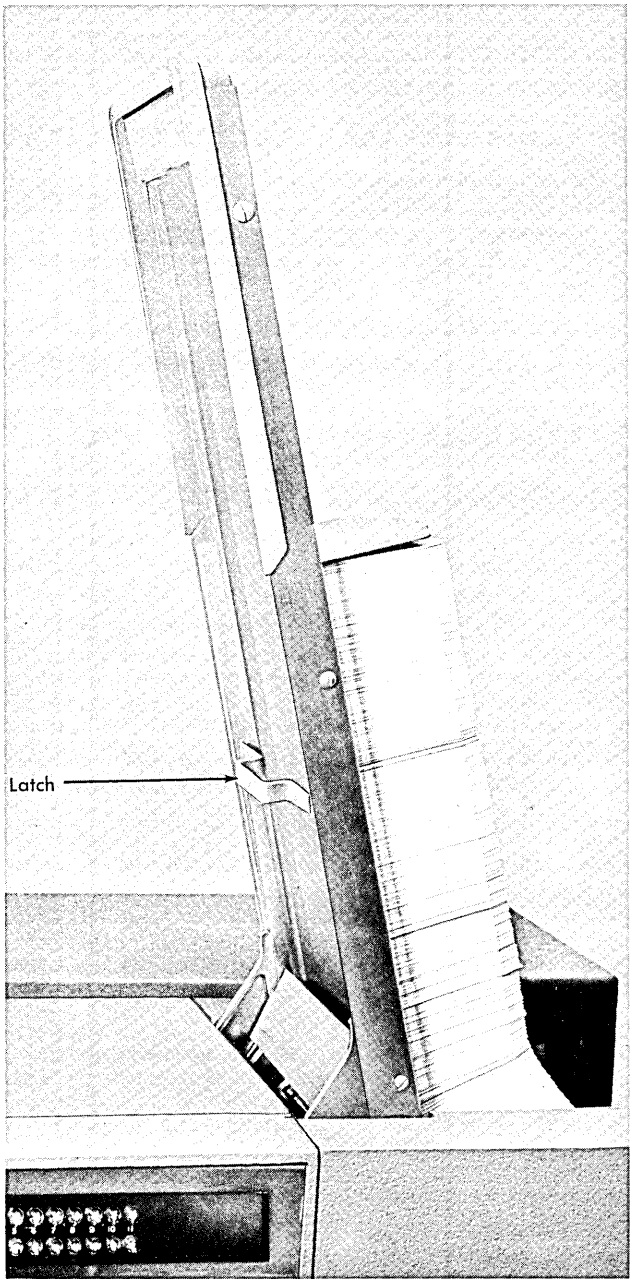


Figure 6. File Feed — Latched Up

Secondary Hopper

The secondary hopper holds approximately 1200 cards. This is normally adequate, as most operations involve less cards in the secondary. However, a file feed can be installed on the secondary. (See *Special Features.*)

Card Feeds

Cards are fed from opposite directions toward the pockets in the center of the machine (see Figure 2). Cards in the primary are fed from right to left; those in the secondary are fed from left to right. Cards feeding from the hoppers pass a throat knife that limits passage to one card at a time.

Just inside the throat a card lever senses the presence of a card. If no card is present on a feed cycle, card feeding stops and a check light signals a card-feed failure.

Reading Stations

The cards in each feed pass the 80 brushes of the sequence read station, and continue past the 80-brush comparing read station. The result of comparisons determines whether the card advances, and into which pocket it is selected. Selector magnets (Figure 7) position the chute blades to guide the cards to the proper pocket. Cards travel through the selected chute to a deflector plate and spring (see Figure 7) that direct them into the selected pocket.

The brush units are accessible for removal by unlatching and pushing back the cover between the hoppers. In the primary, raise the file feed until it locks in the upright position.

Speed Relationship

Continuously-operating rollers (see Figure 7) transport the cards along the chutes to the prescribed pocket. Primary rollers operate slightly faster than the secondary rollers. Thus, a primary card (master card, for example) reaches the merge pocket before an equal secondary card (detail card). This feature allows maximum speed to be attained (both feeds operating) during an equal comparing condition.

Jam Protection

A card jam or card-feed failure at the reading station is detected by card levers. Card feeding stops and the check light associated with the corresponding feed turns ON.

Along the entire card-transport line over the stackers is a metal tape that actuates a jam switch (see Figure 7). If any card is deflected from the normal path, card feeding stops and the transport light turns ON.

When the jamming condition is remedied, the transport light turns out. Pressing the start key resumes operation. (Note: All comparing is lost when the master switch is turned OFF or the top cover is opened.)

Pockets

After cards are read, they pass into one of five pockets (or stackers). Each pocket holds about 1000 cards and is equipped with a pocket-stop lever (Figure 8) to stop card feeding when that pocket is full. The operator can lift out the cards in proper sequence without stopping the machine.

The five pockets (Figure 8) are numbered 1 to 5 from right to left, and are designated according to the cards normally stacked in them:

Pocket 1 — Primaries
Pocket 2 — Selected Primaries
Pocket 3 — Merged Cards
Pocket 4 — Selected Secondaries
Pocket 5 — Secondaries

Primary cards normally go into pocket 1, unless directed by control-panel wiring to pocket 2 or 3. Secondary cards normally go into pocket 5, unless directed by control-panel wiring to pocket 3 or 4. Pocket 3 is common to both feeds and serves as the merging pocket. Error cards automatically run out to pockets 1 and 5. Therefore, when possible, pockets 2 and 4 should be used for selected cards, reserving pockets 1 and 5 for error cards.

As a card enters the pocket (Figure 9), the column-1 end rests on a pivot assembly, while the opposite end falls freely in an arc until stopped by spring-loaded alignment levers (see Figure 8). When approximately 5 to 10 cards accumulate at the aligners, they drop onto the oscillating card pusher that steps the cards to the front.

Card-retaining levers mounted on the pivot plate prevent the cards from falling backward into the stacker. These retaining levers are free to pivot forward to allow a card to pass, but cannot pivot backward.

As the stacker fills, the card deck is pushed outward until it activates the pocket-stop switch to stop card feeding.

Because cards are stacked on end, cards that have been folded at the creases (card form S-2) and internally-scored cards (card forms M-2A, M-3, OM-2) may cause stacking difficulties and are not recommended for use in the 88.

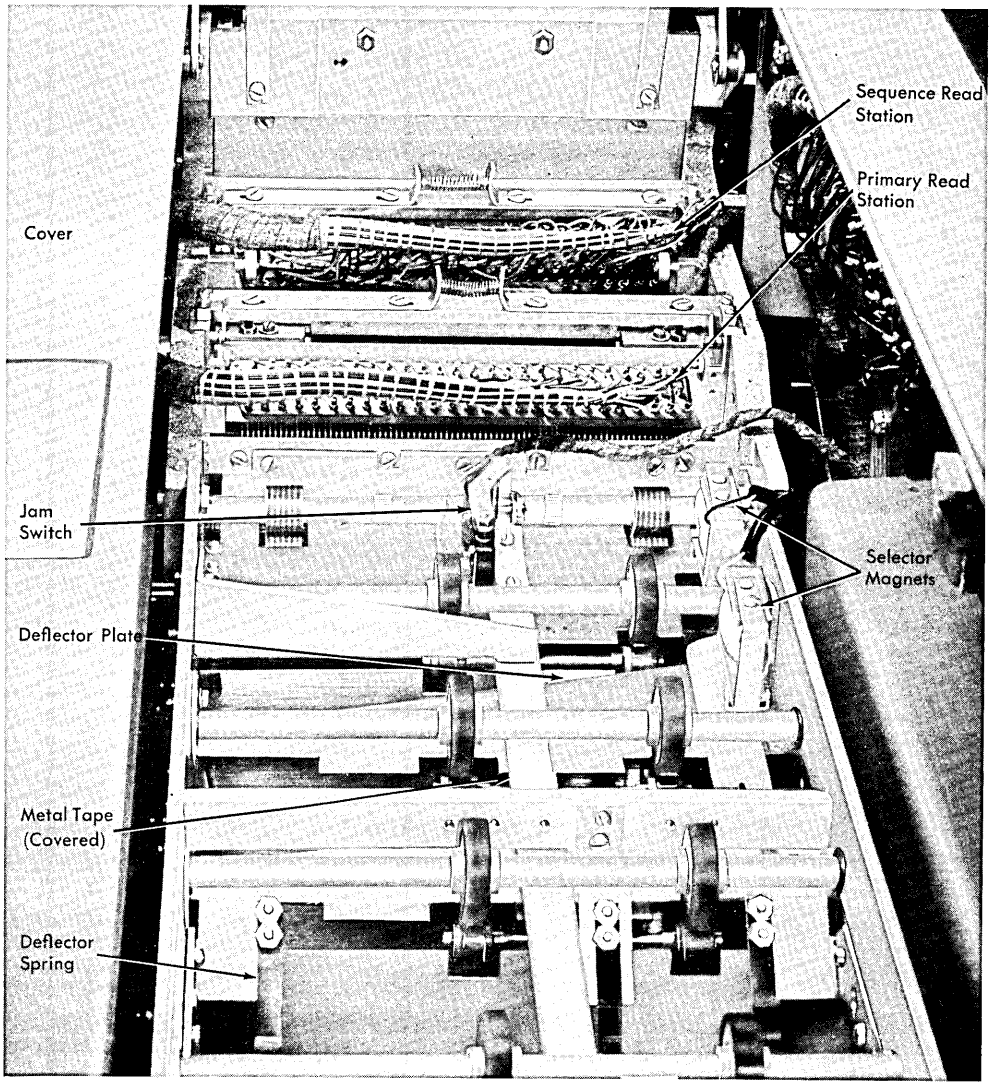


Figure 7. Card Transport Area

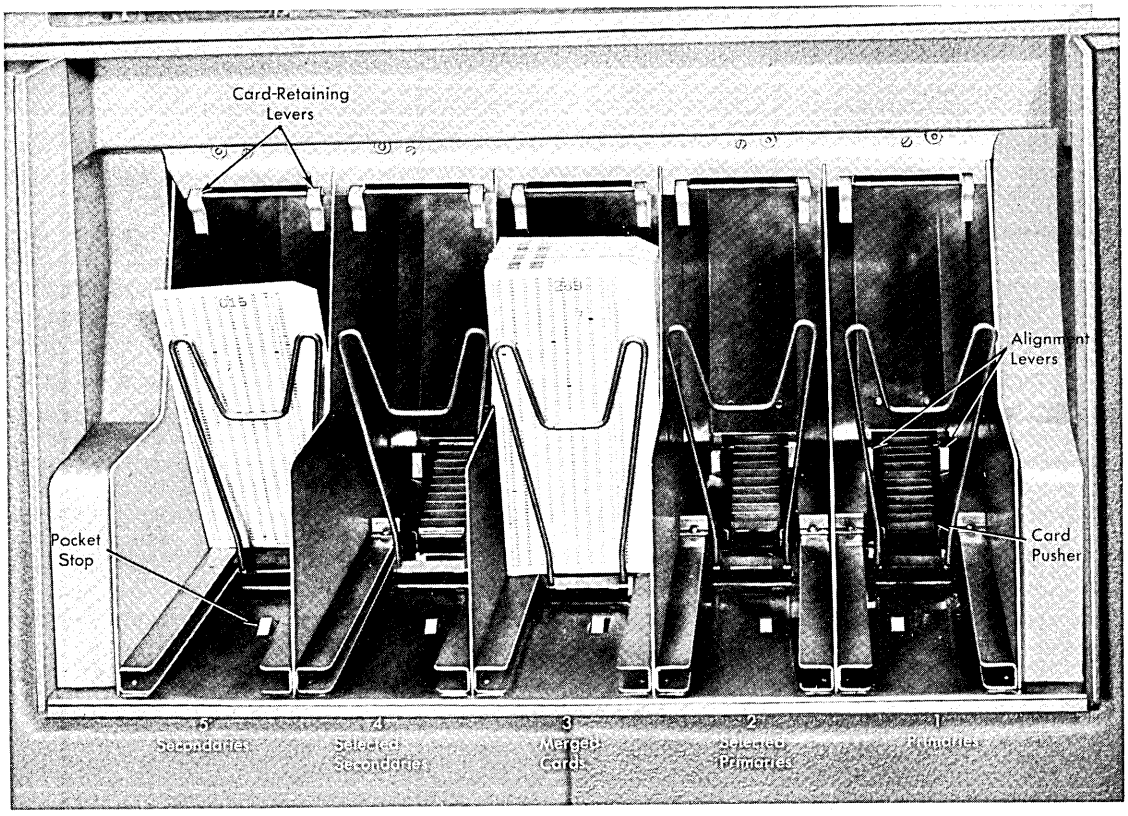


Figure 8. Stackers

Control Panel

External wiring on the control panel governs all machine functions. Information read from the cards is channeled through the control panel to the machine circuitry. The output of this circuitry, through the control panel, controls card feeding and selects the proper pocket for each card.

The two sections of the panel correspond generally to the primary and secondary feeds of the machine. Wires placed in the panel have terminals that protrude through the panel to make connection with spring contacts on the machine. Care should be taken not to bend or damage these contacts when inserting or removing the panel.

Templates (Right — #602974; Left — #602976) adapt the standard 22-hub control panels of the IBM 85, 87, 519, 521, 557, and 602 for use in the IBM 88 Collator.

Control-panel diagrams (X24-6423) are available for planning control-panel wiring and analyzing machine operations.

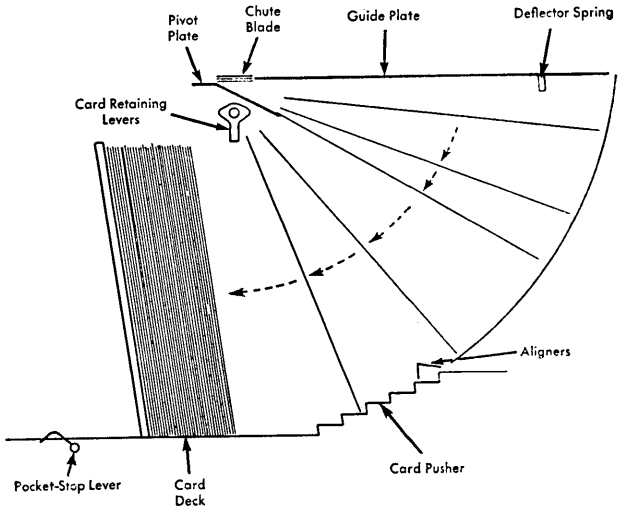


Figure 9. Schematic of Pocket

Diagnostic Panel

A lamp panel located behind the card-transport area provides a rapid and convenient means for IBM Customer Engineers to analyze the sequence and comparing circuits. These lamps indicate the high, equal, and low output of each of the three control units. Other lights, controlled by rotary switches, indicate the condition of the position or group tested.

Any of the operations mentioned previously (sequence checking, merging, matching, etc.) requires that two numbers be compared. This is true regardless of whether the operation is performed manually, or automatically by the collator. In checking sequence for example, the number in one card must be compared to that in the preceding card, to assure that the cards are in order. In a merging operation, the number in a card in one file must be compared with the number in a card in another file to determine which card should be first in the merged file.

Therefore, in any operation performed by the collator, cards are read and their data compared. The result of the comparison is then used to control advancing of cards and choice of pockets.

The collating sequence (low to high) recognized by the 88 is: blank, 0-9.

Schematic Diagram

The schematic diagram (Figure 10) shows the paths of the cards from the hoppers to the pockets, the reading stations, and the three control units. The five pockets in the middle are labeled to indicate the types of cards usually stacked in them.

Primary Feed

As cards are fed from the primary feed hopper to the pockets, they pass two 80-column reading stations; *primary sequence read* and then *primary read.*

Primary sequence read and primary read are normally connected by control-panel wiring to the *primary sequence unit* to compare the cards at the two reading stations for checking sequence. In addition, primary read is normally connected to the *comparing unit* to compare the primary card with a card in the secondary feed for matching or merging.

If card feeding is stopped during a run, cards in the primary feed are positioned as indicated in the schematic diagram (Figure 10): before primary sequence read, between primary sequence read and primary read, and after primary read.

Secondary Feed

As cards are fed from the secondary feed hopper to the pockets, they pass two 80-column reading stations: *secondary sequence read* and then *secondary read.*

Secondary sequence read and secondary read are normally connected by control-panel wiring to the *secondary sequence unit* to compare the cards of the two reading stations for sequence checking. In addition, secondary read is normally connected to the *comparing unit* to compare the secondary card with the card passing primary read for matching or merging.

If card feeding is stopped during a run, cards in the secondary feed are positioned as indicated in the schematic diagram (Figure 10): before secondary sequence read, between secondary sequence read and secondary read, and after secondary read.

Comparing Unit

The comparing unit in a full-capacity machine has 22 control positions. Each position has two entries: PRIMARY and SECONDARY. A number read into the primary comparing entry is compared with a number read into the secondary comparing entry in the corresponding position. The comparing unit is normally used to compare primary and secondary cards in the two feeds

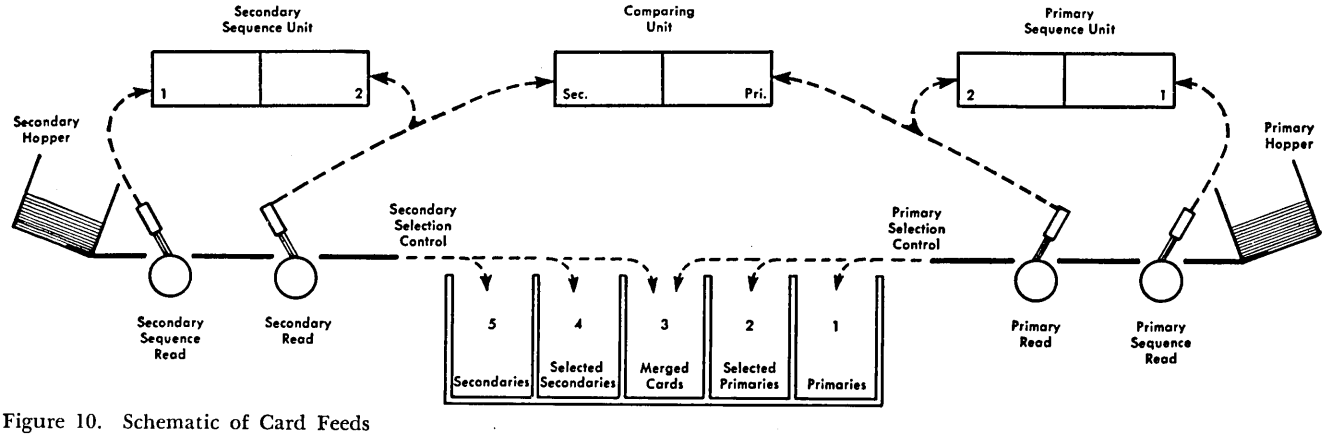


Figure 10. Schematic of Card Feeds

to determine whether they are equal or, if unequal, which of the two is lower. These conditions can be recognized (by control-panel wiring) to cause feeding and selection of cards.

Each side of the comparing unit reads in independently of the other. New numbers read in selectively according to control-panel wiring. The comparing unit stores the actual digit value read in the card.

Primary Sequence Unit

The primary sequence unit in a full-capacity machine has 22 control positions. Each position has two entries: SEQUENCE ENTRY 1 and SEQUENCE ENTRY 2. A number read into an entry-1 position is compared with a number read into the corresponding entry-2 position. The primary sequence unit is normally used to compare two cards in the primary feed, to determine whether the card passing primary sequence read is higher than, equal to, or lower than the card passing primary read. These conditions can be recognized by control-panel wiring to indicate errors in sequence and to cause feeding and selection of cards.

Reading into the sequence unit cannot be selectively controlled because the unit restores and reads in automatically with each primary card-feed cycle. The unit stores only the result of comparison, not actual numbers.

Secondary Sequence Unit

The secondary sequence unit in a full-capacity machine has 22 control positions. Each position has two entries: SEQUENCE ENTRY 1 and SEQUENCE ENTRY 2. A number read into an entry-1 position is compared with a number read into the corresponding entry-2 position. The secondary sequence unit is normally used to compare two cards in the secondary feed to determine whether the card passing secondary sequence read is higher than, equal to, or lower than the card passing secondary read. These conditions can be recognized by by control-panel wiring to indicate errors in sequence and to cause feeding and selection of cards.

Reading into the sequence unit cannot be selectively controlled because the unit restores and reads in automatically with each secondary card-feed cycle. The unit stores only the result of comparison, not actual numbers.

Modifying the Control Units

The sequence and comparing units in each feed can be divided into two sections (A and B). By control-panel wiring, each of these sections can be used as an independent comparing group to double the fields for control.

The function of the three control units is the same. However, because of a difference in operation and in the direction of card feeding, they cannot be used interchangeably.

The sequence units cannot be used for comparing between feeds. Furthermore, each sequence unit (primary and secondary) is normally used to compare cards within its corresponding feed. However, the secondary sequence unit can be shifted, by control-panel switches, to check cards in the primary feed. This permits sequence checking up to 44 columns in the primary.

The comparing unit does not normally compare cards within the same feed. However, the secondary side of the comparing unit can be shifted, by control-panel switches, for use in the primary. Therefore, with the shifted secondary sequence unit, up to 66 columns can be sequence-checked in the primary feed of a full-capacity machine. Similarly, one half (section A) of the primary side of the comparing unit can be shifted for use in the secondary. This permits a maximum of 33 columns to be sequence-checked in the secondary feed of a full-capacity machine.

Analysis Chart

Operations to be performed by the collator should be thoroughly analyzed before beginning to wire the control panel. The various conditions that may arise as

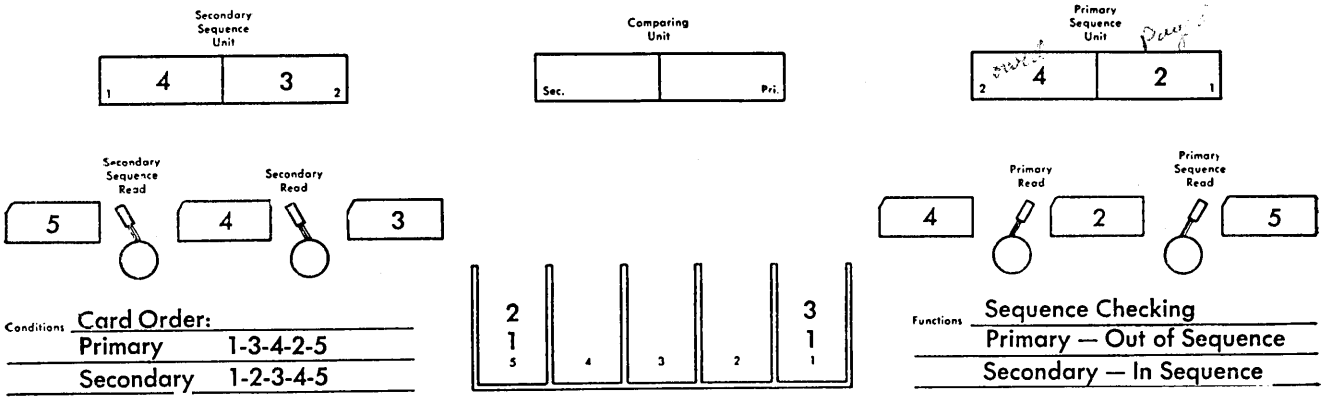


Figure 11. Analysis Chart

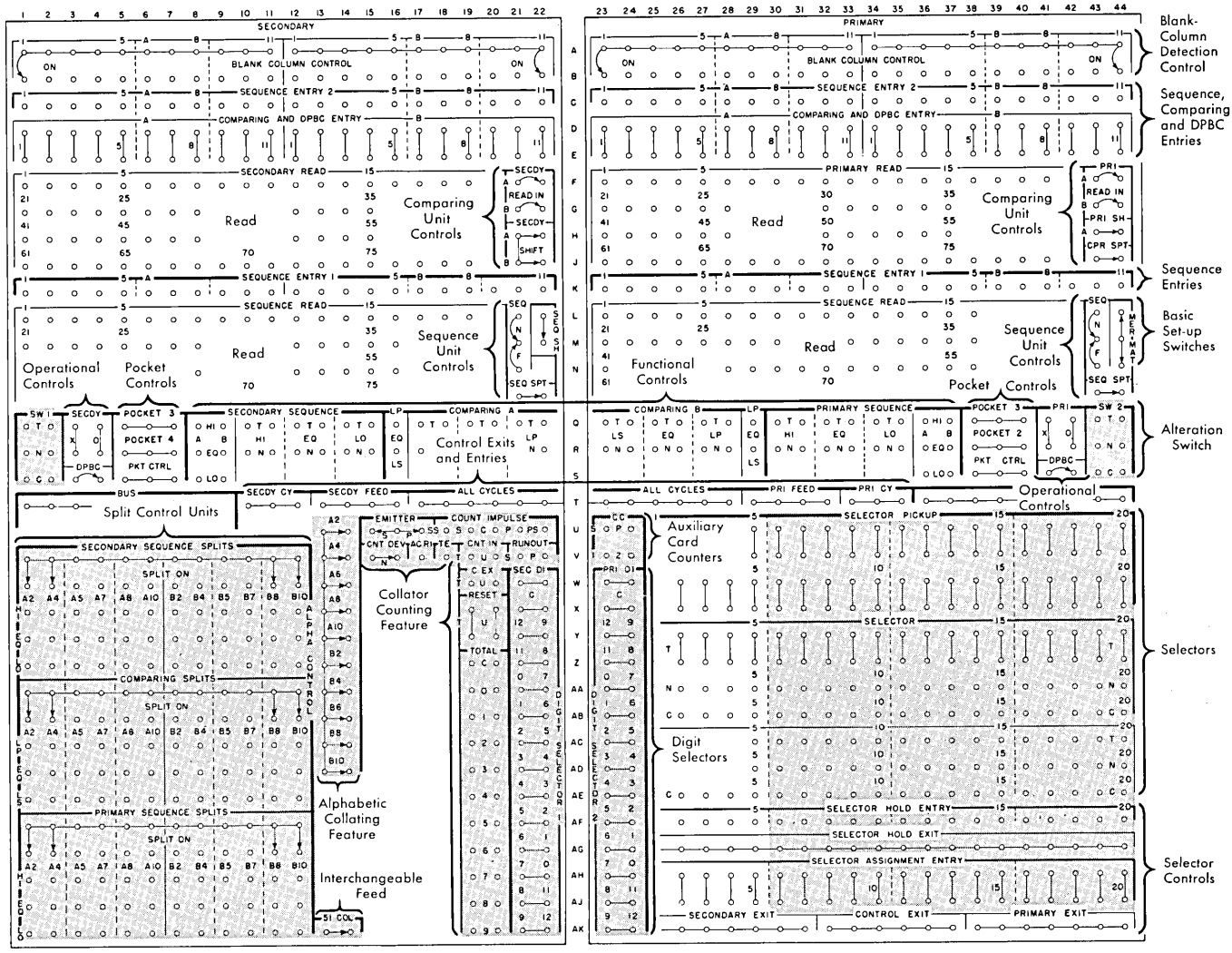


Figure 12. Control-Panel Diagram

cards are fed should be studied, and the relationship between the cards translated into machine terms. An analysis chart (Figure 11) aids this study. This chart is a modification of the schematic diagram, with places provided to write representative numbers in six cards, six blocks corresponding to the comparing and sequence entries, and five pockets.

An example of the use of the analysis chart is shown in Figure 11. The cards are to be checked for sequence. The numbers in this illustration show an error condition in the primary.

The number (2) in the card that has just passed primary sequence read is entered in the primary sequence unit, entry 1; the number (4) in the card that has just passed primary read is entered in the primary sequence unit, entry 2. It can readily be seen that when a card is out of sequence (the 2-card following the 4-card, in this case) primary sequence 1 is lower than primary sequence 2. This low condition, translated to machine terminology, is *low primary sequence*. The resulting impulse can be used, by control-panel wiring, to control machine operations (for example, stop card feeding and turn on the primary control stop light).

In some cases it is advantageous to use several charts to study the relationship between several successive cards fed through the machine. The schematic diagram and seven analysis charts are provided on the back of the control-panel diagrams.

Analysis charts are used in this manual when they contribute to a better understanding of the wiring.

Control Panel

The control panel (Figure 12) contains 44 columns of hubs numbered 1 through 44, and 34 rows of hubs lettered A through AK. The location of any hub can be identified by using these co-ordinates. For example, PRIMARY READ brush 20 is located at co-ordinates F, 42.

The control panel is divided in two main sections corresponding essentially to the feed units in the machine: primary on the right, secondary on the left. Each half is relatively the same. Figure 12 shows the control panel for the full-capacity machine. The

shaded areas indicate optional features or devices.

The control panel has two main types of hubs: *exits* and *entries*. An exit hub emits an impulse; an entry hub accepts an impulse wired to it. Some exits emit impulses that correspond to punches in the card. Other exits emit impulses that result from some function performed, or that are automatic for every card. The exits and entries wired depend entirely upon the operation the machine is to do. Control-panel wiring can be changed to perform each operation, thereby giving to one machine the flexibility to perform different operations for various applications.

Two or more hubs connected by lines are common; that is, two or more exits or entries connected to serve the same purpose (Figure 13-A). These hubs reduce the need for *split wires* (wires with more than two ends). A *bus* (Figure 13-B) is a group of 4 or 5 common hubs. When wired, they expand the capacity of an exit or entry, and reduce the need for split wires.

Two adjacent hubs connected by an arrow form a switch for controlling a machine operation. The arrow indicates the direction of the impulse: exit to entry. The curved arrow (Figure 13-C) designates a selectable timed impulse; the straight arrow (Figure 13-D) denotes a continuous impulse that cannot be selected except through an alteration switch.

The control panel controls card feeding and selection automatically. When a card passes a reading station, the brushes read the punching by contacting a metal roll through the holes in the card. The impulses representing the card punches are available at the control panel. Control-panel wiring directs these impulses to sequence or comparing units, where they are compared with the reading from another or the same card. These units establish a high, low, or equal comparison between the two readings, and make a corresponding impulse available at the control panel. Control-panel wiring then directs this impulse to the functional units that control card feeding and selection.

The hubs on the control panel are labeled in groups in Figure 12, and a description of the general function of each group follows.

Blank-Column Detection Control checks cards in each feed for blank columns. In a full-capacity machine, the unit can check up to 22 columns in each feed independently, or up to 44 columns when checking cards in one feed only. The BLANK COLUMN CONTROL switch must be wired for each position checked.

Sequence, Comparing and DPBC Entries accept digits 0 through 9 for comparison in the sequence or comparing units, and for checking double punches and blank columns. These entries are normally wired from the READ hubs. Two numbers in different feeds are compared in the comparing unit by wiring from PRIMARY READ to primary COMPARING ENTRY and from SECONDARY READ to secondary COMPARING ENTRY. The COMPARING ENTRIES also serve as entries for double-punch and blank-column detection.

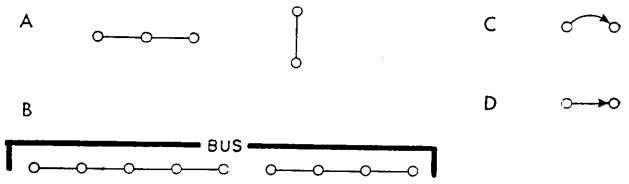


Figure 13. Common Hubs, Bus Hubs, and Switches

For checking sequence of cards at the two reading stations in a feed, the two READ exits are wired to SEQUENCE ENTRIES 1 and 2, respectively.

Read hubs are exits for the two sets of brushes in each feed: PRIMARY and SECONDARY READ for the primary and secondary read brushes, and primary and secondary SEQUENCE READ for the primary and secondary sequence brushes. Impulses emitted from the READ hubs correspond to the punches in the card read by the brushes.

Comparing Unit Controls determine the operation of the comparing unit. When the PRI and SECDY READ IN hubs are wired, the comparing unit clears to accept a new number for comparison. When no connection is made (unwired or through an open selector), the comparing unit is either inoperative or holds a previous reading without restoring.

Other switches of this group are for assigning or shifting portions of the comparing unit for use in the opposite feed, and for dividing the comparing unit into sections A and B to double the fields for control.

Sequence Unit Controls govern the operation of the sequence units. Wiring the sequence switches permits machine operation. Other switches shift the secondary sequence to the primary, and divide the units into sections A and B to double the fields for control.

Basic Setup Switches supplement external wiring on the control panel for the basic operations of merging, matching, and sequence checking. Internal wiring automatically controls card feeding and error checking. Sequence switches and pocket selection must be wired externally.

Functional Controls consist of exits and groups of 2-position selectors. The exits emit impulses and the corresponding selectors transfer for a high, equal, or low comparison in the sequence and comparing units. The exit impulses can be used to pick up other selectors to control machine functions.

The selector groups provide a convenient means for direct control of machine functions. Control impulses wired through these selector groups can control card feeding, pocket selection, etc.

Pocket Controls determine the pocket in which a card is stacked. A pocket control impulse (PKT CTRL)

is wired directly, or through selectors, to POCKET 2 or 3 (primary) and POCKET 3 or 4 (secondary). If no pocket entry is impulsed, a card goes to pocket 1 (primary) or pocket 5 (secondary).

Operational Controls are the means for controlling selectors or editing. The emitted X or 0 is used to operate selectors when a corresponding control impulse comes from the card at the read brushes. Wiring the DPBC switch stops card feeding when a double-punch or blank-column error is detected.

Control Exits and Entries emit or accept impulses to control functional operations of the machine. An ALL CYCLES impulse is normally wired through selectors to control selection or card feeding. PRI and SECDY FEED accept all cycles impulses to cause card feeding in the corresponding feed. PRI and SECDY CY emit every corresponding card-feed cycle to pick up selectors.

Selectors and Selector Controls permit controlling different operations according to varying conditions. Each selector has two pickups, which must be impulsed simultaneously to transfer the selector. An impulse wired to the common (C) hub is available at the normal (N) hub or, when the selector is transferred, at the transfer (T) hub.

Selector controls assign the selectors for use in either the primary or secondary so that they operate only on a primary or secondary feed cycle, or on every machine cycle. The hold circuit maintains a selector in the transferred position until the circuit is broken.

Special Features (shaded areas) include devices that increase the versatility of the collator: alteration switches, auxiliary card counters, digit selectors, collator counting feature, alphabetic collating feature, 51-column interchangeable feed, and split control units.

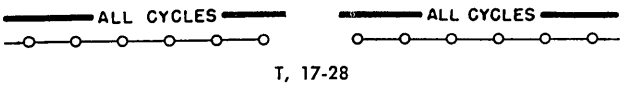
Principles of Control-Panel Wiring

The versatility of the IBM 88 Collator often permits various wiring arrangements to accomplish a specific operation. The methods presented in this manual merely illustrate the hubs discussed, and represent typical functional wiring that may differ with each application. This section presents the hubs or groups of hubs used for basic machine control and for the five basic operations of the machine: selecting, sequence checking, merging, matching, and editing. For control-panel wiring of other specific applications, see *Typical Operations*.

Basic Machine Control

Regardless of the operation performed, four groups of control-panel hubs are essentially involved. Many conditions govern the use of these hubs; however, they must be wired properly for the machine to operate.

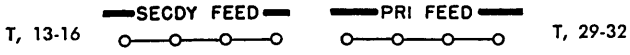
Control-Panel Hubs



T, 17-28

ALL CYCLES. These 12 hubs (6 on the right panel, 6 on the left panel) emit an impulse each machine cycle except when a check or control stop light is ON. This impulse is normally wired to PRIMARY and SECONDARY FEED (the match or merge switch not wired) or to SELECTOR PICKUPS.

Do not wire this impulse to any pocket entry (POCKET 2, 3, 4).

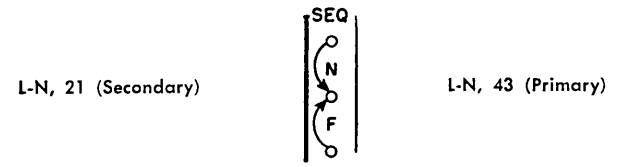


SECDY FEED (Secondary Feed). These four common hubs are entries, operating the feed clutch to feed secondary cards. These hubs are inoperative during run-in, and when the merge (MER) or match (MAT) switch is wired.

Wire these hubs from ALL CYCLES only.

PRI FEED (Primary Feed). These four common hubs are entries, operating the feed clutch to feed primary cards. The hubs are inoperative during run-in, and when the merge (MER) or match (MAT) switch is wired.

Wire these hubs from ALL CYCLES only.



SEQ N, F (Sequence On, Off). The center hub of these selectable switches accepts an impulse every machine cycle, from either the ON or OFF hub, to permit card feeding.

If no impulse is received, the corresponding control stop light goes ON and card feeding stops. With this impulse wired through the normal side of a selector, card feeding stops with the corresponding control stop light ON when the selector transfers.

Both the primary and secondary SEQ ON or OFF switches must be wired for card feeding to occur. Wire SEQ OFF for all operations not involving sequence checking for ascending order. See *Sequence Checking*, for discussion of SEQ ON switch.

Q-S, 5-7 (Secondary) Q-S, 38-40 (Primary)

PKT CTRL (Pocket Control). These common hubs emit an impulse each machine cycle, except when a check or control stop light is ON. Wire this selectable impulse *only* to primary and secondary pocket entries, to direct the card to the proper stacker.

PKT CTRL exits are inoperative when the runout key is pressed with a check or control stop light ON.

POCKET 2, 3. These primary hubs accept an impulse from the POCKET CONTROL exit to direct primary cards to either pocket 2 (selected primaries) or pocket 3 (merged cards). Wire these hubs *only* from PKT CTRL.

Impulsing both POCKET 2 and POCKET 3 directs the card to pocket 3 (merged cards). Impulsing neither pocket entry directs the card to pocket 1 (primaries). For example, on an error runout (PKT CTRL exits inoperative), the cards in the primary stack in pocket 1.

POCKET 3, 4. These secondary hubs accept an impulse from the POCKET CONTROL exit to direct secondary cards to either pocket 3 (merged cards) or pocket 4 (selected secondaries). Wire these hubs *only* from PKT CTRL.

Impulsing both POCKET 3 and POCKET 4 directs the card to pocket 3 (merged cards). Impulsing neither pocket entry directs the card to pocket 5 (secondaries). For example, on an error runout (PKT CTRL exits inoperative), the cards in the secondary stack in pocket 5.

Merging Two Groups of Unpunched Cards

Merging two files of unpunched cards, each of a different color for example, into one file illustrates the use of these two hubs (Figure 14). With unpunched cards no comparison is possible, and the merging operation depends entirely upon the continuous feeding of cards from the primary and secondary feeds. Because the primary card transport feeds cards slightly faster than the secondary, the first card from the primary feed falls into pocket 3 (merged cards) *ahead* of the first card from the secondary. Thus, with white cards in the primary hopper and brown cards in the secondary, the merged file contains alternating white and

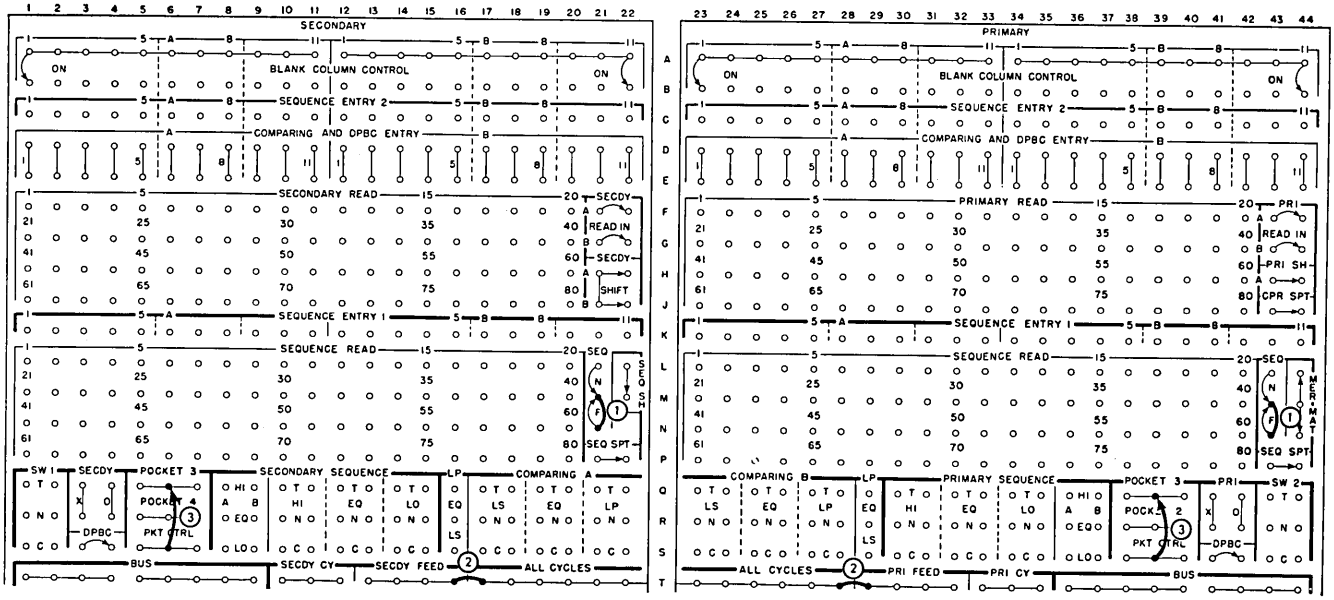


Figure 14. Merging Two Groups of Unpunched Cards

brown cards in that order. Impulsing both feeds continuously merges 1300 cards per minute (combined speed of both feeds).

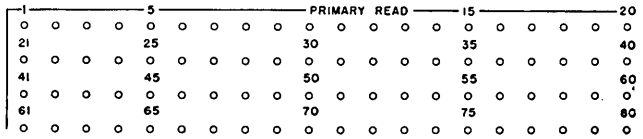
WIRING (FIGURE 14)

1. SEQ OFF switches wired to permit card feeding.
2. ALL CYCLES wired to PRI and SECDY FEED to feed primary and secondary cards.
3. PKT CTRL wired to POCKET 3 in both feeds to direct cards to the merge pocket.

Selecting

The IBM 88 Collator can locate a card punched with specific information and remove that card from the file. Cards can be identified in many ways, but basically this operation involves selectors that respond to prescribed conditions.

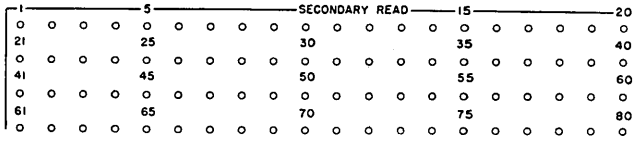
Control-Panel Hubs



F-J, 23-42

PRIMARY READ. The 80 PRIMARY READ hubs are exits from the second set of 80 brushes in the primary feed. These hubs are normally wired to primary COMPARING AND DPBC EPTRY and SEQUENCE ENTRY 2. For X-selection wire PRIMARY READ to one PICKUP of the selector, and PRI X to the other PICKUP.

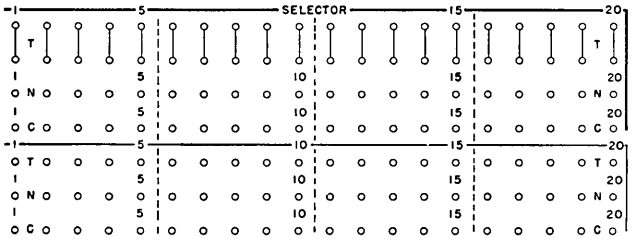
Impulses from these hubs are available only when a card is being fed past these brushes.



F-J, 1-20

SECONDARY READ. The 80 SECONDARY READ hubs are exits from the second set of 80 secondary brushes. These hubs are normally wired to secondary COMPARING AND DPBC ENTRY and SEQUENCE ENTRY 2. For X-selection wire SECONDARY READ to one PICKUP of a selector, and SECDY X to the other PICKUP.

Impulses from these hubs are available only when a card is being fed past these brushes.



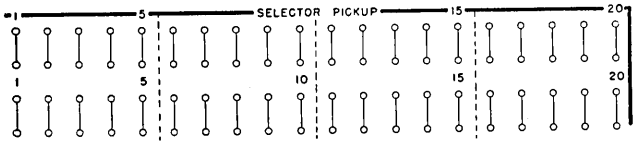
Y-AE, 25-44

SELECTORS. These selectors are similar in purpose to selectors in other IBM machines. However, each selector in the IBM 88 Collator has two pickups. Five selectors are standard; fifteen more, in groups of five, are optional.

Each selector has two sets of common (C), normal (N), and transfer (T), hubs. Impulsing *both* the upper and lower PICKUP hubs at the same time, transfers a selector immediately. A selector picked up by one digit is transferred for the next digit. This permits using a selector as a column split when picked up by X, 0, or digit-selector (special feature) impulses.

When a selector can transfer or drop out depends on the selector assignment and hold control.

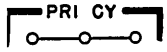
Transferring a selector internally connects C and T so that an impulse entering C is available out of T (Figure 15). When not transferred, C and N are internally connected so that an impulse entering C is available out of N. Numerical field selection on the basis of a control punch (X, 12) can be done at both secondary reading stations. However, because primary cards are fed 9-edge first, numerical field selection cannot be done at the primary sequence station on basis of a control X or 12.



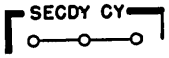
U-X, 25-44

SELECTOR PICKUP. Each selector has two sets of PICKUP hubs which must be impulsed at the same time for the selector to transfer. Each PICKUP can be wired from a different source, or a single impulse can be jackplugged from one PICKUP to the other.

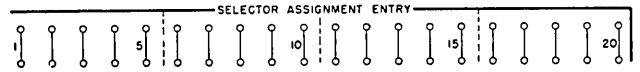
Selectors can be picked up from a card reading, an emitter (or digit selector), a functional exit, PRI and SECDY CYCLES, or ALL CYCLES. Selectors used for stacker selection or feed control must not be picked up by ALL CYCLES.

T, 33-35 

PRI CY (Primary Cycles). These hubs emit an impulse each primary feed cycle. This impulse is used to pick selectors that are to transfer only when the primary feed operates.

T, 10-12 

SECDY CY (Secondary Cycles). These hubs emit an impulse each secondary feed cycle. This impulse is used to pick selectors that are to transfer only when the secondary feed operates.



AH-AJ, 25-44

SELECTOR ASSIGNMENT ENTRY. Each selector has a corresponding set of common hubs that assign the selector to the primary or secondary feed, or for control use. For the selector to operate, ASSIGNMENT ENTRY *must* be wired from either a PRIMARY, SECONDARY, or CONTROL EXIT (Figure 15), and from no other exit. These impulses determine when the selector can transfer, and how long it remains transferred (HOLD not wired).

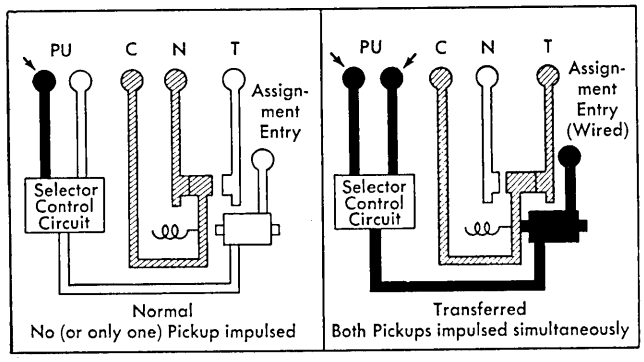
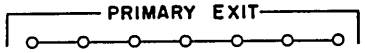
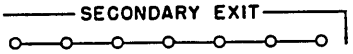


Figure 15. Schematic of Selector Operation

AK, 38-44 

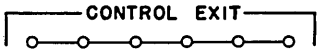
PRIMARY EXIT. When this impulse is wired to SELECTOR ASSIGNMENT ENTRY, the selector can be picked by any card or control impulse, and remains transferred until the start of the next primary card-feed cycle. The selector transfers immediately, so that when picked by a 9-impulse it is transferred for an 8-impulse. These hubs emit an impulse on every primary card-feed cycle.

Wire this impulse *only* to SELECTOR ASSIGNMENT ENTRY.

AK, 25-31 

SECONDARY EXIT. When this impulse is wired to SELECTOR ASSIGNMENT ENTRY, the selector can be picked by any card or control impulse, and remains transferred until the start of the next secondary card-feed cycle. The selector transfers immediately, so that when picked by a 12-impulse it is transferred for an X-impulse. These hubs emit an impulse on every secondary card-feed cycle.

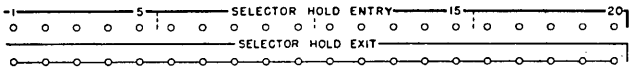
Wire this impulse *only* to SELECTOR ASSIGNMENT ENTRY.

AK, 32-37 

CONTROL EXIT. When this impulse is wired to SELECTOR ASSIGNMENT ENTRY, the selector can be picked on any machine cycle during control time (after card-reading time), and remains transferred through the reading of the next card (except the last digit). These hubs emits an impulse on every machine cycle.

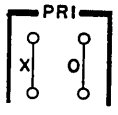
Selectors wired from CONTROL EXIT are mainly used to control operations on the basis of a comparison (HI, EQ, LO), and to control other selectors (for example, a cycle delay).

Wire this impulse *only* to SELECTOR ASSIGNMENT ENTRY.



AF-AG, 25-44

SELECTOR HOLD EXIT, ENTRY. When a selector assignment hub is wired from PRIMARY or SECONDARY EXIT, the selector can be held transferred by wiring SELECTOR HOLD. Once the selector transfers, it remains transferred until the hold circuit is broken. This is done by wiring HOLD EXIT to HOLD ENTRY through the points of another selector.

Q-R, 41-42 

PRI X, 0 (Zero). On every primary card-feed cycle, these hubs emit an impulse corresponding to an X and 0 in the primary. PRI X or 0 is normally wired to one of the PICKUPS of a selector to condition the selector to transfer for an X or 0

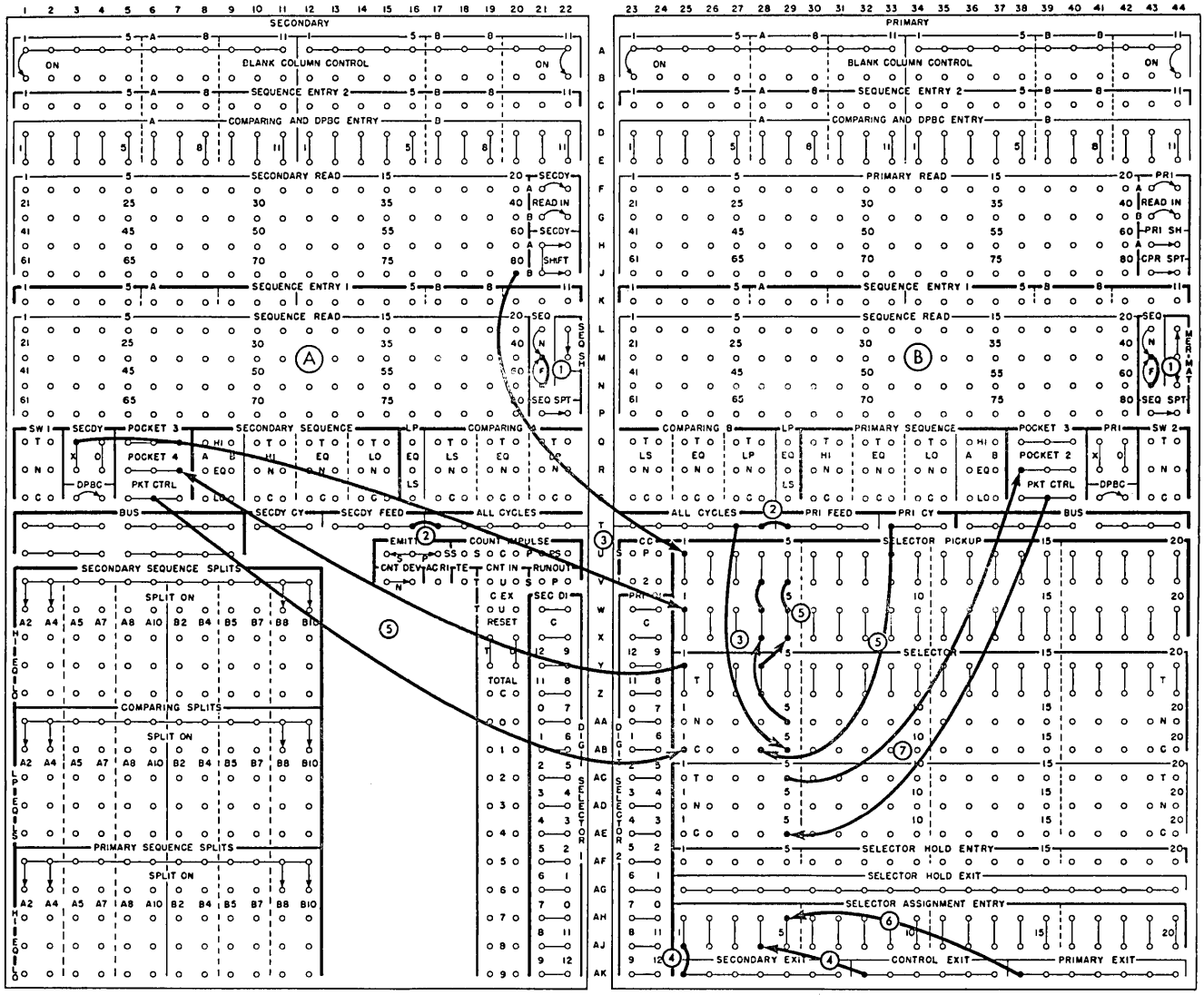
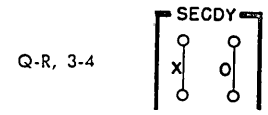


Figure 16. Selecting X-Cards — Secondary Feed; Selecting Alternate Cards — Primary Feed

read from a card in the primary feed. Wiring PRI 0 to a control unit permits checking for zero balances in a primary card.



SECDY X, 0 (Zero). On every secondary card-feed cycle, these hubs emit an impulse corresponding to an X and 0 in the secondary. SECDY X or 0 is normally wired to one of the PICKUPS of a selector to condition the selector to transfer for an X or 0 read from a card in the secondary feed. Wiring SECDY 0 to a control unit permits checking for zero balances in a secondary card.

Selecting X-Cards

All X-punched cards in either feed can be selected and stacked in any of the pockets associated with the corresponding feed. This operation can be performed separately or in combination with other operations.

Figure 16-A illustrates simple X-selection in the secondary feed. An X-80 card is sensed at the secondary read station and is stacked in pocket 4. NX-80 cards stack in pocket 5.

WIRING (FIGURE 16-A)

1. Wire SEQ OFF in both feeds to permit card feeding.
2. ALL CYCLES wired to SECDY FEED feeds cards every machine cycle.
3. Wire card column 80 to one PICKUP of selector 1, and wire the other PICKUP from SECDY X. Selector 1 transfers only for an X in column 80.
4. Assign selector 1 for secondary use by wiring SECONDARY EXIT TO SELECTOR ASSIGNMENT ENTRY 1.
5. PKT CTRL through the C (common) and T (transferred) hubs of selector 1 to POCKET 4 directs X-cards to pocket 4. NX-cards stack in pocket 5.

Selecting Alternate Cards

A file of cards can be separated into two groups by alternate selection; that is, the first, third, and fifth cards are separated from the second, fourth, and sixth cards, etc. The cards are fed continuously and selected without regard to the data punched in them.

Alternate cards, or cycles, are determined by wiring a selector to transfer and drop on alternate cycles. In the illustration (Figure 16-B) selector 5 is controlled, through selector 4, to transfer on alternate cycles; odd-numbered primary cards (1, 3, 5, etc.) are stacked in one pocket and even-numbered cards (2, 4, 6, etc.) are stacked in another pocket.

WIRING (FIGURE 16-B)

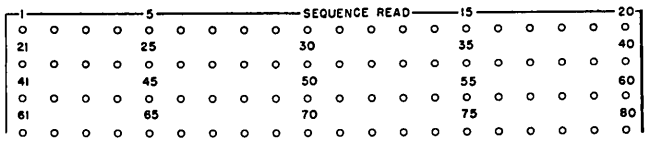
1. Wire SEQ OFF in both feeds to permit card feeding.
2. Wire ALL CYCLES to PRI FEED to feed cards every machine cycle.
3. Wire ALL CYCLES to both PICKUPS of selector 4 through the normal side of selector 5. Selector 4 transfers every cycle that selector 5 is not picked.
4. Assign selector 4 for control use. This permits the selector to be picked up at all cycles time and remain transferred through the next card-feed cycle.
5. Wire PRI CY through the transferred side of selector 4 to both PICKUPS of selector 5. Selector 5 transfers one cycle after selector 4 transfers.
6. Assign selector 5 for primary use by wiring PRIMARY EXIT to SELECTOR ASSIGNMENT ENTRY 5.
7. Wire PKT CTRL to POCKET 2 through the transferred side of selector 5. On alternate cycles selector 5 transfers, and the card goes into pocket 2.

Sequence Checking

A file of cards can be checked to ensure that all the cards are in sequence. The two sets of brushes in each feed make it possible to compare each card with the card ahead. The comparison may be a high-, an equal-, or a low-sequence condition.

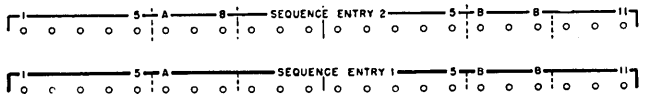
Sequence-checking operations can be performed independently or in conjunction with other operations. The results of the checking operation can be used to perform various functions, such as stopping the machine for a card out of order, recognizing a change in control groups, or identifying the first and last cards of a group.

Control-Panel Hubs



L-P, 1-20 (Secondary); L-P, 23-42 (Primary)

SEQUENCE READ. These two groups of hubs are exits from the 80 sequence brushes in each feed. They are normally wired to SEQUENCE ENTRY 1 for sequence checking, or to a selector pickup. Impulses from these hubs are available only as a card passes the sequence read station.



C, K, 1-22 (Secondary); C, K, 23-44 (Primary)

SEQUENCE ENTRY 1; SEQUENCE ENTRY 2. These hubs are entries to the two sides of the sequence unit in each feed, and accept 0-9 impulses on corresponding card-feed cycles. Each sequence unit is used to compare a card at the first reading station with a card at the second reading station in its corresponding feed — primary or secondary. ENTRY 1 hubs are normally wired from SEQUENCE READ, and the corresponding ENTRY 2 hubs from PRIMARY OR SECONDARY READ.

The result of the comparison may be high, equal, or low. To indicate this, an impulse is available from the corresponding sequence functional exit, and the corresponding sequence selector group transfers. The exit impulse and the selector can be used for the control of machine operations.

A sequence unit must not be used for comparisons between feeds. However, the secondary sequence unit can be used for additional comparison in the primary feed by wiring the secondary sequence shift switch (SEQ SH; L-M, 22). The primary sequence unit cannot be shifted for use in the secondary feed.

On a full-capacity machine (Model 1), 22 control positions are available in each unit. The positions of a unit are tested from left to right, for one high, equal, or low comparison. Therefore, if major, intermediate, and minor control fields (such as state, county, and city) are to be tested, the major field must be wired to the left, the intermediate field next, and the minor field to the right.

The 22 positions in a full-capacity unit can be split into two groups (A and B) of 11 positions each by wiring the sequence split switch (SEQ SPT; P, 21-22, 43-44). This permits two separate high-equal-low comparisons that can be used independently to control machine operations.

To provide for the split on a Model 2 machine that has 16 positions standard, positions A, 1-8 and B, 1-8 are supplied. On a Model 3 machine (10 positions standard) positions A, 1-5 and B, 1-5 are supplied. When the units are not split, wire these hubs consecutively up to the capacity limit. For example, when wiring an 8-column field on a 10-position machine, use positions A, 1-5 and B, 1-3.

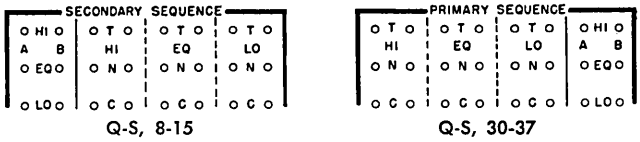
L-N, 21 (Secondary)

L-N, 43 (Primary)

SEQ N, F (Sequence On, Off). The SEQ OFF hub emits every machine cycle; SEQ ON emits every machine cycle except when the corresponding sequence unit recognizes a low condition. The entry hub (center hub) *must* receive an impulse every machine cycle to permit card feeding; if it does not, card feeding stops and the control stop light turns ON.

When wired ON, this switch causes the machine to stop automatically for a low condition in the associated feed (SEQ ON does not emit). This switch is normally used to signal an error condition when cards in ascending order are checked for sequence. If it is also desired to stop the machine for some other condition, wire the switch ON through the normal side of a selector.

Both primary and secondary SEQ switches must be wired ON or OFF for the machine to operate, regardless which feed or sequence unit is used. When SEQ OFF is wired, the sequence units operate but the machine does *not* stop for a low-sequence condition. When SEQ SPT is wired, the corresponding SEQ ON switch stops card feeding for a low-sequence condition in the B section only.



SECONDARY SEQUENCE; PRIMARY SEQUENCE (Functional Controls) These functional exits and selector groups are associated with their respective sequence units, and are used to control machine operation according to the results of comparing in the sequence units.

One of the HI, EQ, LO exits (Q-S, 8-9, 36-37) emits an impulse each machine cycle, depending on the comparison in the sequence unit (high, equal, or low). That is, if the number in ENTRY 1 (normally read from the card at sequence read) is higher than the number in ENTRY 2 (normally read from the card ahead, at primary or secondary read), the HI exit emits an impulse; if the number in ENTRY 1 is lower than the number in ENTRY 2, the LO exit emits; if the numbers are equal, EQ emits. These impulses can be used to pick up selectors to control machine operation.

The exit hubs are divided into two groups, A and B, to correspond to the split groups in the sequence units. The group B hubs are always active, but the group A hubs are active only when the unit is split. In this case, the A hubs emit an impulse corresponding to the comparison in the A section of the sequence unit, and B hubs emit an impulse corresponding to the comparison in the B section.

When a sequence unit is not wired for comparison, the EQ B (EQ A also, if unit is split) exit hub emits an impulse every machine cycle.

One of the HI, EQ, LO selectors (Q-S, 10-15, 30-35) transfers on each machine cycle, depending on the comparison in the associated sequence unit (high, equal, or low).

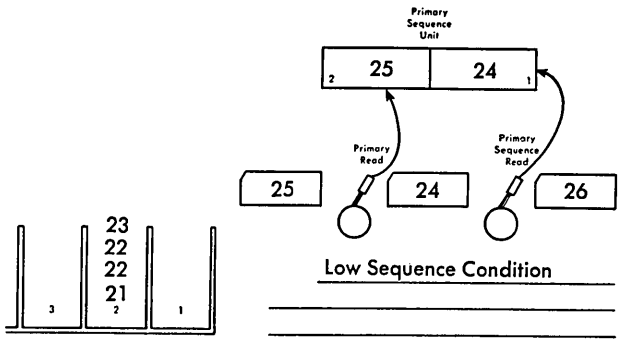
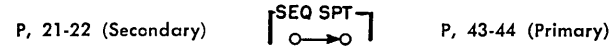


Figure 17. Checking Sequence

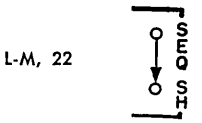
For example, if the number in ENTRY 1 is higher than the number in ENTRY 2, the HI sequence selector transfers. These selectors can be used to control machine operations, by wiring an impulse through the normal or transferred side.

Each selector group has two sets of common (C), normal (N), and transfer (T) hubs. When a selector is normal, C and N are internally connected so that an impulse entering C is available out of N; when the selector transfers, C and T are internally connected so that an impulse entering C is available out of T. A selector group transfers after the reading of a card, and drops out as the next card is being fed.

When a sequence unit is split, the functional selectors for that unit transfer for the comparison in section B.



SEQ SPT (Sequence Split). These switches split the associated sequence unit into two equal sections, A and B. Each section can be used independently to control machine operation. When a SEQ SPT switch is wired, both sequence exits A and B emit impulses corresponding to the comparison in the respective section of the sequence unit. The sequence selectors then operate in conjunction with the B section only, and card feeding stops automatically (SEQ ON wired) for a low-sequence condition in the B section only.



SEQ SH (Sequence Shift). This switch shifts the secondary sequence unit so that it can be used for control in the primary. When SEQ SH is wired, secondary sequence exits and selectors are associated with the primary. Wire the secondary SEQUENCE ENTRIES from read stations in the primary.

Checking Cards in Ascending Order

Because a file should normally be in ascending sequence, the cards are in order if any card is either higher than or equal to the card ahead. However, if a card is lower than the card ahead (a *step-down* condition), an error in sequence is indicated. This error is recognized as a *low-sequence* condition.

Figure 17 illustrates a card (24) out of order. Card 25 has just passed primary read, and the number has been read into primary sequence unit, entry 2. At the same time, card 24 has just passed primary sequence read, and the number has been read into primary sequence unit, entry 1. Thus, a step-down, or a low-sequence condition, exists.

When card feeding stops because of an error in sequence, the cards should be removed from the hopper. Then, after pressing the runout key, examine the cards in pocket 1. The step-down card is the second one run out, but *may* or *may not* be the card out of sequence. If not, a check must be made of several cards from both the stacker and the hopper to determine

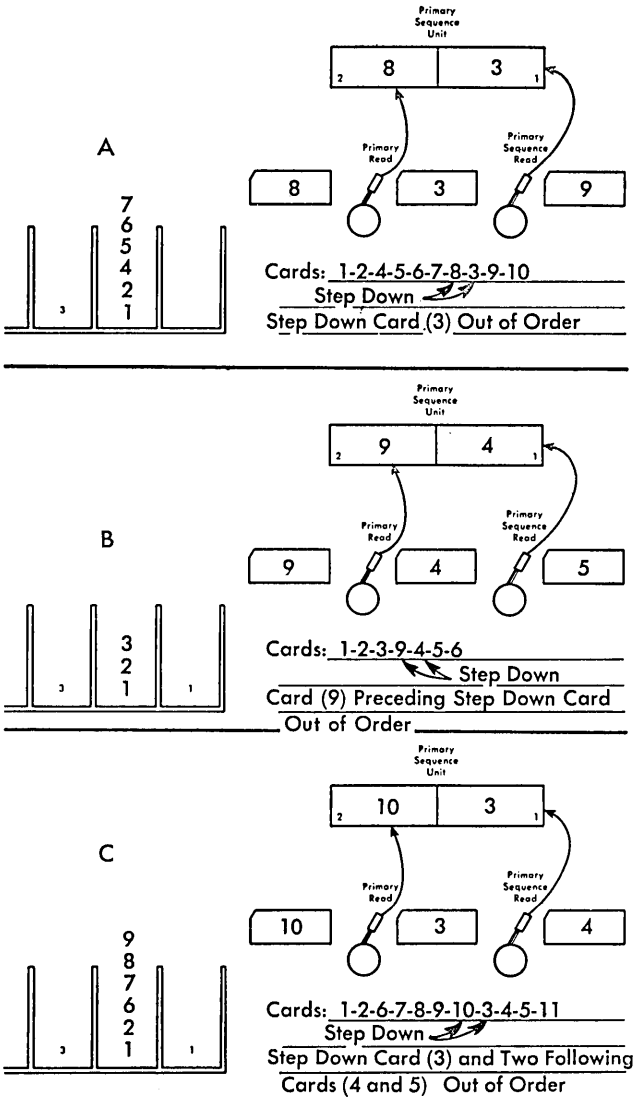


Figure 18. Three Types of Sequence Errors

exactly which card or cards are out of order. Figure 18 illustrates three different errors in sequence: in A, the step-down card (3) is out of order; in B, the card (9) preceding the step-down card is out of order; and in C, the step-down card (3) and the two cards (4 and 5) following it are out of order.

In the illustration (Figure 19) columns 1-5 of secondary cards are checked and card feeding is stopped when any card is out of order.

WIRING (FIGURE 19)

1. Wire columns 1-5 from SEQUENCE READ to SEQUENCE ENTRY 1 and from SECONDARY READ to SEQUENCE ENTRY 2.
2. Wire secondary SEQ ON to stop the machine automatically for a *low* sequence. Wire primary SEQ ON or OFF depending on the operation performed in the primary feed.

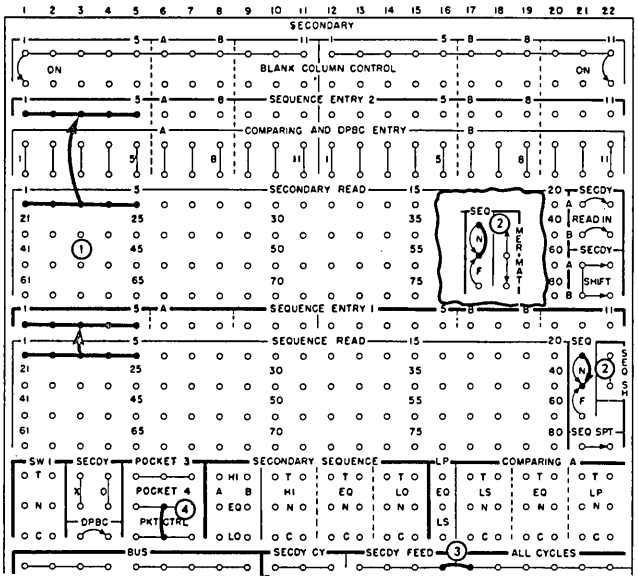


Figure 19. Sequence Checking — Ascending Order

3. Wire ALL CYCLES to SECDY FEED to feed a card in the secondary every machine cycle.
4. Wire PKT CTRL to POCKET 4 to direct cards to pocket 4. (Reserve pocket 5 for error runout.)

Selecting the Last Card of a Group

The end of one control group and the beginning of another is recognized by a change in control numbers. If the cards are in ascending order and the control fields are compared in the same manner as in sequence checking, the change is recognized by a high comparison. This is shown in Figure 20 in which the last card of one group (102) is compared with the first card of the following group (103).

In Figure 21, the last card of each control group is selected to stack in pocket 1; all other cards stack in pocket 2.

WIRING (FIGURE 21)

1. Wire SEQUENCE ENTRY 1 and 2 from SEQUENCE READ and PRIMARY READ, respectively.

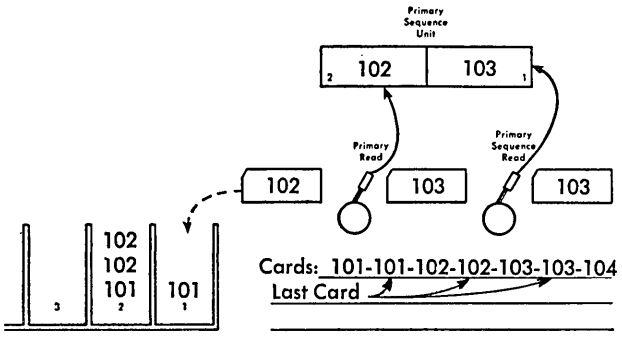


Figure 20. Selecting Last Card of a Group

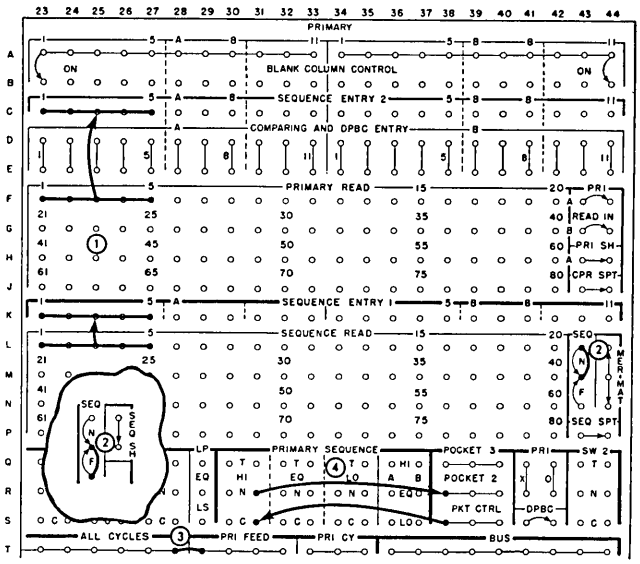


Figure 21. Selecting Last Card of a Group

2. Wire primary SEQ ON to stop card feeding for a low condition. Wire secondary SEQ OFF to permit card feeding.
3. ALL CYCLES to PRI FEED feeds a card every cycle.
4. PKT CTRL through the normal side of the HI primary sequence selector to POCKET 2 selects the last card of a group to pocket 1.

Checking Sequence — More Than 22 Columns

Up to 44 columns can be sequence-checked in one run by shifting the secondary sequence unit to operate in the primary, and then by coupling the primary and secondary sequence units. Twenty-two columns are compared in the primary sequence unit in the normal manner, and 22 columns are compared in the shifted secondary sequence unit. The principle for checking two control units requires checking both units for low sequence. The sequence condition of the high-order unit takes precedence, except on an equal condition. Then, a low sequence in the low-order unit is the determining factor to stop card feeding. If the columns are entered in the sequence units as shown in Figures 22 and 23, a card out of sequence is recognized by either a low-primary or a low-secondary sequence.

WIRING (FIGURE 23)

1. Wire the high-order card columns (1-22) from SEQUENCE READ and PRIMARY READ to secondary SEQUENCE ENTRIES 1 and 2, respectively.
2. Wire the low-order card columns (23-44) to primary SEQUENCE ENTRIES 1 and 2.
3. ALL CYCLES to PRI FEED feeds a card every machine cycle.
4. Wire secondary SEQ OFF to permit card feeding.
5. Shift the secondary sequence unit for use in the primary feed by wiring SEQ SH.
6. Primary SEQ OFF wired through the LO and EQ secondary sequence selectors, and through the LO primary sequence selector, tests both the high-order and low-order sequence units. In the high-order unit:
   a. If low sequence, stop card feeding.
   b. If equal sequence, test the low-order unit (primary sequence) and stop card feeding for a low-sequence condition.
   c. If high sequence (not equal, not low), card feeding proceeds.
7. PKT CTRL to POCKET 2 directs cards to pocket 2. (Reserve pocket 1 for error runout.)

Merging

Merging is combining two files of cards already in sequence into a single file that is also in sequence. For example, a file of master name and address cards combined with a file of detail cards produces a merged file for preparing invoices. One file is placed in the primary feed, and the other in the secondary feed.

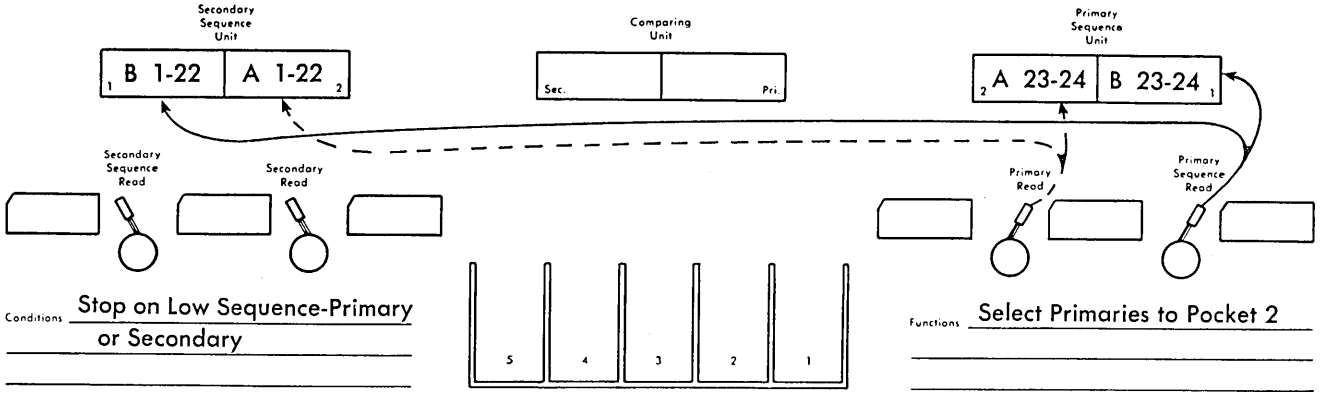


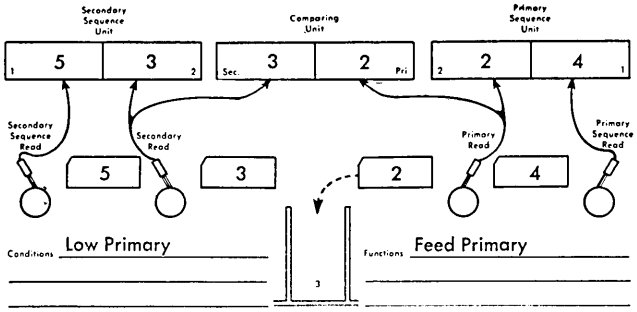
Figure 22. Checking Sequence — More than 22 Columns

Primary cards are fed ahead of secondary cards of the same group. Therefore, place those cards that should be first in the completed file in the primary hopper.

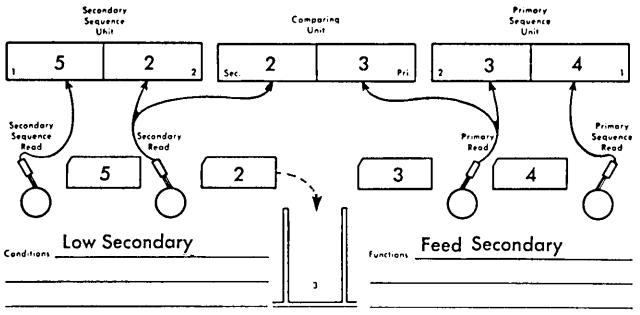
To merge the two files, a card in the master file is compared with a card in the detail file to determine which card should be moved first to the merged file. The comparison indicates one of three conditions (Figure 24):

1. The card in the master file is low (A and C).
2. The card in the detail file is low (B).
3. The cards in both files are equal (D).

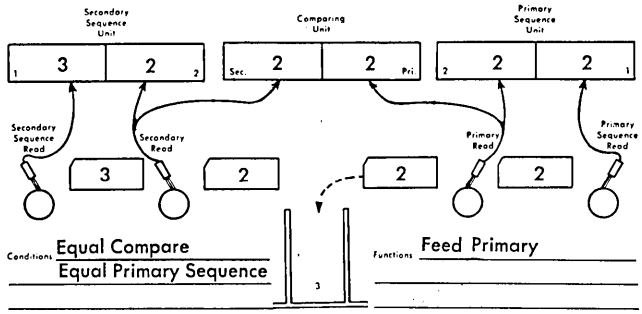
The operation requires using both the comparing unit and the sequence units for comparing four cards simultaneously. When the cards are compared, one of five conditions controls card feeding automatically, if the MERGE switch on the control panel is wired.



1. *Low Primary.* The primary card is lower than the secondary card. The primary card is fed.



2. *Low Secondary.* The secondary card is lower than the primary card. The secondary card is fed.



3. *Equal Comparing and Equal Primary Sequence.* The primary card is equal to the secondary card and to the primary sequence card. The primary card is fed because all primaries are normally filed ahead of the secondaries when there are several cards with the same control number in both files.

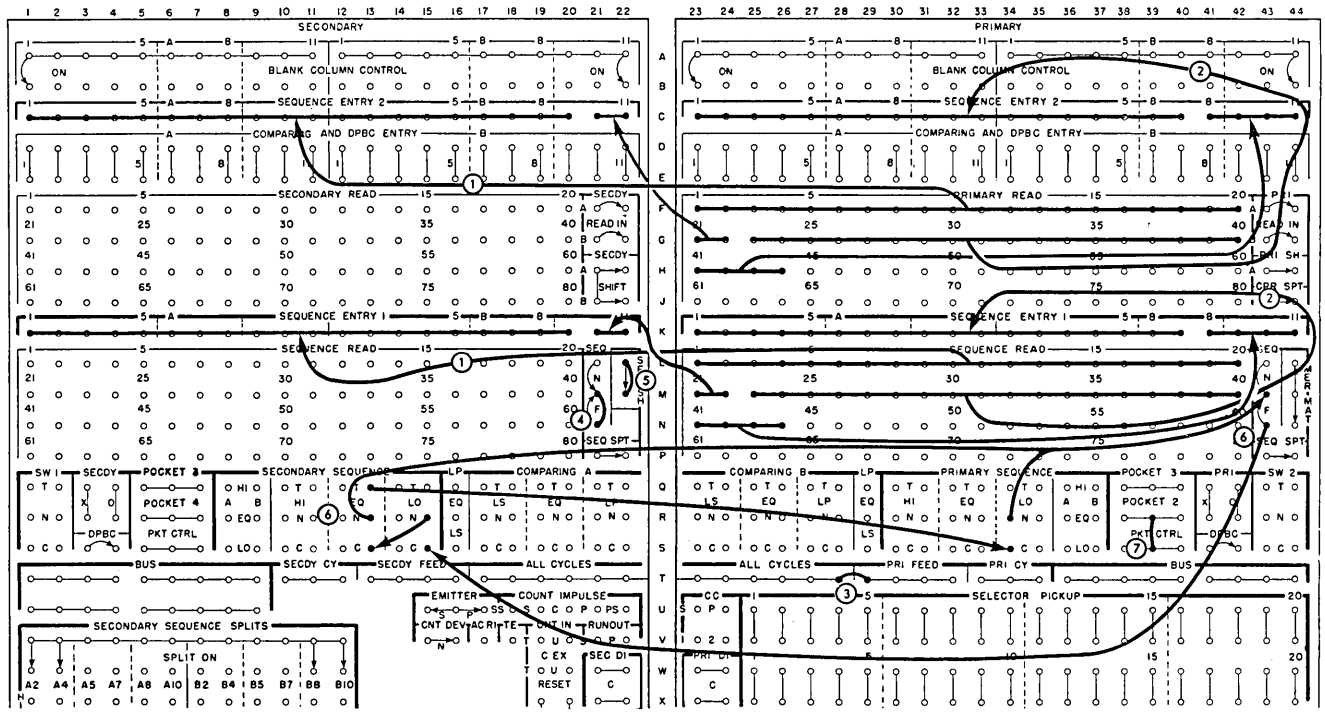
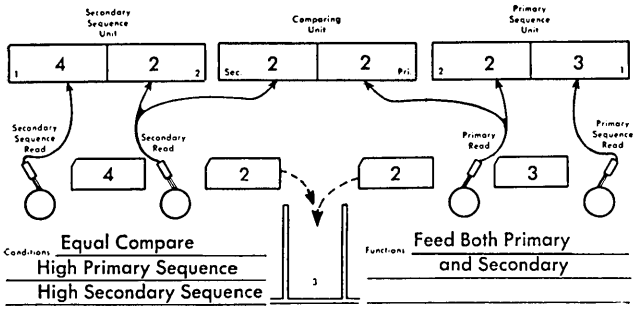
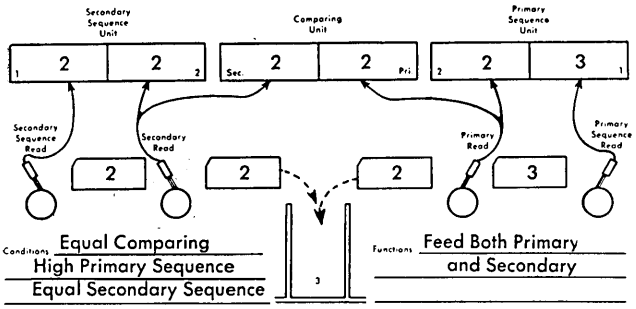


Figure 23. Checking Sequence — More than 22 Columns

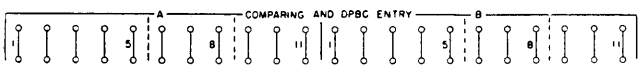


4. *Equal Comparing and High Primary Sequence.* The primary card is equal to the secondary card; the primary sequence card is higher than the primary card. Both the primary and secondary cards are fed. Thus, the last card of a group in the primary file and the first card of the same group in the secondary are fed simultaneously.



5. *Equal Comparing, High Primary Sequence, and Equal Secondary Sequence.* The primary card is equal to the secondary card; the primary sequence card is higher than the primary card; the secondary sequence card is equal to the secondary card. Both the primary and secondary cards are fed. Thus, as in condition 4, the last card of the primary group and the first card of the same group in the secondary are fed simultaneously. In addition, the equal secondary sequence condition interlocks the primary to provide continuous feeding of multiple secondaries on an equal comparison, until a high secondary sequence occurs. If this were not done, additional secondaries of an equal group (2) would be compared with the next primary card (3), and fed and erroneously selected as low secondaries in a merging-with-selection operation.

Control-Panel Hubs



D-E, 1-22 (Secondary); D-E, 23-44 (Primary)

COMPARING AND DPBC ENTRY. These two sets of hubs are entries to the comparing unit for comparing and double-punch and blank-column checking. They are normally wired from PRIMARY and SECONDARY READ to compare cards at the primary

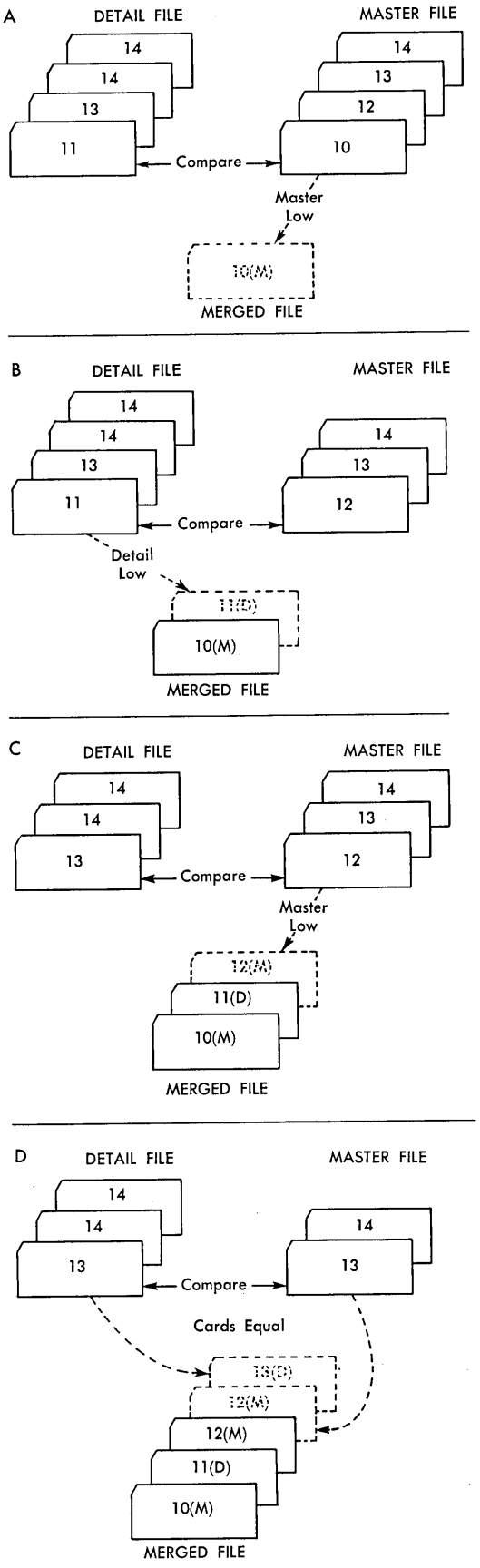


Figure 24. Merging

and secondary read stations. (Common hubs for each position provide convenience for jackplugging to SEQUENCE ENTRY 2.) The results of the comparison may be low secondary, equal, or low primary. An impulse is available from the corresponding comparing exit, and the corresponding comparing selector transfers, for control of machine operation.

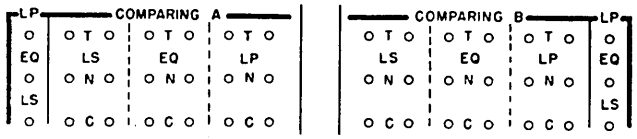
The comparing entries accept digit impulses 0-9 only when the READ IN or the MATCH or MERGE switches are wired. Because the comparing unit distinguishes between blanks and zeros, numerical fields should be fully punched.

On a full-capacity machine (Model 1), 22 control positions are available. The positions of the comparing unit are tested from left to right, for one low-secondary, equal or low-primary comparison. Therefore, if major, intermediate, and minor control fields (such as state, county, and city) are to be tested, the major field must be wired to the left, the intermediate field next, and the minor field to the right.

The 22 positions in a full-capacity unit can be split into two groups (A and B) of 11 positions each, by wiring the comparing split switch (CPR SPT; J, 43-44). This permits two separate comparisons that can be used independently to control machine operations.

To provide for the split on a Model 2 machine (16 positions), positions A, 1-8 and B, 1-8 are supplied. On a Model 3 machine (10 positions), positions A, 1-5 and B, 1-5 are supplied. When the units are not split, wire these hubs consecutively up to the capacity limit. For example, when wiring an 8-column field on a 10-position machine, use positions A, 1-5 and B, 1-3.

The comparing unit is not normally used for comparison within the same feed. However, the secondary side of the comparing unit can be shifted to the primary, for additional comparison in the primary feed, by wiring the secondary shift switches (SECDY SHIFT; H-J, 21-22). Also, primary shift A switch (PRI SH A; H, 43-44) permits wiring section A of the primary side of the comparing unit from a secondary reading station, for additional comparing in the secondary feed.



Q-S, 16-29

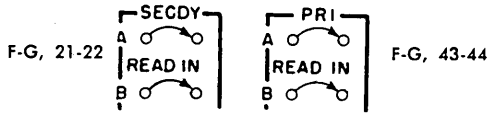
COMPARING A; COMPARING B (Functional Controls). These comparing exits and selector units are associated with the comparing unit for the control of the machine according to the comparison between the primary and secondary feeds.

One of the LP, EQ, LS exits (Q-S, 16, 29) emits an impulse each machine cycle depending on the comparison in the comparing unit (low primary, equal, or low secondary). For example, if the number in primary COMPARING ENTRY is lower than the number in secondary COMPARING ENTRY, the LP exit emits. Use these impulses to pick up selectors to control machine operation.

Both COMPARING A and B exits emit every machine cycle. When the unit is split, the A exits correspond to the comparison in section A, and B exits to the comparison in section B. When the unit is not split, the A and B exits give the comparison for the entire unit.

One of the LS, EQ, LP selectors (Q-S, 17-28) transfers on each machine cycle depending on the comparison in the comparing unit (low secondary, equal, low primary). For example, if the number in the secondary COMPARING ENTRY is lower than the number in the primary COMPARING ENTRY, the LS comparing selector transfers. Use these selectors to control machine operations, by wiring an impulse through the normal or transferred side.

The comparing A and B selectors operate together and transfer for the comparison in the entire comparing unit, when the unit is not split. When the unit is split, the A and B selectors operate in conjunction with their corresponding split sections.

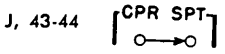


SECDY READ IN; PRI READ IN. These switches cause the associated side of the comparing unit to clear an old reading on each corresponding card-feed cycle, so that a new number can be read in. These switches can be selectively operated.

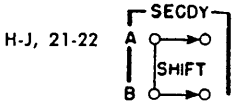
Two switches are provided in each feed to correspond to the A and B sections of a split unit. When the comparing unit is split, wire the READ IN switch of the section used; when it is not split, the READ IN A and B hubs are common and either may be wired to control the whole unit.

When the secondary unit is shifted (with or without splitting) and the SECDY READ IN hubs are wired, the shifted secondary unit is cleared on every *primary* card-feed cycle. Similarly, when primary section A is shifted and the PRI READ IN A hubs are wired, primary section A is cleared on every *secondary* card-feed cycle.

When the MERGE or MATCH switch (L-N, 44) is wired, the READ IN hubs need not be wired because read-in is internally controlled. If the unit is split and MERGE or MATCH is wired, comparing section B reads in automatically, but PRI and SECDY READ IN A must be wired to use comparing section A.



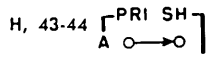
CPR SPT (Comparing Split). This switch splits the comparing unit into two equal sections, A and B. Use each section independently to control machine operations. When CPR SPT is wired, both COMPARING A and COMPARING B exits emit impulses every machine cycle. These impulses correspond to the comparison in the respective sections. Also, COMPARING A and COMPARING B selectors operate in conjunction with their associated comparing exits. The CPR SPT switch must be wired whenever primary comparing section A is shifted for use in the secondary feed.



SECDY SHIFT A, B. These switches shift sections A and B of the secondary side of the comparing unit for comparisons in the primary feed. When shifting only half the secondary unit, wire CPR SPT also.

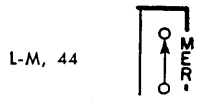
With a SECDY SHIFT switch wired, the corresponding SECDY READ IN hubs function on every *primary* card-feed cycle.

Do not wire MERGE or MATCH when SECDY SHIFT B is wired.



PRI SH (Primary Shift). This switch shifts section A of the primary side of the comparing unit for use in the secondary feed. When shifted and PRI READ IN A is wired, primary section A reads in on every *secondary* card-feed cycle.

When PRI SH is wired, CPR SPT must also be wired.



MER (Merge). This switch eliminates much control-panel wiring by internally establishing circuits to control card feeding in a merging operation in ascending sequence.

The control numbers must be entered in the comparing unit to compare cards in the two feeds, and they must also be entered in both sequence units to determine the sequence of cards in each feed. To enter the numbers in the comparing unit, it is necessary only to wire the fields to the entries; the READ IN switches need not be wired because read-in is controlled by the MER switch. With these units properly wired and the MER switch wired, cards are fed for these conditions:

1. Low primary cards are fed ahead of secondary cards. These primary cards can be selected to stack in a separate pocket in a merging-with-selection operation.
2. Low secondary cards are fed ahead of primary cards. These secondary cards can be selected to stack in a separate pocket in a merging-with-selection operation.
3. Equal primary cards (except the last one) are fed ahead of equal secondaries.
4. The last equal primary card of a group and the first equal secondary card are fed together.
5. All succeeding secondary cards of the same equal group are fed as equals. This prevents erroneous selection of equal secondaries, that would occur if they were compared to the next primary card (first card of the next group) and fed as low secondaries.

Wire PKT CTRL through the proper functional control selectors to direct cards to the merge pocket and to the pockets desired for selected cards. Also wire the SEQ ON switches to stop card feeding for any cards out of order.

With SEQ SPT or CPR SPT wired, the MER switch functions only for the B sections of the units. The A sections operate as independent control units and all controls must be wired separately. With the MER switch wired, do not shift the secondary B section of the comparing unit for primary-feed use.

When MER is wired, the PRIMARY and SECONDARY FEED entries are inoperative.

The merge and match (MAT; M-N, 44) switches must not be wired for the same operation.

Cards should be checked for sequence, blank columns, and double punches during a merging operation.

Merging with Selection — Basic Setup

Cards can be selected from both files during a merging operation. For example, if master name and address cards are being merged with detail cards, it may be desirable to remove those master cards for which there are no corresponding detail cards, or *vice versa*. By doing this, the merged file contains only *equal* cards — that is, master and detail cards with the same control numbers. Primary cards to be selected are recognized by a low-primary comparison, and secondary cards to be selected are recognized by a low-secondary comparison.

In the illustration (Figure 25), selected primary cards stack in pocket 2, and selected secondary cards stack in pocket 4. Equal cards merge in pocket 3.

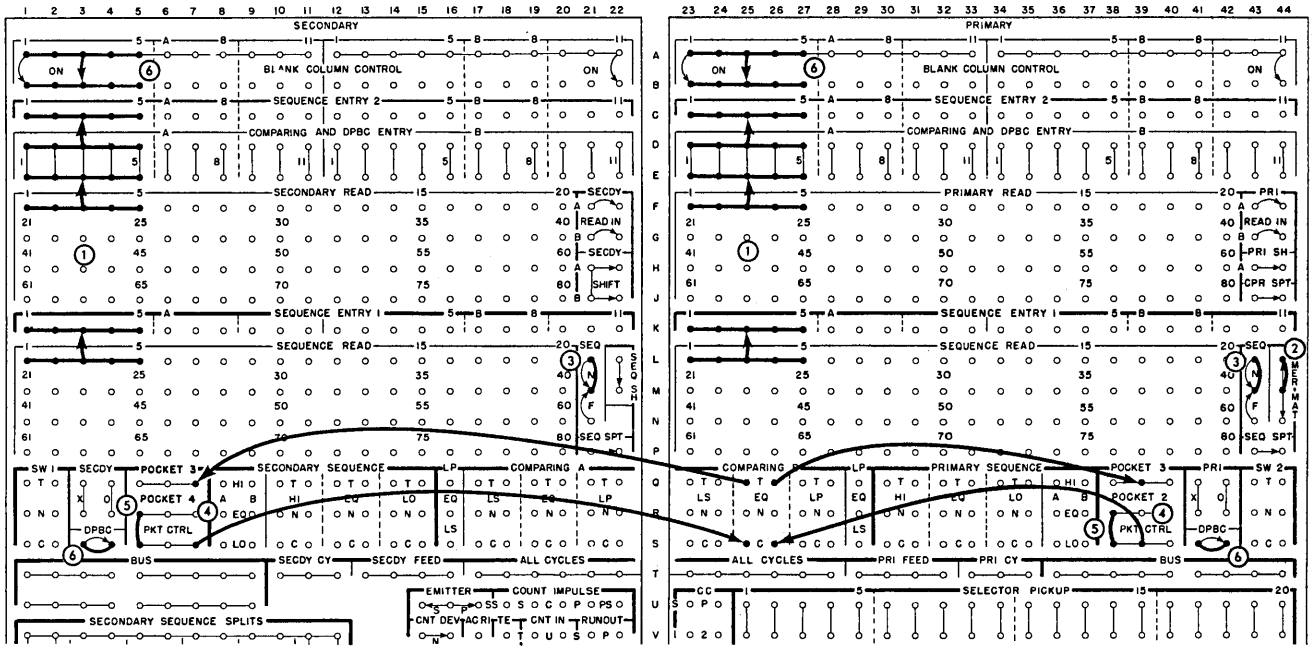


Figure 25. Merging with Selection — Basic Setup

WIRING (FIGURE 25)

1. Wire columns 1-5 from PRIMARY and SECONDARY READ to COMPARING ENTRY and SEQUENCE ENTRY 2. Wire columns 1-5 from primary and secondary SEQUENCE READ to SEQUENCE ENTRY 1.
2. Wiring MER controls card feeding automatically.
3. Primary and secondary SEQ ON switches stop card feeding for an error in ascending sequence in either feed.
4. PKT CTRL to POCKET 3 in both feeds, through the transferred points of the EQ comparing selector, directs all equal card groups to the merge pocket.
5. PKT CTRL to POCKET 2 and POCKET 4 selects low primaries into pocket 2 and low secondaries into pocket 4. When equals feed, the impulse to POCKET 3 takes precedence.
6. Stop card feeding for double-punch and blank-column errors. (See *Editing.*)

Sequence Checking — Selecting All Low Cards (Both Feeds)

This application illustrates the function of the control-panel hubs that split the comparing unit and shift the unit to the opposite feed.

When a sequence error is detected, one or more low cards may follow the step-down card. By control-panel wiring, all low cards can be recognized and selected (Figure 26).

To do this, in both feeds (1300 cards per minute), the number read from PRIMARY READ or SECONDARY READ when the step-down occurs is held in one side of the comparing unit. Then, each following card is compared with it and additional low cards are detected. A new number reads in only when an equal or high-sequence comparison occurs. Sequence checking then continues in the normal manner.

Because only the comparing unit can read in selectively, this unit must be used to retain the high

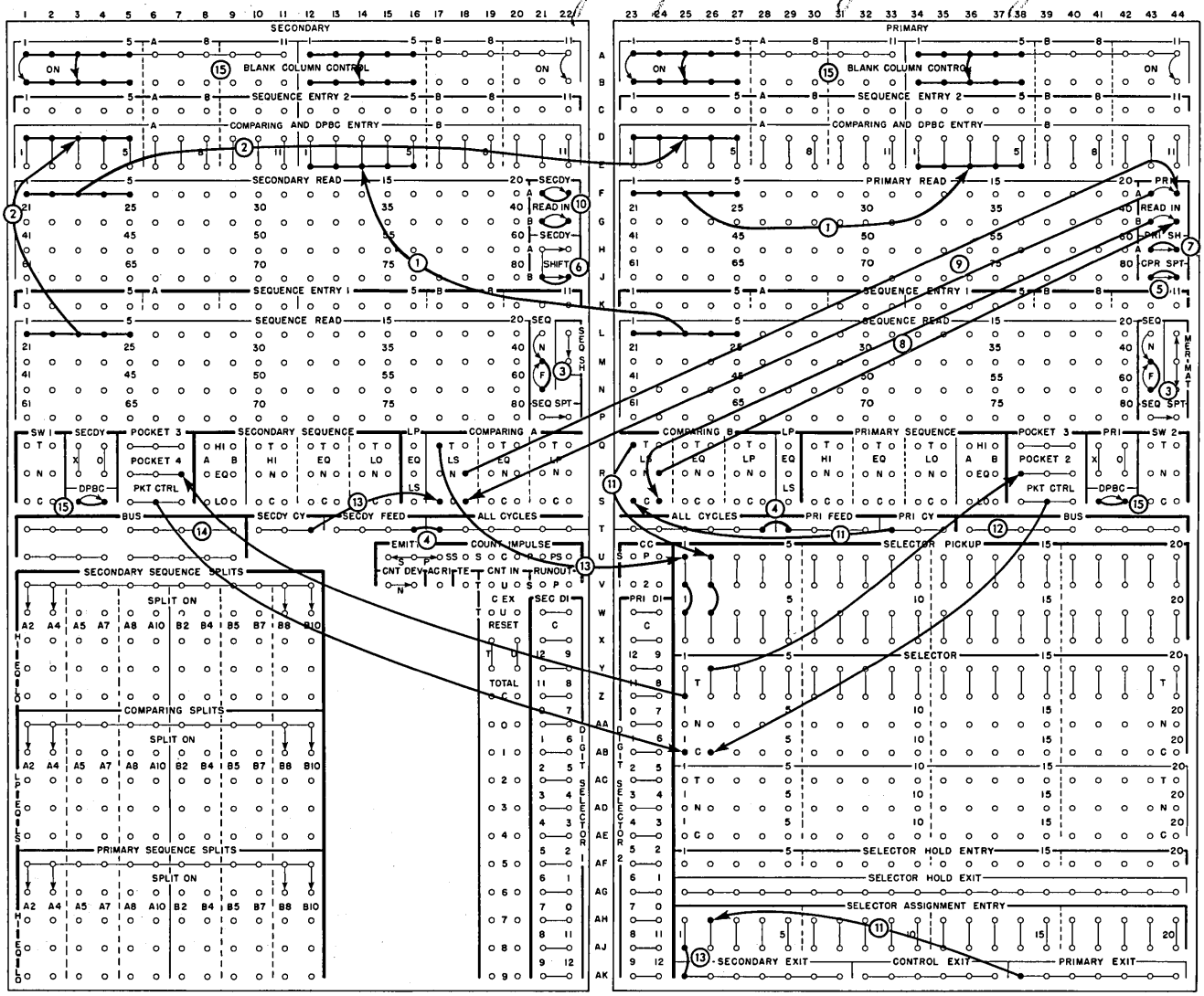


Figure 26. Sequence Checking — Selecting All Low Cards (Both Feeds)

number for comparison with successive low cards. A selector must be used to delay the pocket selection one cycle for low cards read at the sequence read station.

In a sequence-checking operation, a step-down indicates a sequence error, but does not indicate *which* card is out of order. Therefore, the cards selected may *not* be the cards out of order. For example, in a file of of cards 1-2-3-4-8-5-6-7-9-10, card 8 is out of sequnce, but low cards 5-6-7 are selected.

Cards selected in this operation cannot be assumed to be in sequence within the selected group. The DP&BC DETECT light turns on when cards are run out.

WIRING (FIGURE 26)

1. Wire the primary card field from PRIMARY READ and from primary SEQUENCE READ to primary and secondary COMPARING ENTRY B, respectively.
2. Wire the secondary card field from SECONDARY READ and from secondary SEQUENCE READ to primary and secondary COMPARING ENTRY A, respectively.
3. SEQ OFF in both feeds permits card feeding.
4. Wire ALL CYCLES to PRI FEED and SECDY FEED to feed cards in both feeds every machine cycle.
5. CPR SPT splits the comparing unit when using both feeds.
6. SECY SHIFT B shifts the B section of the comparing unit for use in the primary.
7. PRI SH shifts the A section of the comparing unit for use in the secondary.
8. PRI READ IN B through the normal side of LS COMPARING B selector, reads in a new number every card-feed cycle, except when a low-sequence condition occurs in the primary feed.
9. PRI READ IN A, through the normal side of LS COMPARING A selector, reads in a new number every card-feed cycle, except when a low-sequence condition occurs in the secondary feed.
10. Wire SECDY READ IN A and B to read in new numbers each machine cycle from cards at the sequence read stations.
11. PRI CY, through the transferred side of LS COMPARING B selector to both PICKUPS of Selector 2 assigned for primary use, transfers Selector 2 for the next card-feed cycle to select the low card at the primary sequence read station.
12. PKT CTRL, through the transferred side of Selector 2 to POCKET 2, selects all low cards in the primary.
13. SECDY CY, through the transferred side of LS COMPARING A selector to both PICKUPS of Selector 1 assigned for secondary use, transfers Selector 1 for the next card-feed cycle to select the low card at the secondary sequence read station.
14. PKT CTRL, through the transferred side of Selector 1 to POCKET 4, selects all low cards in the secondary.
15. Wire BLANK COLUMN CONTROL and DPBC switches to stop card feeding for double punches and blank columns.

Matching

Matching is searching two files of cards for corresponding cards, or groups of cards. The corresponding, or matched, cards are stacked separately in two groups. Any unmatched cards are selected from each file. In this operation the matching is by equal groups, regardless of the number of cards in a group.

The two original files of cards are arranged in numerical sequence, and each of the four groups is also

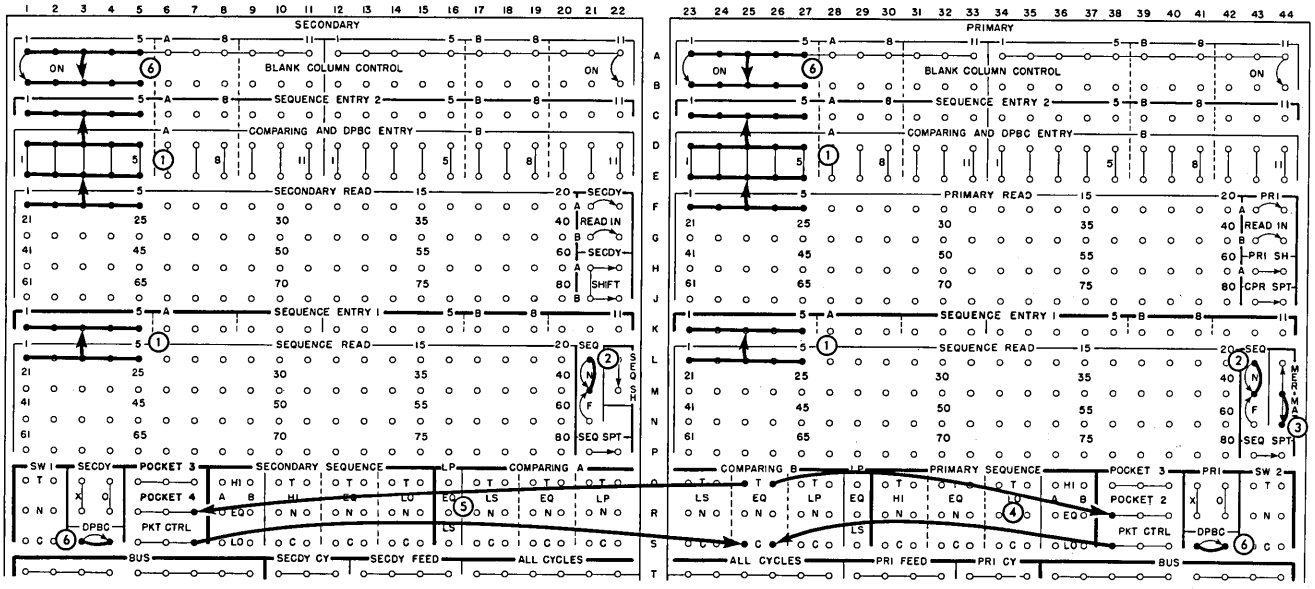


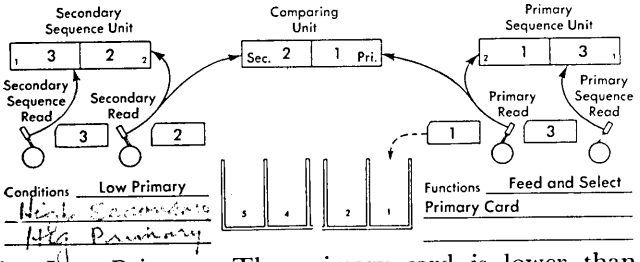
Figure 27. Matching

in sequence when the operation is completed. Thus, matching differs from merging with selection in only one respect: the matched cards from both files are stacked in two groups rather than in one combined group. This operation is performed at high speed because equals are fed from both feeds simultaneously.

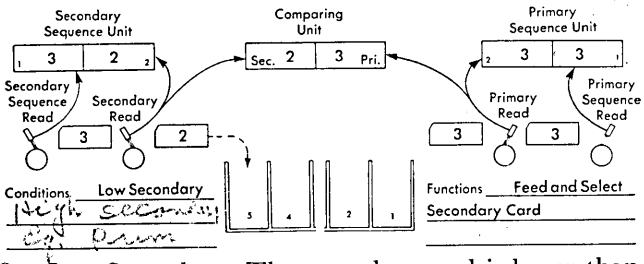
Four pockets in the collator are used for this operation, two for the matched cards and two for the unmatched. The matched cards in the primary and secondary are normally stacked in pockets 2 and 4, respectively (Figure 27). The unmatched primary and secondary cards are normally stacked in pockets 1 and 5, respectively.

Cards should be checked for sequence, double punches, and blank columns during a matching operation.

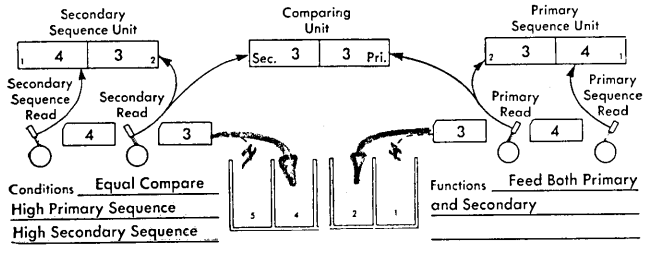
A matching operation requires using both the comparing unit and the sequence units for comparing four cards simultaneously. When the cards are compared with the MATCH switch on the control panel wired, one of five conditions controls card feeding automatically.



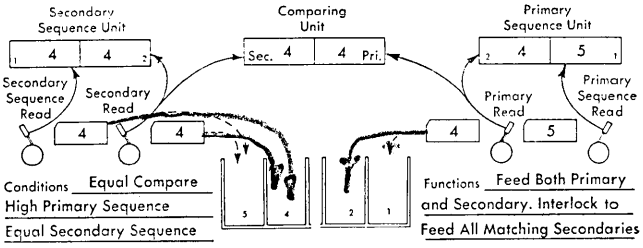
1. *Low Primary.* The primary card is lower than the secondary card. This unmatched primary card is fed and selected.



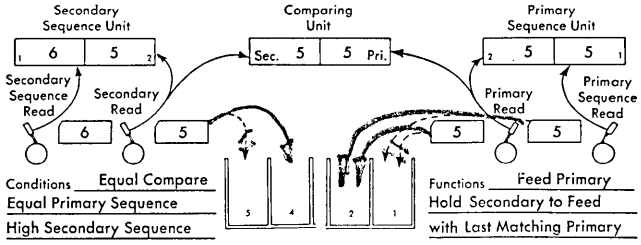
2. *Low Secondary.* The secondary card is lower than the primary card. This unmatched secondary card is fed and selected.



3. *Equal Compare.* The primary card is equal to the secondary card. Both cards are fed simultaneously, and stacked in separate pockets.



4. *Equal Comparing, High Primary Sequence, and Equal Secondary Sequence.* The primary card is equal to the secondary card; the primary sequence card is higher than the primary card; the secondary sequence card is equal to the secondary card. Both the primary and secondary cards are fed. The equal secondary sequence condition interlocks the primary to provide continuous feeding of multiple secondaries on an equal comparison, until a high secondary sequence occurs. If this were not done, additional secondaries of an equal group (4) would be compared with the next primary card (5), and be fed and erroneously selected as low secondaries.



5. *Equal Comparing, Equal Primary Sequence, and High Secondary Sequence.* The primary card is equal to the secondary card and to the primary sequence card. The primary card is fed. The secondary card is held and fed with the last equal primary card. If this were not done, additional primaries of an equal group (5) would be compared with the next secondary card (6), and be fed and erroneously selected in low primaries.

Control-Panel Hubs

MAT (Match). This switch eliminates much control-panel wiring by internally establishing circuits to control card feeding in a matching operation in ascending sequence.

As in merging, the control numbers must be wired to the comparing and sequence entries, but the comparing

read-in control need not be wired because the MAT switch controls this. With these units properly wired and the MAT switch wired, cards are fed for these conditions:

1. Low secondary cards are fed ahead of primaries. These unmatched cards are selected by control-panel wiring to stack separately from matched groups.
2. Low primary cards are fed ahead of secondaries. These unmatched cards are selected by control-panel wiring to stack separately from matched groups.
3. Equal primaries and secondaries are fed simultaneously. They are stacked in two separate pockets by control-panel wiring.
4. All extra primary or secondary cards of an equal control group are fed as equals. For extra secondaries, an interlock holds the equal comparison; for extra primaries, the last equal secondary is held and then stacked with the last equal primary. This permits extra equal cards to be stacked with the other equals of the same group. Otherwise, they would be compared with the next higher card in the opposite feed, and thus fed as low and erroneously selected with the unmatched low cards.

Wire both SEQ ON switches to stop card feeding for any card out of order. Also wire PKT CTRL to direct cards to the desired pockets.

With CPR SPT or SEQ SPT wired, the MAT switch functions only for the B sections of the units. The A sections operate as independent control units and all controls must be wired separately. With the MAT switch wired, do not shift the secondary B section of the comparing unit for use in the primary.

Use the MAT switch instead of the MER switch to speed up a merging operation, when it is *not* necessary for all primary cards of one group to precede the equal secondary cards. These mixed-merged cards are fed to the merge pocket by wiring PKT CTRL to POCKET 3. (See *Typical Operations — Mixed Merging.*)

When MAT is wired, the PRIMARY and SECONDARY FEED entries are inoperative.

The MERGE and MATCH switches must not be wired for the same operation.

Wiring: Matching (Figure 27)

1. Wire columns 1-5 for comparison in the comparing and sequence units.
2. Wire both SEQ ON switches to check for ascending sequence in both feeds.
3. Wiring MAT automatically controls card feeding according to comparisons.
4. Stack matched primaries in pocket 2 by wiring PKT CTRL through the transferred side of the EQ comparing selector to POCKET 2; unmatched primaries stack in pocket 1.
5. Stack matched secondaries in pocket 4 by wiring PKT CTRL through the transferred side of the EQ comparing selector to POCKET 4; unmatched secondaries stack in pocket 5.
6. Stop card feeding for double-punch and blank-column errors. (See *Editing.*)

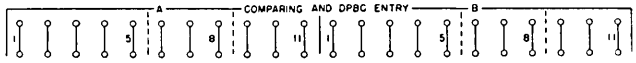
Editing

To assure accuracy, cards in each feed should always be checked for errors of double punching and blank columns. Up to 22 columns in each feed (or up to 44 columns in one feed) can be edited for these types of errors. Because the IBM 88 Collator is a numerical machine, double-punch detection is automatic for every position read into the comparing unit. To detect unpunched columns, a switch for each position must be wired. When a double-punch or blank-column error is detected and the DPBC switch is wired, card feeding stops, the DP&BC DETECT light glows, and a CHECK light indicates the feed containing the error card.

The DPBC circuitry checks punching positions 0 through 9, but does not detect control punches (X and 12) in a column.

Double-punch blank-column detection can be performed in conjunction with other operations, or as a separate operation (Figure 28).

Control-Panel Hubs



D-E, 1-22 (Secondary); D-E, 23-44 (Primary)

COMPARING AND DPBC ENTRY (Double-Punch Blank-Column Entry). These hubs are entries to the comparing and double-punch blank-column unit, and are normally wired from primary and secondary read. The unit checks only punching positions 0 through 9; overpunching of a control X or 12 is not detected as a double punch.

Double-punch detection operates whenever the DPBC ENTRY and DPBC switch are wired and the comparing unit reads in. Blank-column detection requires that BLANK COLUMN CONTROL is also wired ON for each position checked.

The comparing feature of these entries and the read-in control are described under *Merging — Control-Panel Hubs.* Procedures for locating the double punches or blank columns are explained under *Signal-Light Indications and Procedures.*

S, 3-4 (Secondary) S, 41-42 (Primary)

DPBC (Double Punch, Blank Column). With these selectable switches (one for each feed) wired, card feeding stops and the DP&BC DETECT and CHECK lights turn on when a double punch or blank column is detected. The left hub emits an impulse, when a double punch or blank column is detected, and the right hub (entry) accepts the impulse to stop operations before the next card is fed. This impulse can also be used to pick a selector to control selection of error cards.

The primary and secondary check lights indicate the *feed* in which an error is detected. If any portion of the comparing and DPBC unit is shifted for use in the opposite feed and an error is detected, the check light corresponding to that feed turns ON. For example, if secondary section A is shifted to the primary, an error in that section is indicated by the *primary* check light.

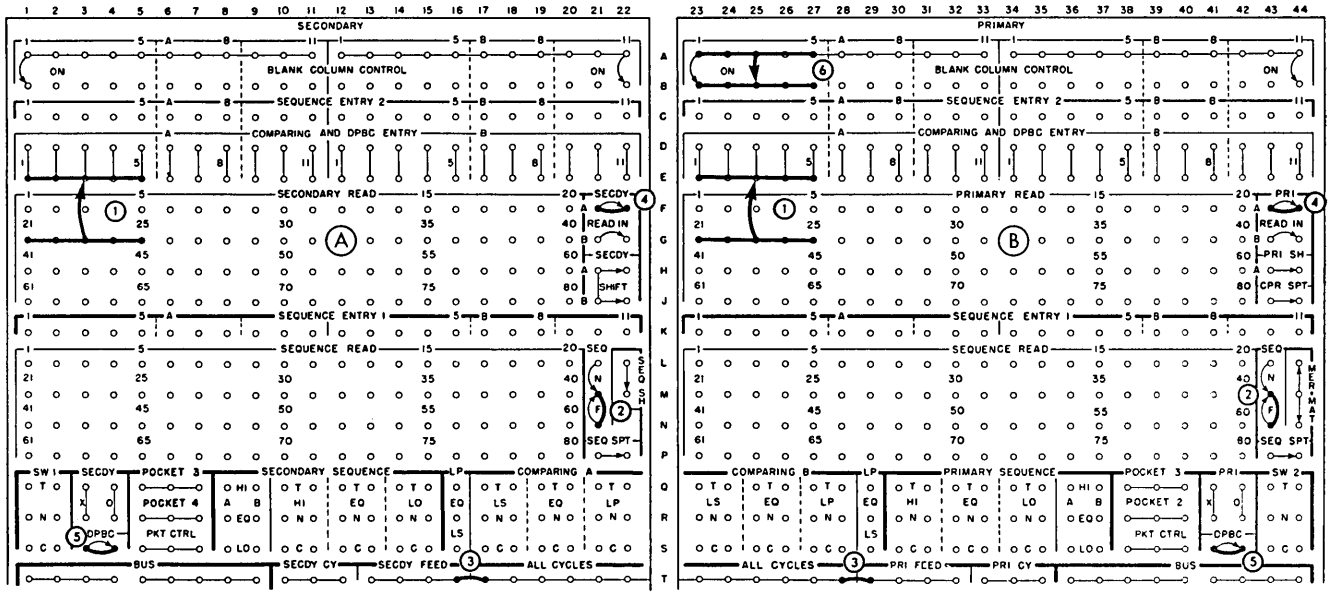
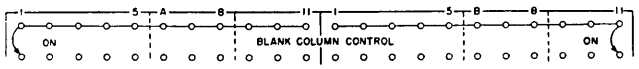


Figure 28. Checking for Double Punches — Secondary Feeds



A-B, 1-22 (Secondary); A-B, 23-44 (Primary)

BLANK COLUMN CONTROL. These switches cause the corresponding position of the comparing and DPBC unit (READ IN wired) to check for blank columns (punching positions 0-9). Every switch wired ON must have the corresponding DPBC ENTRY position wired; if the ENTRY is not wired, the unit senses the position as a blank. Each switch can be controlled by a selector.

The comparing and DPBC position that detects a blank is signalled by a light in the corresponding indicator panel. The left indicator panel corresponds with the secondary COMPARING AND DPBC ENTRY positions and signals blanks in these positions, regardless of whether or not the positions are shifted for use in the primary feed. Similarly, the right panel is always associated with the primary COMPARING AND DPBC ENTRY positions, regardless of shift.

Wiring: Checking for Double Punches (Figure 28-A)

1. Wire SECONDARY READ to secondary COMPARING AND DPBC ENTRY.
2. Wiring primary and secondary SEQ OFF permits card feeding.
3. ALL CYCLES to SECDY FEED feeds a card in the secondary every machine cycle.
4. Wire SECDY READ IN to enter the number read from each card.
5. Wire the DPBC switch, so that card feeding stops and the signal lights turn ON when a double-punched column is detected.

Wiring: Checking for Double Punches and Blank Columns (Figure 28-B)

1. Wire PRIMARY READ to primary COMPARING AND DPBC ENTRY.
2. Wiring primary and secondary SEQ OFF permits card feeding.
3. ALL CYCLES to PRI FEED feeds a card in the primary every machine cycle.
4. Wire PRI READ IN to enter the number read from each card.
5. Wire the DPBC switch so that card feeding will stop and the signal lights will turn on if a double-punched or blank column is detected.
6. Wiring the BLANK COLUMN CONTROL switches checks these positions for blanks.

This section presents typical operations to illustrate the versatility of the IBM 88 Collator. The analysis charts and control-panel wiring are representative of operations often performed on collators, and can serve as guides for specific applications. Generally, the presentation follows the same previous order: selecting, sequence checking, merging, matching, and editing. Locate combined operations by the index.

Comparing Two Fields in the Same Card

Two fields in the same card can be compared with each other to determine whether they are equal or, if unequal, which of the two is lower (or higher). In the illustrations (Figures 29 and 30), it is desired to select from a file all cards in which field B is less than field A. This can be done by comparing the two fields in a sequence unit as shown (or in the comparing unit if one side is shifted) and selecting on a low comparison.

WIRING (FIGURE 30)

1. Wire field A (cols. 1-5) from PRIMARY READ to SEQUENCE ENTRY 2.
2. Wire field B (cols. 6-10) from PRIMARY READ to SEQUENCE ENTRY 1.
3. Wiring the SEQ OFF switches in both feeds permits card feeding.

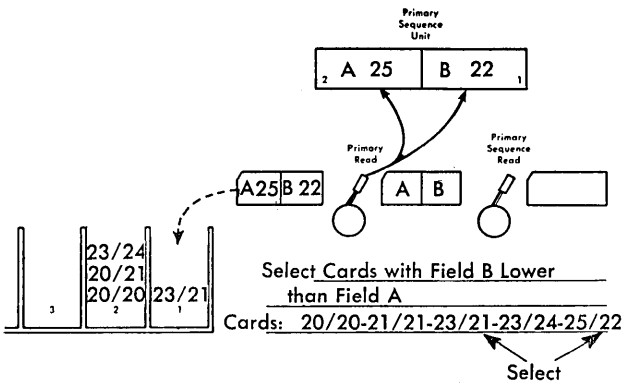


Figure 29. Comparing Two Fields in the Same Card

4. ALL CYCLES to PRI FEED feeds a card every cycle.
5. Wire PKT CTRL through the normal side of the LO primary sequence selector to POCKET 2. All cards with field B equal to, or higher than, field A are stacked in pocket 2; those with field B lower than field A are stacked in pocket 1.

Selecting Cards by Either of Two Control Numbers

Cards punched with either of two control numbers can be pulled from a file in one run of the cards through the primary. The selected cards can be stacked in two groups.

Both control numbers are punched in the same finder card (field A and field B), and the number in the file cards can be punched in the same field as either of the control numbers, or in a separate field.

The comparing unit is required in this operation and must be split into two sections: one to compare each file card with the control number in field A, and

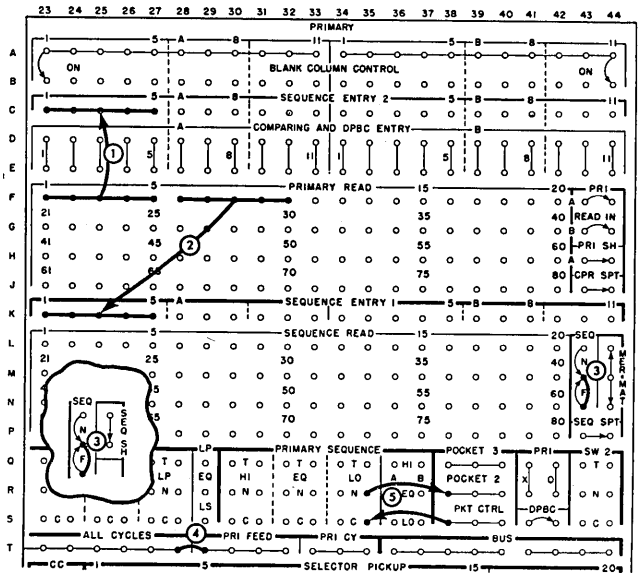


Figure 30. Comparing Two Fields in the Same Card

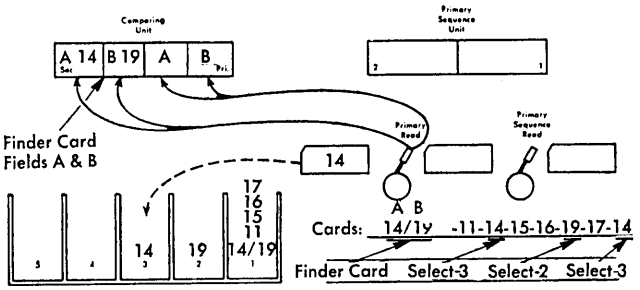


Figure 31. Selecting Cards by Either of Two Control Numbers

the other to compare with the control number in field B. The two control numbers must be entered from the finder card only and *remembered* throughout the run, or until another finder card is read. Finder cards require a control punch to control read-in.

In the illustrations (Figures 31 and 32), the primary feed is used, and the cards are stacked in three groups: cards punched with the number in field A (14) in pocket 3, those punched with the number in field B (19) in pocket 2, and all others in pocket 1. Because the primary feed is used, the secondary side of the comparing unit is shifted. The comparing unit is split, and the field-A number (14) is stored in secondary section A, and the field-B number (19) in secondary section B. Therefore, file cards punched with the number 14 are recognized by an equal comparison in section A of the comparing unit, and those punched 19 by an equal comparison in section B. The file-card number is punched in a separate field (not field A or B) in the detail cards and that field is unpunched in the finder card; therefore, the finder card is stacked in pocket 1.

WIRING (FIGURE 32)

1. Wire fields A and B of the finder card to sections A and B of secondary COMPARING ENTRY, respectively.
2. Wire the card columns of the file cards from PRIMARY READ to both sections A and B of primary COMPARING ENTRY.
3. SEQ OFF in both feeds permits card feeding.
4. ALL CYCLES to PRI FEED feeds a card every cycle.
5. Split the comparing unit into sections A and B for the two control numbers by wiring CPR SPT.
6. Wire the SECDY SHIFT switches to use both sections of the secondary side of the comparing unit in the primary.
7. Wire column 65 (X-finder card) from primary SEQUENCE READ to one PICKUP of selector 1.
8. Wire PRI X to the other PICKUP of selector 1. Selector 1 transfers when the X-finder card is at the sequence read station.
9. SECDY READ IN through the transferred side of selector 1 reads in the finder card.
10. PRI READ IN through the normal side of selector 1 reads in the file cards. This wiring prevents stopping for blank columns when the finder card is read.
11. Wire column 65 from PRIMARY READ to ONE PICKUP of selector 2. Wire the other PICKUP from PRI X (wire 8). Selector 2 transfers when the X-finder card is at the primary read station.
12. Assign both selectors 1 and 2 for primary use.
13. PKT CTRL through the normal side of selector 2 and the transferred side of the EQ comparing B selector stacks cards with numbers equal to field B in pocket 2.
14. PKT CTRL through the normal side of the EQ comparing B selector and the transferred side of the EQ comparing A selector stacks cards with numbers equal to field A in pocket 3. (When selector 2 transfers, no pocket is impulsed, thus directing the finder card and all unequal cards to pocket 1.)
15. Wire BLANK COLUMN CONTROL to check all fields for blanks.
16. Wiring the DPBC switch stops card feeding for double-punched or blank columns.

Selecting Cards between Two Control Numbers

Cards with numbers that are higher than a minimum and lower than a maximum can be selected. The minimum and the maximum limits are punched in the same finder card.

The comparing unit is required in this operation and must be split into two sections: one to compare each file card with the minimum limit, and the other to compare with the maximum limit.

The minimum and maximum limits must be entered from the finder card and retained throughout the run. Finder cards must have a control punch to control the read-in.

In the illustration (Figure 33), cards are fed in the primary, and the secondary side of the comparing unit is shifted to the primary. Finder cards and file cards punched with numbers between the limits are stacked in pocket 2, and all other cards are stacked in pocket 1.

WIRING (FIGURE 33)

1. Wire the minimum limit (columns 71-75) from PRIMARY READ to secondary COMPARING ENTRY A.
2. Wire the maximum limit (columns 76-80) from PRIMARY READ to secondary COMPARING ENTRY B.

3. Wire the field in the file cards (columns 1-5) from PRIMARY READ to both sections A and B of the primary COMPARING ENTRY.
4. Wiring primary and secondary SEQ OFF permits card feeding without checking for sequence.
5. ALL CYCLES to PRI FEED feeds a card every machine cycle.
6. CPR SPT splits the comparing unit into section A (low limit) and section B (high limit).
7. SECDY SHIFT A and B shift both sections of the secondary comparing unit to the primary.
8. Wire column 70 from SEQUENCE READ to one PICKUP of selector 1. Wire the other PICKUP from PRI X. Selector 1 transfers for the X-finder card.
9. READ IN exit wired, through the transferred side of selector 1, to SECDY READ IN A and B reads in the minimum and maximum limits from the X-finder card only.
10. READ IN exit wired to PRI READ IN A and B through the normal side of selector 1 reads in the card field in the file cards only.
11. Wire column 70 from PRIMARY READ to one PICKUP of selector 2. Wire PRI X to the other PICKUP. Selector 2 transfers for each X-finder card.
12. PKT CTRL to POCKET 2 through the transferred side of selector 2 directs the X-finder card to pocket 2.
13. PRIMARY EXIT to SELECTOR ASSIGNMENT ENTRY 1 and 2 assigns selectors to the primary.
14. Wire PKT CTRL to POCKET 2, through the transferred sides of both the LS comparing A selector and the LP comparing B selector, to direct all cards between the minimum and maximum limits to pocket 2. All other file cards are stacked in pocket 1.
15. Wiring BLANK COLUMN CONTROL checks the fields in both the finder card and file cards for blanks

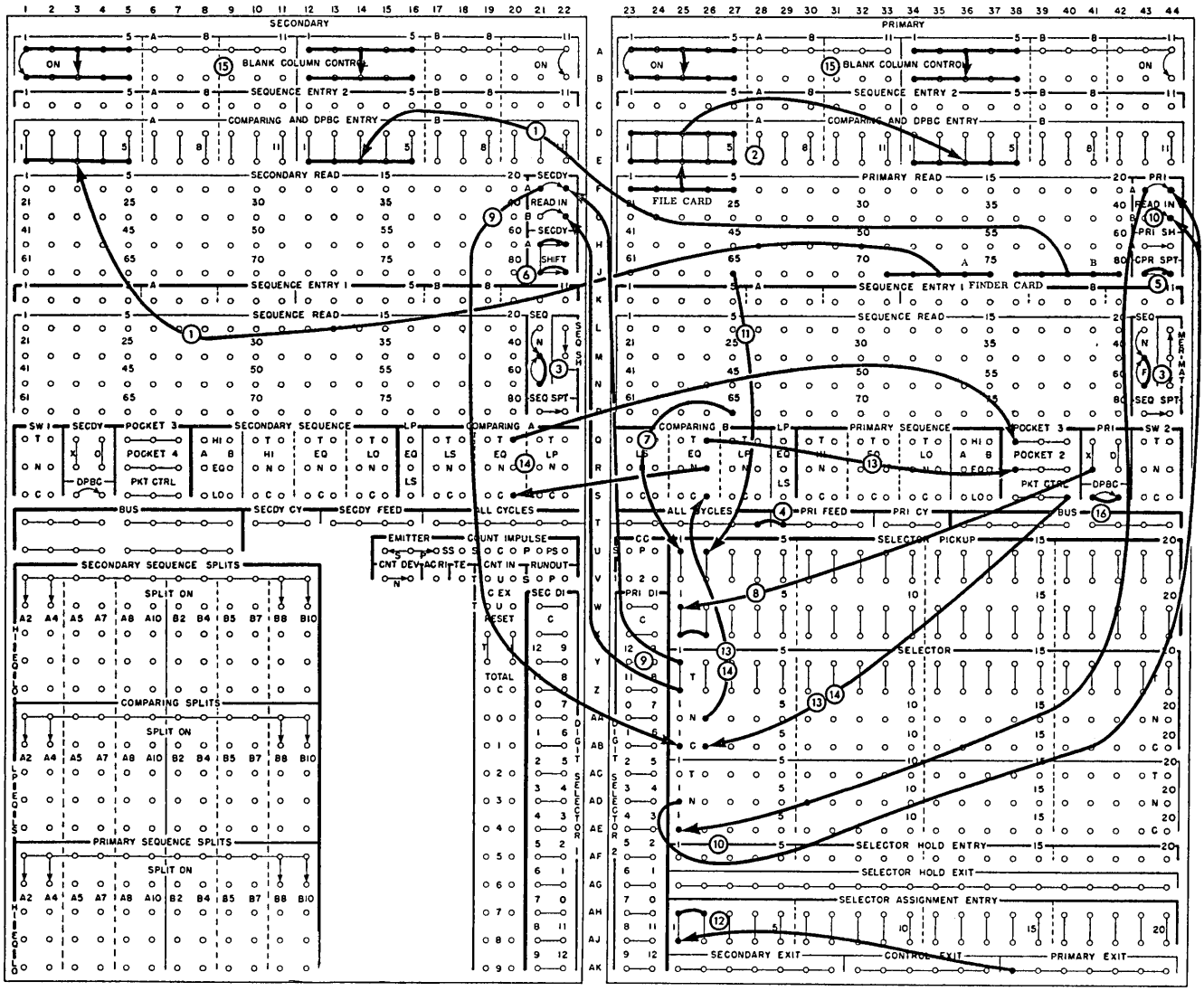


Figure 32. Selecting Cards by Either of Two Control Numbers

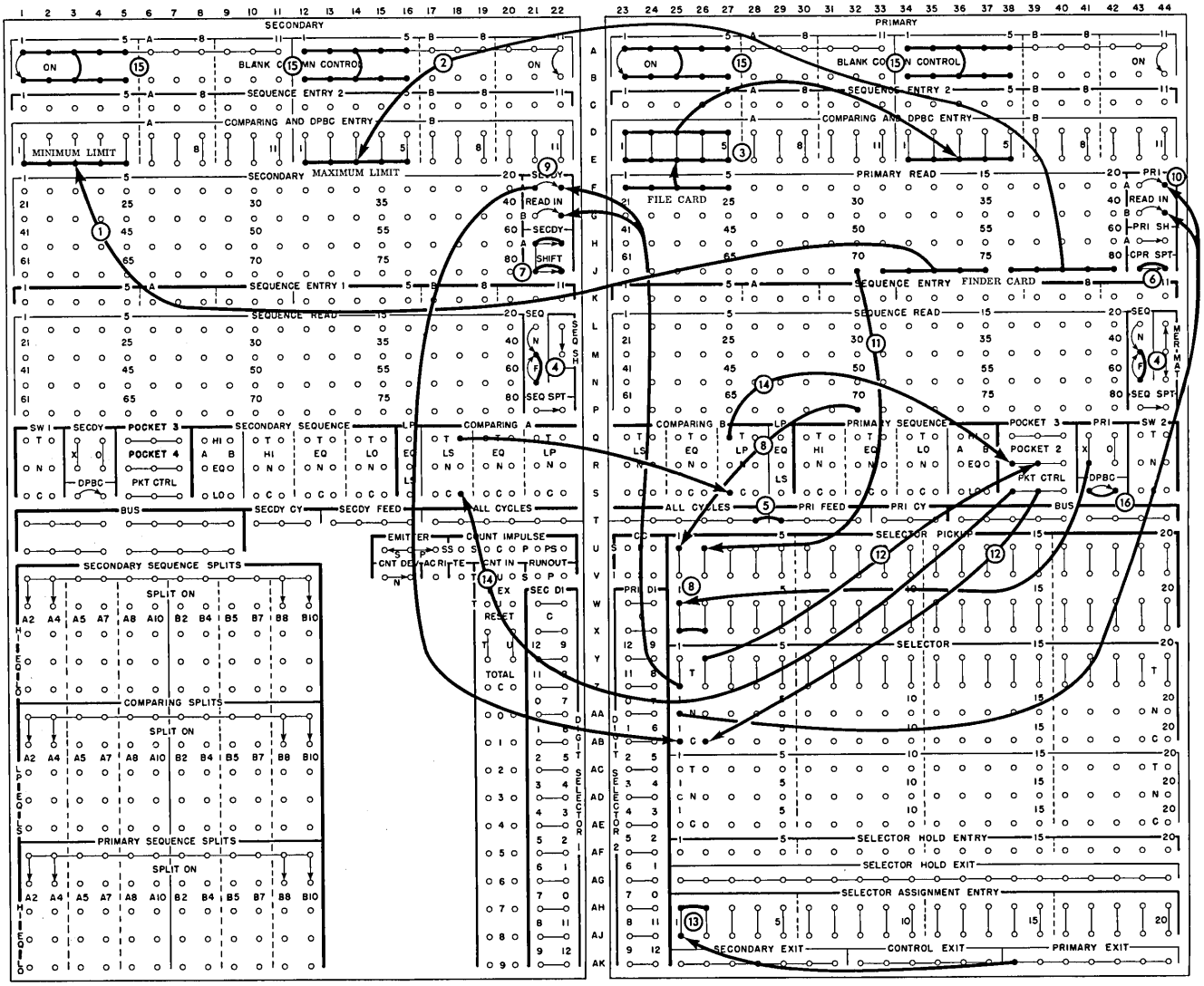


Figure 33. Selecting Cards Between Two Control Numbers

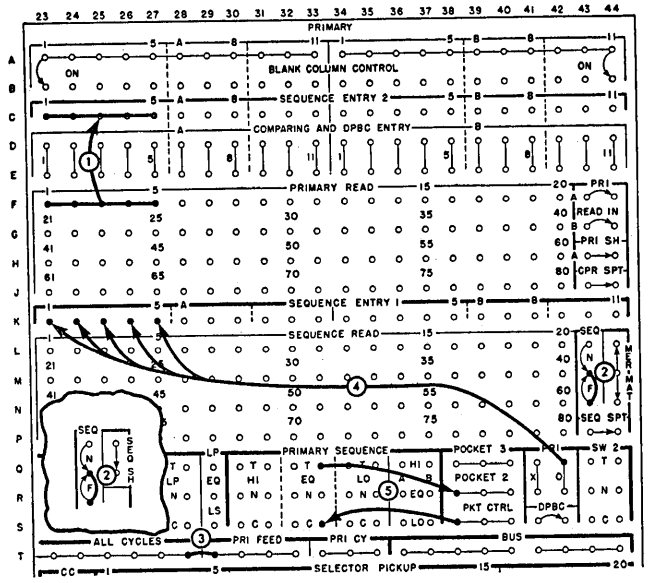


Figure 34. Selecting Zero-Balance Cards

16. The DPBC switch is wired to stop card feeding when a double-punched or blank column is detected.

Selecting Zero-Balance Cards

Zero-balance cards can be selected from either the primary or secondary feed, or from both feeds simultaneously. By placing one-half of the file in the primary feed and the other half in the secondary, processing time is reduced. When both feeds are used, a maximum of 33 columns per card can be checked for a zero balance; if all cards are fed in the primary, up to 66 columns can be checked.

Zero balances are detected by entering the field to be checked into one side of a control unit, and emitted zeros into the other side. Zero balances are then recognized as an equal comparison. Blanks are not recognized as zeros. Therefore, the fields must be fully punched if the blanks represent zero balances.

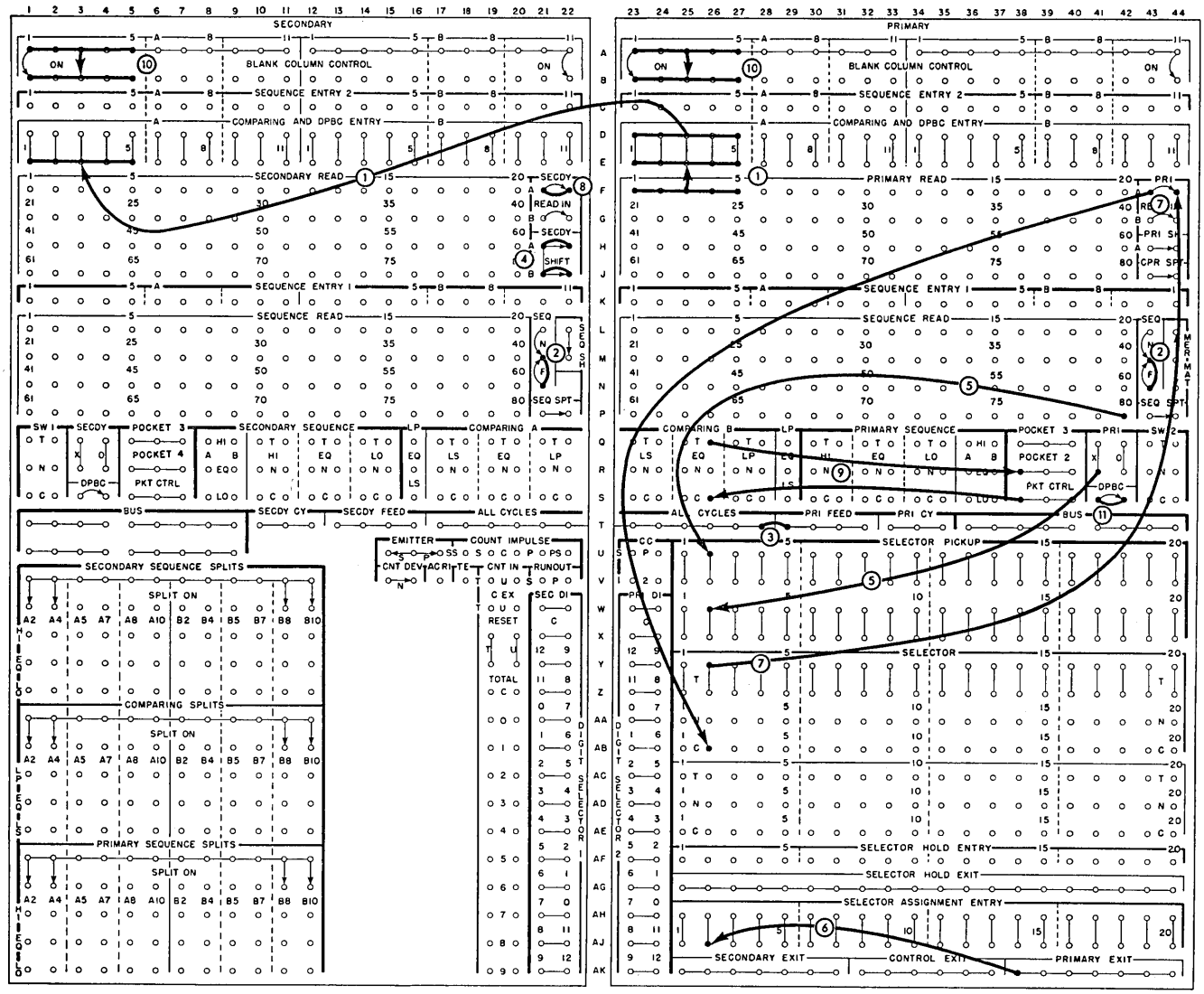


Figure 35. Checking Master-and-Detail Groups

In the illustration (Figure 34) cards are fed in the primary, and zero-balance cards are stacked in pocket 2.

WIRING (FIGURE 34)

1. Wire columns 1-5 from PRIMARY READ to SEQUENCE ENTRY 2. (Cards read at this station are ready to be stacked without delay.)
2. Wiring SEQ OFF in both feeds permits card feeding.
3. ALL CYCLES to PRI FEED feeds a card every cycle.
4. Split wire PRI 0 to five positions of SEQUENCE ENTRY 1.
5. Wire PKT CTRL through the transferred side of the EQ primary sequence selector to POCKET 2. All zero-balance cards stack in pocket 2; all other cards stack in pocket 1.

Checking Master-and-Detail Groups

A file of cards consisting of groups (master card and details) can be checked to ensure that each detail card follows the proper master card. If the groups were in sequence, this could be done by a normal sequence-checking operation. However, if the groups are not in any particular order, they can be checked by the wiring shown in Figure 35.

The master cards are X-punched, and the control number is punched in the same field in both the master and detail cards. The cards are fed in the primary. The master-card number is entered in one side of the comparing unit and held until the next master card is fed. Each detail-card number is entered in the other side of the comparing unit (shifted to operate in the primary). An equal comparison indicates that the detail card follows the correct master card. An unequal impulse (either high or low) indicates that a detail card does not follow its corresponding master, and therefore should be selected and refiled properly.

This principle and the wiring in Figure 35 also apply to selecting cards by a control number using interspersed X-finder cards.

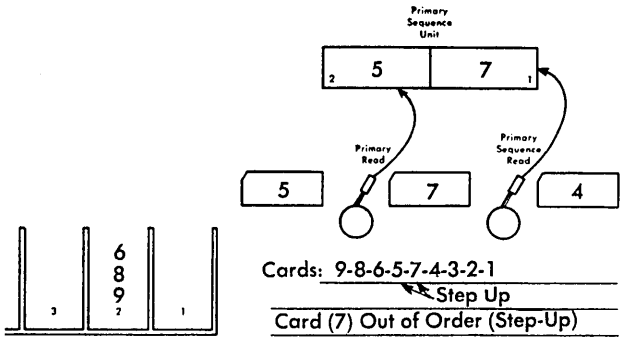


Figure 36. Sequence Checking — Descending Order

WIRING (Figure 35)

1. Wire PRIMARY READ to both primary and secondary COMPARING AND DPBC ENTRY.
2. Wiring SEQ OFF switches in both feeds permits card feeding.
3. ALL CYCLES to PRI FEED feeds a card every cycle.
4. SECDY SHIFT A and B shifts the secondary side of the comparing unit for use in the primary.
5. Wire column 80 (master-card X) from SEQUENCE READ to one PICKUP of selector 2. Wire PRI X to the other PICKUP. The selector transfers when an X-master card is at the sequence read station.
6. Assign the selector for primary use.
7. PRI READ IN through the transferred side of selector 2 reads in each new master card.
8. Wire SECDY READ IN to read in every card. (Master card also reads in and compares with itself, so it is not selected.)
9. Wire PKT CTRL through the transferred side of the EQ comparing selector to POCKET 2. Detail cards that do not correspond to the preceding master are stacked in pocket 1.
10. BLANK COLUMN CONTROL checks the control-number field for blank columns.
11. Wire the DPBC switch to stop card feeding for a double-punched or blank column.

Sequence Checking Cards in Descending Order

Cards in descending order can be sequence-checked. The example (Figures 36 and 37) shows the error card to be a *step-up* in sequence, rather than a *step-down*. A step-up in sequence is recognized as a high-primary-sequence condition.

Another method of checking cards in descending order is by reversing the wiring to the sequence entries; that is, by wiring from PRIMARY READ TO SEQUENCE ENTRY 1, and from SEQUENCE READ TO SEQUENCE ENTRY 2. The error would then be indicated by a low-primary-sequence comparison, the same as when checking cards in ascending order, and could therefore be signalled by wiring the SEQ ON switch.

With both these methods, a control stop light occurs on run-in and run-out. To continue the operation, merely press the reset and start keys.

WIRING (FIGURE 37)

1. Wire SEQUENCE ENTRY 1 and 2 from SEQUENCE READ and PRIMARY READ, respectively.
2. SEQ OFF in the secondary permits card feeding.
3. Wire primary SEQ OFF through the normal side of the HI primary sequence selector. Card feeding stops for a high primary sequence.
4. ALL CYCLES to PRI FEED feeds a card every cycle.

Sequence Checking — Up to 66 Columns

Up to 66 columns can be checked for sequence in one run by shifting the secondary sequence and comparing units to the primary, and coupling these with the primary units. Twenty-two columns can be compared in the normal manner in each control unit.

A low condition in any control unit indicates a sequence error. The sequence condition of the high-order unit takes precedence, except on an equal condition. Then the intermediate unit is tested for a low condition to stop card feeding. If this unit is equal, then the low-order unit is tested for a low-sequence condition.

If the field is wired to the control units as shown in Figure 38, a card out of sequence is recognized by either a low-secondary comparison, a low-secondary sequence, or a low-primary sequence. To simplify the wiring illustration, the full field is divided into three representative fields of 5 columns to each control unit.

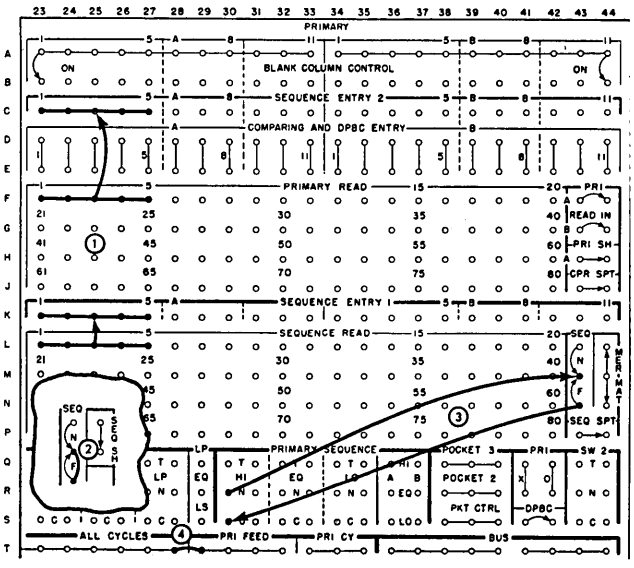


Figure 37. Sequence Checking — Descending Order

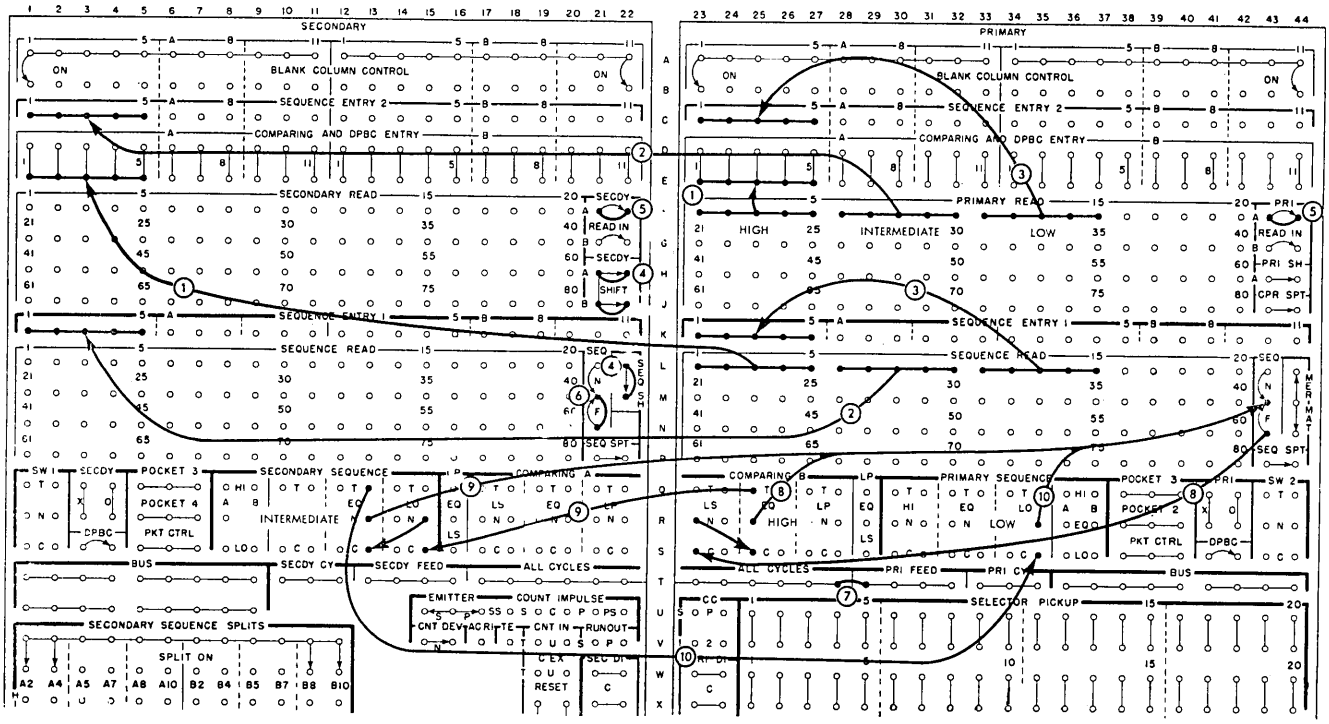


Figure 38. Sequence Checking — Up to 66 Columns

WIRING (FIGURE 38)

1. Wire the high-order columns (1-5) from PRIMARY READ and primary SEQUENCE READ to primary and secondary COMPARING ENTRIES, respectively.
2. Wire the intermediate-order columns (6-10) from PRIMARY READ and primary SEQUENCE READ to secondary SEQUENCE ENTRIES 2 and 1, respectively.
3. Wire the low-order columns (11-15) from PRIMARY READ and primary SEQUENCE READ to primary SEQUENCE ENTRIES 2 and 1, respectively.
4. SECDY SHIFT and SEQ SH shift the secondary control units for use in the primary.
5. PRI and SECDY READ IN switches to permit new numbers to read into the comparing unit every machine cycle.
6. Secondary SEQ OFF permits card feeding.
7. ALL CYCLES to PRI FEED feeds a card every machine cycle.
8. Wire primary SEQ OFF, through the normal side of LS COMPARING B selector and through the normal side of EQ COMPARING B selector, checks the high-order field for a low and equal condition. If not low, card feeding proceeds.
9. If the high-order comparison is equal, check the intermediate-order field for a low condition and equal condition. If not low, card feeding proceeds.
10. If the intermediate comparison is equal, check the low-order for a low condition to stop card feeding.

Inserting Indicator Cards for Sequence Errors

During a sequence-checking operation, it is possible to insert an indicator card of a different color or with an opposite corner cut, each time a step-down (or step-up) in sequence occurs. This operation can be used in place of the error-stop feature, to cause an indicator card to be inserted while the machine remains in continuous operation. The cards to be sequence-checked are placed in the primary hopper, and the indicator cards are placed in the secondary hopper. Each indicator card is inserted in the file immediately ahead of the step-down card (Figures 39 and 40). The indicator card and the card preceding the step-down are stacked simultaneously.

WIRING (FIGURE 40)

1. Wire SEQUENCE ENTRY 1 and 2 from SEQUENCE READ and PRIMARY READ, respectively.
2. Wiring SEQ OFF in both feeds permits card feeding.
3. ALL CYCLES to PRI FEED feeds a card every cycle.
4. Wire ALL CYCLES through the transferred side of the LO primary sequence selector to SECDY FEED. An indicator card feeds for each step-down condition.
5. PKT CTRL to POCKET 3 directs all cards to the merge pocket.

Inserting an Indicator Card behind Each Group

Indicator cards can be inserted behind each control group. The punched cards are placed in the primary

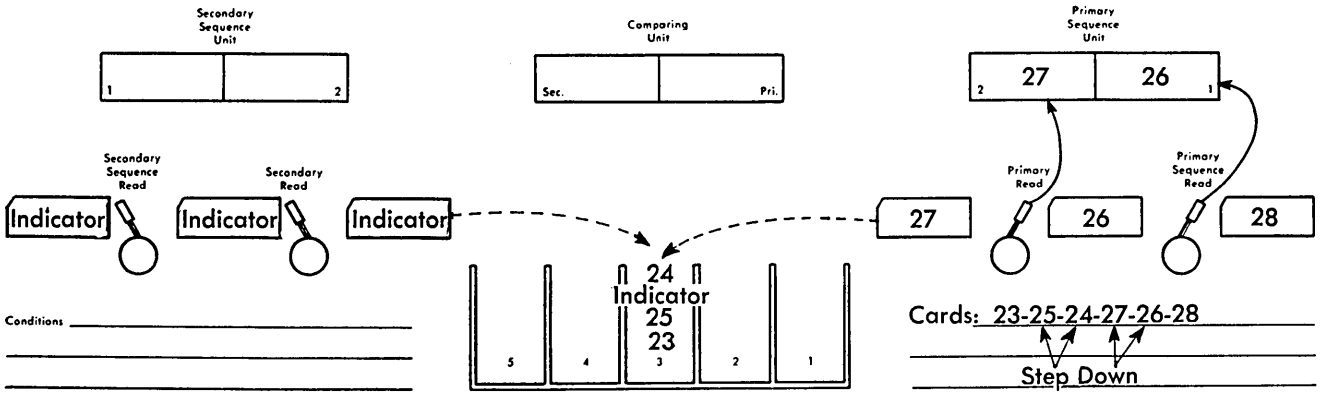


Figure 39. Inserting Indicator Cards

feed hopper, and the indicator cards are placed in the secondary feed hopper. The high primary sequence comparison, indicating a control change, can cause an indicator card to be fed. The last primary card of each group and the indicator card are stacked simultaneously.

The wiring for this operation is the same as that shown in Figure 40, with two exceptions: the primary SEQ ON switch is wired to check sequence, and ALL CYCLES (wire 4) is wired to SECONDARY FEED through the transferred side of the HI primary sequence selector. This causes a secondary card to be fed whenever a control change occurs.

Inserting Cards behind Specific Groups

The presence (or absence) of a specific X-card within a group of cards can cause a special card to be inserted after the group. For example, in a billing operation the card may be a special-discount, terms-allowed, or description card to explain the presence of symbols listed on selected customer invoices.

In this example (Figure 41), a card is to be inserted after each group that contains an X-80 card. Because the X-80 card can be anywhere within the group, the X-reading must be held until the end of the group. This is accomplished by transferring a selector (1) when the X is read and holding it transferred until a control change occurs (high primary sequence condition).

WIRING (FIGURE 41)

1. Wire the control field (columns 1-5) to SEQUENCE ENTRY 1 and 2 from SEQUENCE READ and PRIMARY READ, respectively.
2. Wiring primary SEQ ON stops card feeding for a

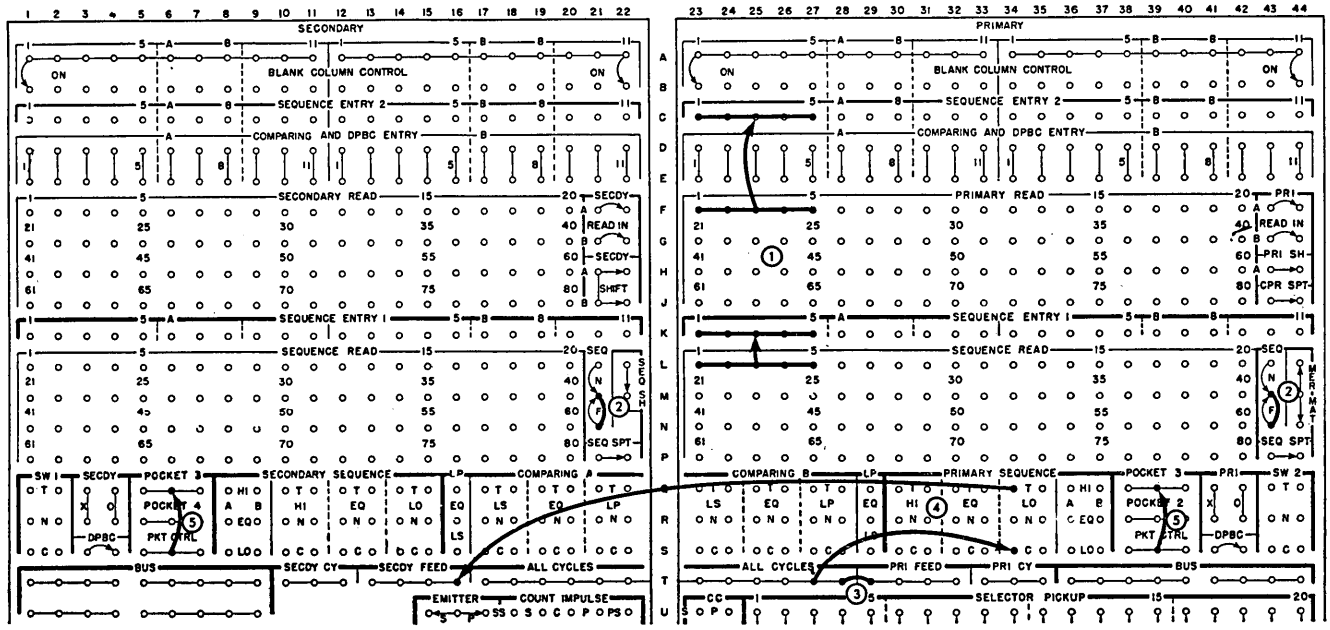


Figure 40. Inserting Indicator Cards

low primary sequence. Wire secondary SEQ OFF to permit card feeding.

3. ALL CYCLES to PRI FEED feeds a card in the primary every cycle.
4. Wire card column 80 from PRIMARY READ to one PICKUP of selector 1. Wire PRI X to the other PICKUP. Selector 1 transfers for every X-80 card.
5. Assign selector 1 for primary use.
6. Wire ALL CYCLES through the transferred side of the HI primary sequence selector and the transferred side of selector 1 to both PICKUPS of selector 2. Selector 2 is used to break the hold wiring for selector 1 when a change in control group occurs.
7. SELECTOR HOLD through the normal side of selector 2 holds selector 1 transferred until the end of a control group.
8. Wire ALL CYCLES through the transferred side of the HI primary sequence selector and the transferred side of selector 1 to SECDY FEED. The secondary feeds a card at every control change following a group containing an X-80 card.
9. Assign selector 2 by CONTROL EXIT.
10. PKT CTRL to POCKET 3 directs all cards to the merge pocket.

Selecting the Last Card of a Group if an X-Card

The principles explained in both Figures 16-A and 21 are used to select the last card of each control group, only if it is an X-card. That is, both the X-punching in the cards and the control change between groups must be considered in the control-panel wiring. Therefore, in reference to Figure 16-A, the pocket control impulse must be available for X-cards only on a high

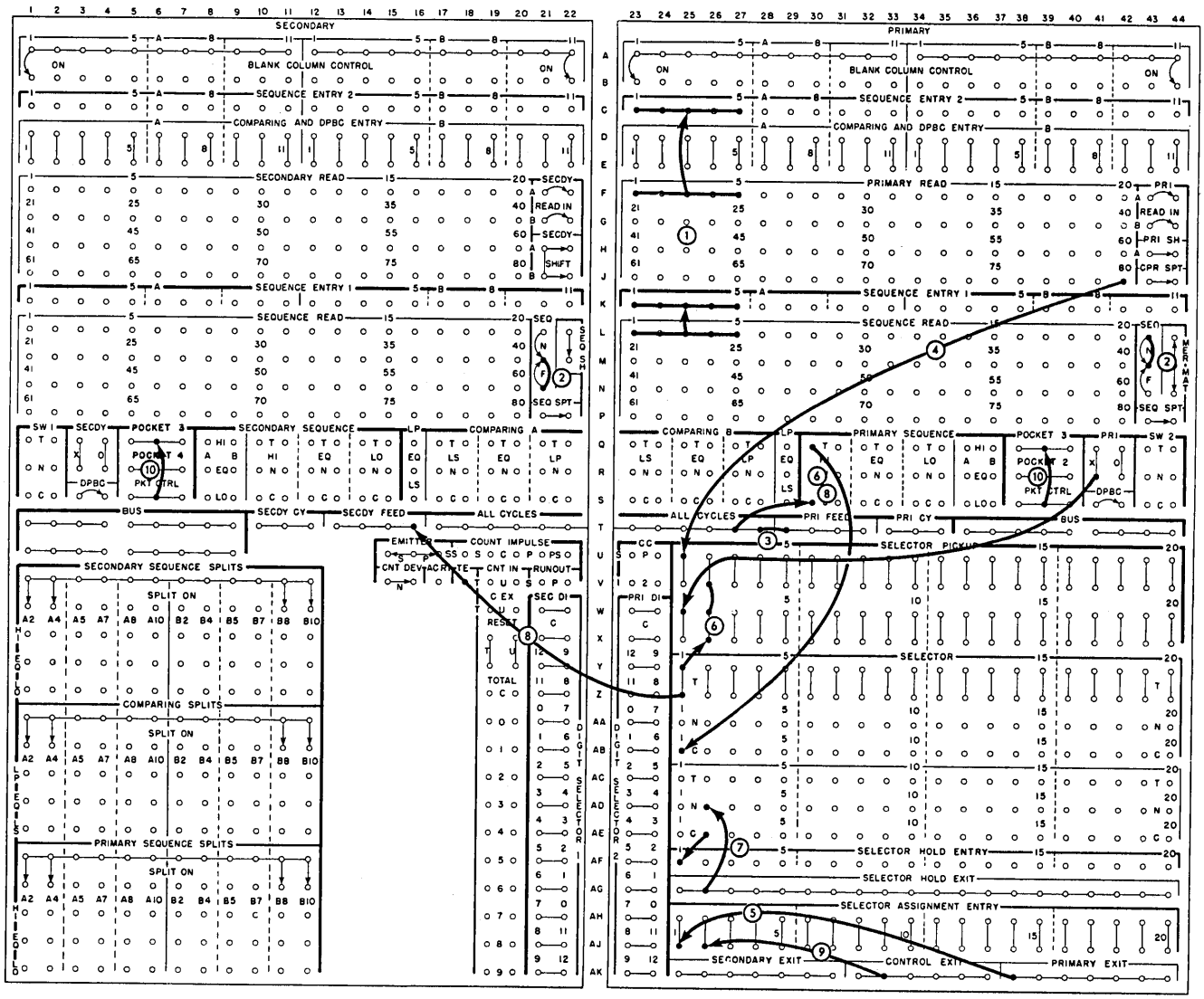


Figure 41. Inserting Cards Behind Specific Groups

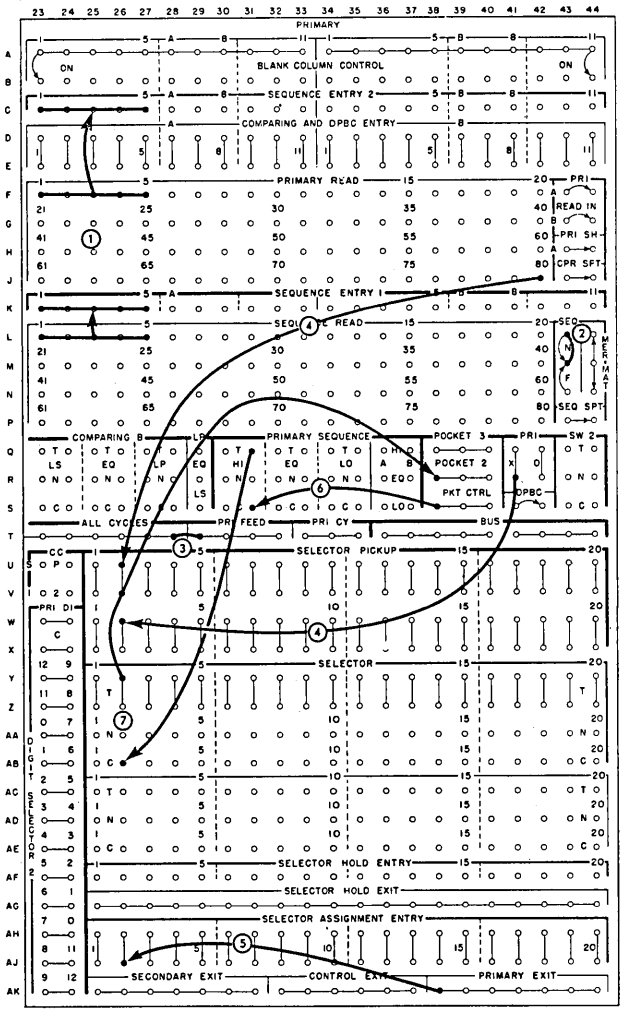


Figure 42. Selecting the Last Card of a Group If an X-card

primary sequence condition (control change). In this illustration (Figure 42), the control field is punched in columns 1-5 and the X is punched in column 80.

WIRING (FIGURE 42)

1. Wire SEQUENCE ENTRY 1 and 2 from SEQUENCE READ and PRIMARY READ, respectively.
2. Wiring primary SEQ ON stops card feeding for a low primary sequence. Wiring secondary SEQ OFF permits card feeding.
3. ALL CYCLES to PRI FEED feeds cards every cycle.
4. Wire column 80 from PRIMARY READ to one PICKUP of selector 2. Wire the other PICKUP from PRI X. Selector 2 transfers for every X-80 card.
5. Assign the selector for primary use.
6. PKT CTRL through the transferred side of the HI primary sequence selector tests for a change in control group.
7. Wire PKT CTRL further through the transferred side of Selector 2 to POCKET 2. The X-80 cards stack in pocket 2; all others, in pocket 1.

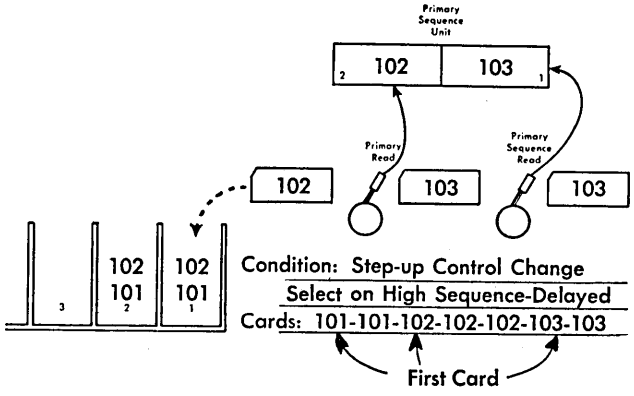


Figure 43. Selecting the First Card of a Group

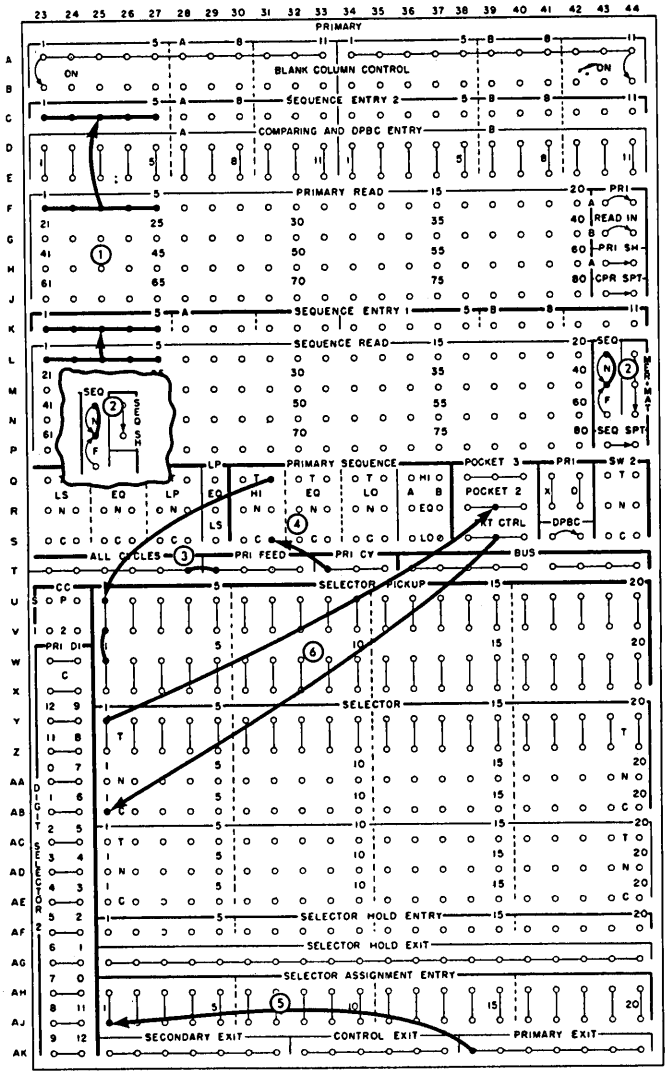


Figure 44. Selecting the First Card of a Group

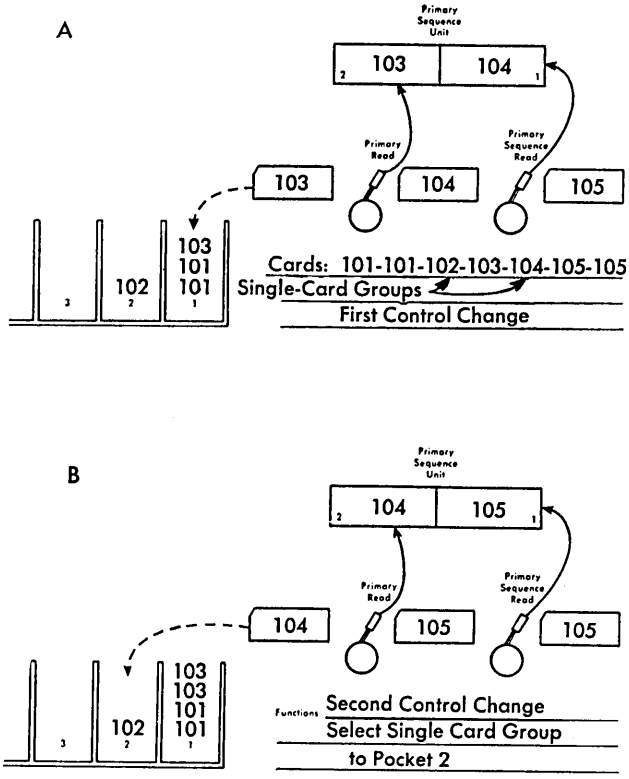


Figure 45. Selecting Single- or Multiple-Card Groups

Selecting the First Card of a Group

The first card of each group is recognized by a change in control number. As shown in Figure 43, the first card of a group (103) has been read by the primary sequence brushes, and a high primary sequence comparison exits. Because the first card is not in stacking position at this time, an impulse to select the card on a high primary sequence comparison must be made available one cycle later (Figure 44).

WIRING (FIGURE 44)

1. Wire the control-number field (columns 1-5) from SEQUENCE READ to SEQUENCE ENTRY 1, and from PRIMARY READ to SEQUENCE ENTRY 2.
2. Wiring primary SEQ ON stops card feeding automatically for a low sequence. Wire the secondary SEQ switch to permit card feeding.
3. ALL CYCLES to PRI FEED feeds a card in the primary every machine cycle.
4. Wire PRI CY through the transferred side of the HI sequence selector to both PICKUPS of selector 1. Selector 1 transfers on the following cycle and stays transferred (wiring 5) until the next PKT CTRL impulse is available. This delays pocket selection until the first card of the group passes the primary read station.

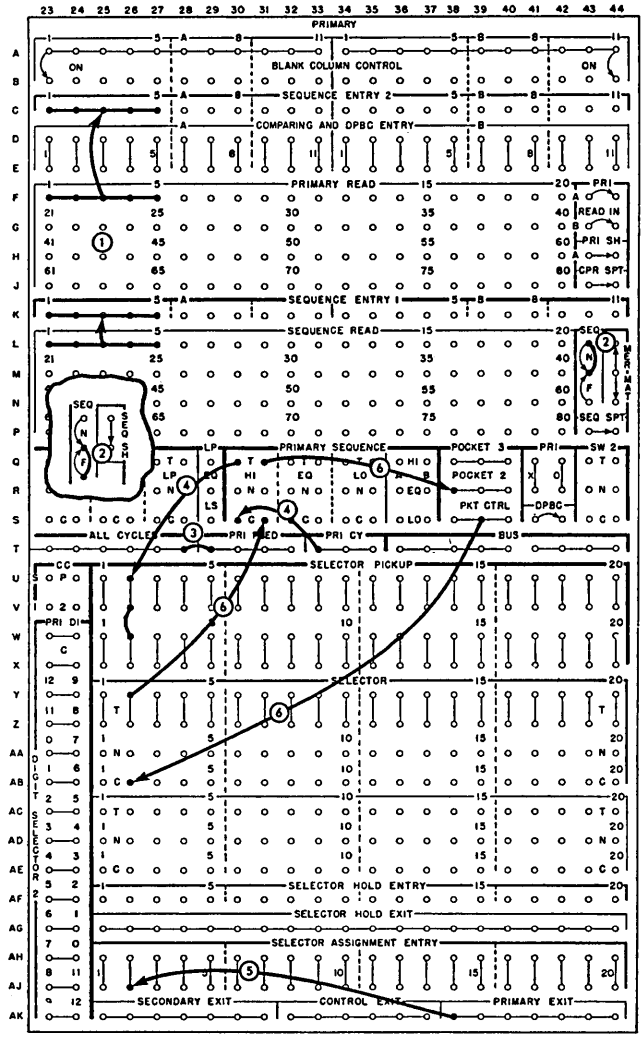


Figure 46. Selecting Single- or Multiple-Card Groups

5. PRIMARY EXIT to SELECTOR ASSIGNMENT ENTRY 1 permits selector 1 to transfer on a primary feed cycle.
6. PKT CTRL to POCKET 2 through the transferred side of selector 1 directs the first card of a group to pocket 2. All other cards stack in pocket 1.

Selecting Single-Card Groups, or Multiple-Card Groups

Single-card groups are recognized by a high primary sequence followed by another high primary sequence, as shown in Figure 45. Card 103 followed by card 104 (in A) is recognized as a high primary sequence comparison; and card 104 followed by card 105 (in B) immediately causes another high primary sequence comparison. Therefore, a single card is always recognized when two consecutive high primary sequence comparisons occur. When the second high primary sequence comparison occurs, the single card can be selected to stack in pocket 2 (Figure 46).

Because single-card groups are stacked in pocket 2, the groups stacked in pocket 1 are multiple-card groups.

WIRING (FIGURE 46)

1. Wire columns 1-5 to SEQUENCE ENTRY 1 and 2 from SEQUENCE READ and PRIMARY READ, respectively.
2. Wiring primary SEQ ON stops card feeding for a low primary sequence. Wiring secondary SEQ OFF permits card feeding.
3. ALL CYCLES to PRI FEED feeds a card every cycle.
4. Wire PRI CY through the transferred side of the HI primary sequence selector to both PICKUPS of selector 2. Transferring the selector is thus delayed until the next card-feed cycle (when PRI CY emits), and the selector remains transferred (wiring 5) until the next PKT CTRL impulse is available.
5. Assign the selector for primary use.
6. Wire PKT CTRL through the transferred side of selector 2 and the transferred side of the HI primary sequence selector to POCKET 2. This selects all single-card groups (recognized by two consecutive high primary sequence comparisons) to pocket 2. All multiple-card groups stack in pocket 1.

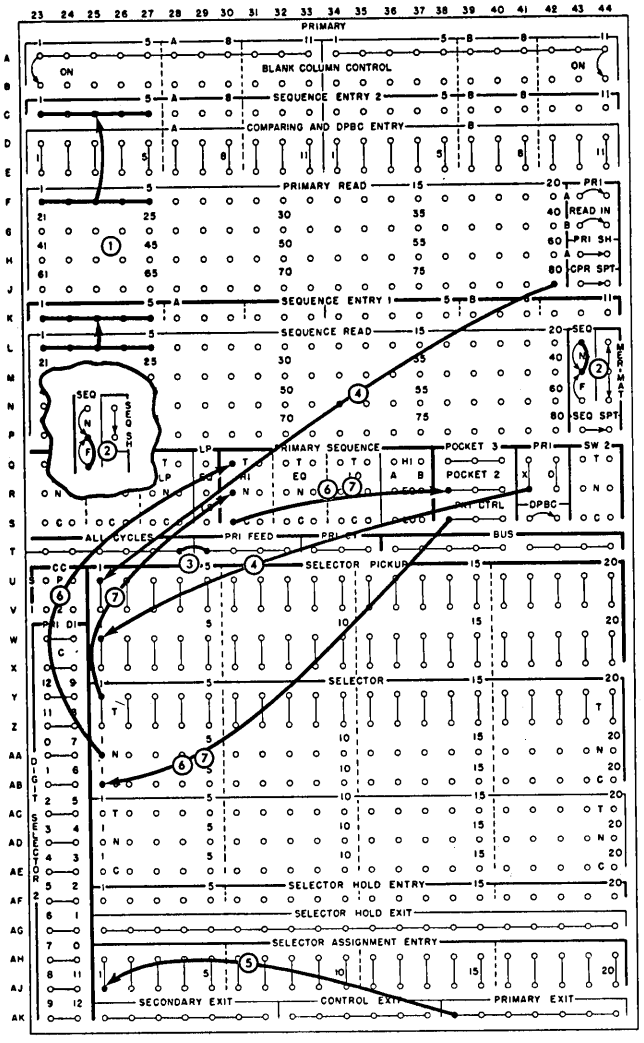


Figure 47. Checking that an X-Card Is the Last Card in a Group

Checking that an X-Card Is Last in a Group

In some accounting machine operations, the last card of each control group must be an X-card. For example, in a payroll operation it may be necessary that the last card for each employee be a summary earnings card punched with a specific X. This can be checked on the collator before the cards are placed in the accounting machine.

In this illustration (Figure 47) the last card of each group is selected if it is not an X-80 card, and any X-80 card that is not last in a group is selected. The selected cards indicate, to the operator, which groups should be adjusted before the cards are processed further.

The wiring principles for this operation are similar to those shown in Figure 42.

WIRING (FIGURE 47)

1. Wire the control number (columns 1-5) to SEQUENCE ENTRY 1 and 2 from SEQUENCE READ and PRIMARY READ.
2. Wiring primary SEQ ON stops card feeding for a low primary sequence. Wiring secondary SEQ OFF permits card feeding.
3. ALL CYCLES to PRI FEED feeds a card every cycle.
4. Wire column 80 from PRIMARY READ to one PICKUP of selector 1. Wire PRI X to the other PICKUP. Selector 1 transfers for X-80 cards.
5. Assign selector 1 for primary use.
6. Wire PKT CTRL through the normal side of selector 1 and the transferred side of the HI primary sequence selector to POCKET 2. Any last card of a group that is not an X-80 card stacks in pocket 2.
7. Wire PKT CTRL through the transferred side of selector 1 and the normal side of the HI primary sequence selector. All X-80 cards that are not last in a group stack in pocket 2.

Merging with Selection — No Basic Setup

In this illustration (Figure 48), the conditions are the same as in the preceding operation, except that the basic setup MERGE switch is not wired. Instead, external wiring, illustrating the use of control-panel hubs, replaces the internal wiring accomplished by the MERGE switch.

WIRING (FIGURE 48)

1. Wire columns 1-5 from PRIMARY and SECONDARY READ to COMPARING ENTRY and SEQUENCE ENTRY 2. Wire columns 1-5 from primary and secondary SEQUENCE READ to SEQUENCE ENTRY 1.
2. Primary and secondary SEQ ON switches check for accuracy of sequence in both feeds.

3. Wiring PRI and SECDY READ IN enters new numbers in the comparing unit every cycle.
4. Primary PKT CTRL to POCKET 3, through the transferred side of the EQ comparing selector, directs equal primary cards to the merge pocket.
5. Wire ALL CYCLES to the COMMON of the LS comparing selector. Wire from the NORMAL hub to PRI FEED to feed a primary card when comparison is an equal or low primary. Wire from the TRANSFERRED hub to SECDY FEED to feed low secondary cards.
6. Wire ALL CYCLES to SECDY FEED through the transferred side of both the EQ comparing selector and the HI primary sequence selector, to feed a secondary card along with the last primary card of an equal card group. Primary card reaches the stacker ahead of secondary card.
7. Wire the EQ comparing exit to both PICKUPS of selector 1, and assign the selector to the secondary.
8. Wire secondary PKT CTRL to POCKET 3 through the transferred side of selector 1, to direct equal secondary cards to pocket 3.
9. Wire SELECTOR HOLD 1 through the transferred side of the EQ secondary sequence selector to keep selector 1 transferred through all secondaries of the same equal group. This accomplishes the same merging of equal secondaries as the automatic interlock in effect when wiring MER. However, the equal secondaries (after the first) are fed as *low* secondaries, but stacked in the merge pocket by controlling POCKET wiring.
10. Wire PKT CTRL to POCKET 2 and POCKET 4 to select low primaries into pocket 2 and low secondaries into pocket 4. When equals feed, the impulse to POCKET 3 takes precedence.
11. Stop card feeding for double-punch and blank-column errors.

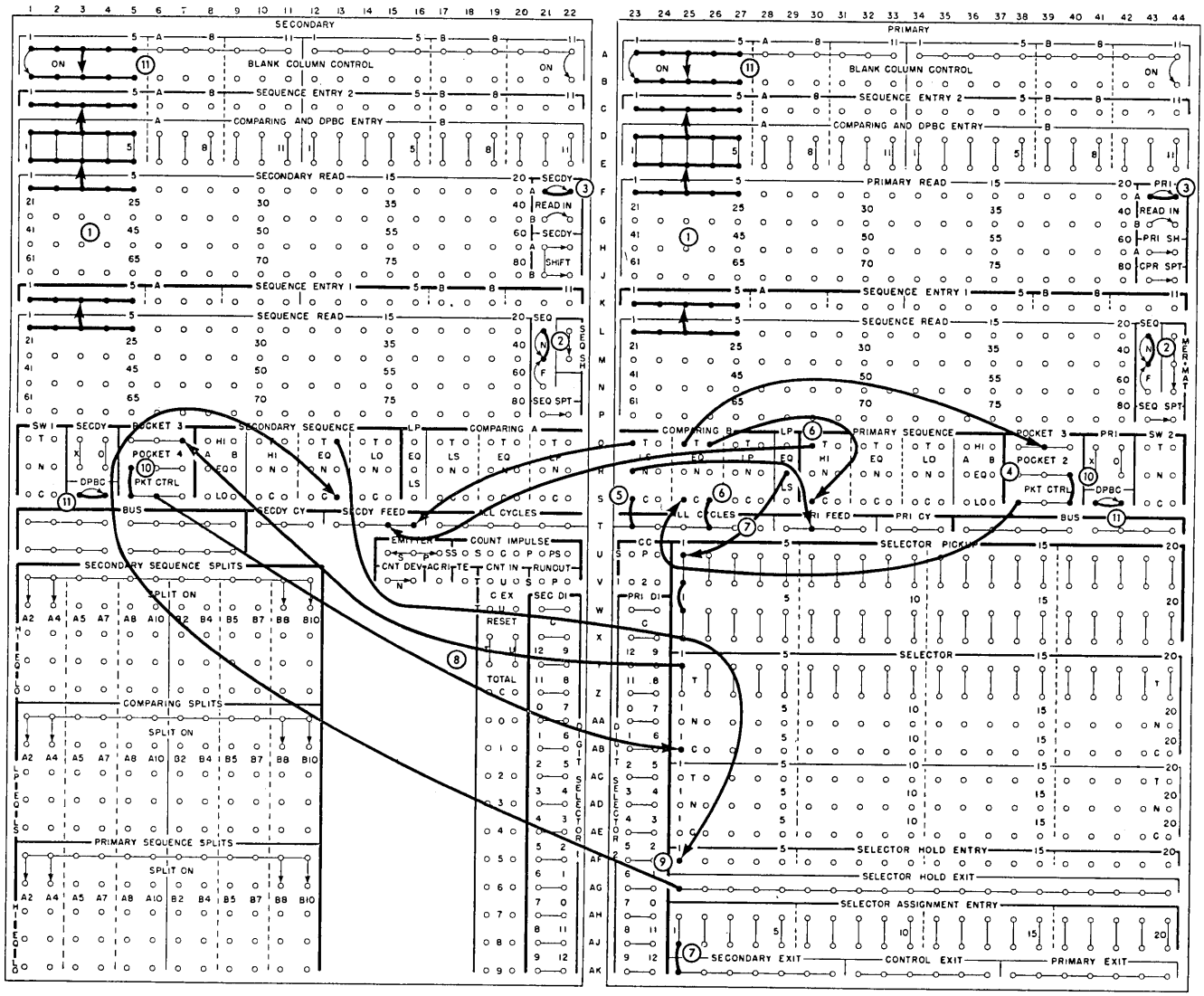


Figure 48. Merging with Selection — No Basic Setup

Merging Small Groups of Cards

Small groups of cards already in numerical sequence can be merged into one complete deck by merging the groups by pairs, and then merging the resulting groups by pairs, until all cards are merged together. This operation uses full control-panel wiring for merging, and requires considerable card handling and attention on the part of the operator.

The same operation can be performed with a minimum of card handling by inserting separator cards between groups and feeding the groups continuously. The separator cards indicate automatically the end of each group, and must be punched with 9's in the control field and X-punched in any column. They can be inserted manually, or by a preliminary run on the collator in which they are inserted after each group on a low primary sequence condition. The cards to be merged *must not* be punched with all 9's in the control field.

After the separator cards are inserted, half the number of groups are placed in the primary feed and half in the secondary feed. If there is an odd number of groups, the extra group can be placed in either feed. To facilitate card handling the separator cards should have a different corner cut.

The number of runs required to completely merge all the cards depends on the number of groups involved. If 16 groups are to be merged, for example, four runs are required. In each run the groups are merged by pairs, the number of groups yet to be merged is cut in half, and half of the separator cards are removed.

Run 1: 16 groups
8 in the secondary
8 in the primary
Result: 8 groups

Run 2: 8 groups
4 in the secondary
4 in the primary
Result: 4 groups

Run 3: 4 groups
2 in the secondary
2 in the primary
Result: 2 groups

Run 4: 2 groups
1 in the secondary
1 in the primary
Result: 1 group

In each run, normal merging occurs until a separator card is read in one feed. Because the separator card is punched with 9's in the control field, feeding in that feed is stopped and cards in the other feed are fed on a low comparison until a separator card is read. At that time, both separator cards are stacked simultaneously, and one of them is merged while the other is selected. In Figure 49, the secondary separator card is selected to pocket 5. The cards are completely merged when only one separator card remains at the end of the deck.

WIRING (FIGURE 49)

1. Wire the control field (columns 1-5) from SEQUENCE READ to SEQUENCE ENTRY 1, from PRIMARY READ to both COMPARING ENTRY and SEQUENCE ENTRY 2 in the primary, and from SECONDARY READ to both COMPARING ENTRY and SEQUENCE ENTRY 2 in the secondary.
2. Wiring PRI and SECDY READ IN reads in new values every corresponding card-feed cycle.
3. Wire ALL CYCLES through the transferred side of the LS comparing B selector to SECDY FEED, and through the normal side to PRI FEED. Secondary cards feed only on a low secondary comparison; primary cards feed on an equal or low primary comparison.
4. Wire column 80 from PRIMARY READ to one PICKUP of selector 3. PRI X to the other PICKUP transfers Selector 3 for each X-80 primary separator card.
5. Assign selector 3 for primary use.
6. Wire column 80 from SECONDARY READ to one PICKUP of both selectors 1 and 2. SECDY X to the other PICKUPS transfers selectors 1 and 2 for each X-80 secondary separator card.
7. Assign selectors 1 and 2 for use in the secondary.
8. Wire ALL CYCLES through the transferred side of selector 3 and the transferred side of selector 1 to SECDY FEED. This wiring feeds the secondary separator card along with the primary separator card.
9. PKT CTRL through the normal side of selector 1 to POCKET 3 stacks secondary separator cards in pocket 5.
10. Wire primary SEQ ON through the normal side of selector 3; because the separator card cannot be sequence checked, SEQ OFF must be wired through the transferred side for each X-80 card.
11. Wire secondary SEQ ON to the normal side of selector 2; because the separator card cannot be sequence checked, SEQ OFF must be wired through the transferred side for each X-80 card.
12. PKT CTRL to POCKET 3 stacks all primary cards in pocket 3.
13. BLANK COLUMN CONTROL checks for blanks in primary and secondary card columns 1-5.
14. Wire the DPBC switches to stop card feeding for double punches or blank columns.

Merging, Selecting Single Unmatched Primaries

Unmatched single-card primaries can be selected during a merging operation (Figures 50 and 51). This selection is advantageous when current detail cards (secondaries) are merged behind balance-forward cards (primaries) preparatory to creating new balance-forward cards. The balance-forward cards for which there are no current-period detail cards are usually

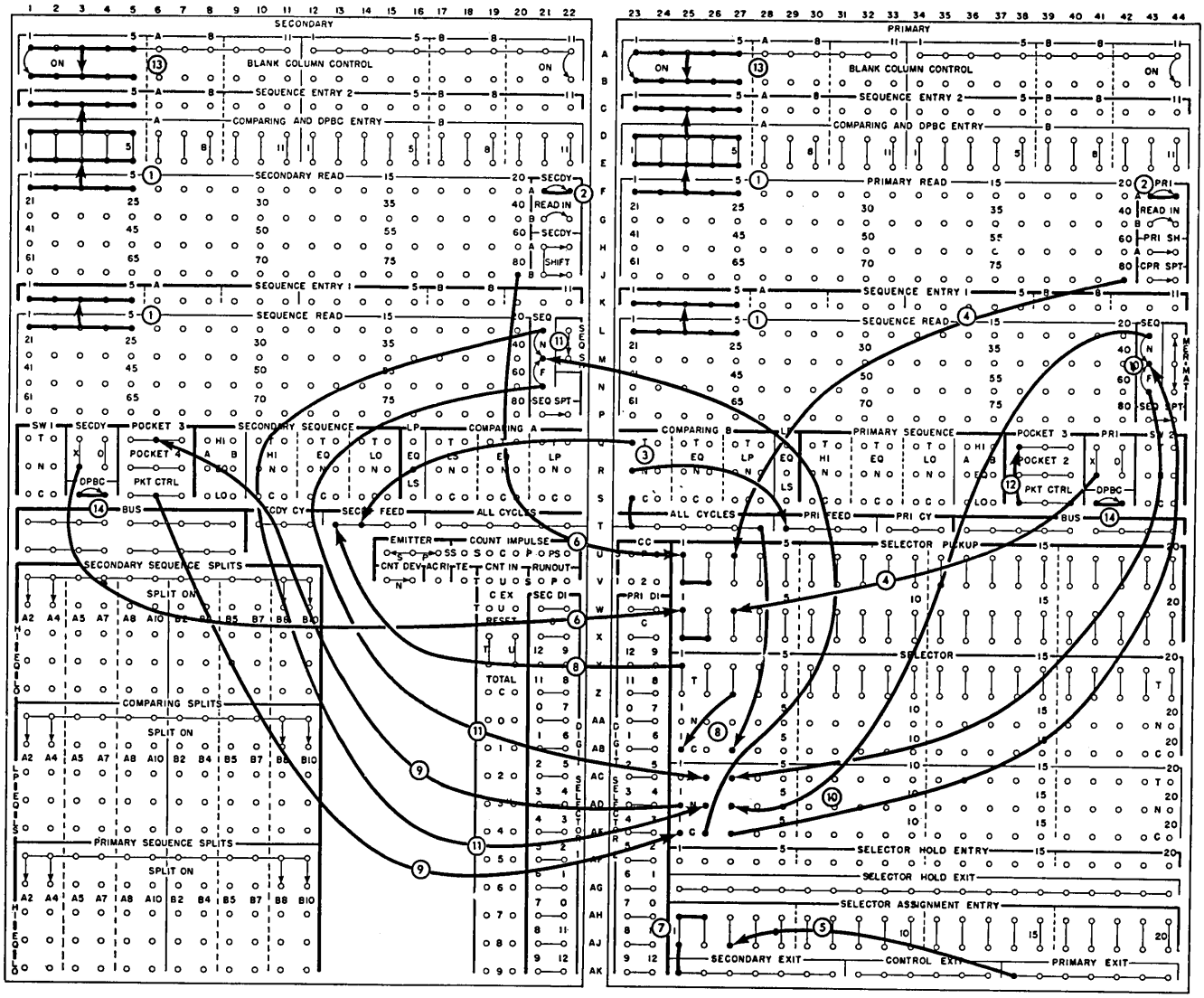


Figure 49. Merging Small Groups of Cards

selected. Then after new balance-forward cards are summary punched, the selected cards and the new balance cards are merged into one file.

In some cases, however, there may be two or more cards with the same control number in the balance-forward file. For example, changes may have been made in the balance by inserting adjustment cards in the file. In this case the balance-forward cards should not be selected even if they are unmatched in the detail file. Instead, the old balance and adjustment cards should be summarized into a new balance-forward card, along with the summarization of the detail cards.

Therefore, this typical operation is a combination of two operations described previously:

1. Merging with primary-card selection
2. Selecting single-card groups.

Each low primary card is selected if it is also a single-card group. Single-card groups are detected by two consecutive high primary sequence comparisons.

WIRING (FIGURE 51)

1. Wire primary and secondary cards columns 1-5 to SEQUENCE ENTRY 1, and to COMPARING AND DPBC ENTRY and SEQUENCE ENTRY 2.
2. Wiring SEQ ON in both feeds stops card feeding for a low sequence condition.
3. Wire MER to establish the internal circuitry for merging.
4. Wire PRI CY through the transferred side of the HI primary sequence selector to both PICKUPS of selector 1. Selector 1 transfers on the cycle following every control change (high primary sequence) in the primary.
5. Assign selector 1 for primary use.
6. Wire PKT CTRL separately through the normal sides of selector 1, the LP comparing B selector, and the HI primary sequence selector to POCKET 3, to stack all cards but single unmatched primaries in pocket 3.

7. PKT CTRL to POCKET 2 stacks all single unmatched primary cards in pocket 2. (The impulse to POCKET 3 takes precedence over POCKET 2).
8. Secondary PKT CTRL to POCKET 3 stacks all secondary cards in pocket 3.
9. BLANK COLUMN CONTROL checks for blanks in primary and secondary card columns 1-5.
10. Wire the DPBC switches to stop card feeding for a double-punched or blank column.

Merging, Selecting Low-Primary-Sequence Cards

Much machine attention for sequence errors can be eliminated by selecting the out-of-sequence cards. Figure 52 illustrates selecting low-sequence primary cards during a merging operation.

WIRING (FIGURE 52)

1. Wire the control fields for a normal merging operation.
2. MER establishes the internal circuitry for merging.
3. SEQ ON in the secondary stops card feeding for a sequence error in the secondary. SEQ OFF in the primary permits card feeding without stopping for a sequence error in the primary.
4. PRI CY through the transferred side of LO PRIMARY SEQUENCE selector to the PICKUPS of Selector 1, transfers Selector 1 on the next cycle for a low-sequence condition in the primary. Assign Selector 1 for secondary control to hold selector transferred while the primary feeds and selects out-of-sequence cards.
5. PKT CTRL, through the normal side of Selector 2, merges all primaries, except low-sequence cards.
6. PKT CTRL, through the transferred side of Selector 1 and EQ COMPARING B selector to POCKET 3 assures all matching cards are stacked in pocket 3. (Primary cards following the step-down card (s) are fed ahead of matching secondaries. Selector 1 remains transferred until a secondary feed cycle occurs.)
7. Assign Selector 1 for secondary control to hold the selector transferred while the primary feeds out-of-sequence cards (automatic on a low-primary comparison with MER wired).

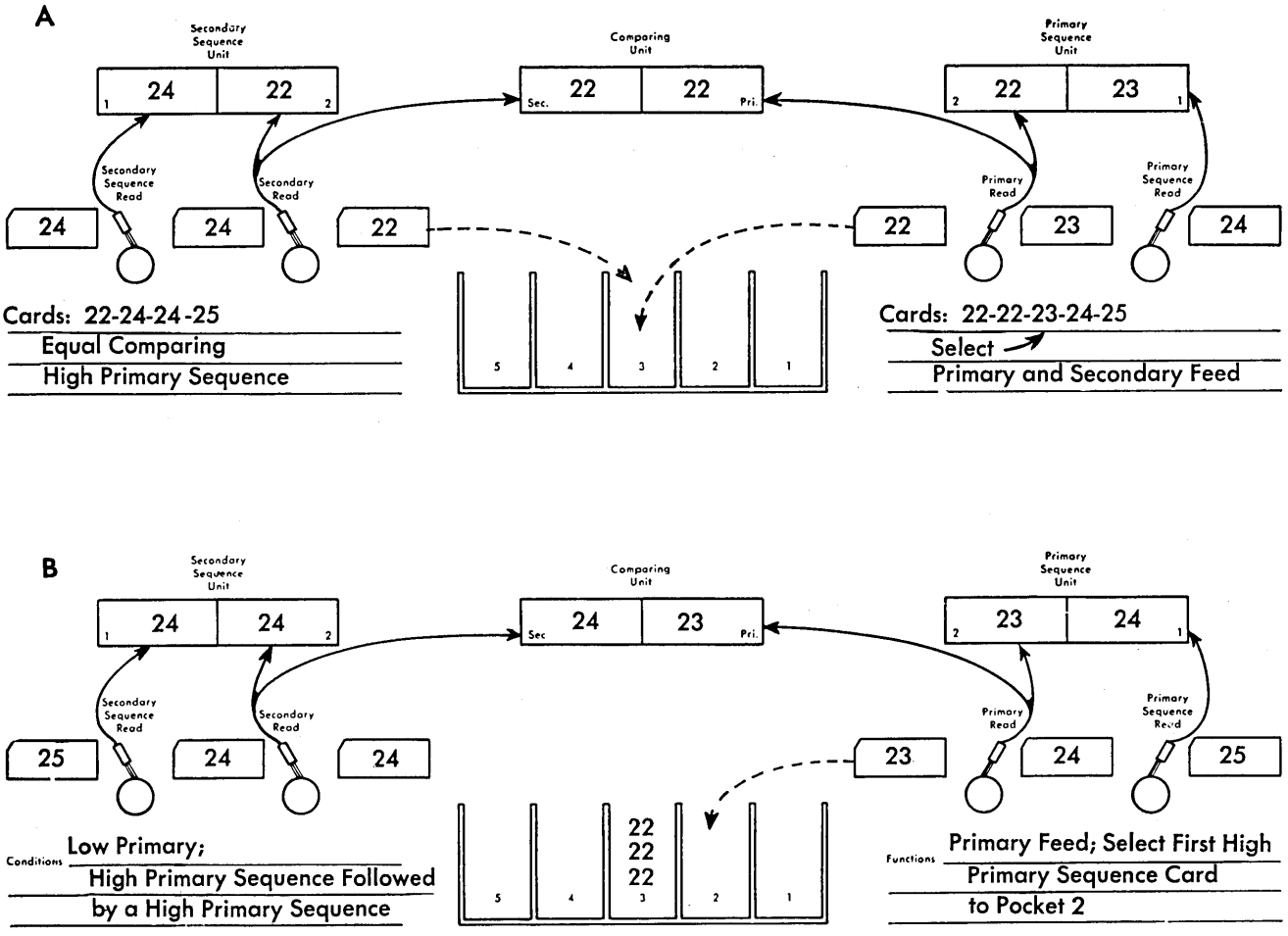


Figure 50. Merging, Selecting Single Unmatched Primaries

8. PKT CTRL to POCKET 2 selects out-of-sequence cards.
9. PKT CTRL to POCKET 3 merges all secondary cards.
10. Wire BLANK COLUMN CONTROL and DPBC switches to stop card feeding for double punches and blank columns.

Merging Primary Cards behind Secondary Cards (with Selection)

In a normal merging operation, primary cards are filed ahead of secondary cards. Control-panel wiring can reverse this to file primary cards behind secondary cards. Reversing the normal order is advantageous when the volume of cards normally fed in the secondary is considerably larger than that fed in the primary. Using the file feed in the primary for the larger volume of cards can save much card handling and machine alteration, without changing the file sequence.

Because card feeding in this operation is the reverse of that required in a normal merging operation, the basic set-up switch (MER) cannot be used. Feeding must be governed by control-panel wiring.

Cards are fed from one feed at a time and, in the case of equals, all secondary cards are fed ahead of the primaries. The conditions controlling card feeding are:

Low Secondary	—	Secondary Feed
Equal	—	Secondary Feed
Low Primary	—	Primary Feed

Figure 53 shows the wiring to merge primaries behind secondaries, and to select all unmatched cards.

WIRING (FIGURE 53)

1. Wire card fields for a normal merging operation.
2. Jackplug SEQ ON to permit card feeding and to stop card feeding for a sequence error.

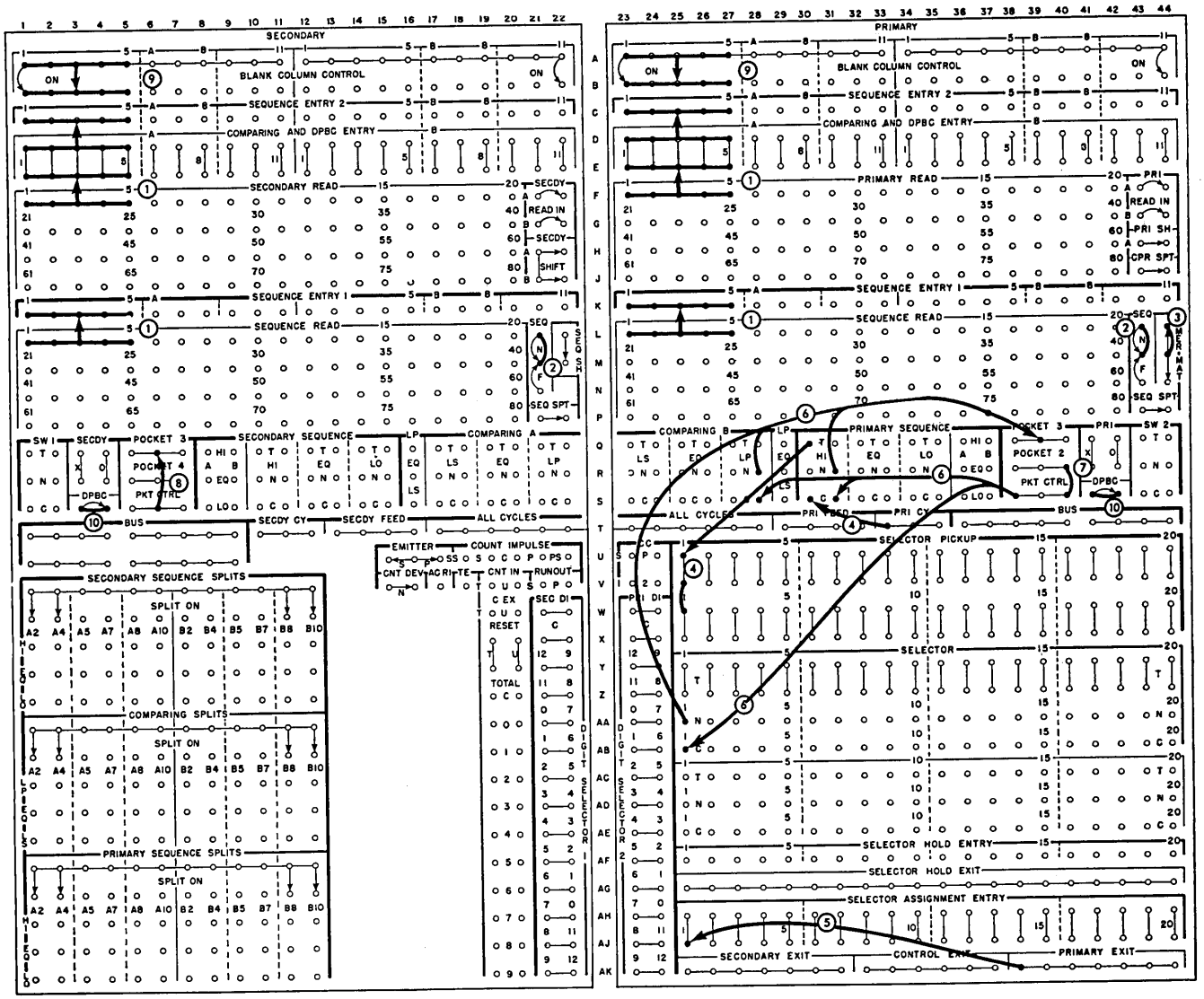


Figure 51. Merging, Selecting Single Unmatched Primaries

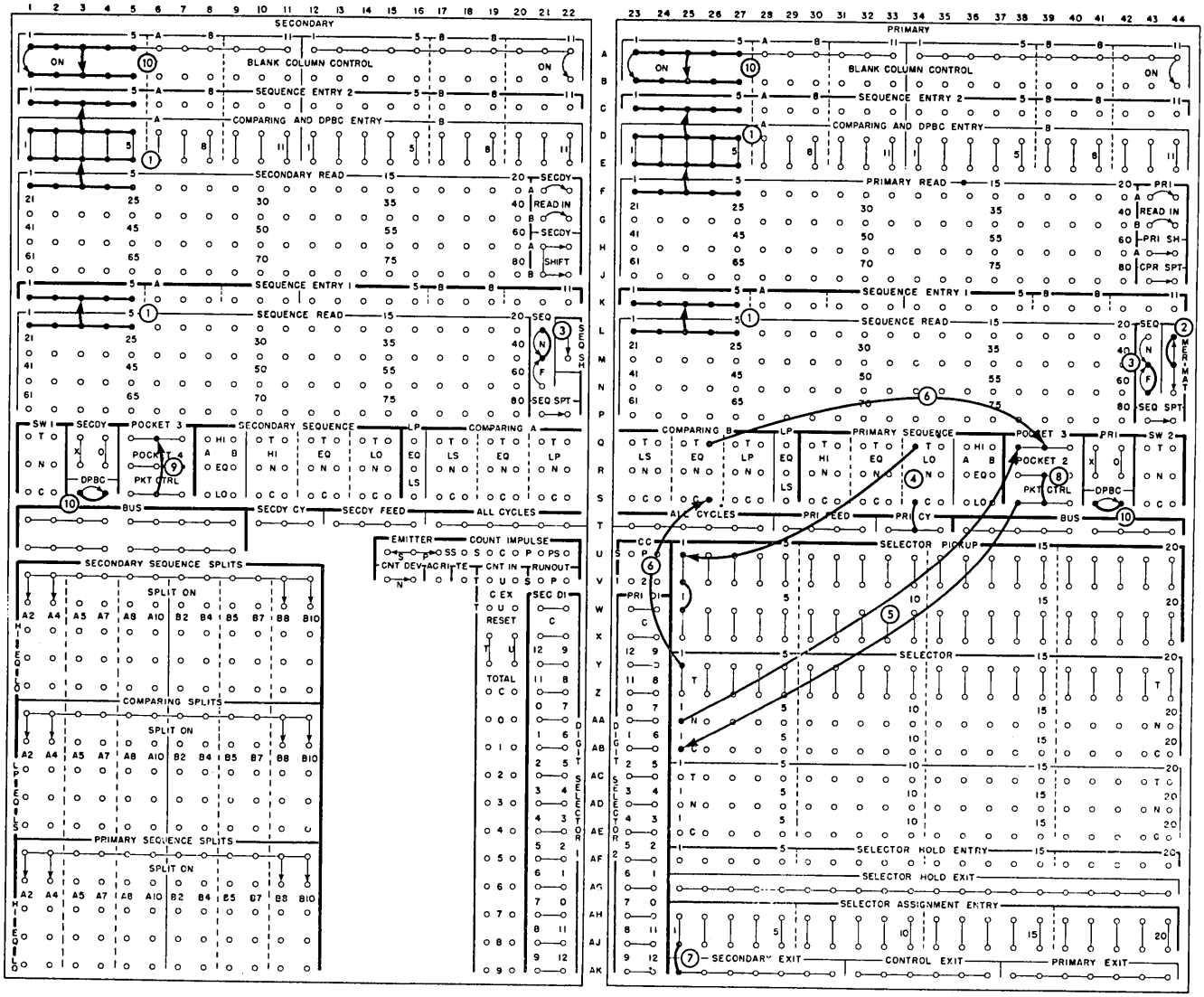


Figure 52. Merging — Selecting Low-Primary-Sequence Cards

3. Wire PRI and SECDY READ IN to enter a new value to both sides of the comparing unit each respective card-feed cycle.
4. ALL CYCLES, through the normal side of LP COMPARING B selector, feeds secondary cards, except when the primary cards are low.
5. ALL CYCLES, through the transferred side of LP COMPARING B selector, feeds primary cards on a low-primary condition.
6. EQ COMPARING B exit to both PICKUPS of Selector 1 transfers Selector 1 to control merging of matching primaries and secondaries. Assign Selector 1 for primary use.
7. PKT CTRL, through the transferred side of Selector 1 to POCKET 3 in both feeds, merges matching primary and secondary cards.
8. PKT CTRL to POCKET 2 and POCKET 4 selects all unmatched primary and secondary cards. (Selector 1 not transferred.)
9. SELECTOR HOLD, through the transferred side of EQ PRIMARY SEQUENCE selector, allows multiple primary cards of a matching group to stack in pocket 3.
10. Wire BLANK COLUMN CONTROL and DPBC switches to stop card feeding for double punches and blank columns.

Merging One Secondary behind Two Primary Card

Some applications require adding summary or trailer cards to make up sets of cards prior to a calculating or summary-punching operation. Figure 54 shows the control-panel wiring to insert one secondary trailer card after each two primary cards. This also applies

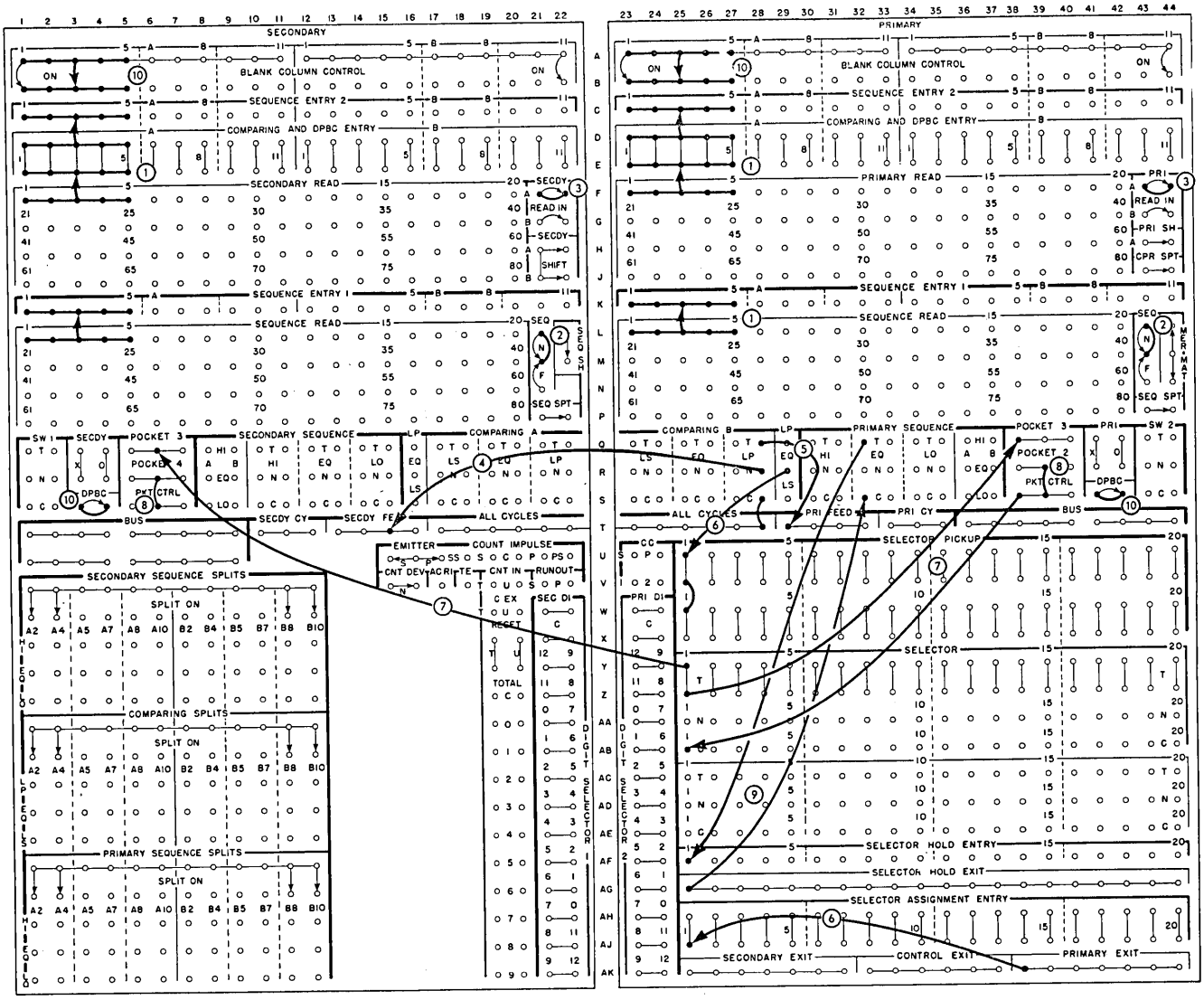


Figure 53. Merging Primaries behind Secondaries (with Selection)

to inserting one secondary leader card ahead of two primary cards.

The operation relies solely on control of card feeding, not on punching in the card. A cycle-delay circuit controls the alternate feeding of the secondary feed, while the primary feeds continuously. As the number of selectors permits, this principle can be expanded to merge a secondary card after each 3, 4, etc., primary cards.

When starting or restarting an operation, check the first group of cards to insure that one secondary card follows two primary cards.

WIRING (FIGURE 54)

1. Wire SEQ OFF in both feeds to permit card feeding.
2. PKT CTRL to POCKET 3 in both feeds merges all cards.
3. ALL CYCLES to PRI FEED feeds a card every machine cycle.
4. ALL CYCLES, through the normal side of Selector 2 to the PICKUPS of Selector 1 and to SECDY FEED, transfers Selector 1 and feeds a secondary card along with a primary card.
5. PRI CY, through the transferred side of Selector 1 to the PICKUPS of Selector 2, transfers Selector 2 to allow feeding a secondary card only on alternate cycles.
6. Assign Selector 1 for control use, and Selector 2 for primary use.

Merging Master and Trailer Cards with Transaction Cards

Some applications, such as a perpetual-inventory-control operation, merge transaction cards into a file made

up of old-balance master cards and blank new-balance trailer cards. For calculation or summary punching, the transaction cards must be filed between the master and trailer cards. Figure 55 shows the control-panel wiring to accomplish this operation. The matching master card is fed first and the number held for comparison with matching transaction cards. The associated trailer card is fed with the last matching transaction card when a control break is recognized. Unmatched cards in each feed are selected.

WIRING (FIGURE 55)

1. Wire the control fields for comparing secondary master cards with primary transaction cards. (Secondary trailer cards have no control punching.)
2. Wire primary SEQ ON to check the transaction cards for sequence.
3. Control X (col. 80) from secondary SEQUENCE READ to one PICKUP of Selector 1 transfers Selector 1 for an X-master card at the secondary sequence read station.
4. Control X (col. 80) from SECONDARY READ to one PICKUP of Selectors 2 and 3 transfers Selectors 2 and 3 for an X-master card at the secondary read station.
5. SECDY X to the other PICKUP of Selectors 1, 2, and 3 conditions the selectors to transfer for an X.
6. Assign Selectors 1, 2, and 3 for secondary use.
7. Wiring secondary SEQ OFF through the normal side of Selector 1 and the transferred side of Selector 2, and also through the transferred side of Selector 1 and the normal side of Selecter 2, checks that each X-master card is followed by a trailer card.
8. Wire PRI READ IN to read in the control number of each transaction card.

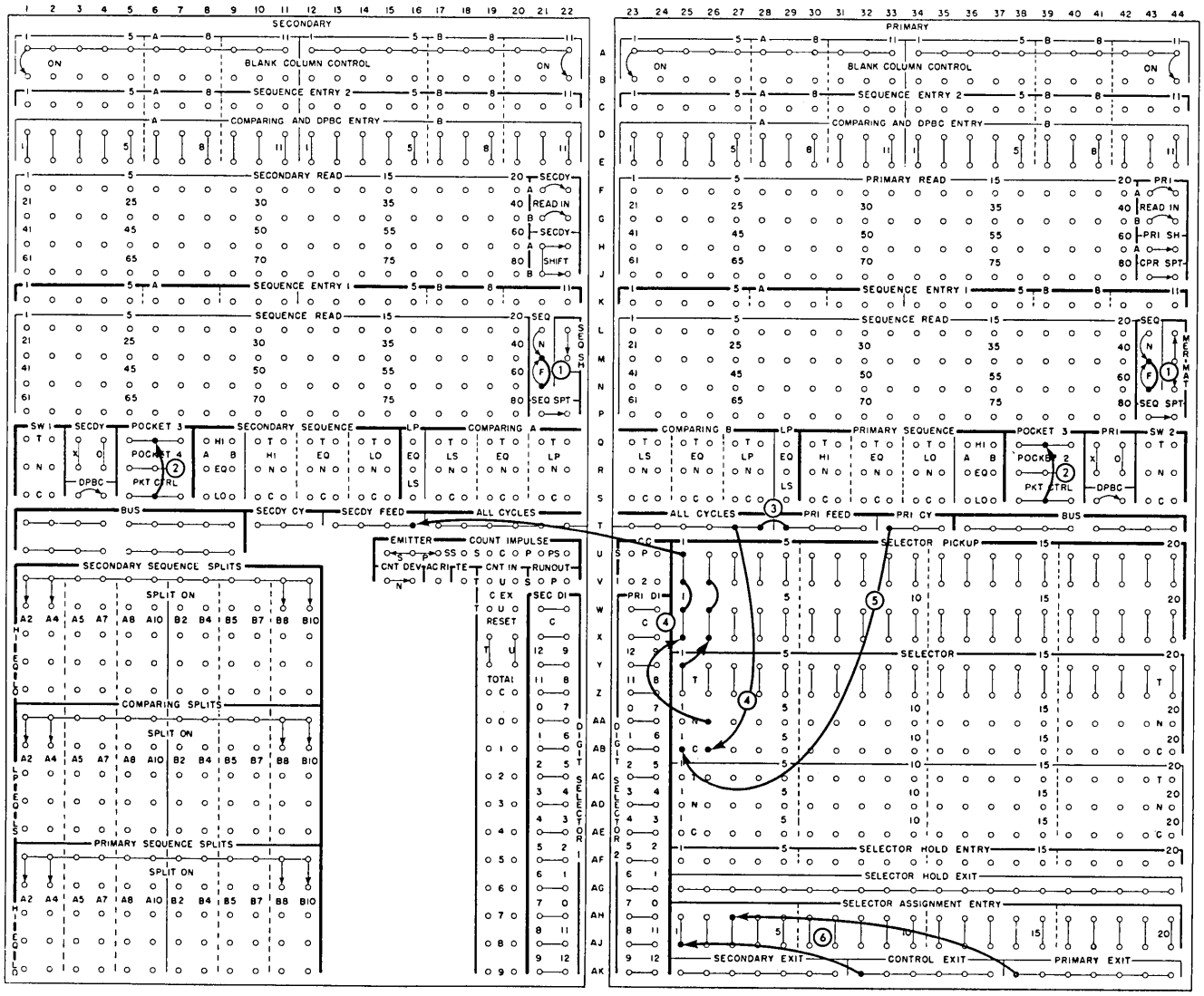


Figure 54. Merging One Secondary behind Two Primary Cards

9. SECDY READ IN, wired through the transferred side of Selector 1, reads in and retains the control numbers of the master cards (and associated blank trailer cards) for comparison with the transaction cards.
10. ALL CYCLES, through the transferred side of EQ COMPARING B selector, and (1) through the transferred side of Selector 2, to SECDY FEED feeds each matching master card; and (2) through the normal side of Selector 2 to PRI FEED feeds all matching transaction cards.
11. ALL CYCLES, through the transferred side of LS COMPARING B selector, to SECDY FEED feeds each unmatched master and associated trailer cards.
12. ALL CYCLES, through the transferred side of LP COMPARING B selector, to PRI FEED feeds each unmatched transaction card.
13. ALL CYCLES, through the normal side of Selector 3 and through the transferred side of HI PRIMARY SEQUENCE selector, feeds the blank secondary trailer card along with the last transaction card of a matching group.
14. PKT CTRL, through the normal side of LS COMPARING B selector, to POCKET 3 merges all matching master and associated trailer cards.
15. PKT CTRL to POCKET 4, through the transferred side of Selector 3, selects unmatched master cards to pocket 4. Trailer cards of unmatched master cards stack in pocket 5.
16. PKT CTRL to POCKET 3, through the normal side of LP COMPARING B selector, merges matching transaction cards. Unmatched transaction cards stack in pocket 2.
17. Wire BLANK COLUMN CONTROL and DPBC switches to stop card feeding for double punches and blank columns.

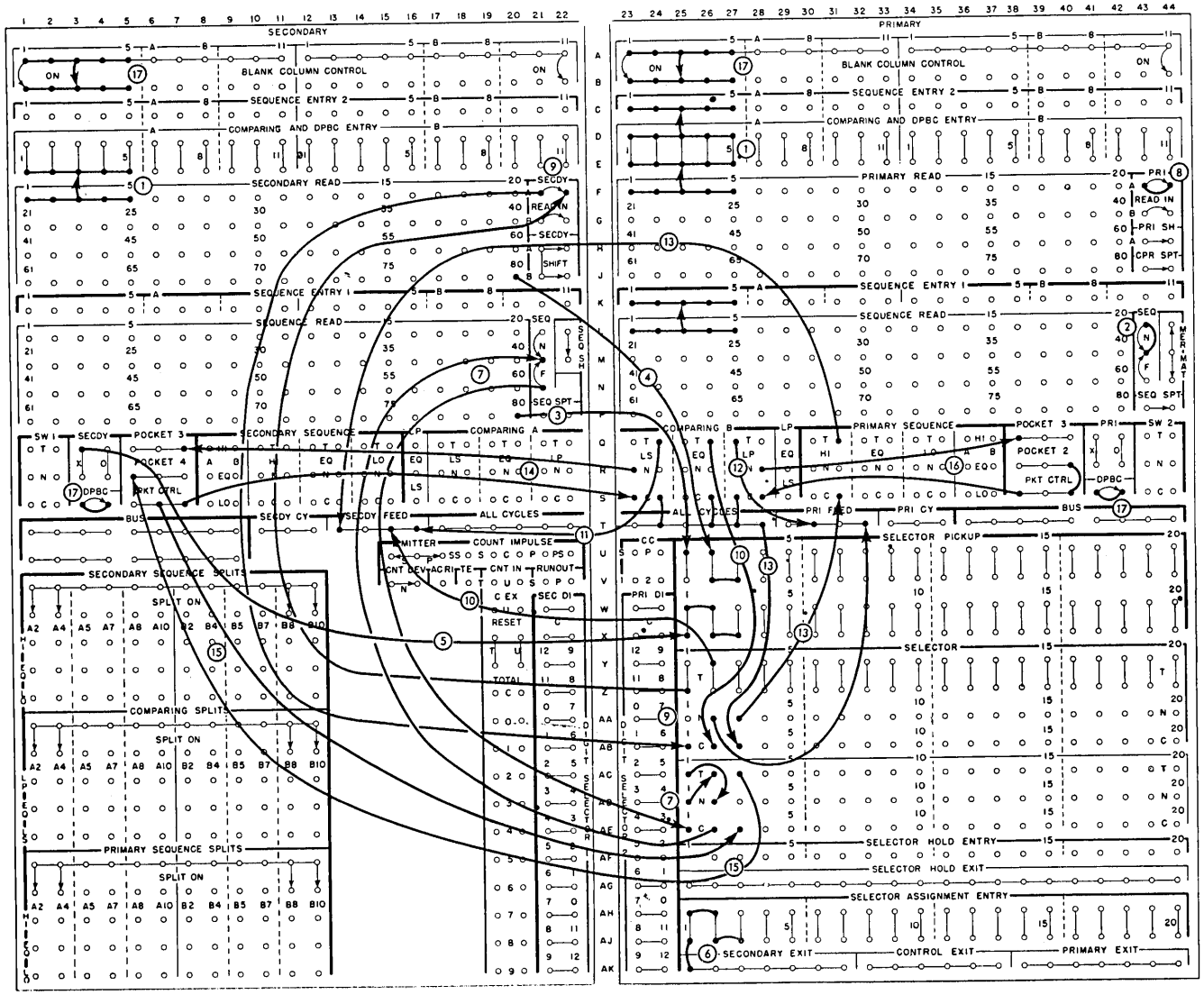


Figure 55. Merging Master and Trailer Cards with Transaction Cards

Mixed Merging with Selection

In a normal merging operation all primary cards of a group are filed ahead of the secondary cards with the same control number. Whenever it is not necessary that equal secondary cards merge behind an equal primary *group,* operating time can be reduced by feeding equal primary and secondary cards simultaneously. This can be done by using the MAT switch rather than the MER switch. Any additional primary or secondary cards with the same control number are also fed on an equal comparison. Additional primaries are fed as equals, because the last equal secondary card is held and stacked with the last equal primary card. Additional secondaries are fed as equals, because the comparing unit is interlocked in an equal comparison as the last equal primary card is fed.

If desired, unmatched primaries and secondaries, which are fed on a low comparison, can be stacked separately.

Figure 56 illustrates the feeding and stacking of unmatched cards (10, 11), equal cards, and an extra equal secondary card. Three 12-cards are fed in the secondary, and two 12-cards in the primary. The pairs of equal cards are stacked simultaneously on an equal comparison as shown in A; the third 12-card in the secondary is also stacked on an equal comparison as shown in B. With basic setup MAT wired (Figure 57), this requires 3 cycles; in normal merging, these 5 cards would require 4 cycles (MER wired).

WIRING (FIGURE 57)

1. Wire columns 1-5 from SEQUENCE READ to SEQUENCE ENTRY 1, and from PRIMARY and SECONDARY READ to COMPARING AND DPBC ENTRY and to SEQUENCE ENTRY 2.
2. Primary and secondary SEQ ON stop card feeding for low sequence conditions.
3. Wiring MAT establishes internal circuits to feed equal cards simultaneously.
4. PKT CTRL to POCKET 3 merges all cards. PKT CTRL to POCKET 2 and POCKET 4 selects all unmatched cards.
5. BLANK COLUMN CONTROL checks primary and secondary columns 1-5 for blanks.
6. Wire the DPBC switches to stop card feeding for double punches and blank columns.

Rapid Merging with Selection

Control-panel wiring can speed up a merging operation (MER not wired) by anticipating a specific condition. The card at the secondary read station is compared with both the cards at the primary read and the primary sequence read stations. When the secondary card is equal to, or higher than the primary card, but lower than the primary sequence card, both

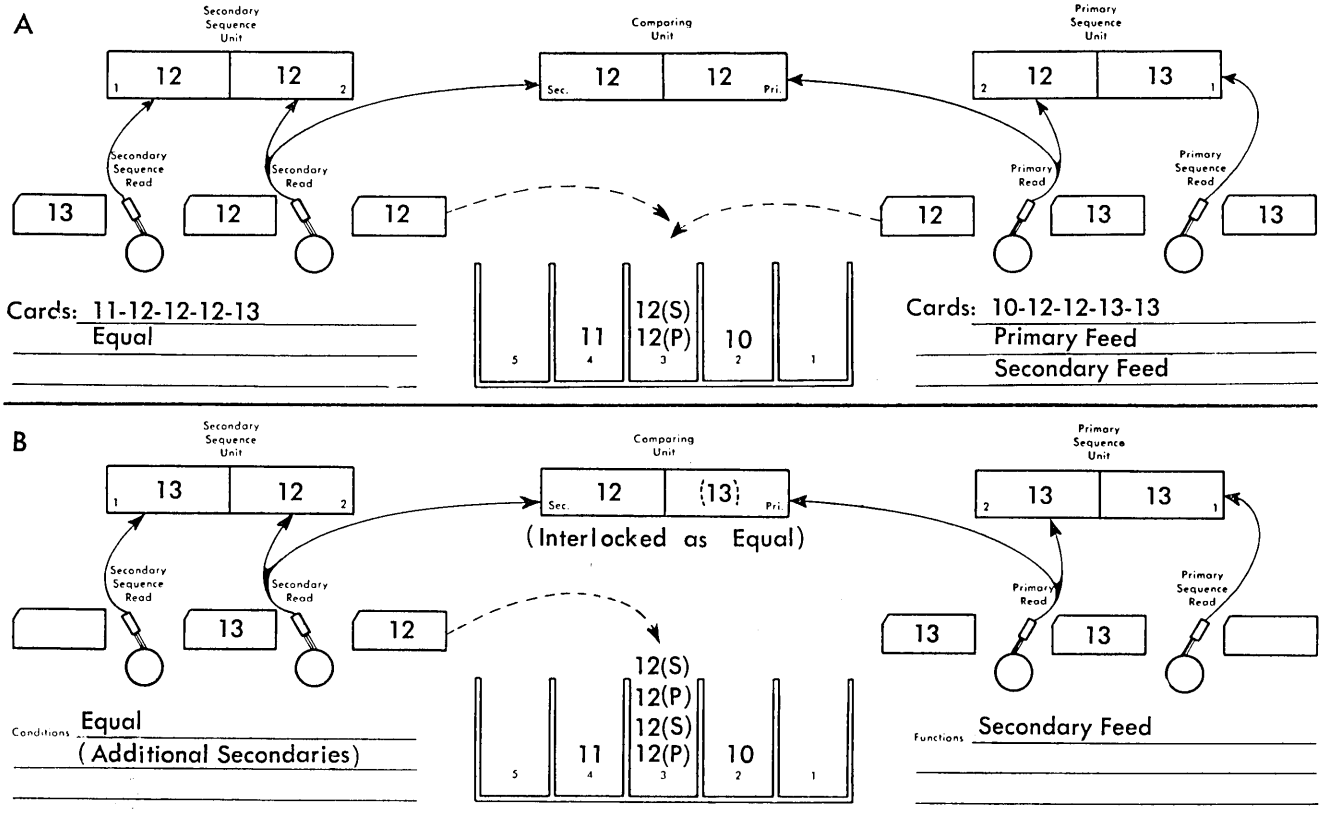


Figure 56. Mixed Merging with Selection

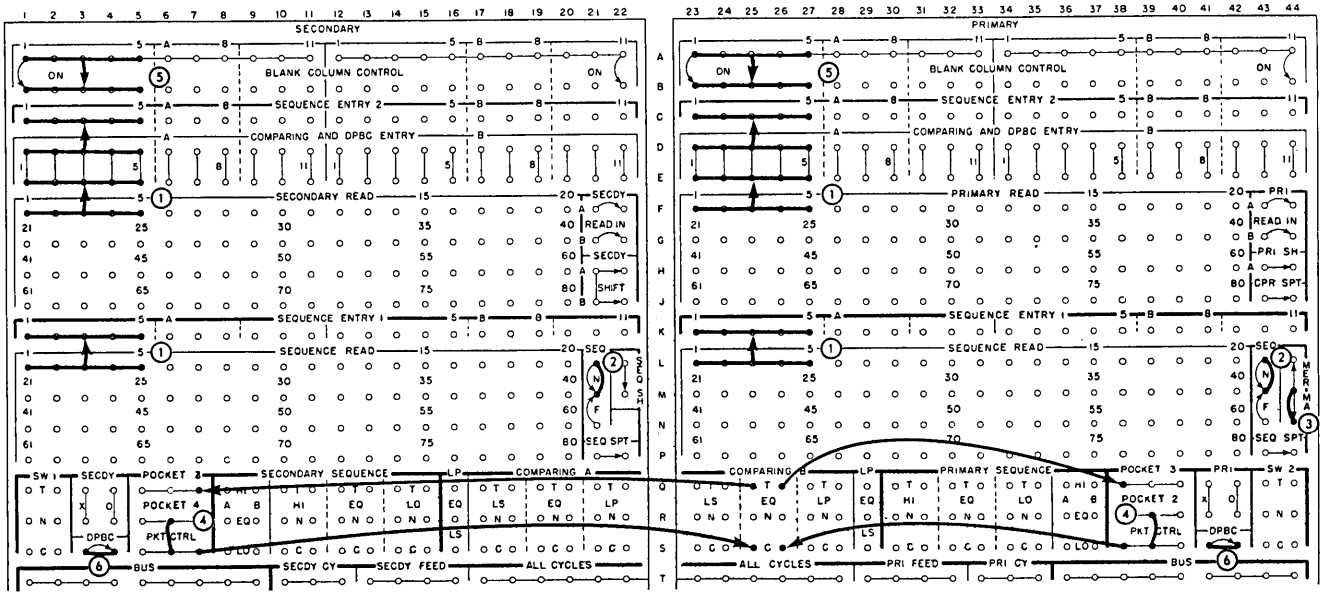


Figure 57. Mixed Merging with Selection

the primary and secondary cards can feed simultaneously. Normally (MER wired) the secondary card is held for comparison with the succeeding primary card, and fed on a low-secondary comparison. The wiring shown in Figure 58 makes this comparison a cycle earlier, and thus saves one machine cycle.

The comparing unit must be split to permit comparing both feeds. Unmatched cards in both feeds can be selected. On runout, the DP&BC DETECT light turns on when the COMPARING ENTRY B reads in from the empty primary sequence read station.

WIRING (FIGURE 58)

1. Wire the control fields in both primary and secondary feeds for normal merging. Use comparing unit A.
2. Wire primary SEQUENCE READ and SECONDARY READ to primary and secondary COMPARING ENTRY B, respectively.
3. SEQ ON in both feeds stops card feeding for a sequence error.
4. CPR SPT splits the comparing unit into sections A and B.
5. Wire both PRI and SECDY READ IN A and B to read in new values every machine cycle.
6. ALL CYCLES, through the normal side of LS COMPARING A selector to PRI FEED, feeds all primary cards.
7. ALL CYCLES, through the transferred side of LS COMPARING A selector to SECDY FEED, feeds secondary cards.
8. ALL CYCLES, through the transferred side of LS COMPARING B selector to SECDY FEED, causes a secondary feed cycle when the card at the secondary read station is lower than the card at the primary sequence read station. This occurs simultaneously when feeding the last equal or low-primary card.
9. EQ COMPARING A exit to the PICKUPS of Selector 1 transfers Selector 1 for matching cards or groups. Assign Selector 1 for secondary use.
10. SELECTOR HOLD, through the transferred side of EQ SECONDARY SEQUENCE selector, holds Selector 1 transferred to feed multiple secondary cards of matching groups.
11. PKT CTRL, through the transferred side of Selector 1, to POCKET 3 in both feeds merges matching groups.
12. PKT CTRL to POCKETS 2 and 4 selects all unmatched cards.
13. Wire BLANK COLUMN CONTROL and DPBC switches to check for double punches and blank columns.

Matching Card-for-Card

It is sometimes necessary to match two files of cards, card-for-card. Groups in either file may be single-card groups or multiple-card groups. The purpose of this operation is to ensure that single-card groups in one file are balanced by single-card groups in the other, or that multiple-card groups in one file are balanced by an equal number of cards for the same group in the other file. If not, all excess cards in either file are to be selected. For example, if one file has three cards of a given control number, the other file must also have three. In addition, all unmatched cards (for example, control numbers in one file for which there are none in the other) must be selected.

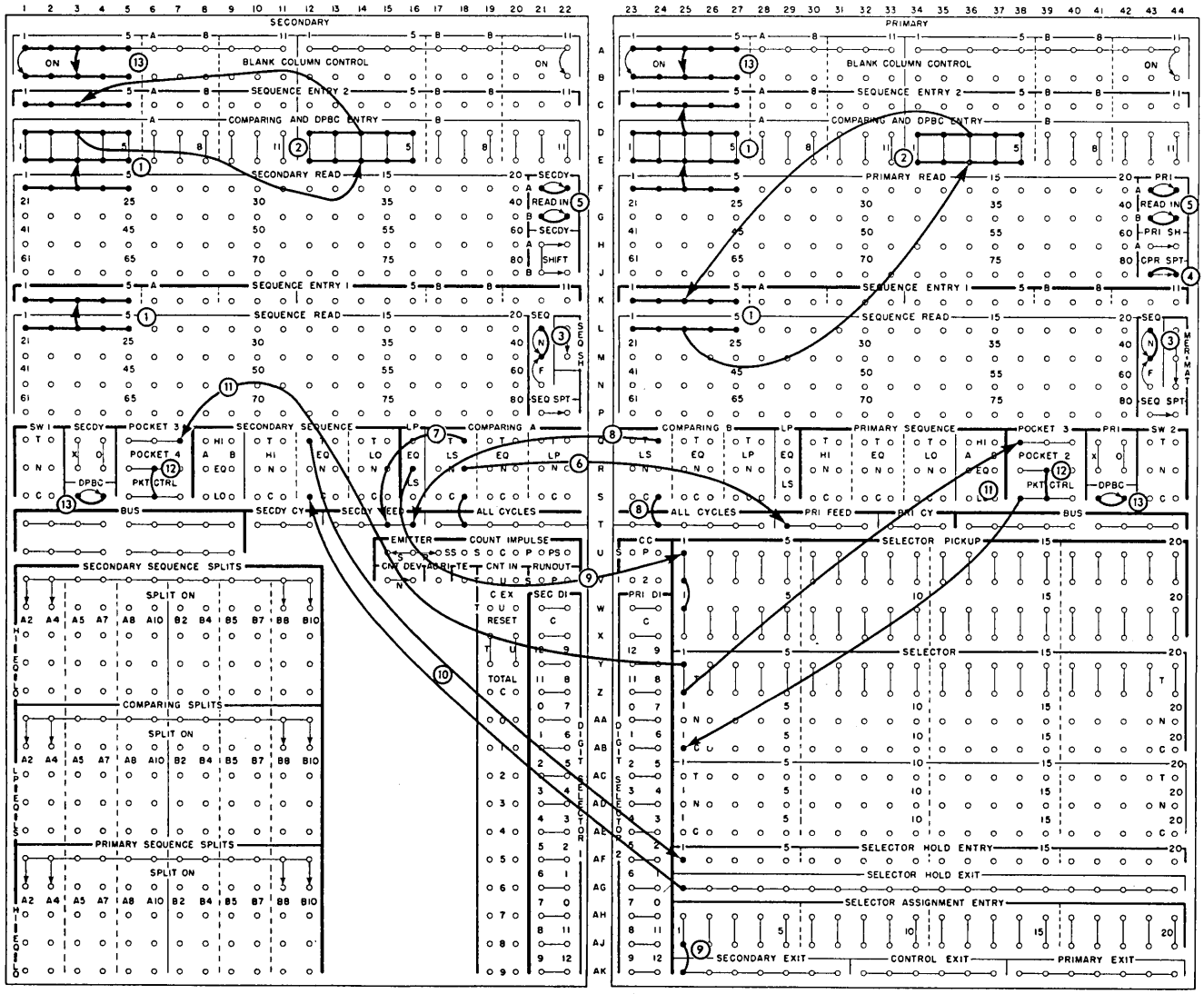


Figure 58. Rapid Merging with Selection

Secondary Cards: 1, 2, 3, 3, 4, 4, 5, 6, 8

Primary Cards: 1, 2, 2, 3, 3, 4, 5, 7, 8

POCKET 5	POCKET 4	POCKET 2	POCKET 1
	8	8	
	5	5	
	4	4	
	3	3	
	3	3	
6	2	2	7
4	1	1	2

Figure 59. Matching Card-for-Card

This operation is illustrated in Figures 59 and 60; in Figure 59 there is an extra 2-card in the primary file and an extra 4-card in the secondary. Cards 6 and 7 are unmatched.

In Figure 60, pairs of equal cards are matched, and extra cards and unmatched cards are selected. Equal primary and secondary cards are selected into pockets 2 and 4, respectively, and extra and unmatched cards are stacked in pockets 1 and 5, respectively.

WIRING (FIGURE 60)

1. Wire card columns from SEQUENCE READ to SEQUENCE ENTRY 1, and from PRIMARY and SECONDARY READ to COMPARING AND DPBC ENTRY and to SEQUENCE ENTRY 2 .
2. Wiring SEQ ON checks for low sequence in both feeds.
3. Wire PRI and SECDY READ IN to read in new values every corresponding card-feed cycle.

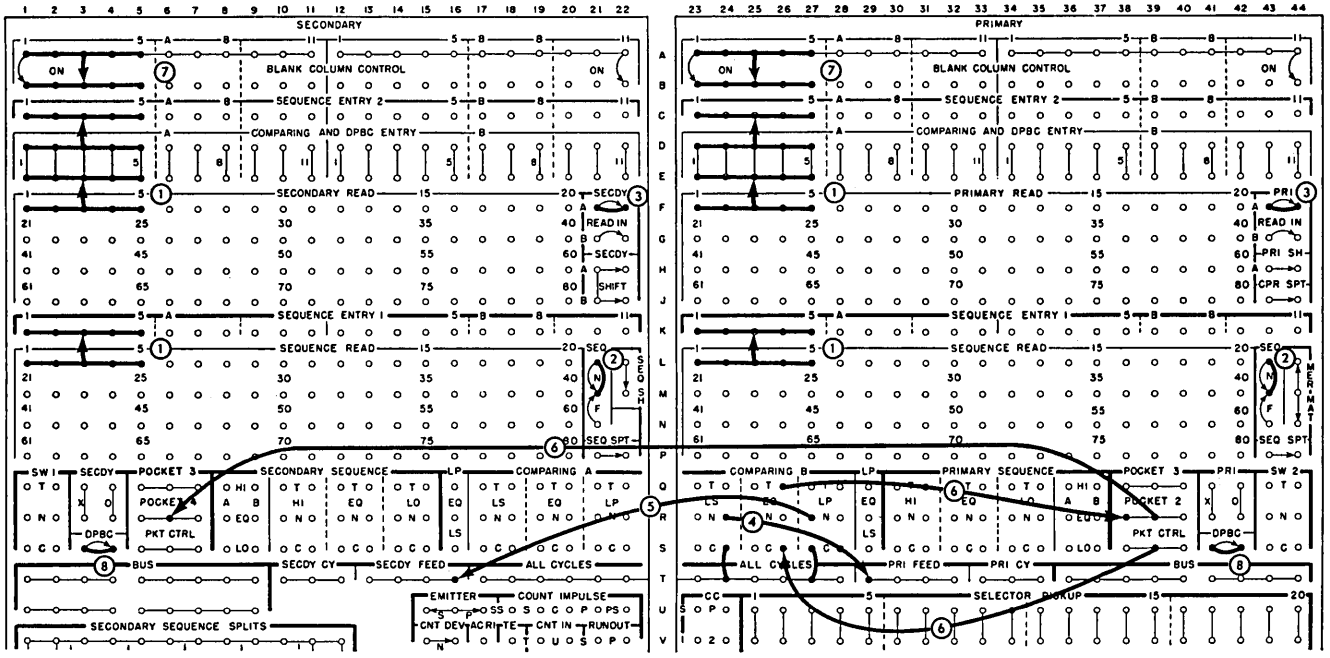


Figure 60. Matching Card-for-Card

4. ALL CYCLES to PRI FEED through the normal side of the LS comparing B selector feeds a primary card, except for a low secondary comparison.
5. ALL CYCLES to SECDY FEED through the normal side of the LP comparing B selector feeds a secondary card, except for a low primary comparison.
6. PKT CTRL to POCKET 2 and POCKET 4 through the transferred side of the EQ comparing B selector selects all matching cards to pockets 2 and 4.
7. BLANK COLUMN CONTROL checks for blanks in primary and secondary columns 1-5.
8. Wire the DPBC switches to stop card feeding for double punches and blank columns.

Selecting Double-Punched or Blank-Column Cards

When it is desirable to select double-punched or blank-column cards, rather than stop card feeding for these error cards, the impulse from the DPBC exit can pick up a selector to control stacking (Figure 61).

WIRING (FIGURE 61)

1. Wire columns 1-5 from PRIMARY READ to COMPARING AND DPBC ENTRY.
2. Wiring SEQ OFF in both feeds permits card feeding.
3. ALL CYCLES to PRI FEED feeds a card every cycle.
4. Wire PRI READ IN to enter card columns for checking.
5. BLANK COLUMN CONTROL checks for blanks in columns 1-5.

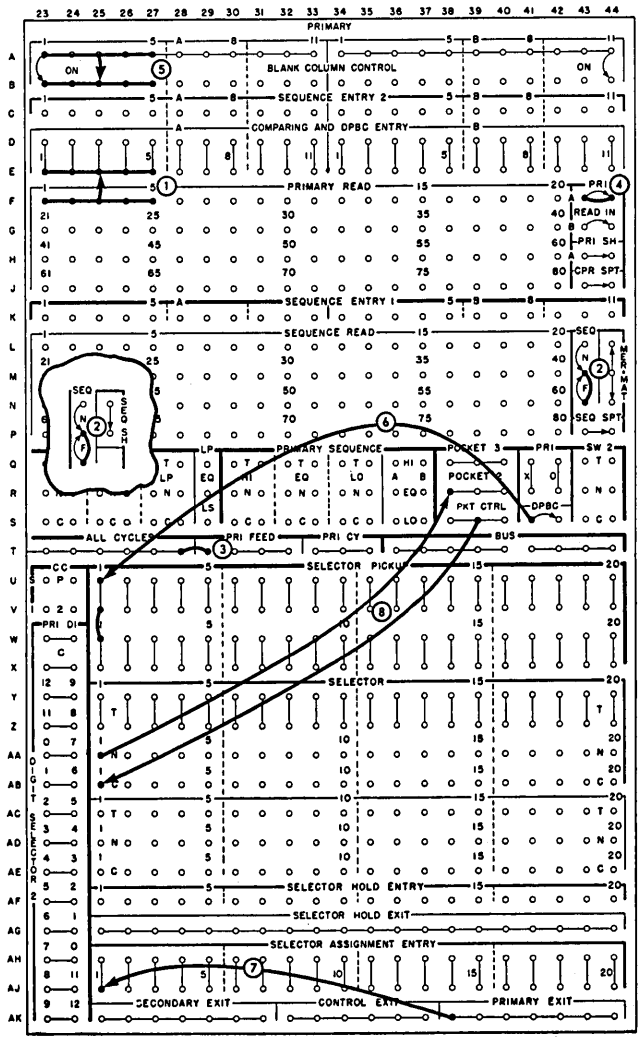


Figure 61. Selecting Double-Punched or Blank-Column Cards

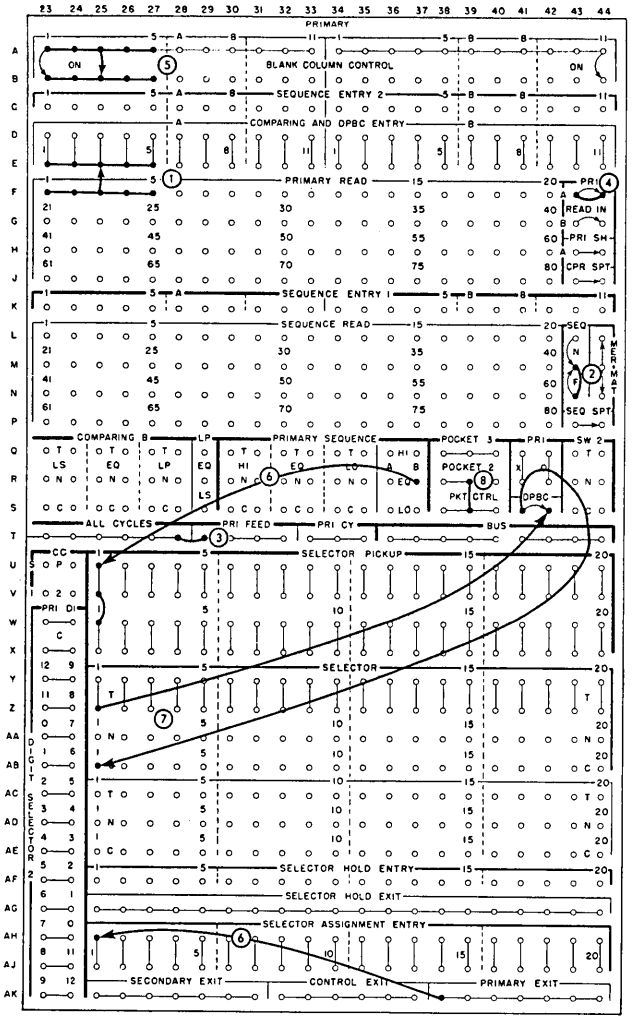


Figure 62. Checking for Blank Columns Only

6. Wire the DPBC exit to both PICKUPS of selector 1. Selector 1 transfers for a double-punch or blank-column error.
7. Assign selector 1 for primary use.
8. PKT CTRL to POCKET 2 through the normal side of selector 1 directs correct cards to pocket 2; error cards stack in pocket 1.

Checking for Blank Columns Only

To avoid stopping the machine for double punches, yet still check for blank columns, the DPBC impulse must be selected. During card-reading time, the DPBC exit emits for double punches; after the card is read, the DPBC exit emits for blank columns. The EQ exit of any unused control unit emits every machine cycle just after card reading time. This impulse can transfer a selector to isolate the blank-column impulse from any double-punch impulse (Figure 62). Assign the selector to the corresponding feed. If desired, the selected impulse can be used to pick up another selector to direct blank-column cards to another pocket, rather than stop card feeding.

WIRING (FIGURE 62)

1. Wire columns 1-5 from PRIMARY READ to COMPARING AND DPBC ENTRY.
2. Wiring SEQ OFF in both feeds permits card feeding.
3. ALL CYCLES to PRI FEED feeds a card every cycle.
4. Wire PRI READ IN to enter values every machine cycle for checking.
5. BLANK COLUMN CONTROL checks for blanks in primary columns 1-5.
6. Wire the EQ primary sequence B exit to both PICKUPS of Selector 1. Assign the selector for primary use.
7. Wire the DPBC switch through the transferred side of the EQ primary sequence selector. If the DPBC exit emits, only the blank-column impulse stops the machine.
8. PKT CTRL to POCKET 2 stacks all cards in pocket 2.

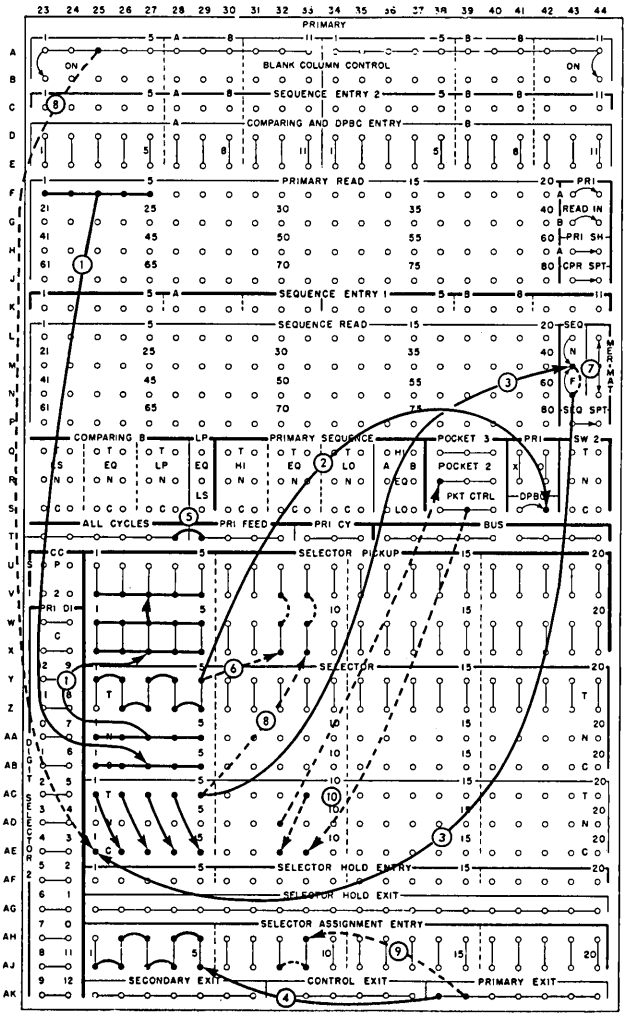


Figure 63. Double-Punch and Blank-Column Detection Using Selectors

Double-Punch and Blank-Column Detection (Digits 9-12)

All punching positions (0-9, X, 12) can be checked for double punches or blanks by wiring selectors as shown in Figure 63. This method also provides a means for additional positions of double-punch and blank-column detection.

A selector picked up by one digit is transferred immediately for the following digit. The second digit in the column impulses the machine to stop card feeding, and turns on the DP&BC DETECT light and a corresponding check light. If a selector is not transferred (column blank), the SEQ entry does not receive an impulse and card feeding stops with a control stop light on.

To select the error cards, rather than to stop card feeding, requires using a selector for each type of error detected. This wiring is shown as broken lines in Figure 63.

WIRING (FIGURE 63)

1. Wire each card column (1-5) through the normal side of Selectors 1-5, respectively, to the corresponding PICKUPS. Each selector transfers immediately for the digit in the column.
2. Wire the transferred side of each selector to DPBC entry. The second digit in any column stops card feeding and turns on the DP&BC DETECT and the PRIMARY CHECK lights.
3. Primary SEQ OFF switch, wired through the transferred side of each selector, stops card feeding for a blank column and turns on the PRIMARY CONTROL STOP light. Wire secondary SEQ OFF to permit card feeding.
4. Assign the selectors for primary use.
5. ALL CYCLES to PRI FEED feeds a card every machine cycle.

To direct the error cards to pocket 1 (broken lines):

6. Wire the transferred side of the last selector to the PICKUPS of Selector 8. (Remove wire 2.) The second digit in any column transfers Selector 8.
7. Jackplug SEQ OFF. Remove wire 3.
8. Wire BLANK COLUMN CONTROL exit through the transferred side of each selector to the PICKUPS of Selector 9. If a blank column occurs, Selector 9 does not transfer and the blank-column card stacks in pocket 1.
9. Assign Selectors 8 and 9 for primary use.
10. PKT CTRL through the transferred side of Selector 9 and the normal side of Selector 8 directs correct cards to pocket 2. Error cards stack in pocket 1.

Procedures and Operating Notes

This section presents recommended operating procedures and suggestions for the operator's understanding and convenience. Normal operating and error procedures are outlined in detail to help the trainee. Diagnostic aids provide rapid analysis of collating situations.

Normal Operations

Joggling Cards

Always fan and joggle cards before placing them in hoppers. When cards are placed in the file feed, this is not necessary because the file feed automatically joggles the cards as they enter the hopper.

Joggle the cards against the joggle plate near the secondary hopper to make the deck even on all sides.

Loading Hoppers

Place cards face down in both hoppers. Because primary and secondary cards travel in opposite directions, place them 9-edge first in the primary hopper, but 12-edge first in the secondary. A simple method of remembering is: Place cards in both hoppers face down, *9-edge* to the *left*.

Operating the File Feed

Place cards on the primary file-feed magazine 9-edge down with the face of the cards toward the hopper. Take care to place the cards within the guide channels. Place the card weight behind the last card on the magazine.

The file feed operates independently of the primary feed. Card feeding from the file-feed magazine is controlled by the level of cards in the hopper.

Lower the hinged joggler to make the hopper accessible for inserting or removing cards and the card weight. An interlock prevents card feeding when the joggler is fully open.

To reduce card handling and to facilitate running out cards in the primary feed, press the RUNOUT key while lifting the cards off the hopper card-levers without opening the joggler and removing the cards from the hopper. Or, if the cards are removed from the hopper, lower the hinged joggler partially and press the RUNOUT key. These methods allow the primary feed to operate on runout without feeding additional cards from the file-feed magazine.

To make the card transport area more accessible, latch the file feed in an upright position by raising the magazine until the latch drops in place. Cards need not be removed from the magazine. However, exercise care not to throw them out of the file feed. To lower: raise the magazine slightly, and pull up the handle (see Figure 6) on the back to unlatch the magazine and permit it to be lowered.

Starting Card Feeding

Before starting an operation, always press the RUNOUT key for at least 3 cycles to be certain no cards remain in the machine from a previous operation. Then put the cards in and press the START key. It need not be held although no immediate card feeding occurs. Except when cards are placed directly in the hopper, a 3-second delay is in effect to fill the primary hopper with cards from the file feed. This delay also occurs when the RUNOUT key is pressed and the primary hopper is empty.

If, after the 3-second delay, card feeding does not start when the START key is pressed, check the following and make any necessary adjustment:

power cord properly plugged in
MASTER switch ON
green READY light ON; all other signal lights OFF
cards in hopper(s)
cards run out after a card-feed failure
pockets — none filled to capacity
joggler closed
top cover properly closed
control panel properly inserted
control panel wired to feed cards
main fuses — check that none is burned out
electrical service ON.

Removing Cards from Stackers

Card feeding need not be stopped to remove cards from a stacker. Simply grasp as many cards as can be conveniently held, and lift them out. Any remaining cards are automatically positioned forward by the card pusher.

Single-Cycle Operation

To operate the card feeds one cycle at a time, press both the START and STOP keys simultaneously, and then release the STOP key momentarily. This operation is convenient when checking control-panel wiring or when ascertaining that a card jam is cleared. For single-cycle operation, cards must be in the hopper(s) and only the READY light ON.

Signal-Light Indications and Procedures

This section presents suggested procedures to be followed when specific conditions exist in the machine, as indicated by the signal lights.

Control Stop Lights

The PRIMARY and SECONDARY CONTROL STOP lights turn ON whenever the corresponding sequence switch on the control panel is *not* impulsed. These lights are normally used to indicate errors in sequence. When card feeding stops and a CONTROL STOP light is ON, check the cards in the corresponding feed for a low-sequence condition:

1. Remove the cards from the hopper of the feed indicated.
2. Press the RUNOUT key to run out the three cards in the feed. Primary cards stack in pocket 1, secondary cards in pocket 5. The second card run out is the card causing the error stop.
3. Check the cards to determine the sequence error. This may involve examining several cards in the stacker and hopper. Correct the error.
4. Beginning at a convenient control break, place the cards in the hopper and press the RESET key.
5. Press the START key to restart card feeding. If the primary hopper has been emptied, a 3-second delay occurs after the cards are placed in the hoppers, before card feeding starts. The feed previously run out takes 3 run-in cycles to position cards at the reading stations and to re-establish proper comparing. Normal operation continues according to control-panel wiring.

A card-feed stop with both CONTROL STOP lights ON, but with no error in the cards, may indicate a random error in the comparing circuits.

1. Remove cards from both hoppers, and press the RUNOUT key.
2. Check the cards already processed.
3. Beginning at a convenient control break, replace the cards, including the runout cards, in the hopper(s) and press the RESET key.
4. Press the START key.
5. If the CONTROL STOP lights continue to go ON after repeated re-runs, report this to an IBM Customer Engineer.

Although a CONTROL STOP light normally indicates an error in sequence, this light can also indicate that card feeding has stopped for other conditions set up by control-panel wiring. The SEQ ON or SEQ OFF switch in either feed can be selected through the normal side of any selector. When selection occurs, the corresponding CONTROL STOP light goes ON. The location of the card involved depends on where the impulse to pick up the selector originates. If picked up from PRIMARY or SECONDARY READ, the card is the first card run out to pocket 1 or 5 when the RUNOUT key is pressed. If the selector is picked up from an impulse at SEQUENCE READ, the card is the second card run out. Figure 64 shows the wiring to stop card feeding for an X in column 80. Only an X transfers the selector to stop card feeding and turn on the corresponding CONTROL STOP light.

Double-Punch and Blank-Column Detection Light

Although the DP&BC DETECT light normally indicates double-punch and blank-column errors, this light can also indicate that card feeding has stopped for other conditions set up by control-panel wiring. The right hub of the DPBC switch is an entry that accepts an impulse to stop card feeding, and to turn on the DP&BC light and the corresponding CHECK light. The location of the card involved depends on where the impulse to

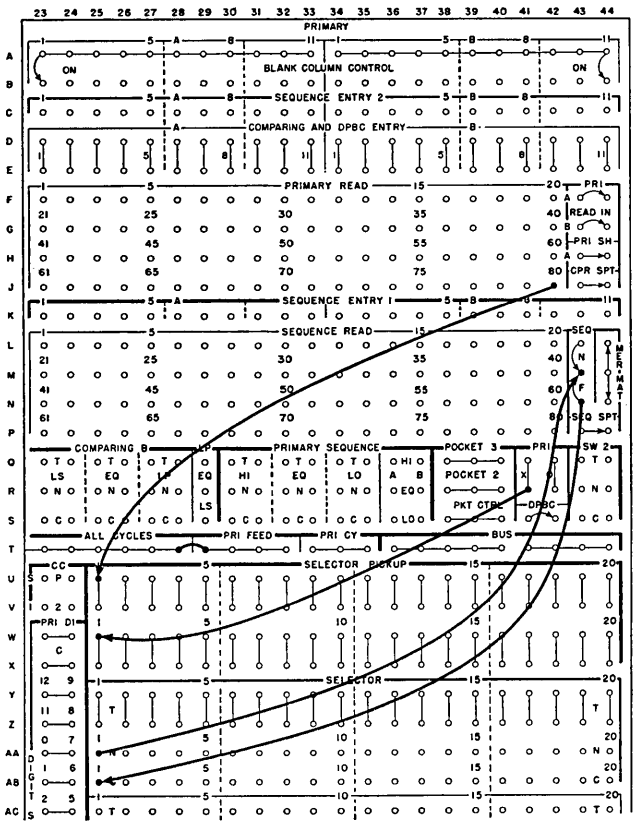


Figure 64. Selected Stop for X-Cards

pick the selector originates. Figure 65 illustrates the wiring to stop card feeding for an equal sequence condition (for example, duplicate cards).

Check Lights

If a PRIMARY or SECONDARY CHECK light is ON along with the DP&BC DETECT light, the CHECK light indicates the feed in which the double punch or blank column was detected.

If only a CHECK light is ON, it indicates a card jam or a card-feed failure along the card line between the hopper and the second reading station in the feed indicated. To correct the condition:

1. Remove cards in the hopper to see if a card failed to be fed.
2. If no card is in the throat, run out the cards in the feed. Check the bottom card from the hopper to see if the edge is damaged.
3. If the card is damaged, duplicate it.
4. Replace the cards (including runout cards) in the hopper. Be sure the joggler is closed.

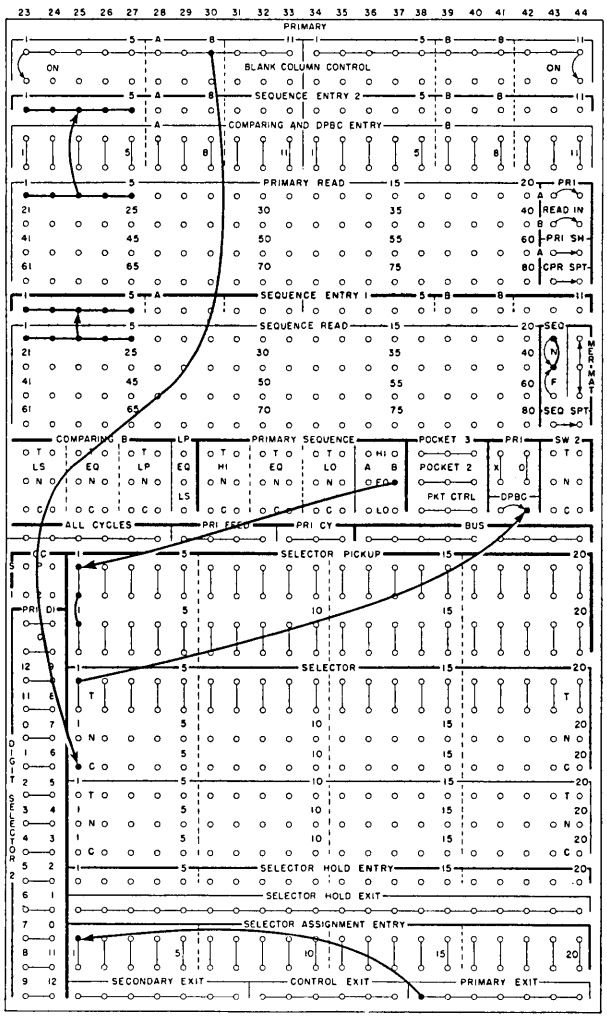


Figure 65. Selected Stop for Duplicate Cards

5. Press the RESET key to extinguish the CHECK light.
6. Press the START key to continue the operation.

If the cause of the stop is in the throat or at the reading stations (Figure 66):

1. Turn off the MASTER switch.
2. Remove cards from the hoppers.
3. Raise the joggle plate, and push back the top cover.
4. Remove the brush holder(s). Pinch the spring latches toward the center, and lift the unit out. Check the brushes for damage. Handle the brush assembly with care, so as not to damage the projecting brushes.
5. Remove the card plate, if necessary. Using both hands, pull the two knurled locking pins toward the center, and lift the plate out.
6. Remove the cards. Be certain no pieces of card remain in the machine.
7. Remake any damaged cards.
8. Replace the card plate. Pull the locking pins toward the center, properly seat the unit in its slots, and release the locking pins.
9. Replace the brush holder(s). Pinch the latches toward the center and latch the unit in place. Rotate clockwise the hand-feed wheel (located inside the left front cover).
10. Close the top cover.
11. Turn on the MASTER switch. When the READY light turns ON, run out any cards remaining in the feed.
12. Replace properly all the cards in the hoppers. Be sure the joggler is closed.
13. Press the START key.

Transport Light

A card jam in the card transport line over the stackers stops card feeding and turns on the TRANSPORT light. To correct this condition:

1. Turn off the MASTER switch, and remove cards from the hoppers.
2. Raise the joggle plate, push back the top cover, and locate the card jam.
3. If possible, straighten the cards sufficiently to allow normal card feeding to occur.
4. If the jam is severe, remove the card(s) carefully with a steady pull. Be careful not to damage the chute blades.
5. To free a card, it may be necessary to advance the card under the rollers by turning the hand-feed wheel. This wheel, located inside the left front cover, turns clockwise.
6. Turn on the MASTER switch and close the top cover. When the READY light goes ON, press the RUNOUT key.

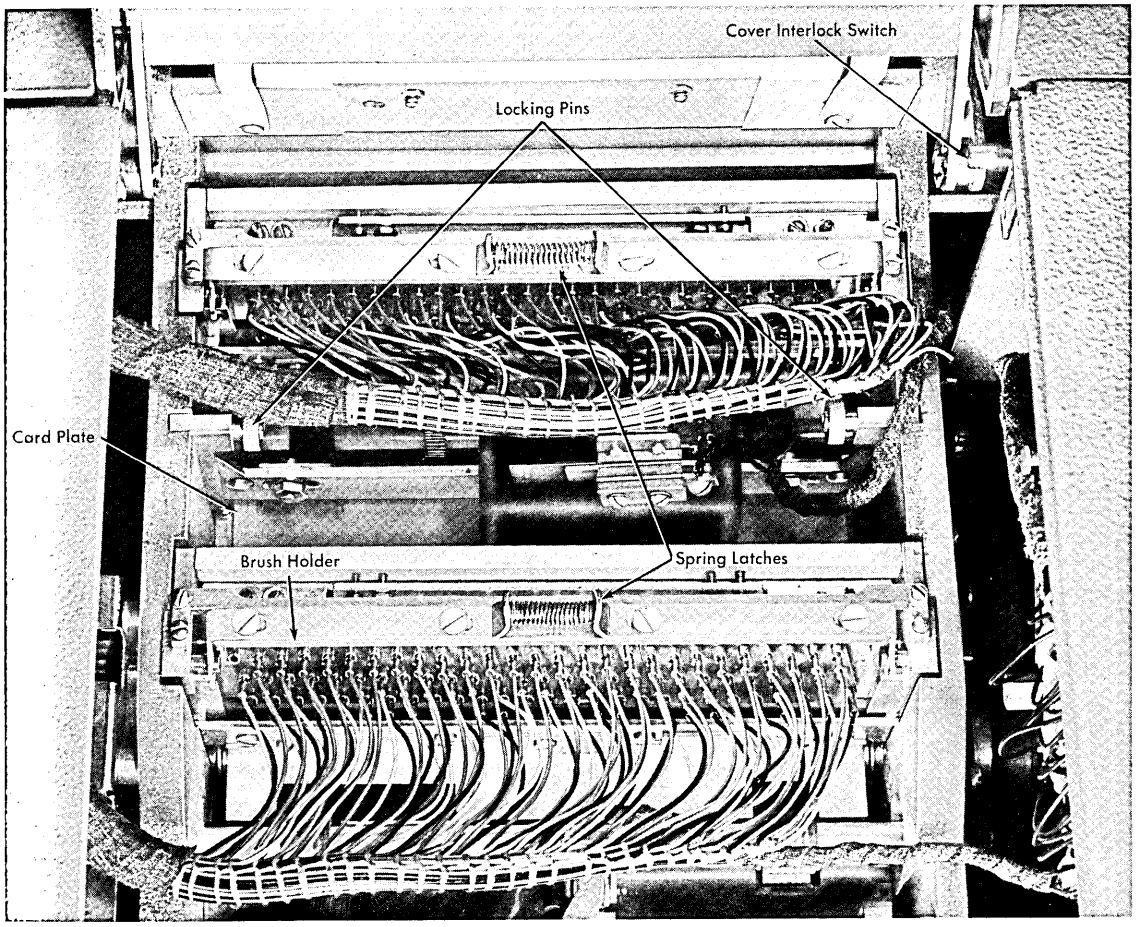


Figure 66. Brush Holders

7. Remake any damaged cards, and replace the cards (including runout cards) in the hoppers. [Note: since all comparing was lost when the MASTER switch was turned OFF or the top cover was opened, the operation should be restarted at a convenient control break.]
8. Press the START key.

Physical Planning Considerations

This section contains pertinent physical planning information for installing an IBM 88 Collator. Weight and ratings are for Model 1.

Weight and Dimensions

The IBM 88 Collator weighs approximately 1210 pounds. Casters facilitate moving the machine.

Over-all dimensions are:

Width — 57⅞″
Depth — 28″
Height — 44½″
(57½″ including file feed)

Recommended clearances required around the machine for servicing are:

Front — 42″
Rear — 24″
Right side — 30″
Left side — 24″

Electrical Requirements

The power service for the 88 Collator should be rated not less than 15 amperes. Single-phase operating current (full-capacity machine) and the Pass and Seymore plug members are:

Voltage	*Amperes*	*Plug*
115V	9.5	P&S 5267
208V	5.3	P&S 5666
230V	4.8	P&S 9951

Heat Dissipation

The 88 Collator requires no special air-conditioning. The full-capacity machine dissipates approximately 3560 BTU per hour (100% duty).

Special Features

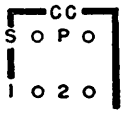
In addition to the standard features, several special features increase the versatility of the IBM 88 Collator.

Auxiliary Card Counter

One or two unit counters (Figure 67) can be mounted on the front of the machine beneath the signal lights. Each counter has a capacity of 999,999. A count can be made of the total number of cards passing through either feed, or the number of cards conforming to a specific pattern set up by control-panel wiring (Figure 68). The counter can be reset to zero by turning the counter reset wheel.

Control-Panel Hubs

U-V, 23-24



CC (Card Counter). Each counter has an entry hub (1 and 2) on the control panel to cause the counter to add 1 for each card counted. When two counters are installed, entry 1 is for the left counter. A counter can be operated by an impulse from either the primary (P) or secondary (S) exit. The P and S exit hubs emit impulses on the corresponding primary and secondary card-feed cycles.

Wiring (Figure 68)

1. Counter 1 counts each card passing through the secondary feed. (Secondary feed wiring not shown.)
2. Counter 2 counts the number of control groups in the primary as indicated by a high-primary-sequence condition.

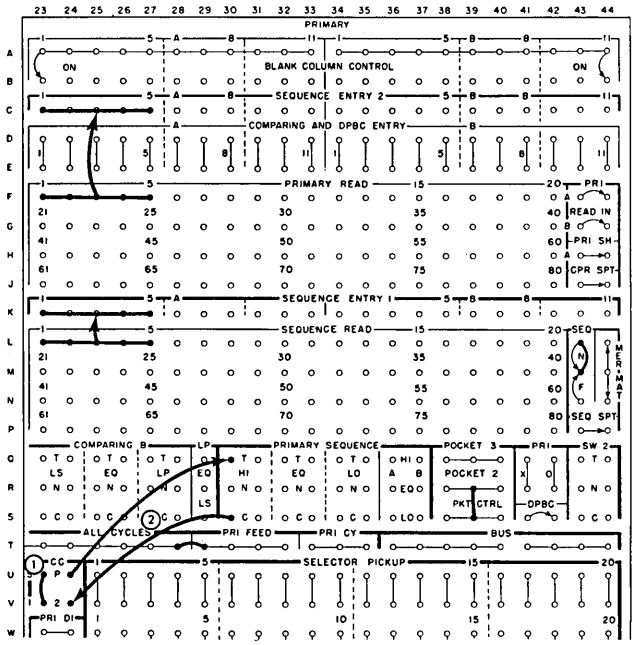


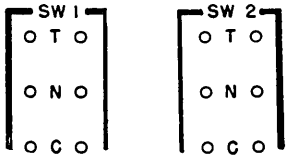
Figure 68. Counting Each Card — Secondary Feed; Counting Card Groups — Primary Feed

Alteration Switches

Within reasonable limitations, alteration switches permit using one control panel for several different operations without any change in control-panel wiring.

Control-Panel Hubs

Q-S, 1-2, 43-44



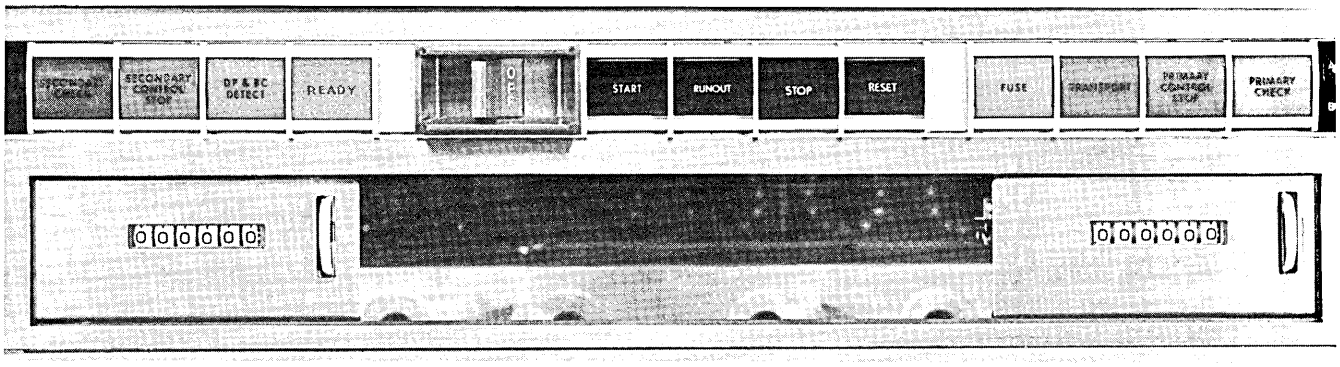


Figure 67. Auxiliary Card Counters

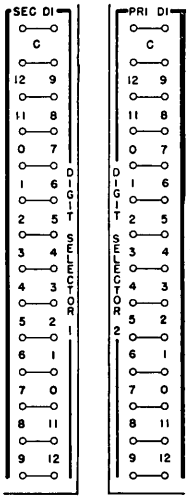
Sw 1, Sw 2 (Switch 1, Switch 2). Alongside pocket 1 are two toggle switches (Figure 69). Each of these alteration switches controls a corresponding set of hubs on the control panel (sw 1, sw 2). The toggle switches have two positions, N and T. Setting the switch to N connects the C and N hubs on the control panel; setting the switch to T connects the C and T hubs. Any impulse can be wired through C-N or C-T. Do not change the switch setting while the machine is operating.

Digit Selectors

Any punching in a card can control selectors. If the presence of *any* punch in a column is sufficient to identify a card, then the column containing the punch can be wired directly to both pickups of a selector. However, if a specific punch, or pattern of punches, identifies a card or is to control machine operations, then a digit selector is necessary to isolate the particular punch. This is illustrated in Figure 70-A in which the last card of a primary group is selected if it contains a 9-punch in column 80. A digit selector can also be used as a digit emitter to provide digits on each card-feed cycle, as shown in Figure 70-B in which secondary cards are searched for those punched with the number 65530.

Control-Panel Hubs

W AK, 21-24



DIGIT SELECTOR. Each digit selector has a pair of C (common) hubs that is connected successively, every machine cycle, to a pair of hubs for each digit 9 through 0, 11, and 12. When C is wired from a card column, the hubs 9-12 corresponding to the punches in the column emit an impulse. This impulse can pick up selectors or operate machine functions that can be digit-controlled.

Each pair of digit hubs is designated by two numbers. The right number is associated with the primary feed and corresponds to cards fed 9-edge first; use impulses so numbered to control selectors assigned to the primary. The left number corresponds to cards fed 12-edge first in the secondary; use impulses so numbered to control selectors assigned to the secondary.

The SEC DI and PRI DI (secondary and primary digit impulse) hubs emit an impulse for every digit 9 through 0, 11, and 12. Wiring either of these hubs to C of the digit selector changes the selector to a digit emitter. The primary DI hubs emit impulses on every primary card-feed cycle; and the secondary DI hubs on every secondary card-feed cycle. When DI is wired to C, all digit exits are active for the corresponding card-feed cycle. The digit selector then becomes a primary or secondary digit emitter. Use hubs numbered according to the labels on the right for control in the primary, and according to the labels on the left for control in the secondary.

Wire only a digit-timed impulse through a digit selector.

Wiring: Digit Selecting (Figure 70-A)

1. Wire the control field (columns 21-25) from SEQUENCE READ to SEQUENCE ENTRY 1 and from PRIMARY READ to SEQUENCE ENTRY 2.
2. Wire the sequence switches in both feeds.
3. ALL CYCLES to PRI FEED feeds a card every cycle.
4. Wire column 80 from PRIMARY READ to C of digit selector 2, and from the digit-9 hub to both PICKUPS of selector 2. Selector 2 transfers for all cards punched with a 9 in column 80.
5. Assign the selector for primary use.
6. Wire PKT CTRL to POCKET 2, through the transferred side of selector 2 (to check for the presence

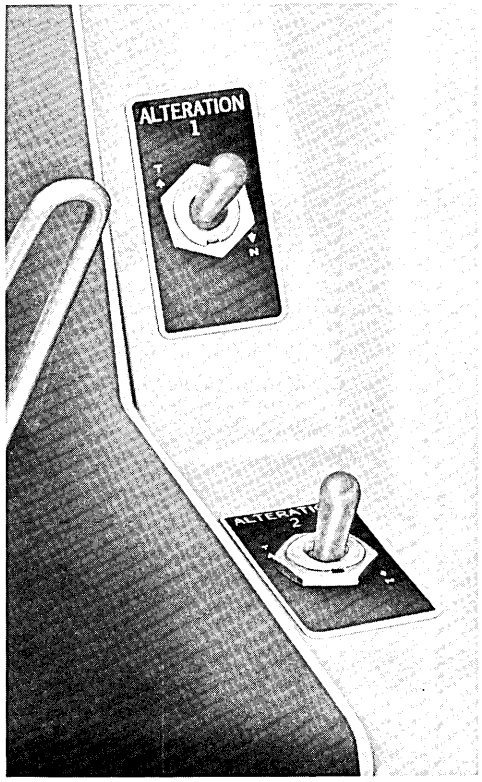


Figure 69. Alteration Switches

of the 9-card) and the transferred side of the HI primary sequence selector (to check for the change in control group). This stacks the last card of a group, if it is a 9-card, in pocket 2.

Wiring: Digit Emitting (Figure 70-B)

1. Wire columns 21-25 from SECONDARY READ to SEQUENCE ENTRY 2. Card is in position to be selected for stacking.
2. Wire the sequence switches in both feeds to permit card feeding.
3. ALL CYCLES to SECDY FEED feeds a card every cycle.
4. SEC DI to C of digit selector 1 causes the digit hubs to emit specific digits.
5. Wire the digit hubs to SEQUENCE ENTRY 1 to enter the number 65530 on each secondary feed cycle.
6. PKT CTRL to POCKET 4, through the transferred side of the EQ selector, selects all cards containing the number 65530 in pocket 4.

File Feed for Secondary

A file feed in the secondary (Figure 71) is particularly advantageous in collating operations that process an exceptionally large volume of cards in the secondary. The secondary file feed operates the same as the primary file feed. Place the cards on the file-feed magazine, 12-edge down. Cards are joggled on the column-80 end and on the 9-edge. A 3-second delay is in effect for filling the secondary hopper from the file-feed magazine.

Alphabetic Collating Feature

This feature permits selecting, sequence checking, merging or matching cards by names, titles, or any other alphabetic information punched in them. Each

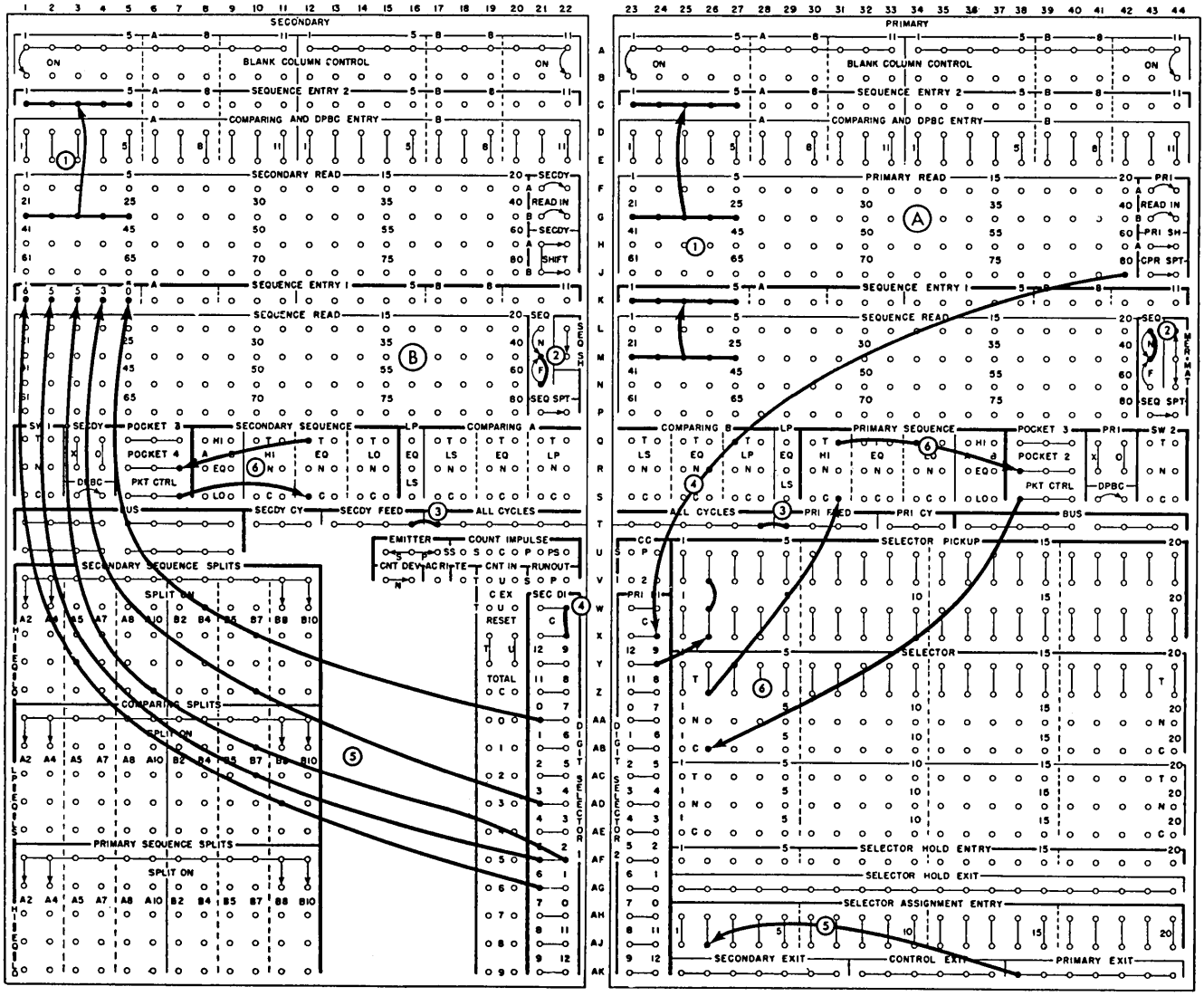


Figure 70. Digit Selecting (A); Digit Emitting (B)

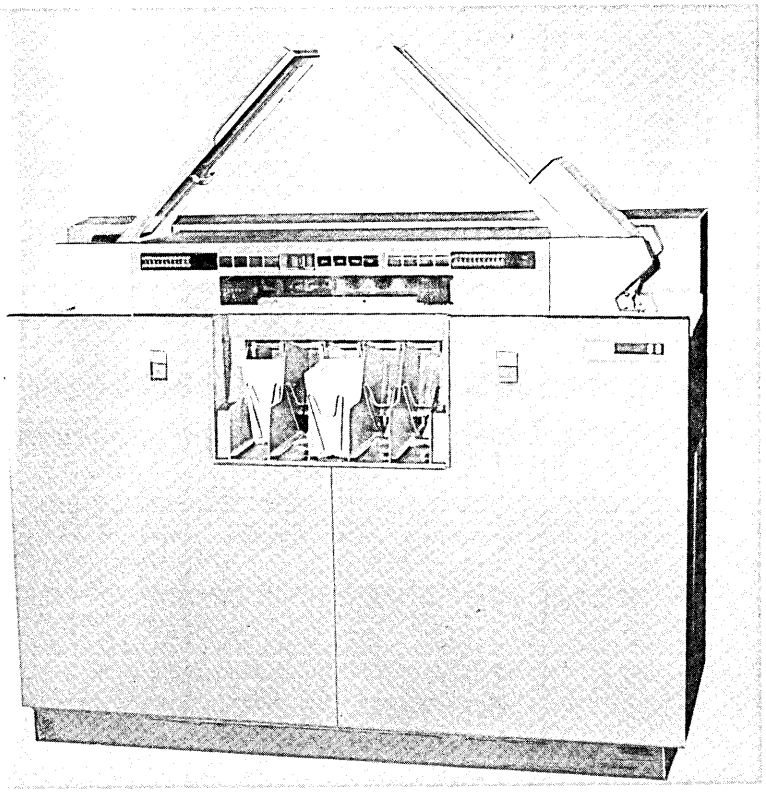


Figure 71. Secondary File Feed

letter is treated as a two-digit number. Consequently, each alphabetic column requires two control-unit positions — one for comparing the digit value, and one for the zone that is converted to a digit. Either entry can be wired. The maximum number of alphabetic positions that can be entered for any operation is:

Model 1 — 10 positions
Model 2 — 8 positions
Model 3 — 4 positions

An Alpha Control switch on the control panel must be wired for each position of alphabetic information. These pluggable switches adapt the three control units to accept zone and digit information. For example, wiring switch A4 causes positions A3 and A4 in the comparing unit and in both sequence units to accept the zone and digit, respectively. The two control positions function normally when the associated switch is not wired.

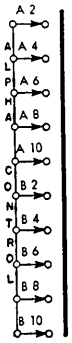
A combination of alphabetic and numerical information can be collated. Reserve two entries for each column containing alphabetic information and wire the corresponding Alpha Control switch. For example, to collate on a field with alphabetic information in the high-order position (for example, D7421), wire the card column to either control-unit entry A1 or A2 and wire Alpha Control Switch A2.

Zeros should not be punched in any column to be wired for alphabetic control. The machine reads a zero as both a *zone* zero and a *digit* zero, and erroneously collates the zero between R and S. The complete sequence (low to high) is: blank, 1-9, 12, A-I, 11, J-R, 0, 0/1, S-Z.

Both zone and digit positions can be checked for double punches and blank columns. BLANK COLUMN CONTROL should not be wired if blanks are present in the alphabetic field.

Control-Panel Hubs

U-AD, 13-14



ALPHA CONTROL: A 2-10, B 2-10. These switches modify all three control units to accept alphabetic information. Each switch corresponds to the two control-unit positions needed for one alphabetic column. Wiring an Alpha Control switch makes the associated control-unit entries common, and stores the zone as a numerical value in the left position, and the digit in the right.

Wiring: Alphabetic Merging with Selection (Figure 72)

1. Wire the alphabetic field (columns 1-5) to alternate COMPARING AND DPBC ENTRIES 2-10 for comparing cards at the primary and secondary read stations.
2. Wire the alphabetic field (columns 1-5) to alternate positions (2-10) of SEQUENCE ENTRIES 1 and 2 in both feeds to check for sequence.
3. SEQ ON in both feeds stops card feeding for a low sequence condition in either feed.
4. Wire MER to establish the internal circuitry for automatic card feeding in a merging operation.
5. Wiring ALPHA CONTROL A2-10 adapts the control units to accept alphabetic information.
6. PKT CTRL to POCKET 3 in both feeds, through the transferred side of the EQ comparing B selector, directs all equal cards to the merge pocket.
7. PKT CTRL to POCKET 2 and POCKET 4 selects low primaries into pocket 2 and low secondaries into pocket 4. When equals feed, the impulse to POCKET 3 takes precedence.
8. Wiring BLANK COLUMN CONTROL switches checks both zone and digit positions of the alphabetic field for blanks. (Omit for any column containing blanks to be collated.)
9. Wire the DPBC switch in both feeds to stop card feeding for double punches and blank columns.

Control Unit Splits

Additional splits provide for independent control of machine operations on more than the six separate fields available in the split control units of the standard machine. Separate functional exits correspond to each position or group of positions of a split. These functional impulses can control machine functions through selectors. Each split has a pluggable switch to make it operative, and to isolate the split. Wiring the

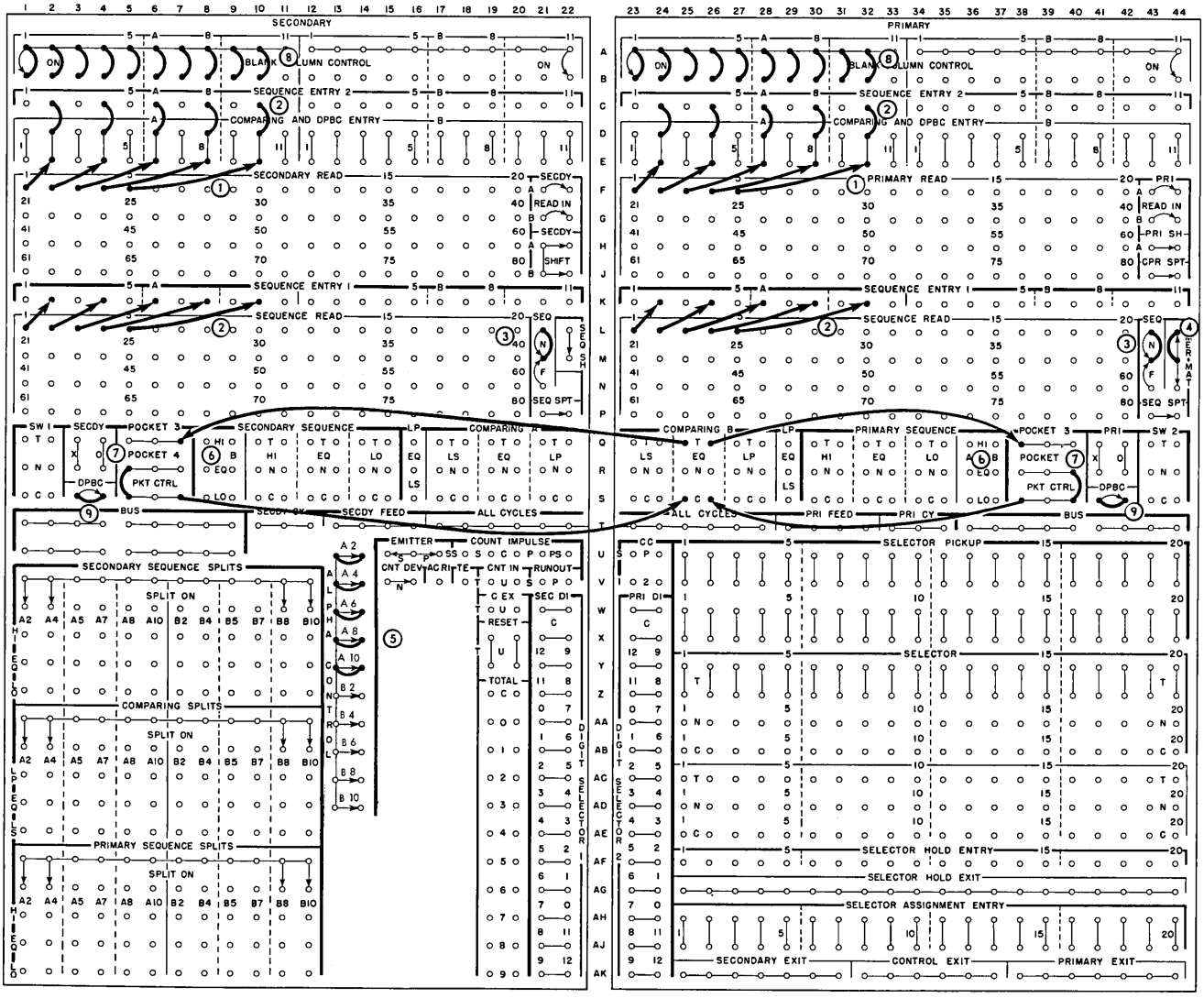


Figure 72. Alphabetic Merging with Selection

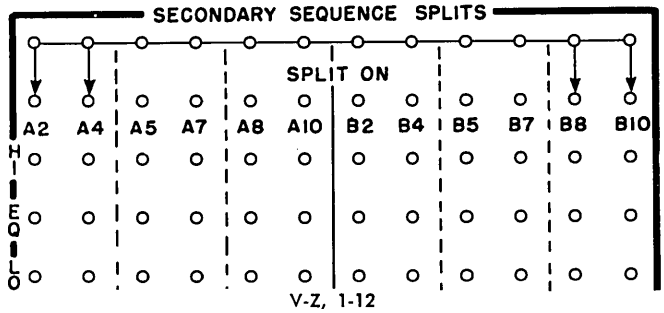
corresponding CPR SPT and SEQ SPT switches isolates the control units at the mid-position (between A11 and B1).

Any split can be used separately or in combination with other splits. The splits of the sequence units read in automatically on each card feed. The comparing splits read in according to the READ IN wiring for sections A and B.

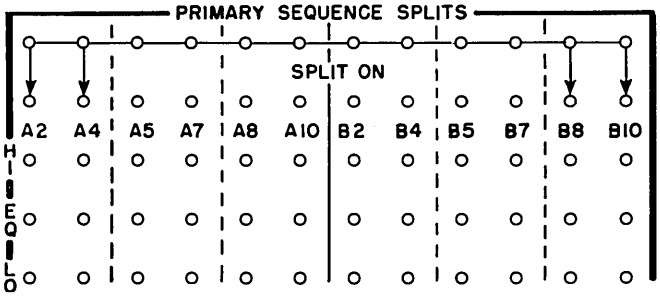
The various combinations of split-position groups available in the A and B sections of the comparing and sequence units are:

MODEL 1		MODEL 2		MODEL 3	
A	B	A	B	A	B
2-2-7	2-2-7	2-2-4	2-2-4	2-2-1	2-2-1
5-2-4	5-2-4	5-2-1	5-2-1		
8-2-1	8-2-1	2-2-1-2-1	2-2-1-2-1		
2-2-1-2-4	2-2-1-2-4				
2-2-4-2-1	2-2-4-2-1				
5-2-1-2-1	5-2-1-2-1				
2-2-1-2-1-2-1	2-2-1-2-1-2-1				

Control-Panel Hubs



V-Z, 1-12

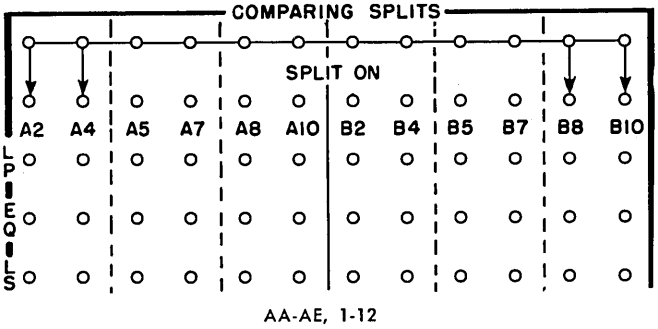


AF-AK, 1-12

SECONDARY SEQUENCE SPLITS; PRIMARY SEQUENCE SPLITS. The SPLIT ON switches split the sequence unit at that position, and make the result of the comparison (HI, EQ, or LO) for that independent group available at the split functional exits. For example, SPLIT ON switches A2 and A8 isolate positions A, 1-2 as an independent control group, and positions A, 3-8 as another independent control group. The remaining positions (A, 9-11 and B, 1-11 in a full-capacity machine) make up a third isolated group. If the standard SEQ SPT switch is *not* wired, the standard functional exits and selectors are operative for this group. If the SEQ SPT switch *is* wired, the standard A functional exits are operative for positions A, 9-11, and the B exits and selectors are operative for positions B, 1-11.

One of the HI, EQ, LO exit hubs emits an impulse each machine cycle for the comparison (high, equal, or low) in the corresponding split group when SPLIT ON is wired for that group. For example, when A8 SPLIT is wired ON, the HI, EQ or LO hub of A8 emits the result of the comparison in positions A, 1-8. These impulses can pick up selectors to control machine operations on the basis of the independent comparison.

With SEQ SPT wired, the standard HI-EQ-LO functional exits for section A (Q-S, 8—Secondary; Q-S, 36—Primary) are operative for the last position of the section A split. In the Model 1 machine (full capacity—22 positions), the standard A functional exits are used for position 11; in Model 2, they are used for position 8; in Model 3, for position 5. The standard B functional exits (Q-S, 9—Secondary; Q-S, 37—Primary) are used in the same way for the last section B split. Functional sequence selectors always operate in conjunction with the last section B split.



AA-AE, 1-12

COMPARING SPLITS. The SPLIT ON switches split the comparing unit at that position, and make the result of the comparison (LP, EQ, or LS) for that independent comparing group available at the split functional exits. For example, SPLIT ON switches B4 and B7 isolate positions A1 through B4 as an independent control group, and positions B, 5-7 as another independent group. The remaining positions (B, 8-11 in a full-capacity machine) make up a third isolated group. If the standard CPR-SPT switch is *not* wired, the standard functional exits and selectors are operative for this group. If the CPR SPT switch *is* wired, the comparing unit is further split between sections A and B, and the standard functional exits and functional selectors A and B correspond respectively to the last independent comparing group of each section.

One of the LP, EQ, LS exit hubs emits an impulse each machine cycle for the comparison (low primary, equal, low secondary) in the corresponding split group when SPLIT ON is wired for that group. For example, when A7 is wired ON the LP, EQ, or LS hub of A7 emits the result of the comparison in positions A, 1-7. These impulses can pick up selectors to control machine operation on the basis of the independent comparison.

With CPR SPT wired, the standard LP-EQ-LS functional exits and selectors for section A (Q-S, 16-22) are operative for the last position of the section A split. In the Model 1 machine (full capacity—22 positions), the standard A functional exits and selectors are used for position 11; in Model 2, they are used for position 8; in Model 3, for position 5. The standard B functional exits and selectors (Q-S, 23-29) are used in the same way for the last section B split.

Selecting Cards by Any One of Four Control Numbers

In this operation (Figure 73) the machine selects cards having any one of four control numbers. An X-80 finder card, punched in four 4-digit fields, inserts the control numbers into one side of the split comparing unit. The machine compares each detail card with these stored values, and directs the X-master card and any corresponding card to pocket 2.

WIRING (FIGURE 73)

1. Wire the four fields (columns 1-16) of the X-finder card to primary COMPARING AND DPBC ENTRY.
2. Wire the control-number field (columns 1-4) of the detail cards to secondary COMPARING AND DPBC ENTRY.
3. SEQ OFF in both feeds permits card feeding.
4. Wire ALL CYCLES to PRI FEED to feed cards continuously in the primary.
5. Wiring SECDY SHIFT A and B shifts both sections of the secondary comparing unit to the primary.
6. CPR SPT divides the comparing units into sections A 1-11 and B 1-11.
7. Wiring the SPLIT ON switches splits each section of the comparing unit: A 1-4, A 5-11, B 1-4, B 5-11.
8. Wire from column 80 of primary SEQUENCE READ to one PICKUP of selector 1. Selector transfers for every X-finder card.
9. Wire PRI X to the other PICKUP of selector 1 to condition the selector to transfer for an X in column 80.
10. PRI READ IN exit, through the transferred side of selector 1 to PRI READ IN A and B, allows the X-finder card to read in. READ IN exit, through the normal side to SECDY READ IN A and B, permits detail cards to read in.
11. Assign the selector for primary use.
12. Wire from column 80 of PRIMARY READ to one PICKUP of selector 2. Condition the selector (wire

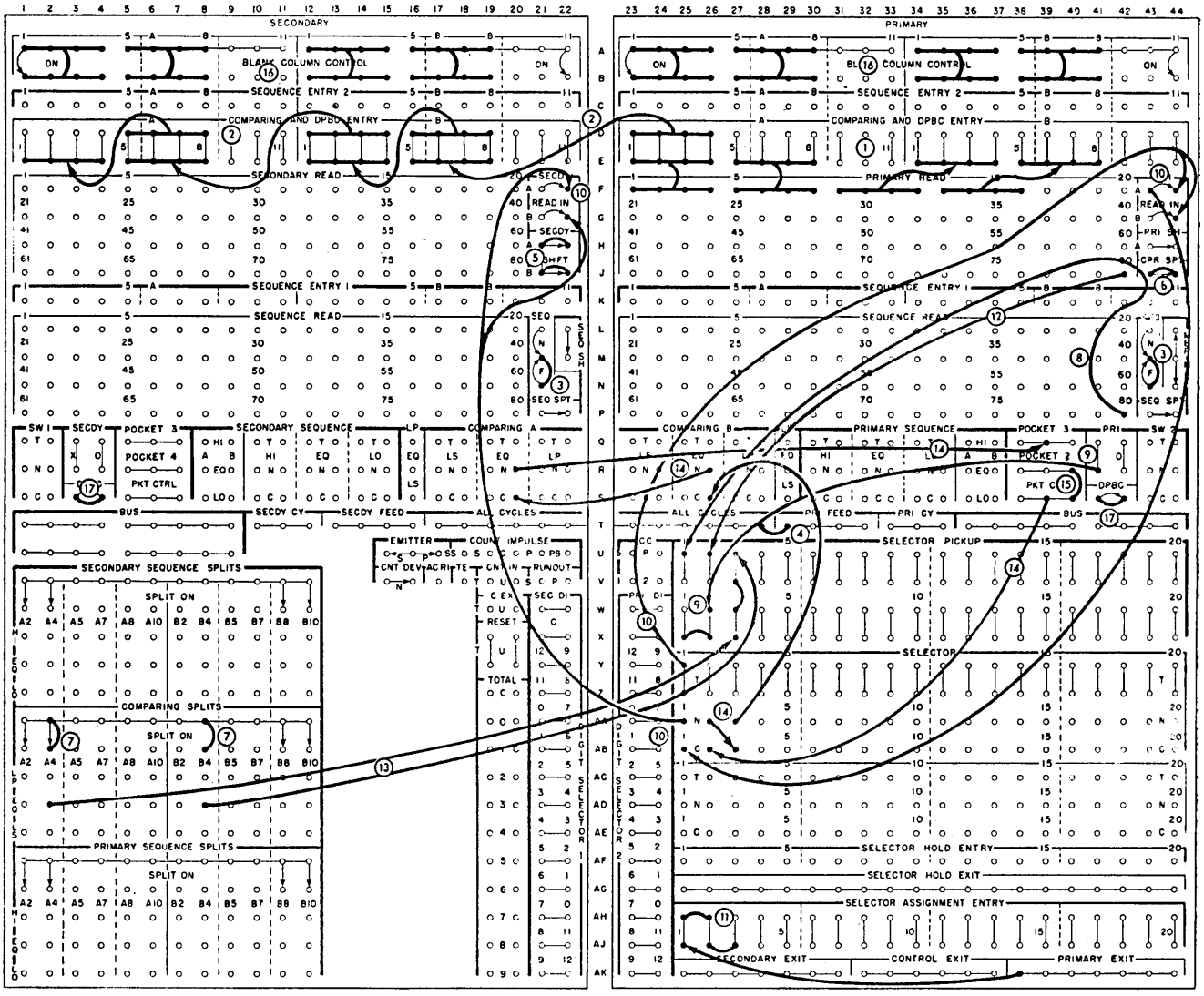


Figure 73. Selecting Cards by Any One of Four Control Numbers

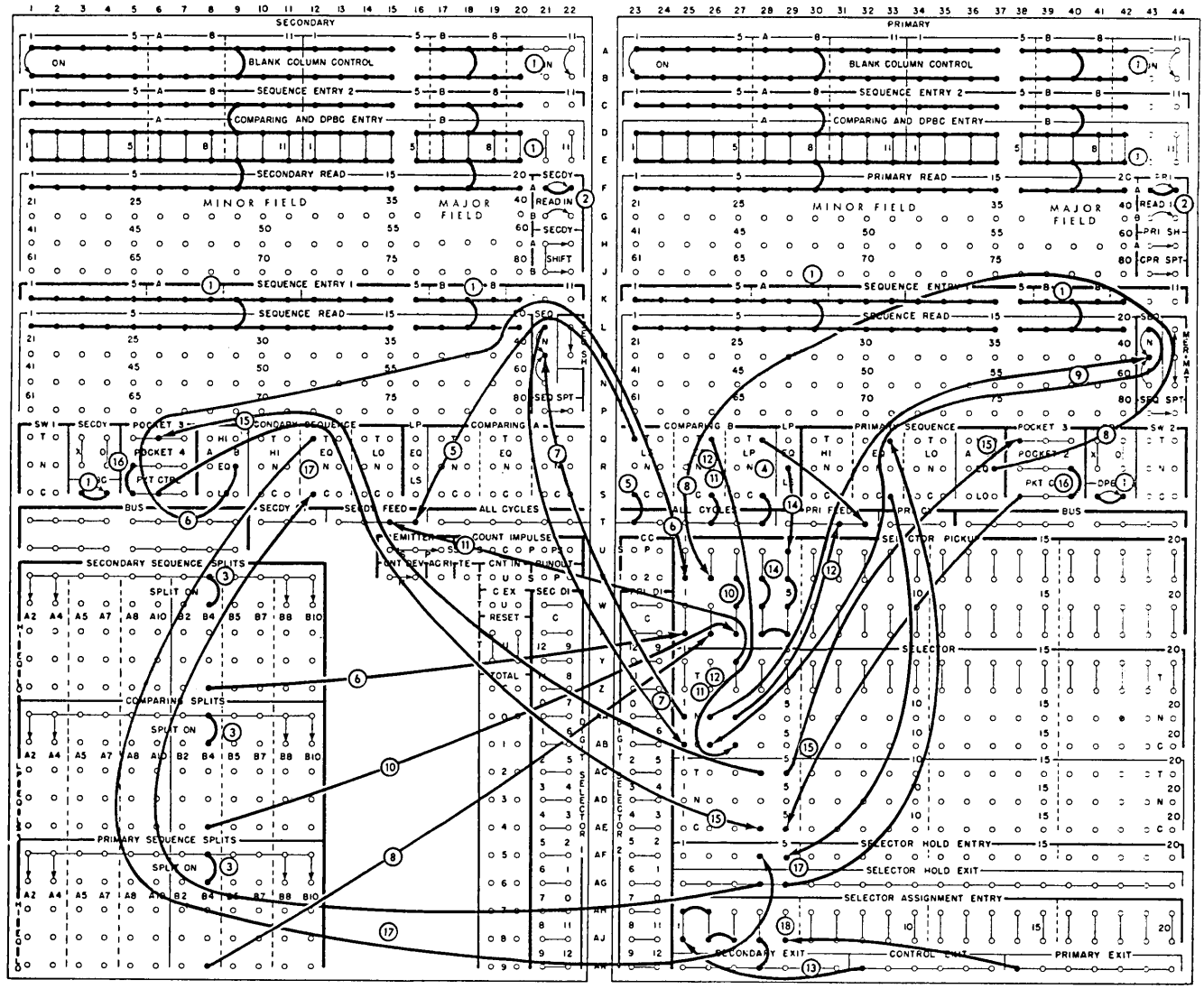


Figure 74. Merging by Major and Minor Control — Selecting Unmatched Majors

9) to transfer for every X-80 finder card. Assign selector 2 for primary use (wire 11).

13. Wiring EQ exit of A4 and B4 comparing splits to both PICKUPS of selector 3 transfers the selector for control numbers corresponding to those stored in either A1-4 or B1-4. Assign selector 3 to the primary (wire 11).

14. Wire PKT CTRL to POCKET 3 through the normal sides of selector 2, selector 3, EQ comparing B selector, and EQ comparing A selector. This wiring directs all cards not equal to any of the 4 finder-card numbers to pocket 3.

15. PKT CTRL to POCKET 2 directs cards equal to any of the finder-card numbers to pocket 2.

16. Wire BLANK COLUMN CONTROL to check all fields for blank columns.

17. Wiring DPBC stops card feeding for a double punch of blank column.

Merging by Major and Minor Control; Selecting Unmatched Majors

Using the control-unit-split device permits merging on a combination of a major field and a minor field, and selecting by the major field only. For example, cards can be merged by both customer number (major) and date (minor). Customer-number cards that have no corresponding cards in the other feed can be selected.

This illustration (Figure 74) is similar to *Merging with Selection — No Basic Setup*. External wiring accomplishes card feeding for merging. However, cards are selected on low primary or low secondary in the major field only. The minor field is tested only when the cards in the major field are equal.

WIRING (FIGURE 74)

1. Wire the major and minor fields for normal comparing, sequence checking, and double-punch and blank-column detection.
2. PRI and SECDY READ IN permit cards to read in every cycle.
3. SPLIT ON switches for each control unit separate the major and minor fields at position B4.
4. ALL CYCLES TO PRI FEED, through the transferred side of LP COMPARING B selector, feeds low primary cards.
5. ALL CYCLES TO SECDY FEED, through the transferred side of LS COMPARING B selector, feeds low secondary cards.
6. Wire EQ Secondary Sequence B4 exit and LO Secondary sequence splits exit to the separate PICKUPS of Selector 1. Selector 1 transfers for a low sequence in the minor field within a major group.
7. Wiring secondary SEQ ON, through the normal side of Selector 1, stops card feeding for a sequence error in both the major and minor fields.
8. Wire EQ primary sequence B4 exit and LO primary sequence splits exit to the separate PICKUPS of Selector 2. Selector 2 transfers for a low sequence in the minor field within a major group.
9. Wiring primary SEQ ON, through the normal side of Selector 2, stops card feeding for a sequence error in both the major and minor fields.
10. LS comparing B4 splits exit, wired to both PICKUPS of Selector 3, transfers the selector when minor fields in the secondary are lower than those in the primary.
11. ALL CYCLES to SECDY FEED, through the transferred side of EQ COMPARING B selector and through the transferred side of Selector 3, feeds low-secondary minor-field cards within a major group.
12. ALL CYCLES TO PRI FEED, through the transferred side of EQ COMPARING B selector and through the normal side of Selector 3, feeds equal or low-primary minor-field cards within a major group.
13. Assign Selectors 1, 2, and 3 by CONTROL EXIT.
14. Wire EQ COMPARING B exit to both PICKUPS of Selectors 4 and 5. Selectors transfer for an equal major field in the primary and secondary.
15. PKT CTRL, through the transferred side of Selectors 4 and 5 to POCKET 3 in both feeds, merges matching groups in pocket 3.
16. PKT CTRL TO POCKET 2 and POCKET 4 selects all unmatched major cards.
17. Wiring SELECTOR HOLD of both Selectors 4 and 5, through the transferred side of EQ primary and EQ secondary sequence selectors, respectively, continues merging primary or secondary cards of the same major-field group in each feed.
18. Assign Selector 4 to the secondary and Selector 5 to the primary.

Collator Counting Feature

With this special feature installed, the collator can perform operations that involve card counting. Some of these operations are:

Inserting a predetermined number of cards behind, or ahead of, each master card.

Inserting a single card behind, or ahead of, a predetermined number of cards.

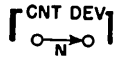
Inserting a variable number of cards behind, or ahead of, each master card.

Merging a predetermined number of primaries and secondaries.

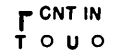
Checking two-column consecutive numbering.

The collator counting device consists of two single-position counters (labeled *units* and *tens*). Each can count up to 9. When coupled, the units and tens counters form one 2-position counter to count up to 99. When using the counters separately, two different counting operations are possible at the same time; when coupled, only one counting operation is possible at a time.

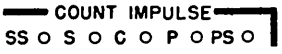
Control-Panel Hubs

V, 15-16 

CNT DEV N (Count Device On). Wiring this switch permits the counting device to operate.

V, 19-20 

CNT IN: T, U (Count In: Tens, Units). Each of these entry hubs accepts impulses to cause the corresponding counter (tens or units) to add 1. When the counters are coupled (CARRY EXIT wired), wire count impulses to the U hub only. COUNT IN is normally wired from COUNT IMPULSE (SS, S, C, P, or PS). The counter advances at the beginning of the following cycle.

U, 18-22 

COUNT IMPULSE: SS, S, C, P, PS. These hubs emit an impulse that is normally wired to COUNT IN to cause the counter to add 1.

SS (Secondary Sequence) emits an impulse when the secondary feed operates and a card is passing from secondary sequence read to secondary read. When wired to COUNT IN, the counter adds 1 for each card leaving the secondary sequence station.

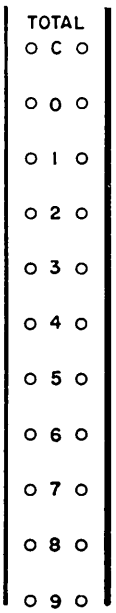
S (Secondary) emits an impulse when the secondary feed operates and a card is passing from secondary read to the stackers. When wired to COUNT IN, the counter adds 1 for each secondary card as it is stacked.

C (Common) emits an impulse after the first card is read at primary read and on every subsequent primary or secondary card-feed cycle.

P (Primary) emits an impulse when the primary feed operates and a card is passing from primary read to the stackers. When wired to COUNT IN, the counter adds 1 for each primary card as it is stacked.

PS (Primary Sequence) emits an impulse when the primary feed operates and a card is passing from primary sequence read to primary read. When wired to COUNT IN, the counter adds 1 for each card leaving the primary sequence station.

Z-AK, 19-20



TOTAL: C, 0-9. A set of these hubs is associated with each counter (units and tens). The digit hubs represent the total accumulated in the counter. The hub corresponding to the total, on any one cycle, is common with the C hub. For example, when the units counter counts one card, the 1 and C hubs are common; when it has counted 2 cards, the 2 and C hubs are common.

These hubs determine when the counter reaches a predetermined total. Wire a test exit (TE) impulse through the C and predetermined digit hubs to the PICKUP of a selector, to control card feeding. The selector transfers when the corresponding number of cards has been counted.

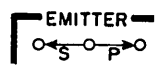
With a primary or secondary EMITTER switch wired, the common hub (C) of a counter emits an impulse corresponding to the total in the counter. Wiring this impulse to one side of a control unit compares the total in the counter with a number entered from a card. The result of this comparison can control card feeding.

V, 18

TE (Test Exit). This impulse is normally wired through the C and predetermined digit hubs of a counter to the PICKUP of a selector. This tests the counter for a predetermined total and, when this total is reached, the selector transfers to control card feeding.

Use the test exit impulse to reset the counters by wiring to a counter RESET hub.

U, 15-17



EMITTER: S, P (Secondary, Primary). Wiring either switch causes the total C hub of the *units* counter to emit, on every card-feed cycle, secondary or primary digits corresponding to the total accumulated. For example, with EMITTER P wired, the TOTAL C hub of the units counter emits a 6 when six primary cards have been counted.

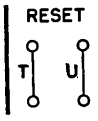
Wiring the impulse from the TOTAL C hub to a corresponding (primary or secondary) control unit compares this total with a number entered from each card. The result of this comparison can control feeding of a variable number of cards.

With this switch wired, each of the units-counter TOTAL digit hubs emits a corresponding 0-9 digit in each card-feed cycle. To secure a 2-position total from the TOTAL C hubs (units and tens) of coupled counters, jack-plug the units-counters 0-9 hubs to the corresponding tens-counter hubs (0-9). To obtain two single-position totals, jack-plug the corresponding units and tens hubs, but do *not* wire the carry exit (C EX) impulse.

W, 19-20

C Ex: T, U (Carry Exit: Tens, Units). Each of these hubs emits a count impulse when the count in the corresponding counter (tens, units) increases from 9 to 10. Wiring the CARRY EXIT of the units counter to COUNT IN of the tens counter couples the separate counters to form a single 2-position counter. With the counters coupled normally, a 1 automatically adds in the tens counter when the total in the units counter increases from 9 to 10. The carry-exit impulse can also be used to control machine operation.

X-Y, 19-20



RESET: T, U. Impulsing these hubs resets the corresponding counter (tens or units) to zero. Use the test exit (TE) impulse to reset the counters.

V, 17

ACRI (All Cycles Read In). This hubs emits a selectable impulse every card-feed cycle. Use this impulse, instead of the PRI or SECDY READ IN exit, when a counting operation requires the comparing unit to read in on all cycles.

V, 21-22

RUNOUT: S, P. These hubs emit impulses that are used to control operations during runout in the corresponding feed (secondary, primary). Wiring these impulses to selectors that control card feeding, selecting, and counting permits proper control on the runout.

S emits when the primary feed becomes empty; P emits when the secondary feed becomes empty. Both S and P emit on the first two run-in cycles.

Inserting a Predetermined Number of Cards ahead of Each Master Card

In this operation, the counted cards from one feed followed by a single card from the other feed are stacked in pocket 3. The cards to be counted can be placed in either the primary or secondary feed. In the illustration (Figure 75), they are placed in the primary feed, and the operation consists of inserting 25 primary cards ahead of each secondary card. No punching is required in either the primary or secondary cards to control this feeding.

The same feeding principles also apply to the operation of inserting a single card after a predetermined number of cards.

WIRING (FIGURE 75)

1. SEQ OFF in both feeds permits card feeding.
2. Wire CNT DEV ON to permit the counting device to be used.
3. COUNT IMPULSE P through the normal side of selector to COUNT IN U (units) counts each primary card as it moves to the stacker, except on runout.
4. C EX U to CNT IN T couples the counters to form a 2-position counter.
5. Wire TE through the predetermined-number hubs (25) to RESET U and T and to both PICKUPS of selector 2. When 25 cards have been counted, the test exit impulse resets both counters and transfers selector 2 which is used to control card feeding.
6. Assign selector 2 for secondary use.
7. Wire ALL CYCLES through the normal side of selector 2 to PRI FEED to feed detail cards up to the predetermined number, and through the transferred side to SECDY FEED to feed a master card after 25 details have been fed.
8. Wire RUNOUT P to both PICKUPS of selector 1,

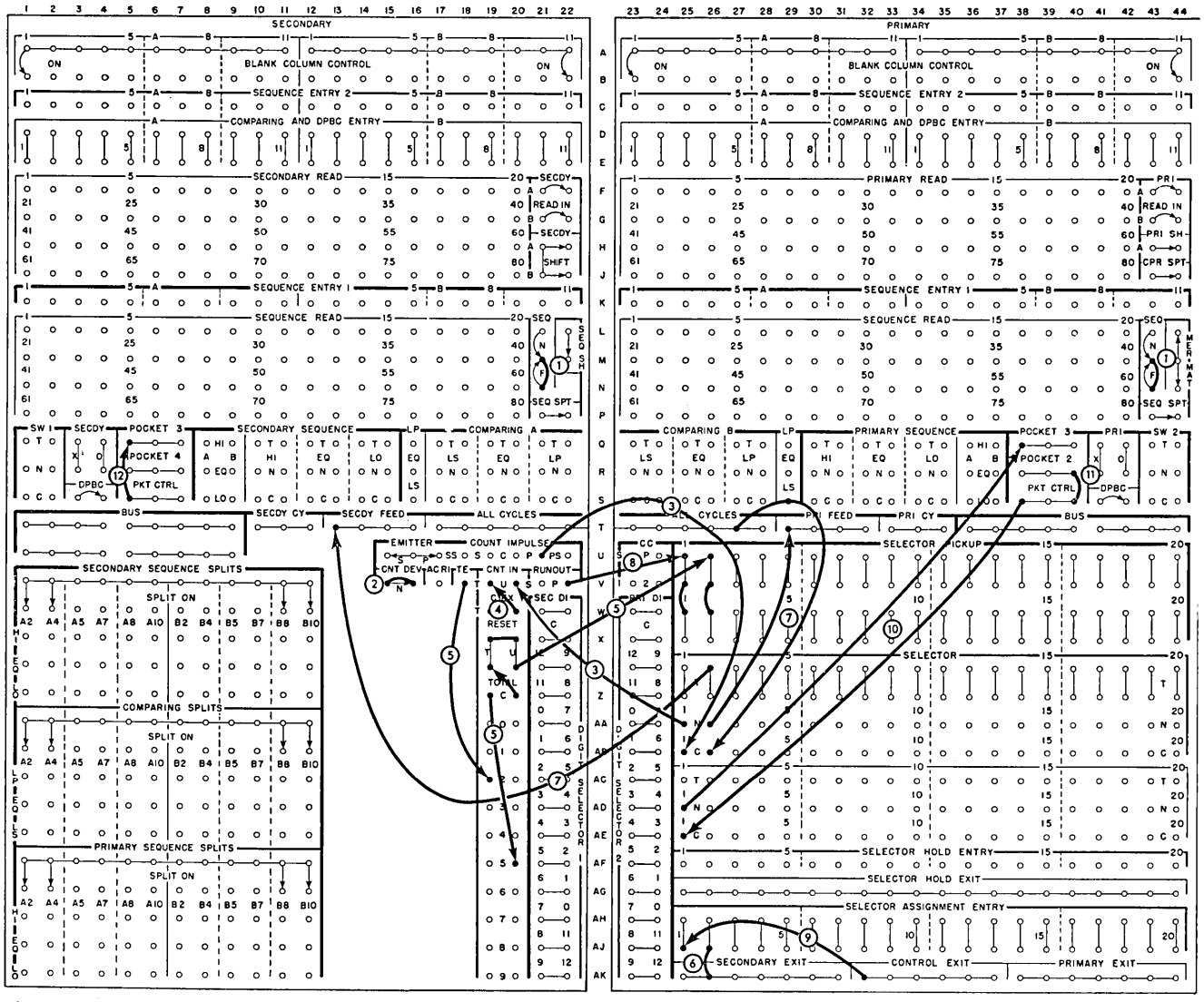


Figure 75. Inserting a Predetermined Number of Cards ahead of Each Master Card

which controls stacking extra primary cards in pocket 2 on the runout and also prevents counting them.

9. Assign selector 1 for control use.
10. Primary PKT CTRL to POCKET 3, through the normal side of selector 1, stacks the predetermined number of detail cards in pocket 3.
11. PKT CONTROL to POCKET 2 stacks detail cards in pocket 2 on the runout with no more master cards in the secondary.
12. Secondary PKT CTRL to POCKET 3 merges the master cards in pocket 3.

Inserting a Variable Number of Cards ahead of Each Master Card

The number of cards to be fed ahead of each master card is punched in each master card. This number can vary from one master card to another, and can be any number from 1-99. After the required number of detail cards have been stacked, the corresponding master is stacked.

The cards to be counted can be placed in either the primary or secondary feed. In the illustration (Figure 76), they are placed in the primary feed, and the specified number of primary cards are fed ahead of each corresponding secondary card (master card).

WIRING (FIGURE 76)

1. SEQ OFF in both feeds permits card feeding.
2. Wire CNT DEV ON to permit the counting device to be operated.
3. COUNT IMPULSE P to CNT IN U through the normal points of selector 1 counts each primary card as it moves to the stacker, except on runout.
4. C EX U to CNT IN T couples the two counters.
5. Wire EMITTER P to cause the units-counter TOTAL C hub to emit the total in the counter, and each digit hub to emit its corresponding digit.

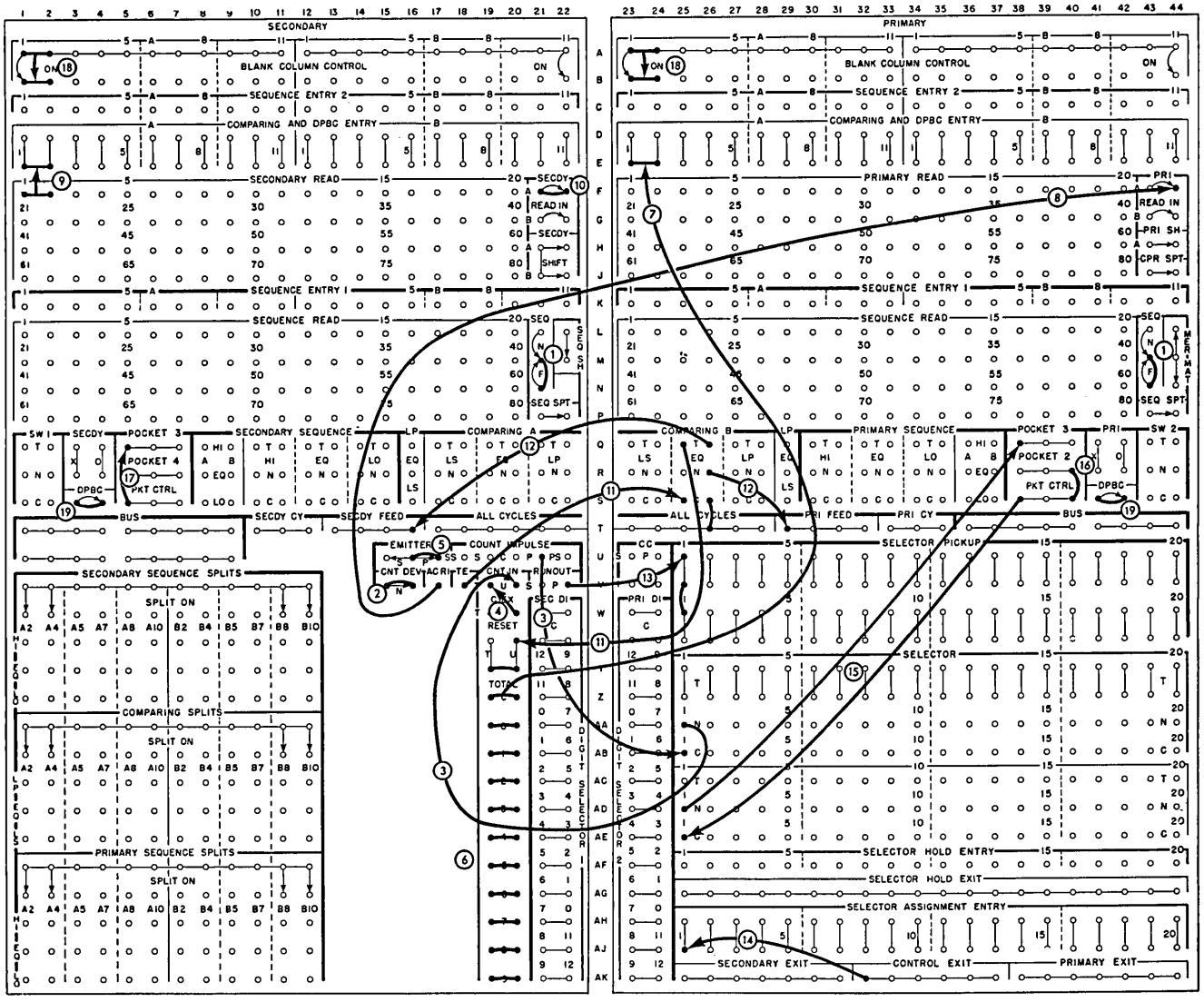


Figure 76. Inserting a Variable Number of Cards ahead of Each Master Card

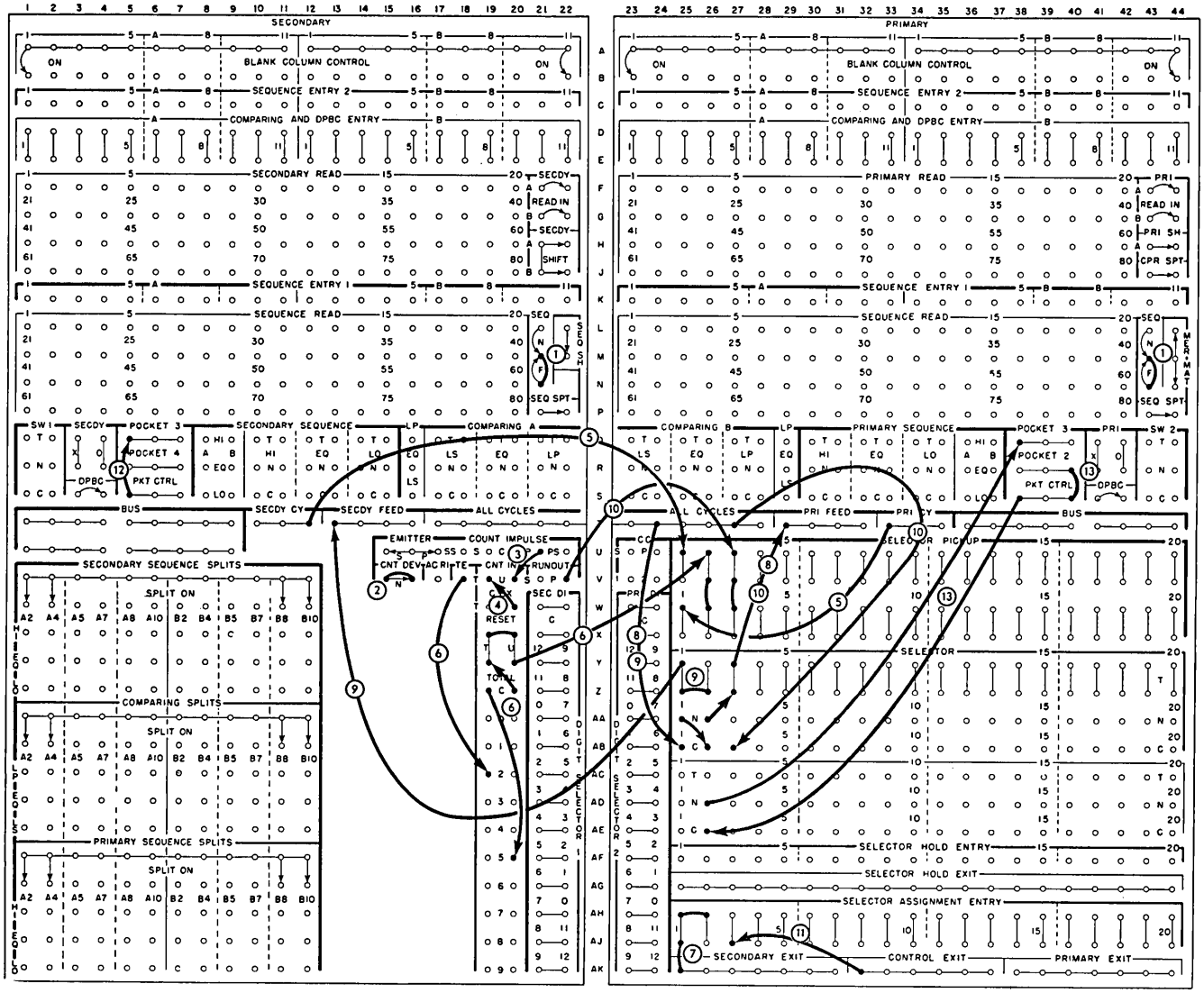


Figure 77. Inserting a Predetermined Number of Cards behind Each Master Card

6. Jackplug all units-counter digit hubs to the tens-counter digit hubs, to cause the tens-counter TOTAL C hub to emit the total in that counter.
7. Wire TOTAL C to primary COMPARING AND DPBC ENTRY.
8. ACRI to PRI READ IN enters the total from the counter on every card-feed cycle.
9. Wire master-columns 1-2 from SECONDARY READ to COMPARING AND DPBC ENTRY.
10. Wire SECDY READ IN to read in, from each master card, the specified number of cards to be counted.
11. TE to RESET U and T, through the transferred side of the EQ comparing B selector, resets both counters when the total cards counted equals the number in the master card.
12. ALL CYCLES, through the normal side of the EQ comparing B selector to PRI FEED and through the transferred side to SECDY FEED, feeds detail cards in the primary until the accumulated total equals the number in the card. Then a secondary card (new master card) is fed.
13. Wire RUNOUT P to both PICKUPS of selector 1, which controls stacking extra primary cards in pocket 2 on the runout and prevents counting them.
14. Assign selector 1 for control use.
15. Primary PKT CTRL to POCKET 3, through the normal side of selector 1, merges all detail cards in pocket 3, except on runout.
16. PKT CTRL to POCKET 2 stacks detail cards in pocket 2 on runout.
17. Secondary PKT CTRL to POCKET 3 directs all master cards to pocket 3.
18. Wire BLANK COLUMN CONTROL for all positions to be checked for blanks.
19. Wire DPBC in both feeds to stop card feeding for double punches and blank columns.

Inserting a Predetermined Number of Cards behind Each Master Card

The cards to be counted are placed in the primary feed, and the master cards are placed in the secondary feed. In the illustration (Figure 77), each secondary card is followed by 25 primary cards and the cards are stacked in pocket 3.

The same feeding principles also apply to the operation of inserting a single card ahead of a predetermined number of cards.

WIRING (FIGURE 77)

1. SEQ OFF in both feeds permits card feeding.
2. Wire CNT DEV ON to permit the counting device to be operated.
3. COUNT IMPULSE P counts every primary (detail) card as it is stacked.
4. C EX U to COUNT IN T couples the counters.
5. Wire PRI CY and SECDY CY to the PICKUPS of selector 1. Selector 1 transfers only at the start of an operation on run-in cycles, because this is the only time primary and secondary cycles impulses are available simultaneously. The selector is used to cause a secondary card to be fed ahead of the primaries at the beginning of the run (wiring 9).
6. Wire TE through the predetermined digit and common hubs of the counters to RESET U and T, and to both PICKUPS of selector 2. The test exit impulse resets the counters and transfers selector 2 when 25 primary cards are counted.
7. Assign selectors 1 and 2 for secondary use.
8. Wire ALL CYCLES through the normal side of selector 1 and the normal side of selector 2 to PRI FEED, to feed a primary card except at run-in time or when the predetermined number of cards has been counted and a new master is fed.
9. SECDY FEED from the TRANSFERRED hubs of both selectors 1 and 2, feeds a secondary master card on the run-in and when the predetermined number of primary cards has been counted.
10. Selector 3 transfers when all secondary master cards have been fed. After the last group of 25 primary cards has been stacked, any extra primary cards are fed by wiring ALL CYCLES through the transferred side of this selector to PRI FEED.
11. Selector 3 is assigned for control use.
12. Secondary PKT CTRL to POCKET 3 stacks all master cards in the merge pocket.
13. The groups of 25 primary cards are merged with the secondary cards in pocket 3, but any extra cards (after the last group of 25) are stacked in pocket 2. To do this, wire PKT CTRL to POCKET 3 through the normal side of selector 2. When the last group of 25 cards is counted, selector 2 transfers and remains transferred because a secondary feed cycle does *not* occur. At this time, the wiring to POCKET 2 stacks cards in pocket 2.

Inserting a Variable Number of Cards behind Each Master Card

The cards to be counted are placed in the primary feed, and the master cards are placed in the secondary feed. The number of primary cards to be fed behind each secondary card is punched in each master secondary card and can vary from one master card to another.

A master-card quantity of 00 is a valid number, and no cards should follow. To allow for this condition, every card is counted including the master cards. Therefore, a card-count total of one more than the number punched in the master card must control card feeding. To compensate for counting the master card, a new master card is fed on the basis of a low secondary, rather than an equal, condition. Thus, when 00 is punched in the master card, a low secondary condition exists immediately upon feeding (and counting) the master card. No primary cards are fed, and another master card is fed.

Because the capacity of the coupled counters is 99 and because the master card is counted, a maximum of 98 detail cards can be inserted behind each master card in this operation (Figure 78).

WIRING (FIGURE 78)

1. Wire SEQ OFF in both feeds to permit card feeding.
2. CNT DEV ON permits the counting device to be operated.
3. Wire COUNT IMPULSE C to CNT IN U to count every card-feed cycle. Every card, including the master card, is counted to allow for the condition when no cards are to follow the master card.
4. C EX U is wired to CNT IN T to couple the counters.
5. EMITTER P causes the units TOTAL C hub to emit the total in that counter.
6. Jackplug the corresponding digits hubs of both counters to cause the tens TOTAL C hub to emit the total in that counter.
7. Wire the TOTAL C hubs to both sections A and B of primary COMPARING AND DPBC ENTRY.
8. Wire CPR SPT to split the comparing unit.
9. ACRI to PRI READ IN A and B enters, on each cycle, the total cards counted.
10. Wire columns 2-3, containing the number of cards to be counted, from SECONDARY READ to both sections A and B of secondary COMPARING AND DPBC ENTRY.
11. Wire ALL CYCLES through the normal side of selector 2 to the PICKUPS of selector 1.
12. Wire SECDY CY through the transferred side of selector 1 to the PICKUPS of both selectors 2 and 3.

This selector network (wiring 11, 12) permits alternate operation of sections A and B of the secondary side of the comparing unit. This holds the master-card number even though a secondary feed cycle occurs, to stack that master card ahead of its details; the following master-card number reads into the other section.

13. Assign selector 1 for control use, and selectors 2 and 3 for secondary use.
14. Wire SECDY READ IN exit through the transferred and normal sides of selector 1 to READ IN A and B, respectively. Section B reads in the number from the master card and section A retains the previous number for comparison with the total count. When the next master card is fed, section A reads in and section B holds the previous value for comparison with the total count.
15. Wire ALL CYCLES through the normal side of selector 2 and the normal side of the LS comparing A selector to PRI FEED, to feed primary cards until the total count is reached; and through the transferred side of the LS comparing A selector to SECDY FEED, to feed a new master card when the count is reached.
16. Wire ALL CYCLES through the transferred side of selector 2 and the normal side of the LS comparing B selector to PRI FEED, to feed primary cards until the total count is reached; and through the transferred side of the LS comparing B selector to SECDY FEED, to feed a new master card when the count is reached.
17. TE, through both the normal and transferred sides of selector 3 and the transferred sides of the corresponding LS comparing A or B selectors to RESET, resets the counters for each new master card.
18. Wire the LS comparing A and B exits to the NORMAL and TRANSFERRED hubs of selector 3, respec-

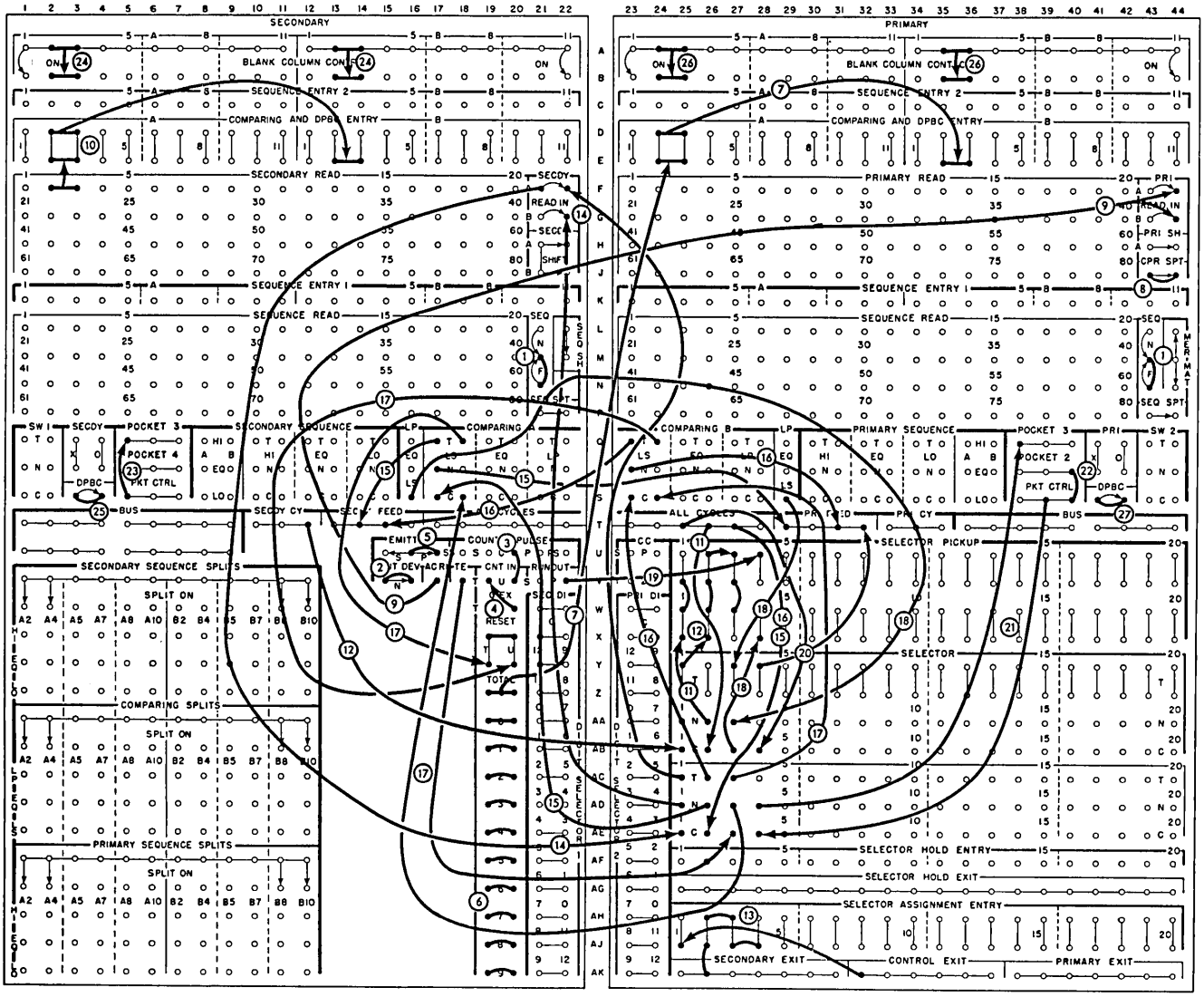


Figure 78. Inserting a Variable Number of Cards behind Each Master Card (up to 98)

tively. Wire COMMON to one PICKUP of selector 4.

19. Wire RUNOUT P to the other PICKUP of selector 4. (Assign selector 4 for secondary use.) Selector 4 transfer when the total count in the last master card has been reached.
20. ALL CYCLES through the transferred side of selector 4 to PRI FEED feeds primary cards after the total count in the last card is reached.
21. PKT CTRL through the normal side of selector 4 to primary POCKET 3 merges primary cards behind their master cards. Any extra primaries are stacked in pocket 2 through wiring 22, because selector 4 is transferred at that time.
22. PKT CTRL to POCKET 2 directs all remaining primary cards to pocket 2 at the end of the run.
23. PKT CTRL to secondary POCKET 3 merges the master cards.
24. Wire secondary BLANK COLUMN CONTROL to check the master cards for blanks.
25. Secondary DPBC switch stops card feeding for double punches or blank columns.
26. Wire primary BLANK COLUMN CONTROL to be certain a total count is read in from the counters.
27. Primary DPBC switch stops card feeding for double impulses or no impulses from the counters.

Inserting a Variable Number of Cards behind Each Master Card — Up to 198

The preceding example describes the operation of inserting up to 98 cards behind each master card. To insert up to 198 cards behind a master card, merely add the wiring in Figure 79 to that in Figure 78.

The master card must be punched with one or zero in the hundreds position of the field (column 1 in Figure 79). An emitted one or zero is used for the hundreds position of the total count and compared with the master card.

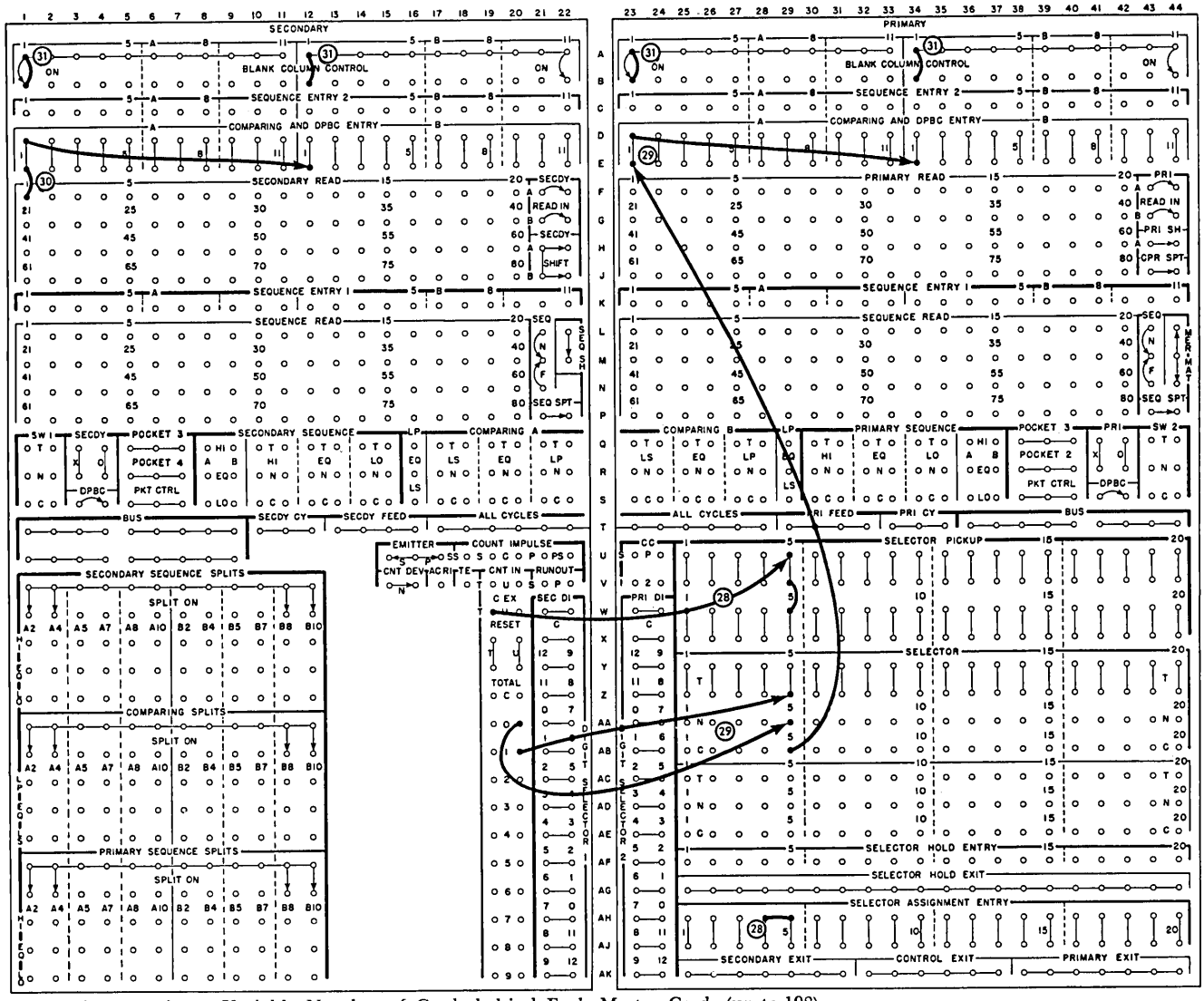


Figure 79. Inserting a Variable Number of Cards behind Each Master Card (up to 198)

WIRING (FIGURE 79)

28. C EX T to the PICKUPS of selector 5 transfers the selector when the total count turns to 100. Assign selector 5 for secondary use.
29. Wire the 0 and 1 digits of the units counter through the normal and transferred sides, respectively, of selector 5 to the 100's position of the total in the primary COMPARING AND DPBC ENTRY. The 0 is compared in the 100's position until the selector transfers for a count above 99; and the 1 is compared for a count of 100-198.
30. The 100's position of the master-card field is entered in both sections A and B of secondary COMPARING AND DPBC ENTRY.
31. The 100's positions are checked for blanks.

Inserting a Single Card ahead of a Predetermined Number of Cards within a Control Group

In this operation, the single cards are punched with control numbers corresponding to those in the detail cards, and they must be inserted within the proper group of details. This type of operation is used, for example, to insert description cards to head each page of a report in a subsequent accounting machine operation. The number of cards in the description card file is predetermined, and varies between groups depending on the average number of details in each group.

The header cards are placed in the secondary feed, and the details are placed in the primary feed. In the illustration (Figure 80), a header card followed by 35 detail cards for the same control group are stacked together in pocket 3. A control group may contain an odd number of detail cards (not a multiple of 35), in which case less than 35 details follow the last header card. For example, if there are 80 details in a control group, 3 header cards are fed; each of the first two is followed by 35 cards, and the third by 10 cards.

Any excess or unmatched header or detail cards are selected.

WIRING (FIGURE 80)

1. Wire the control-number field (columns 1-5) for comparing and sequence checking.
2. SEQ ON in both feeds stops card feeding for a low sequence condition.
3. PRI and SECDY READ IN enter numbers in the comparing unit on every primary and secondary card-feed cycle, respectively.
4. Wiring CNT DEV ON permits the counting device to be operated.
5. COUNT IMPULSE P to COUNT IN U counts every primary card.
6. C EX U to CNT IN T couples the counters.
7. Wire SECDY CY to both PICKUPS of selector 1, to transfer the selector each secondary card-feed cycle.
8. Assign selector 1 for primary use. Selector 1 remains transferred until the beginning of a *primary* card-feed cycle.
9. Wire TE through the transferred side of selector 1 to reset both counters when a secondary header card is fed.
10. Wire TE through the normal side of selector 1 (to avoid split wiring) and through the TOTAL C and predetermined digit hubs (35) to the PICKUPS of selector 2. Selector 2 transfers when 35 primary cards have been fed.
11. Wire SECDY CY through the HI secondary sequence selector to the PICKUPS of selector 3. Selector 3 transfers whenever the last card of a secondary group is fed.
12. Wire ALL CYCLES through the transferred side of the EQ comparing B selector and the transferred side of selector 3 to SECDY FEED. This feeds the first card of a new secondary group if it equals the primary card.

    ALL CYCLES on an equal comparing condition is also wired to SECDY FEED through the normal side of selector 3 and the transferred side of selector 2. This feeds all additional *equal* header cards (after the first) whenever 35 primary cards have been counted.

    Primary cards are fed after their equal header cards (except the last header) by wiring ALL CYCLES through the transferred side of the EQ comparing B selector, the normal side of selector 3, and the normal side of selector 2. The equal primaries following the last header card are fed as low primaries (wiring 14), but merged in pocket 3 until 35 have been fed (wiring 18); any extras are stacked in pocket 2 (wiring 21).
13. Wire ALL CYCLES through the transferred side of the LS comparing B selector to SECDY FEED, to feed excess or unmatched secondary header cards.
14. Wire ALL CYCLES through transferred side of the LP comparing B selector to PRI FEED, to feed primary cards when there are no matching secondary cards or if the last matching header card has been fed. This feeds the last group (or partial group) of 35 behind the last equal secondary header card.
15. Wire PRI CY through the transferred side of the HI primary sequence selector to the PICKUPS of selector 4. Selector 4 transfers with each change of control group in the primary.
16. Assign selectors 2, 3, and 4 for *secondary* use.
17. Wire SELECTOR 4 HOLD through the transferred side of the EQ primary sequence selector and the

normal side of the EQ comparing B selector. This holds selector 4 transferred through the feeding of unmatched secondaries (selector 4 assigned to secondary), to provide for the stacking of any following unmatched primary groups in pocket 2.

18. Wire PKT CTRL through the normal sides of selector 2 and 4 to primary POCKET 3, to merge equal primary groups of 35 or less.
19. Wire PKT CTRL through the normal side of selector 2, the transferred side of selector 4, and the normal side of the LP comparing B selector to primary POCKET 3. This prevents unmatched detail cards from stacking in pocket 3; thus they stack in pocket 2 (wiring 21).
20. Wire PKT CTRL through the normal side of the LS comparing B selector to secondary POCKET 3, to merge all equal header cards in pocket 3.
21. PKT CTRL to POCKET 2 and POCKET 4 directs unmatched and excess detail and header cards to pocket 2 and pocket 4, respectively.
22. Wire BLANK COLUMN CONTROL to check the control fields for blanks.
23. Wire the DPBC switches to stop card feeding for double punches and blank columns.

Inserting a Set of Cards ahead of a Predetermined Number of Cards within a Control Group

This operation is similar to that in the preceding example. The only difference is that sets of description cards, rather than single cards, are inserted. Both the detail and description, or header, cards are punched with control numbers, and the last header card in each

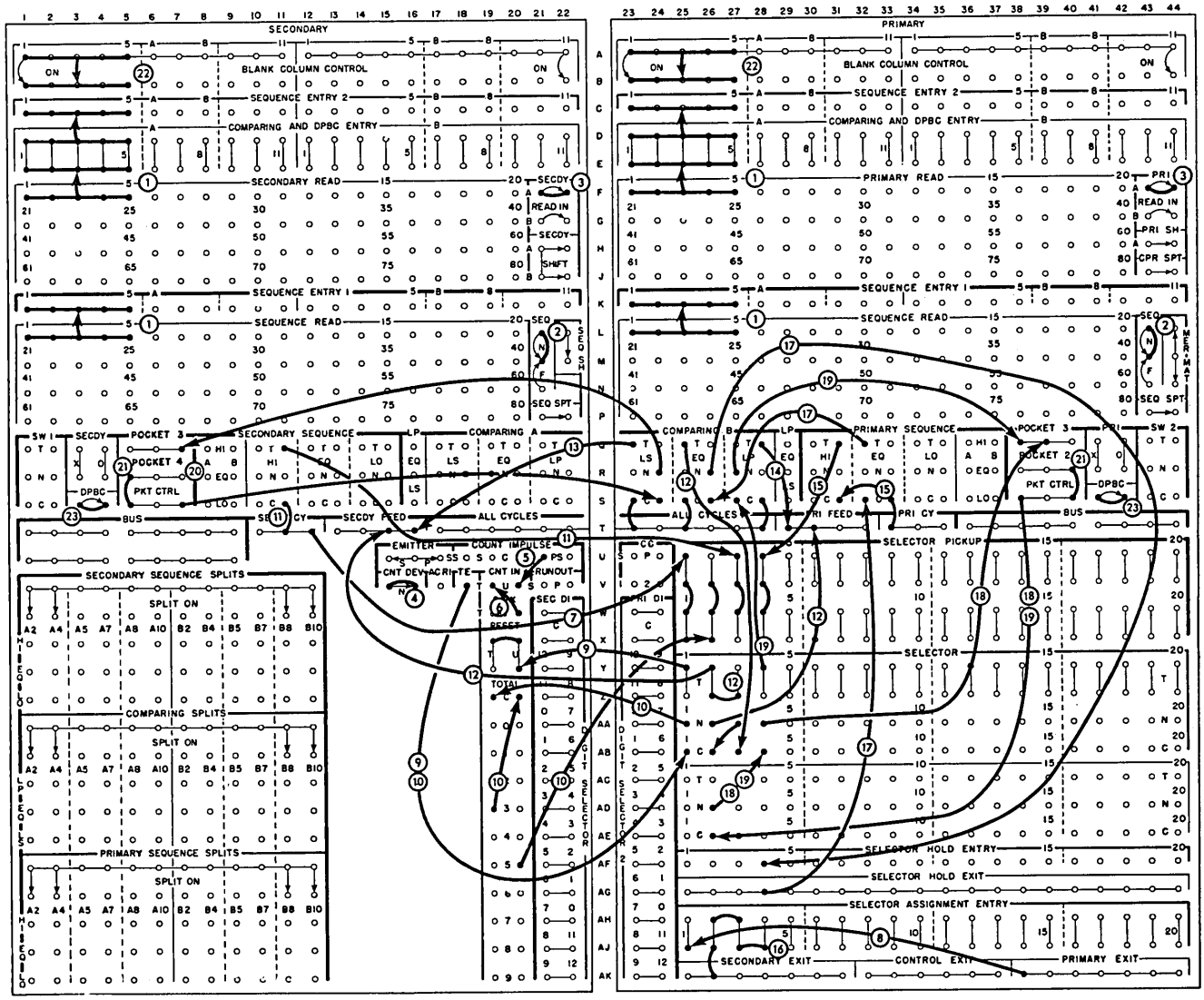


Figure 80. Inserting a Single Card ahead of a Predetermined Number of Cards within a Control Group

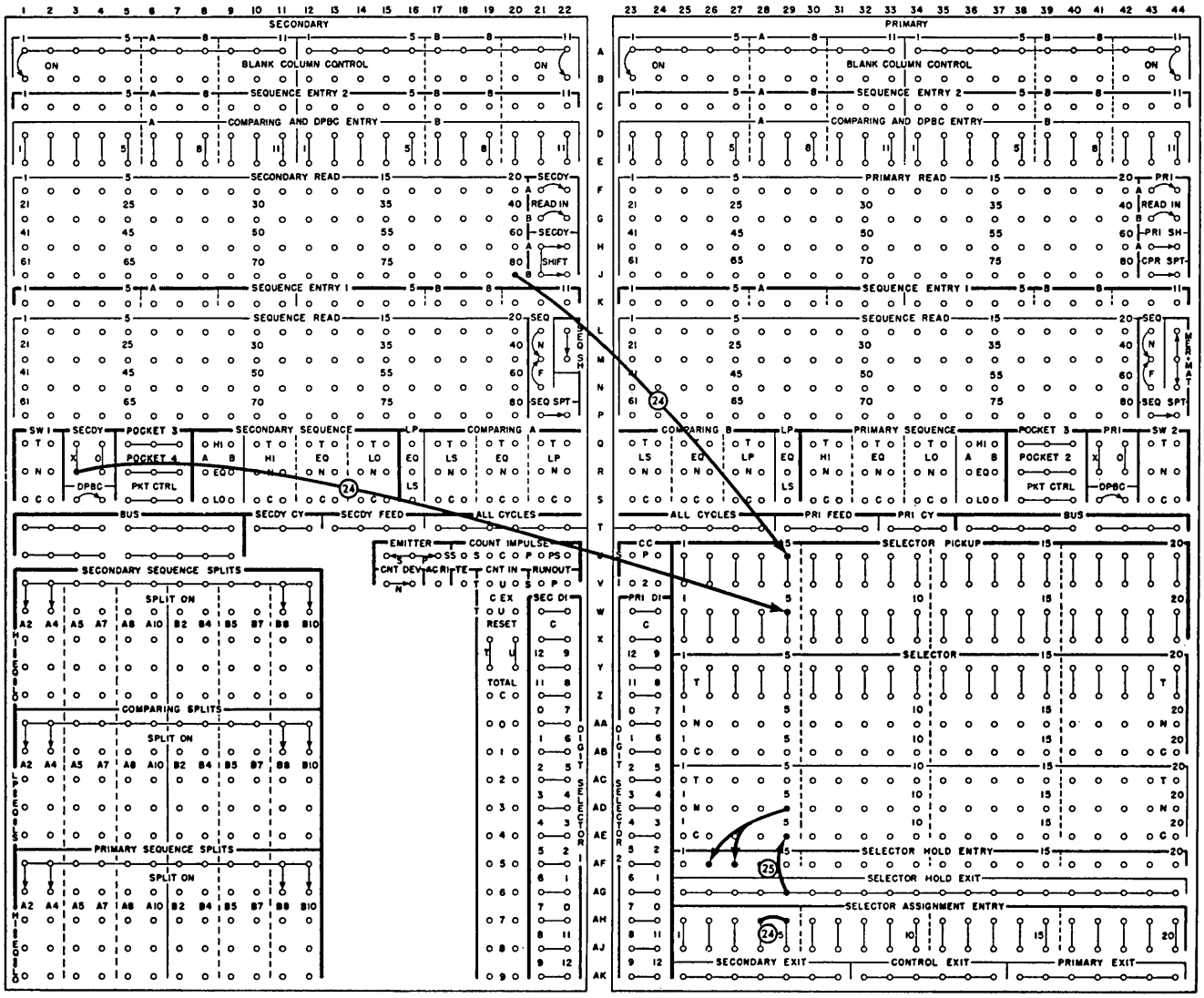


Figure 81. Inserting a Set of Cards ahead of a Predetermined Number of Cards within a Control Group

set must be X-punched. Add the wiring in Figure 81 to that in Figure 80. Any excess or unmatched header or detail cards are selected.

WIRING (FIGURE 81)

24. Wire card column (80) containing the X-punch from SECONDARY READ to one PICKUP of selector 5. Wire the other PICKUP from SECDY X. Selector 5 transfers when the X in the last card of each header set is read. Assign selector 5 for secondary use.

25. Wire SELECTOR HOLD for selectors 2 and 3 through the normal side of selector 5. Secondary cards feed until the last card (X-card) of the set is read.

Merging a Predetermined Number of Primaries and Secondaries

A predetermined number of primary cards can be merged with a predetermined number of secondaries. The number of primaries and secondaries can be the same or different, but neither number can exceed 9 because one counter must be used to count primaries and the other secondaries. No punching is required in either primary or secondary cards to control this feeding.

The last merged group must be checked to ensure that the proper number of cards was merged before either feed became empty. Extra cards in either feed are selected on the runout.

In the illustration (Figure 82), four secondaries are merged behind two primaries.

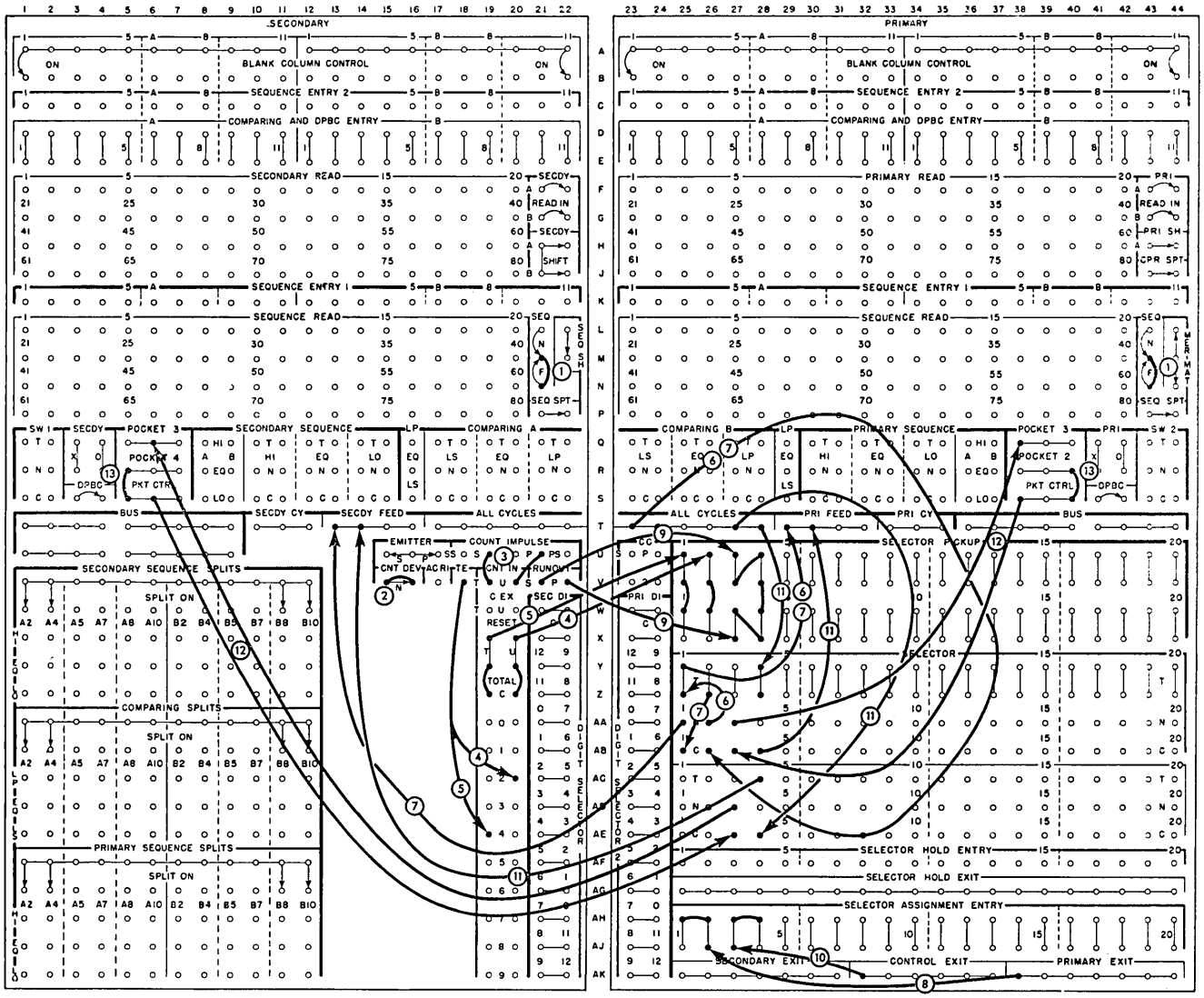


Figure 82. Merging a Predetermined Number of Primaries and Secondaries

WIRING (FIGURE 82)

1. SEQ OFF in both feeds permits card feeding.
2. CNT DEV ON permits the counting device to be operated.
3. Cards in both feeds are counted by wiring COUNT IMPULSE P TO CNT IN U, and COUNT IMPULSE S TO CNT IN T.
4. Wire TE through the predetermined digit (2) and C hubs of the units counter to RESET U and to the PICKUPS of selector 2. When two primary cards have been counted, the units counter is reset and selector 2 is transferred.
5. Wire TE through the predetermined digit (4) and C hubs of the tens counter to RESET T and to the PICKUPS of selector 1. When four secondary cards have been counted, the tens counter is reset and selector 1 is transferred.
6. Two primary cards are fed by wiring ALL CYCLES through the normal side of selector 2 to PRI FEED.
7. After two primary cards are fed, four secondaries are fed by wiring ALL CYCLES through the transferred side of selector 2 and the normal side of selector 1 to SECDY FEED. When four secondaries have been fed, primary feeding is restarted by wiring through the transferred side of selector 1 to PRI FEED.
8. Assign selectors 1 and 2 for primary use. Selector 2, which transfers when 2 primaries have been fed, remains transferred while secondary cards are fed. When primary feeding is restarted, both selectors drop out.
9. Wire RUNOUT P and S to both PICKUPS of both selectors 3 and 4. Both selectors transfer for a runout condition in either feed.
10. Assign selectors 3 and 4 for control use.

11. Wire ALL CYCLES through the transferred side of selector 4 to PRI FEED and SECDY FEED, to feed cards on runout.
12. In both feeds, wire PKT CTRL to POCKET 3 through the normal side of selector 3, to feed cards to the merge pocket except on runout.
13. Wire PKT CTRL to POCKET 2 and POCKET 4, to stack runout cards in pocket 2 or 4.

Checking Consecutive Numbers

A file of cards can be checked to ensure that the cards are numbered consecutively. A blank card is inserted to indicate each missing number, or group of numbers. Two columns of a number can be checked in one operation (Figure 83). In most cases this is adequate even though consecutive numbers may consist of three or more digits, because a check on the units and tens positions detects all discrepancies except missing groups of even hundreds, thousands, ten thousands, etc.

When duplicate numbers occur, all but the last are selected. If desired, blank cards can be inserted in their place, or the duplicates can be left in the file.

The cards to be checked are placed in the primary feed, and blank cards are placed in the secondary. A primary card is compared, on each cycle, with an accumulated count. The card number is read into the primary comparing entries, and the count is entered in the secondary comparing entries. As long as the cards are in consecutive-number order, an equal comparison is detected, the count is increased by 1 on each cycle, and the cards are fed continuously. When duplicates are detected, counting is suspended until the last duplicate feeds. The primary sequence unit is used to check for duplicates.

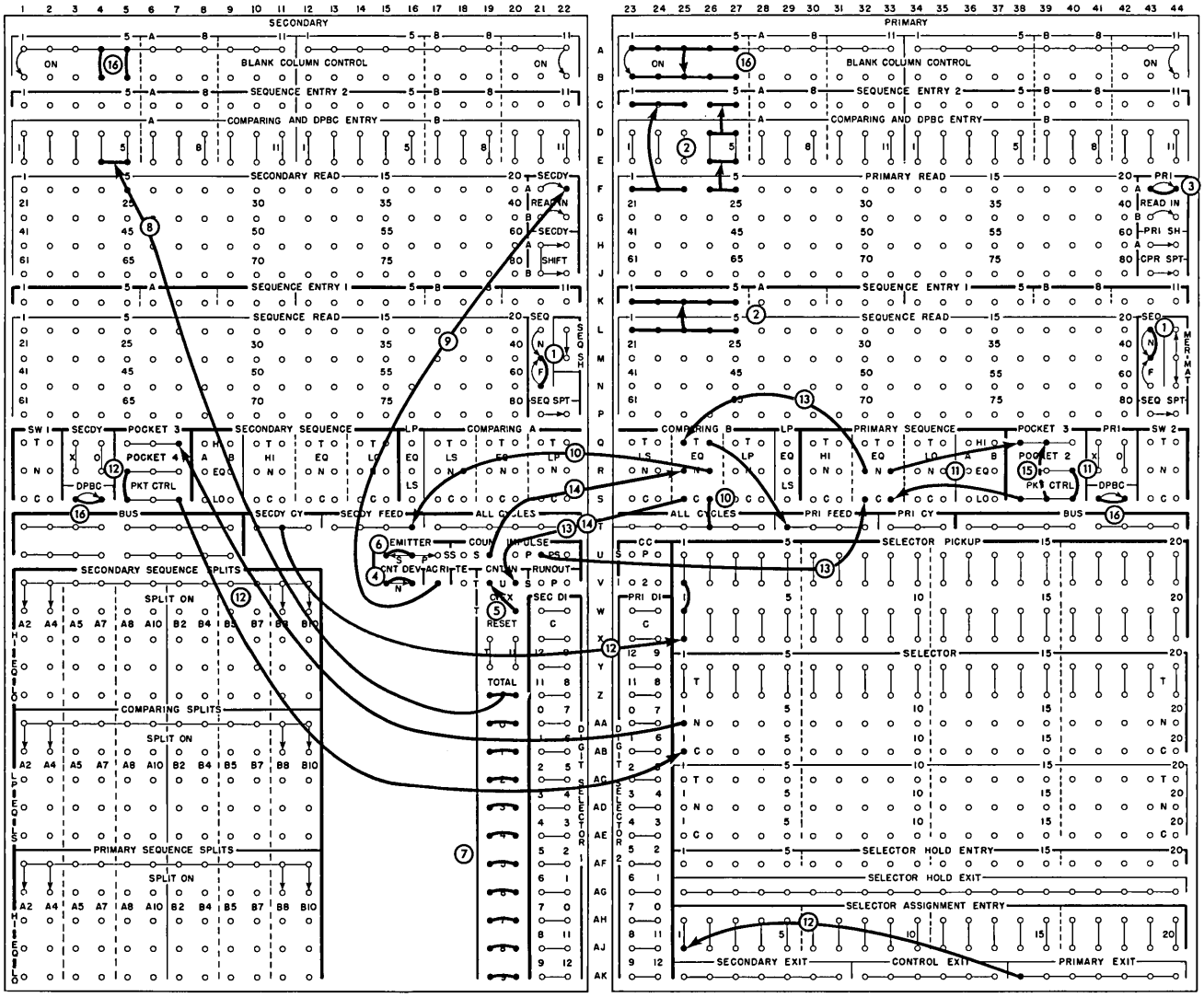


Figure 83. Checking Consecutive Numbers

If any cards are missing, an unequal comparison is detected, primary feeding is stopped, and blank cards are fed and counted until the count again equals the primary-card number. The first blank card is inserted in the file to indicate the discrepancy, and the other blanks are selected. The extra blanks are fed merely to increase the count until it equals the primary-card number.

Misfiled cards stop card feeding, and in some cases a blank is inserted ahead of the misfiled cards. If a *single* card is misfiled ahead of where it belongs (for example, 1, 2, 3, *10,* 4, 5), or if one or more cards are misfiled back of where they belong (for example 64, 65, *30,* 66, 67), a low sequence condition stops card feeding. If two or more cards are misfiled ahead of where they belong (for example, 15, 16, *41, 42,* 17, 18), a "missing-card" condition exists when the first misfiled card is read; when the last misfiled card is read, a low sequence stops card feeding.

WIRING (FIGURE 83)

1. Wire primary SEQ ON to check for low sequence. Wire secondary SEQ OFF to permit card feeding.
2. Wire card columns from SEQUENCE READ to SEQUENCE ENTRY 1, and from PRIMARY READ to COMPARING ENTRY and SEQUENCE ENTRY 2. Wire the whole field for sequence-checking, but wire only the units and tens positions for comparison with the 2-position total count.
3. PRI READ IN enters each primary-card number in the primary side of the comparing unit.
4. CNT DEV ON permits the counting device to operate.
5. C EX U to CNT IN T couples the units and ten counters.
6. EMITTER S causes the units counter TOTAL C hub to emit the total accumulated.
7. Jackplug each unit-tens digit position to cause the TOTAL C hub of the tens counter to emit the accumulated total.
8. Wire the TOTAL C hubs of the counters to secondary COMPARING ENTRY, to compare with the number read from the primary card.
9. Wire ACRI to SECDY READ IN entry to read in the accumulated total every cycle.
10. Wire ALL CYCLES through the transferred side of the EQ comparing B to selector to PRI FEED, and through the normal side to SECDY FEED. An equal comparison (selector transferred) indicates the cards are in consecutive-number order. An unequal comparison (selector normal) indicates missing cards. Blank cards are fed and counted until the count reaches that of the primary card (equal comparison).
11. Wire primary PKT CTRL through the normal side of the EQ primary sequence selector to POCKET 3; also wire primary PKT CTRL to POCKET 2. This stacks all cards except duplicate groups in pocket 3. If duplicates occur, the last one of the group is also stacked in pocket 3; all others are stacked in pocket 2.
12. Wire SECDY CY to both PICKUPS of selector 1, and assign the selector for primary use. Wire secondary PKT CTRL through the normal side of selector 1 to POCKET 3; also wire secondary PKT CTRL to POCKET 4. When primary cards are missing, this wiring merges one blank secondary card in pocket 3 and stacks all other blanks in pocket 4. Once picked up, the selector remains transferred until an equal count feeds the next primary card.
13. Wire COUNT IMPULSE P to CNT IN U through the normal side of the EQ primary sequence selector and the transferred side of the EQ comparing B selector. This counts consecutively-numbered primary cards. If duplicates occur only the last one is counted.
14. Wire COUNT IMPULSE S to CNT IN U through the normal side of the EQ comparing B selector. This counts blank secondary cards that are fed to compensate for any missing primary cards.
15. If duplicates are to be left in the file, substitute wiring 15 (dotted) for wiring 11.
16. Stop card feeding for double punches, blank columns, or *no* impulses from the counters.

Interchangeable 51-Column Secondary Feed

The interchangeable 51-column secondary feed (including file feed) permits feeding either 51-column cards or standard 80-column cards in the secondary feed of the IBM 88 Collator (Figure 84). Using an interchangeable feed allows mechanical handling of filing and file-maintenance operations without reproducing 51-column cards into standard 80-column cards. To adapt the secondary feed for 51-column-card operation, the operator installs a tray and hopper side-plates on the secondary file feed, and adjusts the secondary pockets.

Normal operations of the IBM 88 Collator can be performed with 51-column secondary cards. In a merging operation, however, an 80-column primary card *must* precede the corresponding 51-column secondary cards, and any unmatched secondary cards *must* be selected.

Operations can be performed independently in the primary (80-column cards) and in the secondary (51-column cards). For example, a file of 51-column cards can be sequence-checked in the secondary feed while

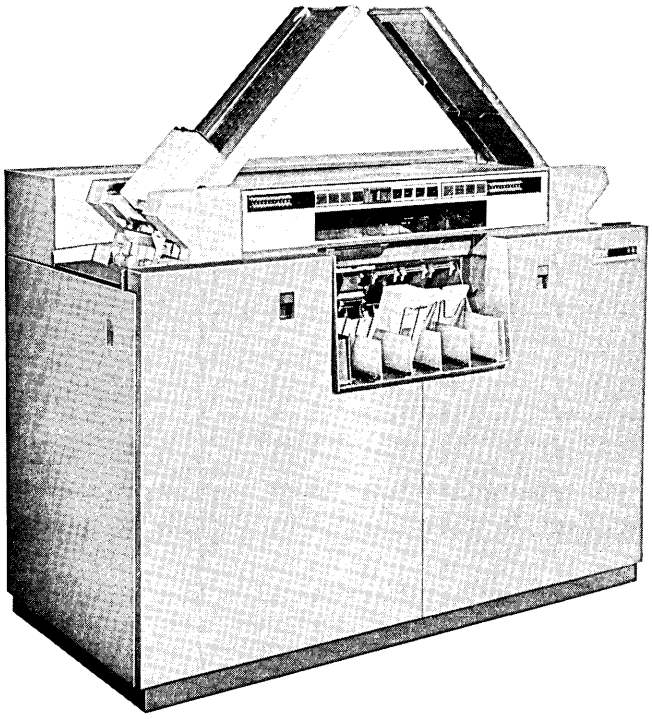


Figure 84. IBM 88 Collator Feeding 51-Column Cards

a file of 80-column cards are being checked for X-cards in the primary feed. However, when the stackers are adjusted to accept 51-column cards, no cards can be *selected* into pocket 3.

Machine Features

Modifying the secondary file feed and stackers readily adapts the IBM 88 Collator for processing 51-column cards.

Modifying the File Feed (Figure 85)

An *adapter tray,* placed on the file-feed magazine, accommodates the 51-column cards. A modified card-weight enables feeding the last cards from the hopper.

Inserting two *hopper side-plates* positions the 51-column cards at the center of the feed. Thumbscrews fasten the side plates to the hopper. Jogglers align the cards in the hoppers, as in standard operation.

In 51-column-card operation, the first column of the card corresponds to column 15 of an 80-column card, and is therefore read by brush 15; the last column corresponds to column 65 and is read by brush 65. A factor of 14 relates the card column to the reading brush.

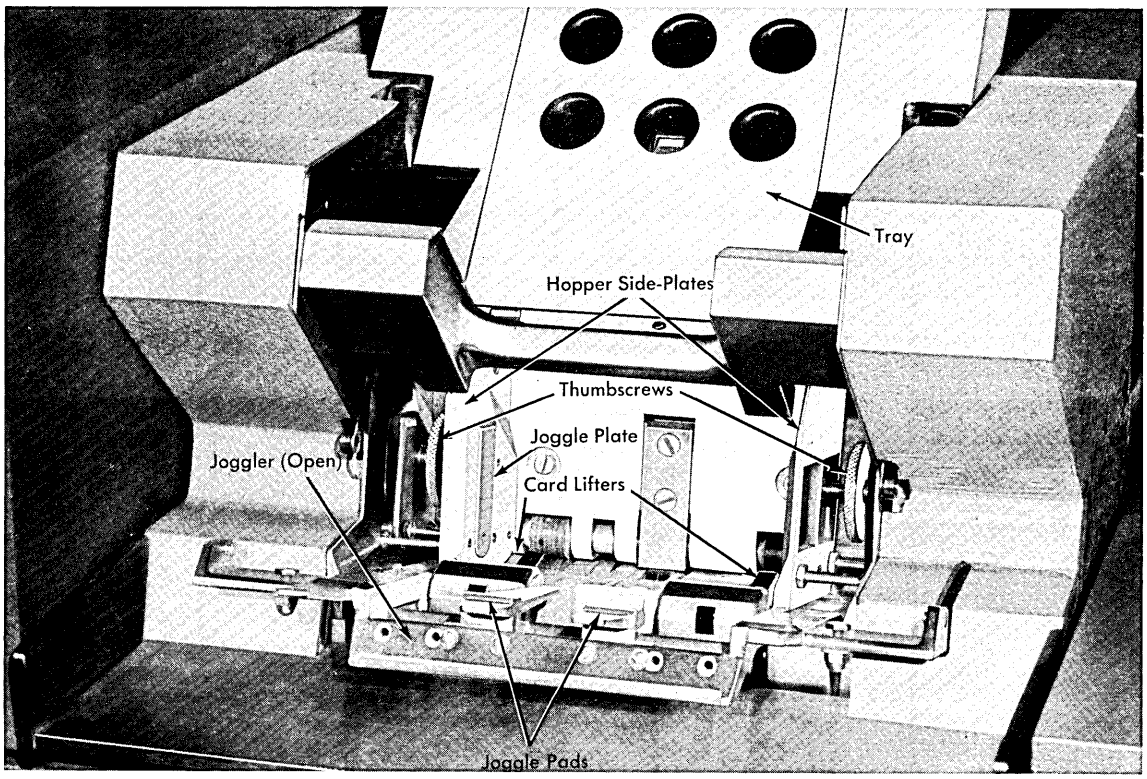


Figure 85. Secondary File Feed Adapted for Feeding 51-Column Cards

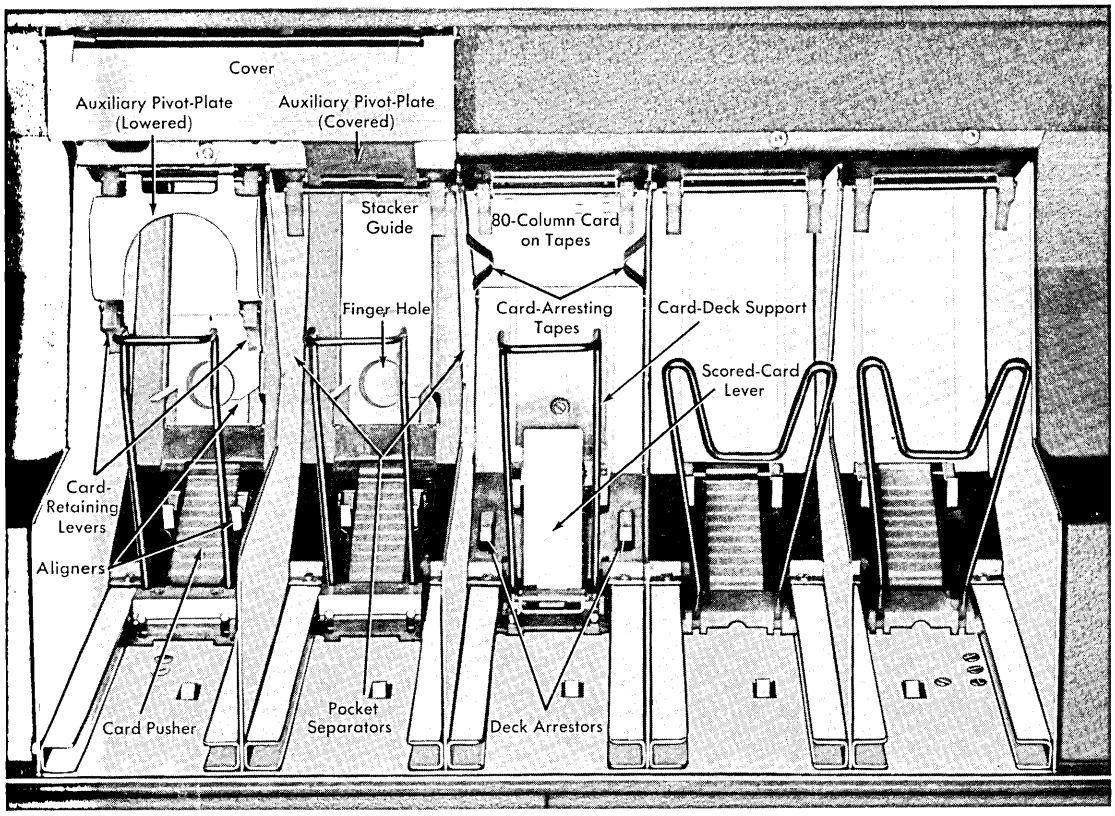


Figure 86. Pocket Modification for Stacking 51-Column Cards

Adjusting the Secondary Stackers (Figures 86 and 87)

The operator adjusts the *stacker guide* at the rear of pockets 4 and 5 to accommodate 51-column cards. A finger hole permits pulling the guide forward to reduce the depth of the stacker. A stop locates the guide accurately in either the 51- or the 80-column-card position. Adapting pocket 4 for 51-column cards automatically raises two *deck arrestors* in pocket 3. These arrestors permit stacking merged 51- or 80-column cards by holding the cards off the card pusher until enough cards accumulate to drop forward as a group.

A *pivot-plate* assembly adapts the front of pockets 4 and 5 for stacking either 51- or 80-column cards. The 51-column pivot-plate with card-retaining levers swings down against a stop on the pocket separators. This assembly provides a lower pivot for properly stacking the 51-column cards.

For standard 80-column operation, the operator pulls each auxiliary pivot-plate assembly forward, and then places it under the cover.

Two metal *arresting tapes* in pocket 3 permit merging 51-column cards with 80-column cards.

These tapes, mounted on the pocket separators, retain as many as ten 80-column cards as support for the 51-column cards falling on top. When a control

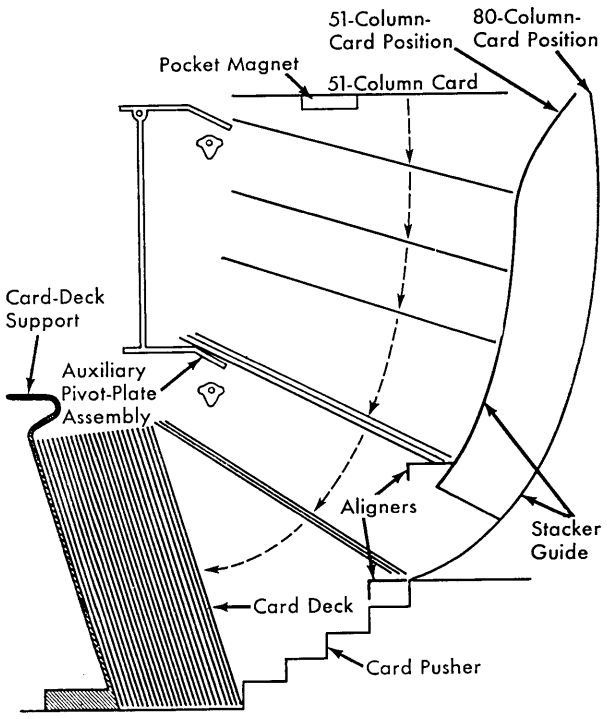


Figure 87. Schematic of Pocket Adapted for 51-Column Cards

change occurs, the tapes retract to allow the cards to drop as a group into the stacker. A control-panel switch (51 COL; AK, 13-14), wired only for merging, makes this feature operative.

Merging applications involving more than one hundred cards in a single control group should be avoided. For example, conditions with more than ten 80-column cards followed by ninety 51-column cards may activate the jam-protection switch and stop card-feeding.

In a merging operation, the machine interrupts card-feeding for two cycles at each control change, provided at least 3 machine cycles have occurred since the last drop. This allows time to retract the arresting tapes, and to clear all cards past the tapes. Thus, the output of a merging operation varies with the number of cards in each control group. For example:

Primary Card	*Matching 51-Col. Secondary Cards*	*Merging Rate Cards per Min.*
1	1	780
1	2	650
1	3	520
1	4	542
1	5	557
1	6	569
1	99	646

A metal *restraining finger,* projecting from the top of pocket 3, helps position the 80-column card on the tapes. The operator *must* lift out this restrainer to stack 80-column secondary cards in pocket 3.

Modified *card-deck supports* for pockets 3, 4, and 5 permit stacking 51-column cards, standard cards, and the scored cards processed by the basic machine. The capacity of each of these pockets is 800 cards.

Setup Operation

To set up the IBM 88 Collator to feed 51-column cards in the secondary feed:

1. Position the side plates in the hopper, and fasten firmly by turning the knurled thumbscrews. Be careful not to interfere with the card lifters.
2. Place the 51-column-card tray over the file-feed magazine.
3. Reach into pockets 4 and 5 and, using the finger hole, pull the guide forward and then down until it latches.
4. Raise the cover over the auxiliary pivot-plate assemblies, lower one assembly partially, and then slide the main pivot-plate to the rear until it latches.
5. Release the auxiliary pivot-plate assembly. A spring positions it against a stop on the pocket separators. (Repeat steps 4 and 5 for the other pivot-plate assembly.)

For a merging operation only:

6. Wire the 51-column switch on the control panel.
7. Open the top cover, and position the card-restrainer finger through the hole in the merge-pocket jam-switch mounting. Close the cover.
8. Raise the deck arrestors in pocket 3 by pulling forward the stacker guide in pocket 4.

Reverse this procedure to return to standard card-feeding. Note: Handle and store the adapter tray and hopper side-plates carefully to avoid damaging them. Also, be certain no cards remain on the aligners in the stackers when an operation is complete.

Control-Panel Summary

This section presents a brief discussion of each hub or group of hubs on the control panel. Numbers on the control panel (Figure 88) provide easy reference to paragraphs in the text. Duplicated numbers refer to corresponding hubs in both feeds. Shaded areas indicate special devices not on the standard machine.

1. BLANK COLUMN CONTROL. Wiring these switches checks for unpunched columns when numbers are entered in the corresponding positions of the COMPARING AND DPBC ENTRY. The exits emit every machine cycle that a card is located at the corresponding primary or secondary read station. When a comparing shift switch is wired, the shifted exits are under control of the opposite feed.

2. SEQUENCE ENTRY 2. These hubs accept impulses to one side of the sequence unit, for comparison with impulses entered in the corresponding positions of SEQUENCE ENTRY 1. The primary and secondary sequence units accept impulses (0-9) originating in the same feed on corresponding card-feed cycles. Control-panel switches split the units into A and B sections for independent comparisons of two separate fields.

3. COMPARING AND DPBC ENTRY. These hubs are entries to the primary and secondary sides of the comparing and double-punch blank-column detection unit. Each side of the comparing unit accepts impulses (0-9) originating in the corresponding feed. When a comparing shift switch is wired, the associated unit accepts digits from the opposite feed. The unit can be split into two sections, A and B, for independent comparisons of two separate fields.

   Detection of double punches is automatic; blanks are detected if BLANK COLUMN CONTROL switches are wired.

4. PRIMARY READ, SECONDARY READ. These 80 hubs in each feed emit impulses corresponding to the punches in the card passing the primary or secondary read station. Wire these hubs to corresponding control units or selector pickups.

5. READ IN. Wiring these selectable switches clears the corresponding side of the comparing unit of previous numbers, and permits new values to read in on a corresponding card-feed cycle. When the comparing unit is split, the A and B switches control the A and B sections but, when it is not split, the switches are common and either may be wired to control all the entry positions in the corresponding feed. With a comparing shift switch wired, these hubs operate under control of the associated feed.

6. PRIMARY SHIFT. This switch assigns the A section of the primary side of the comparing unit to the secondary. When this switch is wired, CPR SPT must also be wired.

7. SECONDARY SHIFT. These switches assign the A and B sections of the secondary side of the comparing unit to the primary.

8. COMPARING SPLIT. Wiring this switch splits the comparing unit into sections A and B, to provide for independent comparisons of two separate fields.

9. SEQUENCE ENTRY 1. These hubs accept impulses to one side of the sequence unit, for comparison with impulses entered in the corresponding positions of SEQUENCE ENTRY 2. The primary and secondary sequence units accept impulses (0-9) originating in the same feed on a corresponding card-feed cycle. Control-panel switches split the units into A and B sections for independent comparisons of two separate fields.

10. SEQUENCE READ. These 80 hubs in each feed emit impulses corresponding to the punches in the card passing the primary or secondary sequence read station. Wire these hubs to corresponding control units or selector pickups.

11. SEQUENCE ON, OFF. The center hub must receive an impulse every card-feed cycle to permit card feeding; if it does not, card feeding stops with a CONTROL STOP light ON. Wire the switch ON when checking cards for ascending sequence, to cause card feeding to stop automatically for a low sequence condition. Wire the switch OFF when not checking sequence, or when using external wiring for special sequence conditions. When SEQ SPT is wired, SEQ ON is effective for the B section only.

12. MERGE, MATCH. Wiring one of these switches sets up internal circuitry to control card feeding automatically for a normal merging or matching operation.

13. SEQUENCE SHIFT. This switch shifts the entire secondary sequence unit for use in the primary.

14. SEQUENCE SPLIT. Wiring these switches splits the corresponding sequence unit into sections A and B, for independent comparisons of two separate fields.

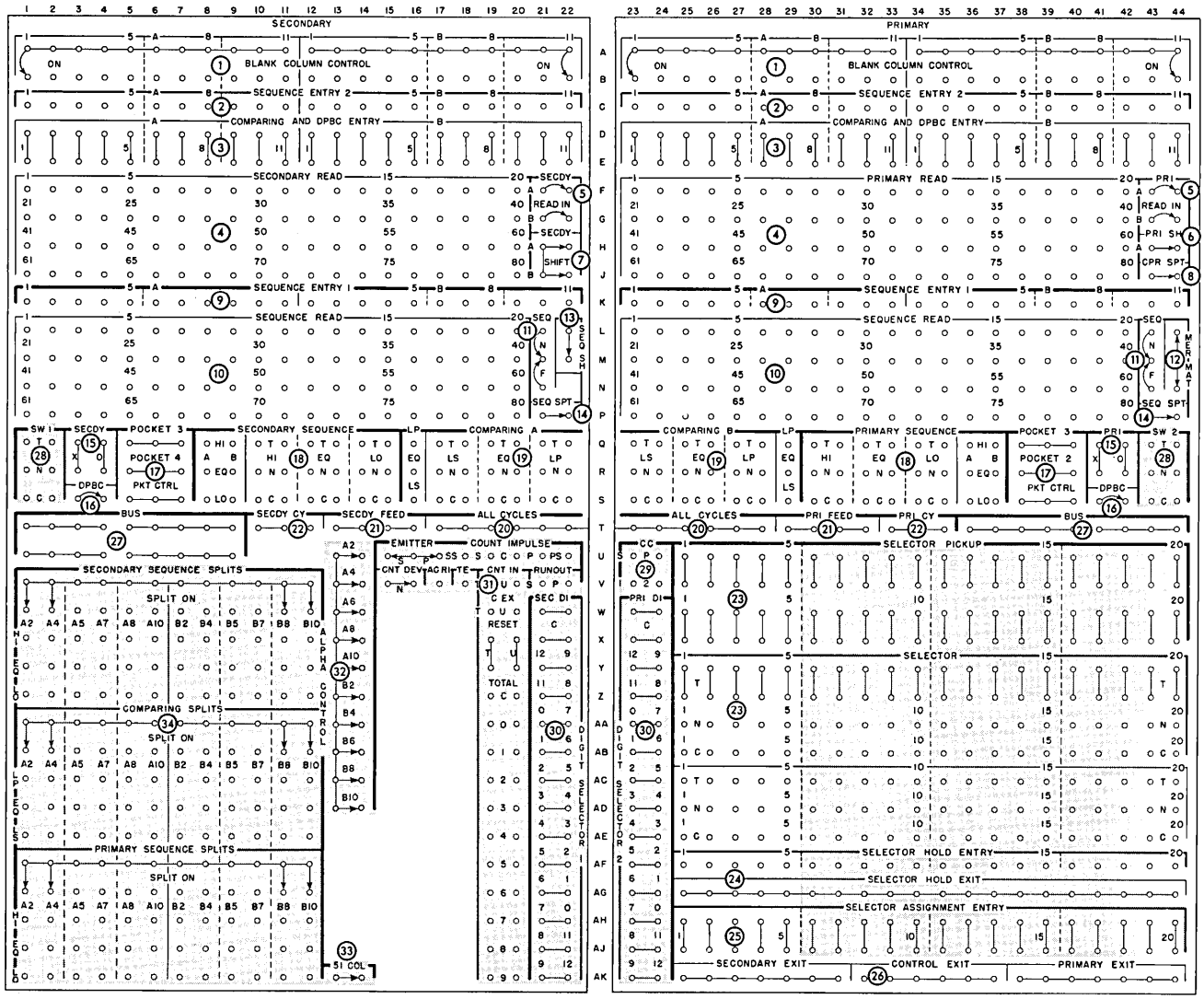


Figure 88. Control-Panel Summary

15. X, 0 IMPULSE. These hubs emit X- and 0-impulses every corresponding primary or secondary card-feed cycle. Wired to one PICKUP of a selector, the X conditions the selector to transfer for only an X in a card column. Split-wired to a control unit, the 0 can be used to check for zero balances in cards.

16. DOUBLE-PUNCH, BLANK-COLUMN DETECTION. With these selectable switches wired, card feeding stops for double punches or blanks detected in the corresponding side of the comparing unit. The left hub emits an impulse that can be used to stop card feeding or to control machine operation. The right hub accepts an impulse to stop card feeding and turn on the DP&BC DETECT and CHECK lights. With a comparing shift switch wired, this impulse to stop is emitted from the switch exit in the feed to which the unit is shifted.

17. POCKET CONTROL, POCKET 2, 3, 4. This group of hubs selects the pockets for stacking cards. The pocket control exits *must* be wired to the pocket entries to stack cards in pocket 2, 3, or 4. Impulsing both primary POCKETS 2 and 3 or both secondary POCKETS 3 and 4 causes the card to stack in pocket 3. With no pocket entry impulsed, a card stacks in pocket 1 in the primary or in pocket 5 in the secondary. Any pocket control exit can be wired to either a primary or secondary pocket entry.

18. SECONDARY SEQUENCE, PRIMARY SEQUENCE. Each sequence unit has two groups of functional controls (exits and selectors) for controlling machine operations according to the result of a comparison in the unit.

One of the functional exits (Q-S, 8-9, 36-37) emits an impulse corresponding to the comparison in the secondary or primary sequence unit

(high, equal, or low). These impulses can pick up selectors to control machine operations. The A exits emit only when a unit is split. The B exits emit for a comparison in the whole unit if it is not split; if the unit is split, the B exits emit for the B section.

One of the functional selectors (HI, EQ, or LO) transfers when the corresponding functional B exit emits. Impulses wired directly through these selectors can control machine operation.

19. COMPARING A, COMPARING B. The comparing unit has two groups of functional controls (exits and selectors) for controlling machine operations according to the result of a comparison in the unit.

    One of the functional exits (Q-S, 16, 29) emits an impulse corresponding to the comparison in the comparing unit (low secondary, equal, or low primary). These impulses can pick up selectors to control machine operations. Both the A and B exits represent the comparison in the whole unit if it is not split; if it is split, the A exits represent the A section and the B exits the B section.

    One of the functional selectors (LS, EQ, or LP) transfers when the corresponding functional exit emits. Impulses wired directly through these selectors can control machine operation. Except when CPR SPT is wired, comparing A and B selectors operate together and represent the whole unit.

20. ALL CYCLES. These hubs emit an impulse every machine cycle except when a red signal light is ON. This impulse is suitable for picking up selectors and operating card feeding.

21. PRIMARY FEED, SECONDARY FEED. These hubs accept an all cycles impulse to feed cards in the corresponding feed. They are inoperative during run-in and when the match or merge switch is wired.

22. PRIMARY CYCLES, SECONDARY CYCLES. These hubs emit every corresponding card-feed cycle and are normally wired to pick up selectors.

23. SELECTOR: PICKUP. These hubs accept *two* simultaneous impulses to transfer the selector immediately. Selectors transfer and drop out according to the selector assignment and hold control.

    C (COMMON), N (NORMAL), T (TRANSFERRED). When a selector transfers, the C and T hubs are common; otherwise the C and N hubs are common.

24. SELECTOR HOLD ENTRY, EXIT. Wiring these hubs causes a selector that is transferred and assigned to the primary or secondary to remain transferred until the hold circuit is broken.

25. SELECTOR ASSIGNMENT ENTRY. These hubs accept an impulse from PRIMARY, SECONDARY, or CONTROL EXIT to assign the associated selector to the particular feed or control use. This determines when the selector can transfer and how long it remains transferred (HOLD not wired). Wire only from PRIMARY, SECONDARY, or CONTROL EXIT.

26. PRIMARY, SECONDARY, CONTROL EXIT. These hubs emit impulses that should be wired only to SELECTOR ASSIGNMENT ENTRY to assign a selector to the primary or secondary feed, or for control use. When assigned to primary or secondary, a transferred selector remains transferred until the start of the next corresponding feed cycle (HOLD not wired). When assigned for control use, a selector picked up during control time remains transferred through the reading of the next card.

27. BUS. These common hubs expand any exit or entry to avoid excessive split wiring.

28. SWITCH 1, 2. These selectors (special feature) correspond to two alteration toggle switches on the machine and transfer when the corresponding switches are turned to T. Within reasonable limitations, these switches permit using one control panel for different operations.

29. CARD COUNTER. The entry hubs, labeled 1 and 2, correspond to two card counters (special feature) that add one for each card counted. The S and P exits emit an impulse every corresponding secondary or primary feed cycle. This impulse can be wired directly to a counter entry (CC, 1, 2) to count every card passing through the respective feed, or it can be selected.

30. DIGIT SELECTOR 1, 2. This special feature selects specific digits from a card column wired to the C hub. The digit hubs are labeled with two sets of numbers: the left set corresponds to the secondary feed, and the right set to the primary.

    Impulsing C from DI changes the selector to an emitter, and each digit hub *emits* its labeled digit. The primary and secondary DI (digit impulse) hubs emit an impulse for every digit (0-9, X, 12) on the corresponding feed cycle.

31. COLLATOR COUNTING FEATURE. This special feature counts up to 99 cards. The two separate counters can perform two counting operations if the count of each does not exceed 9.

    COUNT DEVICE ON (CNT DEV). This switch turns on the counting feature.

    EMITTER. These hubs, when jackplugged primary (P) or secondary (S), cause the TOTAL C hub of the units counter to emit the total in the counter, and the digit hubs of the units counter to emit the corresponding digits.

COUNT IMPULSE: SS, S, C, P, PS (SECONDARY SEQUENCE, SECONDARY, COMMON, PRIMARY, PRIMARY SEQUENCE). These hubs emit an impulse that is normally wired to COUNT IN, to cause the counter to add 1 for each card leaving the corresponding read station. The C hub emits an impulse on every card-feed cycle that a card is located at the primary read station.

RUNOUT. The S and P hubs emit impulses to control machine operations on runout in the corresponding feed. S emits at the end of the cycle in which the last primary card is stacked and for every machine cycle thereafter; P emits at the end of the cycle in which the last secondary card is stacked and for every machine cycle thereafter. Both S and P also emit for the first two cycles on the run-in.

COUNT IN (CNT IN). These entry hubs accept a count impulse to add 1 in the units (U) or tens (T) counter. With the counters coupled, impulse the units counter only.

TEST EXIT (TE). This hub emits an impulse for testing the counter for a predetermined total, or for resetting the counter. If TE is wired through the TOTAL C and predetermined digit hubs to the pickup of a selector, the selector can be used to control machine operations when the predetermined total is reached.

ALL CYCLES READ IN (ACRI). This hub emits a selectable impulse that is used, instead of the READ IN exit, to restore a side of the comparing unit whenever a counting operation requires a read-in on every cycle.

CARRY EXIT (C Ex). The U and T hubs emit an impulse when the count in the corresponding counter goes from 9 to 10. To couple the two counters, wire the U hub to the COUNT IN hub of the tens counter.

RESET. These hubs accept a test exit impulse to reset the units (U) and tens (T) counter.

TOTAL: C, 0-9. The 0-9 hubs for the units and tens counters represent the totals accumulated in the counters. On each cycle a path exists between the TOTAL C and the 0-9 hub corresponding to the total count. An impulse wired through these hubs can pick up selectors to control card feeding and counting for a predetermined number.

With a primary or secondary emitter switch wired, the C hub of the units counter emits the total in the counter for comparing with another number, usually read from a card. The digit hubs also emit 0-9 impulses, respectively, on each cycle. Jackplugging these hubs to the 0-9 hubs of the tens counter causes the C hub of tens counter to emit the total in that counter.

32. ALPHA CONTROL: A2-10, B2-10. Each switch of this special feature conditions two corresponding adjacent positions in all control units to accept alphabetic information.

33. 51 COL. Wiring this switch permits using the 51-column interchangeable feed (special feature) for merging 51-column secondary cards behind 80-column primary cards.

34. CONTROL UNIT SPLITS. This special feature splits each control unit to give separate multiple-field control of machine operations.

SPLIT ON. Wiring these switches isolates the comparing positions between wired switches and makes the result of the comparison in the separate sections available at the split functional exits.

HIGH, EQUAL, LOW (HI, EQ, LO). One of these hubs emits the result of the comparison for each split section wired in the primary or secondary sequence unit.

LOW PRIMARY, EQUAL, LOW SECONDARY (LP, EQ, LS). One of these hubs emits the result of the comparison for each split section wired in the comparing unit.

Timing Chart

The purpose of a timing chart is to show in degrees the approximate time, in each cycle, when exit hubs emit impulses and entry hubs accept impulses. A good working knowledge of the machine is necessary before using a timing chart effectively. Use the timing chart to determine whether doubtful control-panel wiring will function properly, without damaging the machine internally (for example, whether arcing the points of a selector occurs because the selector transfers while an impulse is passing through it).

A cycle is a period of time required to complete a given series of operations. A machine cycle is 360°. For example, from a given point of a cycle to the same point of the next cycle is 360°. In the IBM 88 Collator the machine cycle starts at 310°, when the card-feed clutch unlatches to feed a card. Each cycle is divided into 20 equal parts (or points), of 18 degrees each.

Digit time (10°-214°) is the time the reading brushes read the card digits (9-0, X, 12 in the primary; 12, X, 0-9 in the secondary). During control time (225°-345°), impulses are emitted and accepted to control operations (such as card feeding and selection) for the following cycle.

The transfer time of the high-speed selector relays is approximately 12°. For assured results, always consider this factor of 12° between the picking and the transferring of a selector. The particular assignment used (PRIMARY and SECONDARY EXIT or CONTROL EXIT) governs the picking time of a selector.

The timing chart (Figure 89) gives the timing for hubs associated with the secondary feed, and with controls and switches; the timing chart (Figure 90) gives the timing for hubs associated with the primary feed and with special features. The references under *Location* indicate the position of the hubs on the control panel. The numbers under *Notes* refer to the following list of pertinent facts. The timing shown applies to all machines internally wired according to Wiring Diagram No. 603000A.

Notes

1. Active only when cards are passing the respective read station. On runout, 9's and 0's are emitted by SECONDARY, PRIMARY and primary SEQUENCE READ.
2. Active only when the comparing unit has been controlled to read in.
3. Active only for the corresponding card-feed cycle.
4. Active every machine cycle that a card is passing the corresponding primary or secondary read station.
5. F emits every machine cycle; N emits every machine cycle except for a low sequence in the corresponding primary or secondary feed.
6. Active during a corresponding card-feed cycle (28°-178°) when a second punch in a column is detected, and after card-read time (244°-295°) if a blank column control entry is impulsed.
7. Accept all cycles impulses except when the merge or match switch is wired.
8. One exit emits every machine cycle. The sequence A exits are active only when control unit is split.
9. On each cycle, the selector(s) corresponding to the comparison in the control unit transfers.
10. Must be impulsed from PKT CTRL only.
11. Both PICKUPS must be impulsed simultaneously while the SELECTOR ASSIGNMENT ENTRY is impulsed. The selector transfers immediately. A digit through the normal side to pick up the selector transfers the selector for the next digit. Selector remains transferred for duration of the impulse to SELECTOR ASSIGNMENT and HOLD ENTRY.
12. SS, S, P, and PS emit only when cards are passing the respective read station; C emits every card-feed cycle that a card is at the primary read station.
13. Emits when the count in the corresponding counter turns from 9 to 10.
14. A path exists between C and the digit hub corresponding to the value in the counter. Either can be used as an entry or exit.
15. With EMITTER switch wired, both C and digit hubs are exits: C for the total in the counter, and the digit hubs for corresponding digit impulses.
16. A path exists between C and the digit hub corresponding to the value in the counter, and is normally tested at 240°-260° (TE time). With an EMITTER switch wired and the units-tens digits hubs jackplugged, the digit hubs are entries and the C hub emits the total in the counter.
17. Emits when the last card in the opposite feed is fed to a stacker; also active on the first two run-in cycles.
18. One exit emits every machine cycle that SPLIT ON is wired.

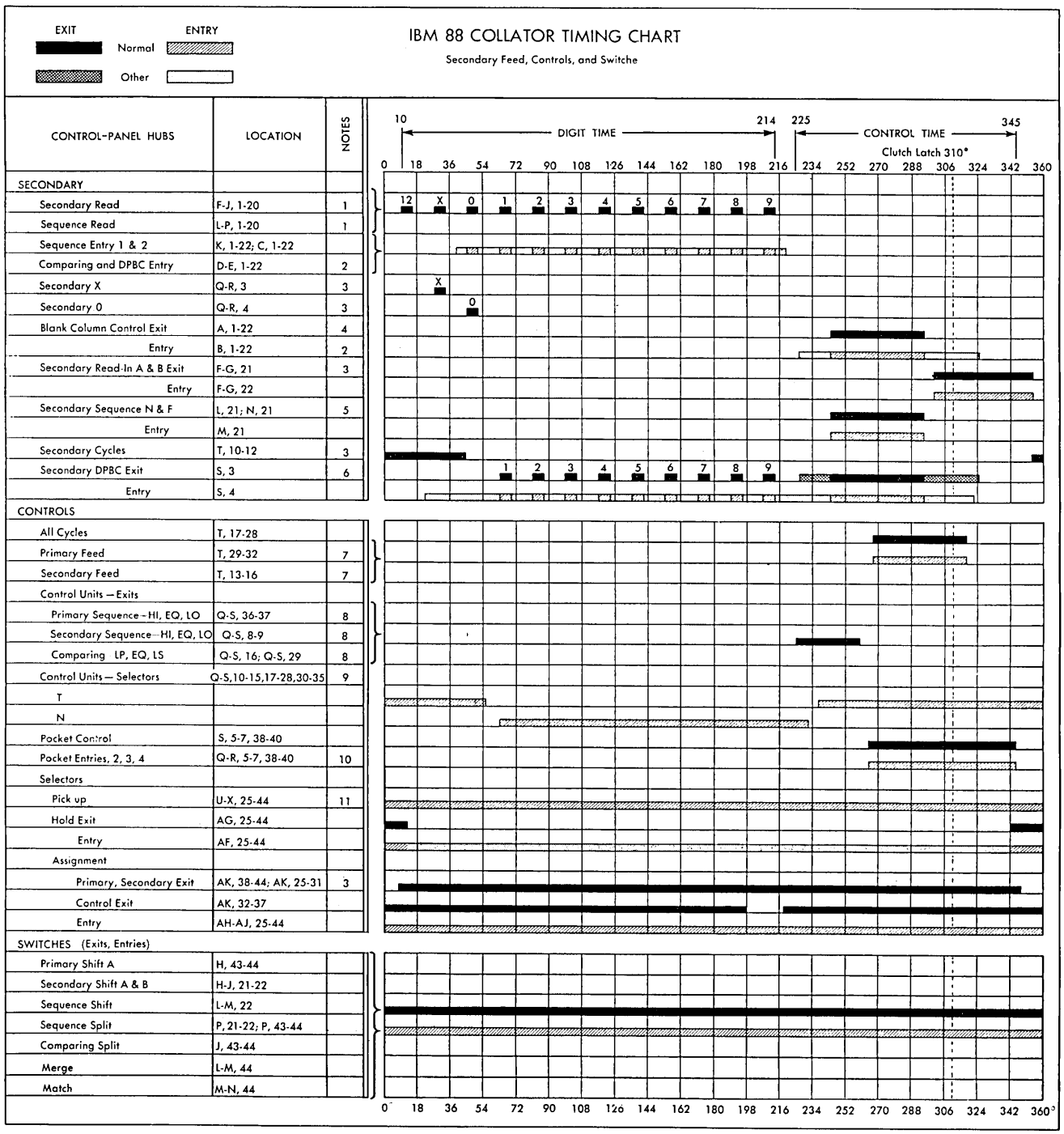


Figure 89. Timing Chart: Secondary Feed, Controls, and Switches

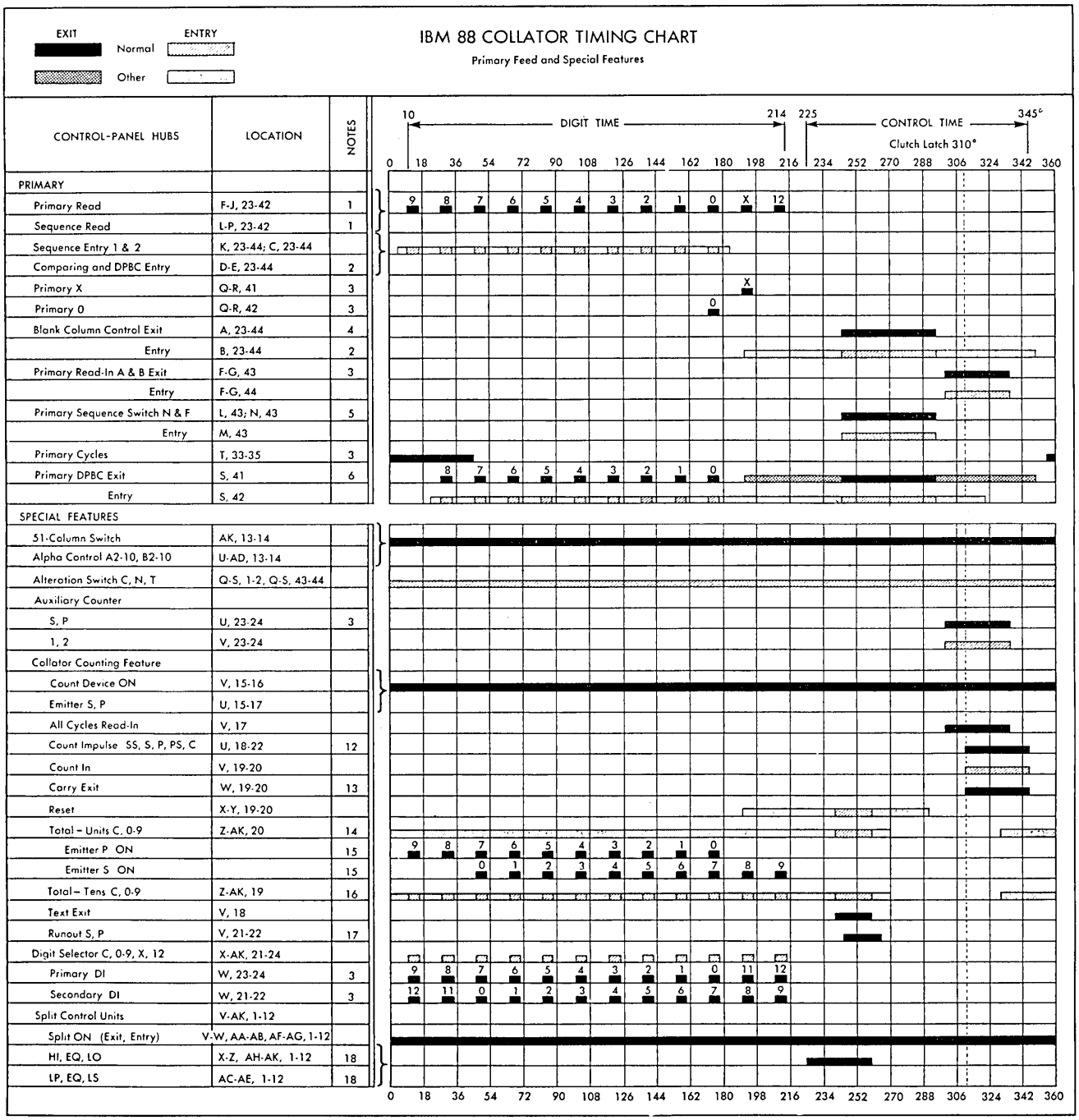


Figure 90. Timing Chart: Primary Feed and Special Devices

Index

IBM 88 Printed in U.S.A. A24-1013-2

IBM

International Business Machines Corporation

Data Processing Division

112 East Post Road, White Plains, New York