IBM

ELECTRIC   PUNCHED   CARD

ACCOUNTING   MACHINES

PRINCIPLES OF OPERATION

COLLATOR

TYPE 077

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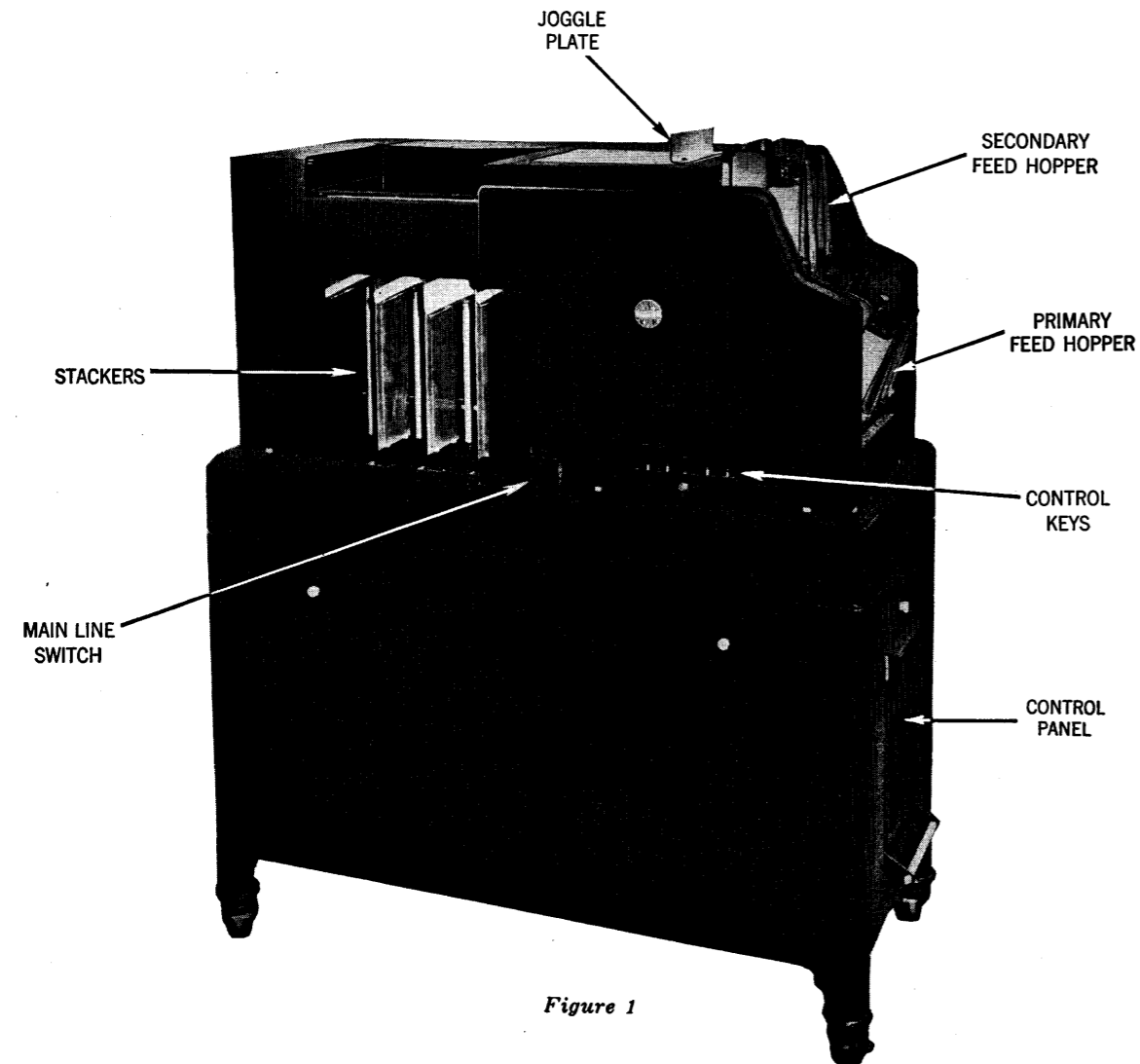SWITCH

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Figure 1

IBM COLLATOR
TYPE 077

THE IBM COLLATOR

TYPE 077

THE FUNDAMENTAL advantage of the IBM Accounting Method is the use of an IBM card as a unit record. These IBM cards can be arranged easily in any sequence required for the summarization of the information punched in them. Prior to the introduction of the Collator, the Sorter was the only machine available for automatic arrangement of cards; in order to file one group of cards with another, the two were placed together and sorted on a common control field. This procedure is ideal if neither set of cards is in proper sequence, but if the groups are already in sequence, they will be sorted a second time. In merging cards by the sorting method it is necessary to sort on each individual column of the control field separately. The Collator has been designed to improve this situation by filing together, on one run through the machine, two groups of cards which are arranged in correct sequence.

The speeds at which various operations are performed on the Collator vary from a minimum of 240 to a maximum of 480 cards per minute, depending on the particular application involved. Either feed, when operating independently, will feed cards at the rate of 240 per minute. Factors affecting the speed of operation will be more fully described later.

Functions of the Collator

The applications of the Collator generally can be classified according to one of the following groups. In any operation, however, only numerical information can be handled.

The Collator can be used to file two sets of cards together. This operation is referred to as *merging;* that is, two sets of cards are filed or merged together according to a control field. For example, in a payroll application, at the end of a pay period, the Daily Payroll cards must be in sequence by Employee Number. A peak load sorting operation can be eliminated by a daily filing operation. At the end of each day, the Daily Payroll cards are sorted and then filed by Employee Number behind the cards of the preceding day. This will eliminate sorting all the Payroll cards together by Employee Number at the end of the pay period.

To the basic merging operation can be added the *selection* of particular cards. When filing Master Rate cards in front of Detail cards by Employee Number, there may be inactive Rate cards (Rate cards for which there are no Detail cards) or missing Rate cards (Detail cards for which there are no Rate cards). These extra Rate and Detail cards can be selected from the files during the merging operation.

At the time this filing or merging operation is done, the Collator can perform another function, that of *checking the sequence* of one of the sets of cards. Checking the sequence will determine whether any cards in the group have been filed in the wrong place. If a card is out of order, the machine will stop and the error will be indicated to the operator by a red light (Error Light).

Another function of the Collator is the *matching* of two sets of cards according to a control field. For example, Master Name cards and Payroll Summary cards can be matched by Employee Number to be sure there is a Name card for each employee who has Payroll cards, and likewise Payroll cards for each corresponding Name card. In this operation, the matched cards, Name and Payroll, are never merged but are kept in two separate groups.

The fifth classification includes a variety of operations possible on the Collator based for the most part on *multiple column selection.* A file of cards, which is not in any particular sequence, can be searched for a specific control number such as a Social Security number, or for cards over or under a specific control number, such as cards on which the hours worked exceed 40. It also is possible to set up two limits for a control field, an upper and lower, and to select all cards between these two limits. Cards on which one field exceeds another field also can be selected.

Principle of Operation

A collating operation, whether manual or automatic, is accomplished by means of comparing two control numbers. If the two sets of cards to be merged are in numerical sequence, the number on the first card of one group can be
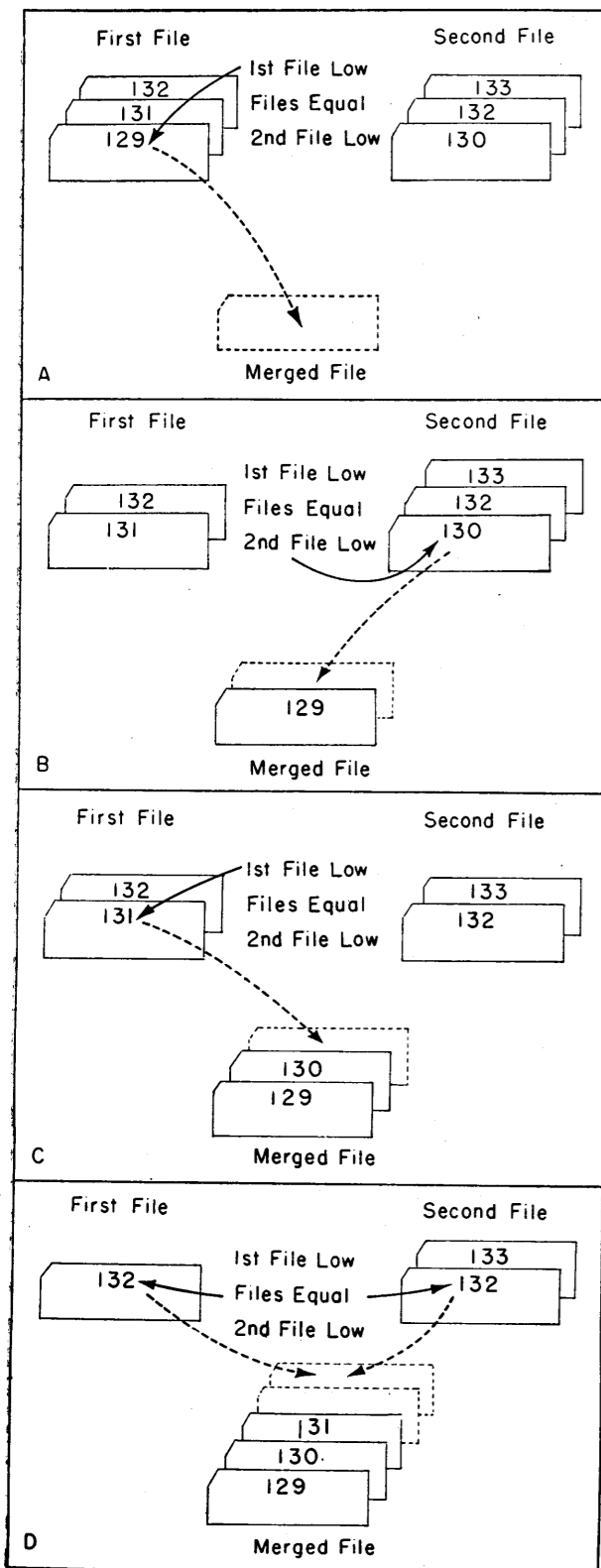
Figure 2

compared with that on the first card of the second group. The comparison will have one of three results: the number on the first card is lower than that on the second (Fig. 2A); the number on the second card is lower than that on the first (Fig. 2B); or the numbers on the two cards are equal (Fig. 2D). The card of the lower number is placed in front of the merged file; the comparison then continues and the two files are arranged together in an ascending numerical sequence.

In a manual collating operation, the cards from the two files are compared and placed together in proper sequence. Through the use of the Collator this operation becomes fully automatic. The two sets of cards are placed in the machine and the control numbers are read from the punched holes in the cards into a comparing unit. In this comparing unit the two control numbers are compared, and the result of the comparison is used in turn to direct the machine to file the cards together in their proper sequence.

MACHINE FEATURES

(See Figure 1)

Card Feeds

The Collator contains two separate feed units; the lower feed unit is referred to as the Primary Feed unit and the upper as the Secondary Feed unit. Cards placed in the primary hopper are called Primary cards; cards placed in the secondary hopper are called Secondary cards. See Figure 4 for Schematic Diagram.

Control Keys—Figure 3

The Main Line Switch controls the power and must be ON if the machine is to be operated. Depressing the Start Key will start feeding of cards. To stop the feeding of cards, the Stop
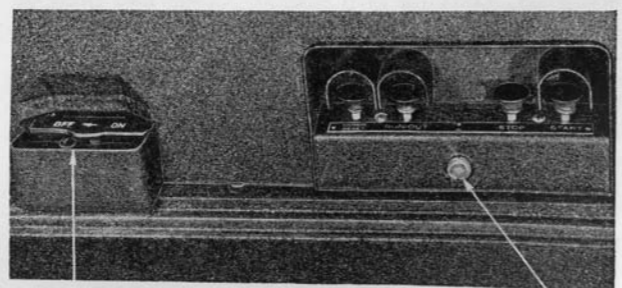

MAIN LINE SWITCH   ERROR LIGHT

Figure 3

Key should be depressed. The Main Line Switch should not be turned off without first depressing the Stop Key.

When the machine stops after the last card is fed from either Primary or Secondary Feed Hopper, the Run Out Key must be depressed in order to move the cards remaining in the machine to the pockets. The Error Key must be depressed to turn off the Error Light. (This will be more fully described later.)

Feed Hoppers

As in the Type 080 Sorter, cards are fed face down, 9's or lower edge first. Cards can be inserted while the machine is in operation. Each feed hopper holds about 800 cards and is equipped with a hopper stop contact. As soon as the last card is fed from either hopper, the machine will automatically stop.

Primary Feed Unit

As cards are fed from the Primary Feed Hopper, they pass two reading stations. Each reading station consists of 80 single brushes, one brush for each card column. At the first reading station are the Primary Sequence Brushes; at the second reading station are the Primary Brushes.

Secondary Feed Unit

As cards are fed from the Secondary Feed Hopper, they pass only one reading station, the Secondary Brushes, which consist of 80 single brushes, one brush for each card column.

Pockets—Figure 5

After being read by the brushes, the cards pass into one of four pockets or stackers. Each

SELECTED SECONDARIES   SELECTED SECONDARIES   MERGED CARDS   SELECTED PRIMARIES
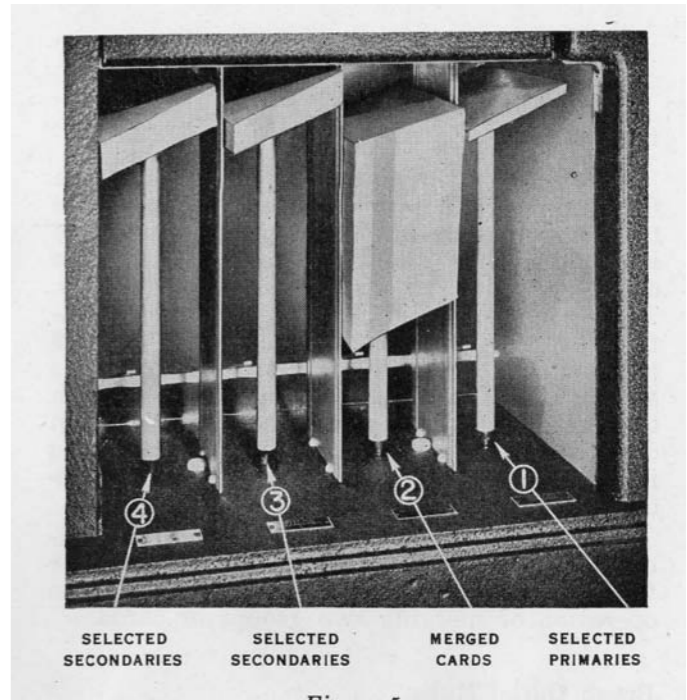
Figure 5

pocket holds 1,000 cards and is equipped with a contact to stop the machine when the pocket is full. The four pockets are numbered from 1 to 4, from right to left. Pocket 1 is for selected primary cards, 2 is for merged cards, 3 and 4 are for selected secondary cards. Primary cards can enter either Pocket 1 or 2 but cannot go into 3 or 4. Secondary cards can enter Pocket 2, 3, or 4 but cannot go into Pocket 1. If two sets of cards are to be merged, the merged cards will fall in Pocket 2.
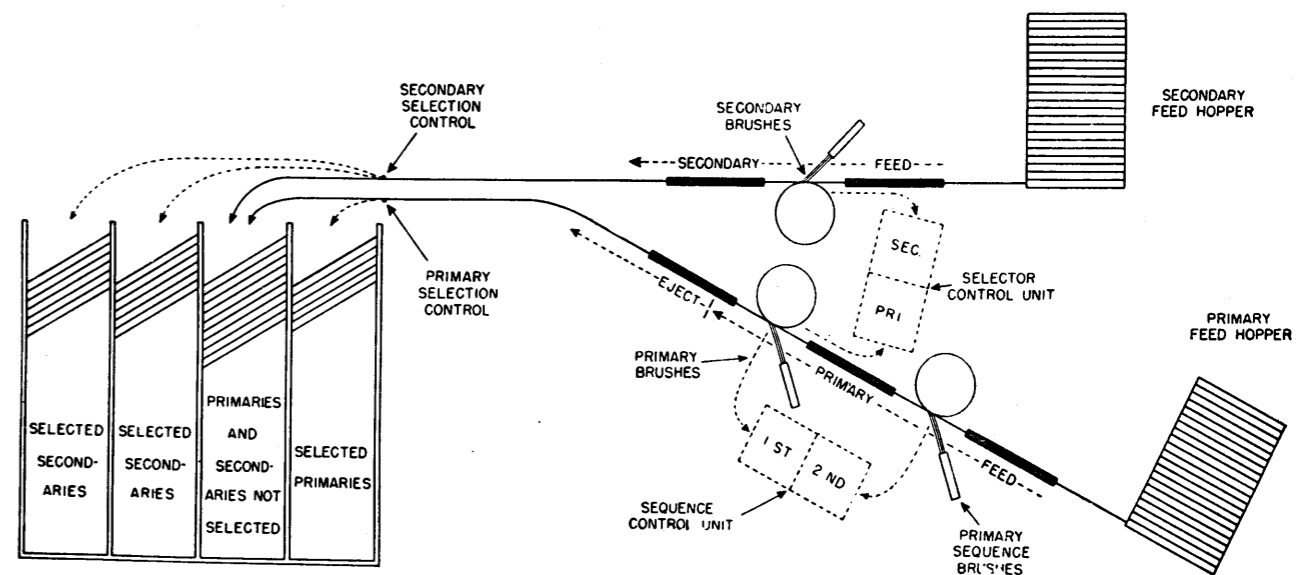
Figure 4

CONTROL PANEL

(See Figure 6)

Function

The basis of the automatic operation of the Collator is found in the units which compare the control information punched in the cards and which then direct the movement of the cards according to predetermined conditions. These conditions vary with the specific application involved. The control panel then becomes the medium through which the comparing units are controlled, and the medium through which the results of these comparisons are in turn directed to control the movement of the cards in accordance with the requirements of the specific application.

The terminology used in describing the various plughubs is based almost entirely upon the functions which these plughubs perform in the operation of merging two groups of cards.

Brush Outlet Hubs

Cards feeding in the Primary feed unit of the machine pass two sets of brushes, the Primary Sequence Brushes and the Primary Brushes. If any holes are sensed in the cards, the corresponding brush outlet hubs will emit impulses. Cards feeding in the Secondary Feed Unit pass the Secondary brushes, and the Secondary Brush outlets will emit impulses if punched holes are read.

Comparing Magnet Hubs

There are two Control Units in the Collator, one unit called the Selector Unit and the other the Sequence Unit. In each unit 16 positions may be compared. Each unit is made up of two sets of magnets which are used for the storage of control numbers read from the cards. These comparing magnets are unlike those in other IBM Accounting Machines in that they determine not only whether two cards contain the same control number, but also, if the two control numbers are different, which card contains the lower control number.

(1) **Selector Magnets**—As on the Type 405 Alphabetical Accounting Machine and the Type 513 Reproducing Punch, each position of comparing magnets has two entry hubs. The entry hubs for the Selector Magnets have been labelled Secondary Selector Magnets and Primary Selector Magnets because the Secondary Brushes are connected to the Secondary Selector Magnets, and the Primary Brushes are connected to the Primary Selector Magnets in Basic Setup operations. In other applications any set of Brushes may be connected to any comparing magnets, according to the requirements of the operation. The corresponding positions in each Selector Unit compare with one another. This comparison will result in one of these three conditions:

The field entered in the Secondary Selector Magnets may contain a number higher than that in the Primary Selector Magnets.
Example: 543—Secondary
541—Primary
Result: Low Primary (Same as High Secondary)

The field entered in the Secondary Selector Magnets may contain a number equal to that in the Primary Selector Magnets.
Example: 543—Secondary
543—Primary
Result: Equal

The field entered in the Secondary Selector Magnets may contain a number smaller than that in the Primary Selector Magnets.
Example: 543—Secondary
545—Primary
Result: Low Secondary (Same as High Primary)

Both the Selector and the Sequence Magnets have the capacity of holding a reading until a new card reads in. This is not true of the comparing magnets on the Type 513 Reproducing Punch or the comparing relays on the Alphabetical Accounting Machine.

(2) **Sequence Magnets**—The entry hubs for the Sequence Unit are labelled 1st and 2nd Primary Sequence Magnets. The Primary Brushes are connected to the 1st Primary Sequence Magnets and the Primary Sequence Brushes are connected to the 2nd Primary Sequence Magnets in Basic Setup operations. In other applications any set of brushes may be connected to any comparing magnets according to the requirements of the operation. It is possible to compare a card at the Primary Brushes with one at the Primary Sequence Brushes, thereby comparing each card of a primary group with the succeeding card. In any case, when two numbers are entered in the Sequence Magnets, there will be one of the three following results:

The 2nd Primary Sequence reading can be higher than the 1st Primary Sequence.
Example: 102—1st Primary Sequence
103—2nd Primary Sequence
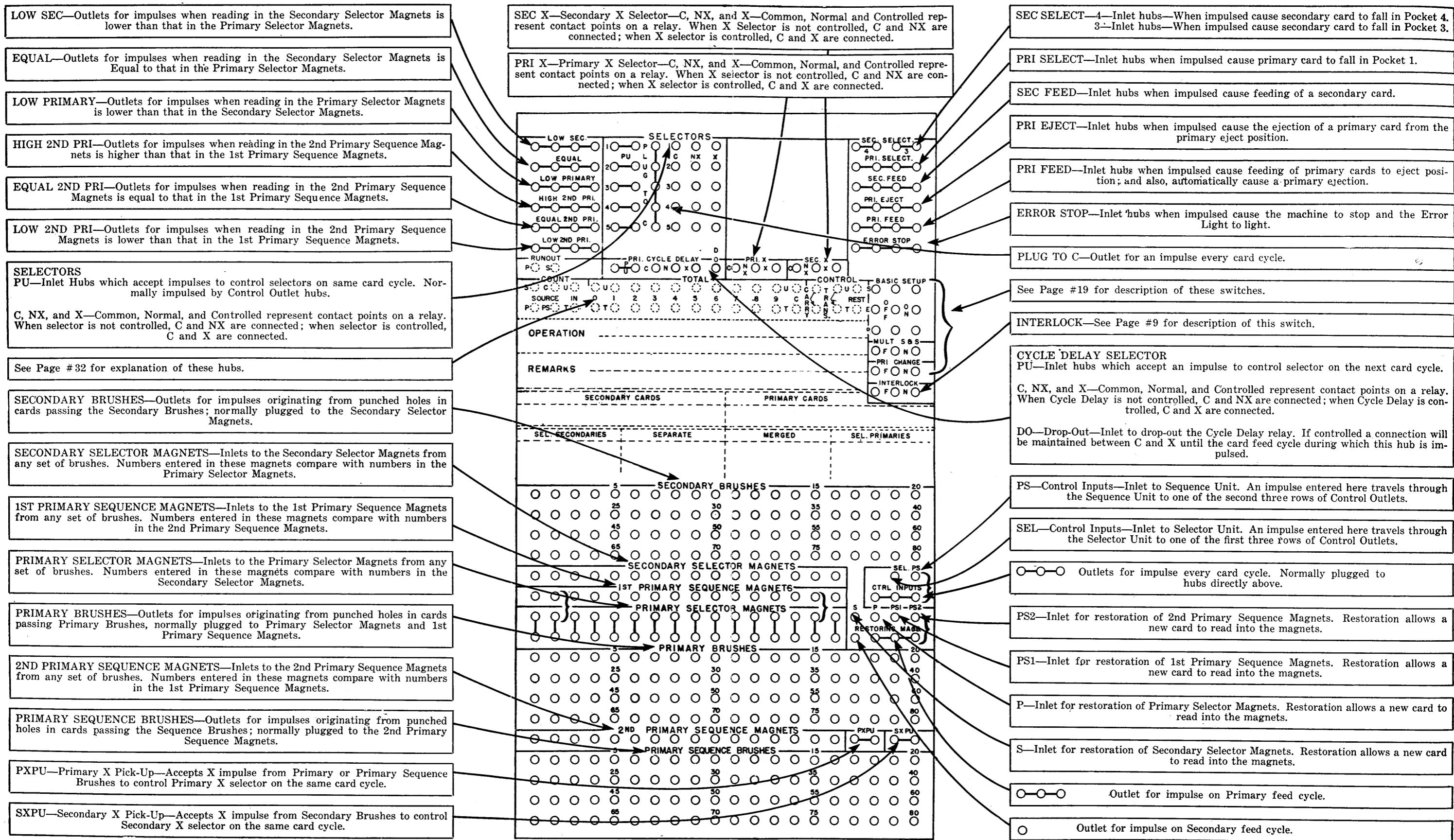Result: High 2nd Primary (Same as Low 1st Primary)

LOW SEC—Outlets for impulses when reading in the Secondary Selector Magnets is lower than that in the Primary Selector Magnets.

EQUAL—Outlets for impulses when reading in the Secondary Selector Magnets is Equal to that in the Primary Selector Magnets.

LOW PRIMARY—Outlets for impulses when reading in the Primary Selector Magnets is lower than that in the Secondary Selector Magnets.

HIGH 2ND PRI—Outlets for impulses when reading in the 2nd Primary Sequence Magnets is higher than that in the 1st Primary Sequence Magnets.

EQUAL 2ND PRI—Outlets for impulses when reading in the 2nd Primary Sequence Magnets is equal to that in the 1st Primary Sequence Magnets.

LOW 2ND PRI—Outlets for impulses when reading in the 2nd Primary Sequence Magnets is lower than that in the 1st Primary Sequence Magnets.

SELECTORS
PU—Inlet Hubs which accept impulses to control selectors on same card cycle. Normally impulsed by Control Outlet hubs.

C, NX, and X—Common, Normal, and Controlled represent contact points on a relay. When selector is not controlled, C and NX are connected; when selector is controlled, C and X are connected.

See Page #32 for explanation of these hubs.

SECONDARY BRUSHES—Outlets for impulses originating from punched holes in cards passing the Secondary Brushes; normally plugged to the Secondary Selector Magnets.

SECONDARY SELECTOR MAGNETS—Inlets to the Secondary Selector Magnets from any set of brushes. Numbers entered in these magnets compare with numbers in the Primary Selector Magnets.

1ST PRIMARY SEQUENCE MAGNETS—Inlets to the 1st Primary Sequence Magnets from any set of brushes. Numbers entered in these magnets compare with numbers in the 2nd Primary Sequence Magnets.

PRIMARY SELECTOR MAGNETS—Inlets to the Primary Selector Magnets from any set of brushes. Numbers entered in these magnets compare with numbers in the Secondary Selector Magnets.

PRIMARY BRUSHES—Outlets for impulses originating from punched holes in cards passing Primary Brushes, normally plugged to Primary Selector Magnets and 1st Primary Sequence Magnets.

2ND PRIMARY SEQUENCE MAGNETS—Inlets to the 2nd Primary Sequence Magnets from any set of brushes. Numbers entered in these magnets compare with numbers in the 1st Primary Sequence Magnets.

PRIMARY SEQUENCE BRUSHES—Outlets for impulses originating from punched holes in cards passing the Sequence Brushes; normally plugged to the 2nd Primary Sequence Magnets.

PXPU—Primary X Pick-Up—Accepts X impulse from Primary or Primary Sequence Brushes to control Primary X selector on the same card cycle.

SXPU—Secondary X Pick-Up—Accepts X impulse from Secondary Brushes to control Secondary X selector on the same card cycle.

SEC X—Secondary X Selector—C, NX, and X—Common, Normal and Controlled represent contact points on a relay. When X Selector is not controlled, C and NX are connected; when X selector is controlled, C and X are connected.

PRI X—Primary X Selector—C, NX, and X—Common, Normal, and Controlled represent contact points on a relay. When X selector is not controlled, C and NX are connected; when X selector is controlled, C and X are connected.

SEC SELECT—4—Inlet hubs—When impulsed cause secondary card to fall in Pocket 4.
3—Inlet hubs—When impulsed cause secondary card to fall in Pocket 3.

PRI SELECT—Inlet hubs when impulsed cause primary card to fall in Pocket 1.

SEC FEED—Inlet hubs when impulsed cause feeding of a secondary card.

PRI EJECT—Inlet hubs when impulsed cause the ejection of a primary card from the primary eject position.

PRI FEED—Inlet hubs when impulsed cause feeding of primary cards to eject position; and also, automatically cause a primary ejection.

ERROR STOP—Inlet hubs when impulsed cause the machine to stop and the Error Light to light.

PLUG TO C—Outlet for an impulse every card cycle.

See Page #19 for description of these switches.

INTERLOCK—See Page #9 for description of this switch.

CYCLE DELAY SELECTOR
PU—Inlet hubs which accept an impulse to control selector on the next card cycle.

C, NX, and X—Common, Normal, and Controlled represent contact points on a relay. When Cycle Delay is not controlled, C and NX are connected; when Cycle Delay is controlled, C and X are connected.

DO—Drop-Out—Inlet to drop-out the Cycle Delay relay. If controlled a connection will be maintained between C and X until the card feed cycle during which this hub is impulsed.

PS—Control Inputs—Inlet to Sequence Unit. An impulse entered here travels through the Sequence Unit to one of the second three rows of Control Outlets.

SEL—Control Inputs—Inlet to Selector Unit. An impulse entered here travels through the Selector Unit to one of the first three rows of Control Outlets.

O—O—O Outlets for impulse every card cycle. Normally plugged to hubs directly above.

PS2—Inlet for restoration of 2nd Primary Sequence Magnets. Restoration allows a new card to read into the magnets.

PS1—Inlet for restoration of 1st Primary Sequence Magnets. Restoration allows a new card to read into the magnets.

P—Inlet for restoration of Primary Selector Magnets. Restoration allows a new card to read into the magnets.

S—Inlet for restoration of Secondary Selector Magnets. Restoration allows a new card to read into the magnets.

O—O—O Outlet for impulse on Primary feed cycle.

O Outlet for impulse on Secondary feed cycle.

Figure 6

The 2nd Primary Sequence reading can be equal to the 1st Primary Sequence.

    Example: 104—1st Primary Sequence
                104—2nd Primary Sequence
    Result: Equal 2nd Primary (Same as Equal 1st Primary)

The 2nd Primary Sequence reading can be lower than the 1st Primary Sequence.

    Example: 106—1st Primary Sequence
                105—2nd Primary Sequence
    Result: Low 2nd Primary (Same as High 1st Primary)

Restoring Magnets

In order to have a new reading enter the Selector or Sequence magnets as each card passes the brushes, the magnets must be restored. This operation is similar in principle to counter add impulsing and counter clearing on an Alphabetical Accounting Machine, in which case the Class of Total impulse resets the counter to zero and the "Plug to C" allows a new card to read or add into the counter. On the Collator both of these operations are controlled by plugging the Restoring Magnets.

There is an inlet hub for restoring each set of magnets: S (Secondary Selector); P (Primary Selector); PS1 (1st Primary Sequence); PS2 (2nd Primary Sequence). When these hubs are impulsed, the respective magnets will be restored. Below the inlet hubs are three common hubs which emit impulses whenever there is a primary feed cycle. There is one single hub which emits an impulse whenever there is a secondary feed cycle. If the comparing magnets are to read each card in the primary unit, a primary feed impulse will be connected to the restoring magnet inlet hub. To restore comparing magnets for a secondary reading, the restoring magnet inlet hub will be connected to the secondary feed outlet hub.

Control Input Hubs

A comparison in the Sequence or Selector Magnets will result in any one of three conditions. In order to have the result of these comparisons available in the form of impulses on the control panel—i.e., Low Secondary, Equal, or Low Primary from the Selector Unit, and High 2nd Primary, Equal 2nd Primary, or Low 2nd Primary from the Sequence Unit—the Con-
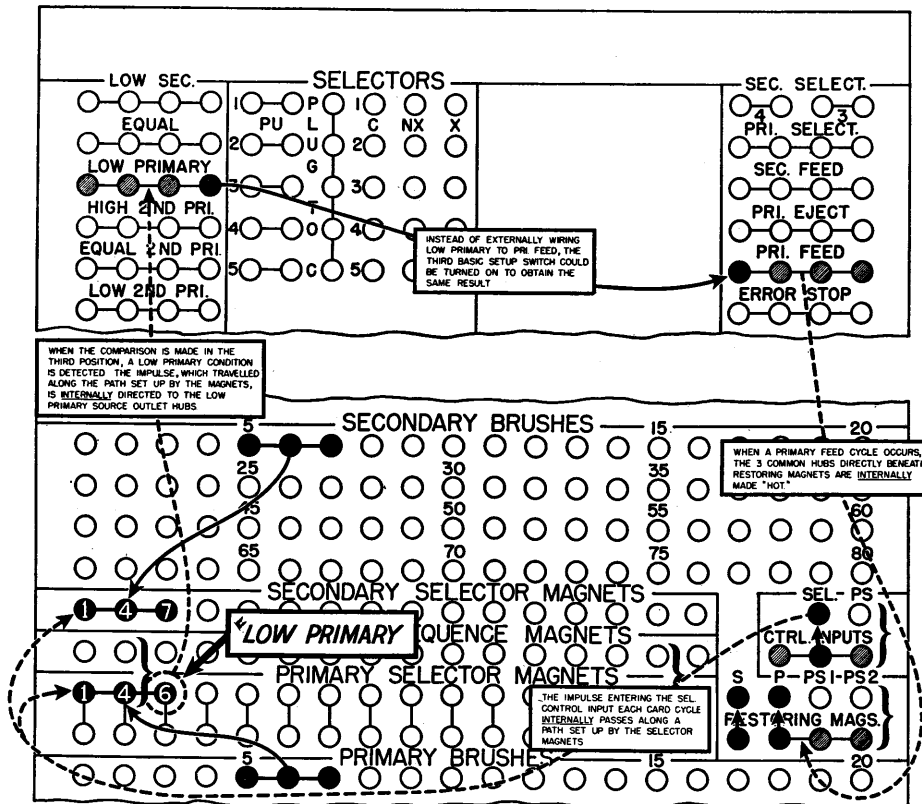
Figure 7

trol Input hubs must be plugged. There is a Control Input hub for the Selector Unit (Sel) and one for the Sequence Unit (PS).

When an impulse enters the Selector Control Input hub (Sel), it travels along a path set up by the Selector Magnets. The comparison made in the magnets directs the impulse internally to one of the Selector Control Outlet hubs labelled Low Secondary, Equal, or Low Primary (Fig. 7).

When an impulse enters the Sequence Control Input hub (PS), it travels along a path set up by the Sequence Magnets. The comparison in the magnets directs the impulse internally to one of the Sequence Control Outlet hubs labelled High 2nd Primary, Equal 2nd Primary, or Low 2nd Primary. The source of the impulses which are directed into the Control Input hubs (Sel, PS) is the row of three common hubs located directly beneath the Input hubs.

Control Outlet Hubs

If the Control Input hubs are plugged, impulses indicating the result of the comparisons in the magnets are available at the Control Outlet hubs. The six rows of Control Outlet hubs are on the upper left hand corner of the plug-board.

(1) The Low Secondary Hubs emit impulses when the reading in the Secondary Selector Magnets is lower than that in the Primary Selector Magnets.

(2) The Equal Hubs emit impulses when the readings in the Selector Magnets are equal.

(3) The Low Primary Hubs emit impulses when the reading in the Primary Selector Magnets is lower than that in the Secondary Selector Magnets.

(4) The High 2nd Primary outlet hubs emit impulses when the reading the 2nd Primary Sequence Magnets is higher than that in the 1st Primary Sequence Magnets.

(5) The Equal 2nd Primary outlet hubs emit impulses when the readings in the 1st and 2nd Primary Sequence Magnets are equal.

(6) The Low 2nd Primary outlet hubs emit impulses when the reading in the 2nd Primary Sequence Magnets is lower than that in the 1st Primary Sequence Magnets.

The Control Outlet hubs are used to direct the feeding, ejecting, and selection of cards.

Functional Inlet Hubs

On the upper right hand corner of the control panel, there are six rows of hubs which are re-

ferred to as functional inlets. These hubs control the feeding, ejecting, and selection of cards and are impulsed by the Control Outlet Hubs, or by a "Plug to C" controlled by a Selector.

(1) **Selection Control** — All cards, primary and secondary, will fall in Pocket 2 unless Pockets 1, 3 or 4 are plugged for selection.

Secondary Select 3—When these inlet hubs are impulsed, a secondary card will enter Pocket 3.

Secondary Select 4—When these hubs are impulsed, a secondary card will enter Pocket 4. If both Secondary Select 3 and 4 hubs are impulsed at the same time, a secondary card will enter Pocket 4.

Primary Select—When these hubs are impulsed, a Primary card will enter Pocket 1.

(2) **Feed and Eject Control**

Secondary Feed—These hubs, when impulsed, cause the feeding and ejection of secondary cards.

Primary Feed—These hubs, when impulsed, cause the feeding of primary cards.

Primary Eject—These hubs, when impulsed, cause the ejection of primary cards. On machines shipped after May 15, 1939, an impulse for a primary feed automatically causes a primary ejection. A primary ejection may occur, however, without a primary feed.

(3) **Error Stop**—When impulsed, causes the machine to stop and lights the Error Light. Error Stop should be impulsed from a Control Outlet, never from a "Plug to C."

Selectors

There are five selectors, each consisting of a Pick-up hub, and C, NX, and X hubs. The C hub is normally connected internally to the NX hub; therefore, an impulse entered in the C hub will come out of the NX hub. As long as no impulse enters the Pick-up hub of the selector, this connection between C and NX will exist. The Pick-up hub can be impulsed by a Control Outlet hub such as Low Sec, Equal, etc. When the Pick-up hub is impulsed, the normal connection between C and NX is broken. Under this condition, the selector is said to be "picked-up" or controlled. When the selector is controlled, the C hubs are connected internally to the X hubs and an impulse taken into C can come out of X.

X Selectors

There are two X Selectors (Pri X and Sec X), each consisting of a Pick-up hub and C, NX and X hubs. The C hub is normally connected internally to the NX hub; therefore, an impulse entered in the C hub will come out of the NX hub. When the Pick-up hub is impulsed, the normal connection between C and NX is broken. The Selector is then controlled, and the C hub is connected internally to the X hub. If an impulse is taken into the C hub at this time, it will come out of the X hub. The Pick-ups of these two Selectors are associated with the two feeds. The Primary X Selector can be controlled only from an X punched primary card; the Pick-up hub for this Selector is PXPU, which is wired from either the Primary Brushes or Primary Sequence Brushes. The Secondary X Selector can be controlled only from an X punched secondary card; the Pick-up hub for this Selector is labelled SXPU, which is wired from the Secondary Brushes.

Basic Setup Switches

The functions of these switches are explained on page 19.

Interlock Switch

On machines with serial numbers lower than 077-10884 AA, this Switch controlled the Secondary Feed Unit and was labelled Sec. Unit on some plugboards. On these machines this switch should be plugged ON when using both Feed Units. This stops all feeding of cards when the last card leaves the Secondary Feed Hopper. When using the Primary Feed Unit alone, this switch should be plugged OFF.

On machines with serial number 077-10884 AA and above, the machine will automatically stop feeding after the last card has left either of the Feed Hoppers, regardless of the setting of this switch. The Interlock Switch on these machines controls the selection of cards when the last cards are being run out of the Feed Hoppers into the Pockets on Basic Setup operations. When using a Basic Setup operation this switch must be plugged ON. On all single feed operations this switch must be plugged OFF.

MERGING TWO GROUPS OF UNPUNCHED CARDS

Function

A simple operation on the Collator is the merging of two groups of unpunched cards such as cards of different color; the two groups are to be combined into a new set consisting of a

card of one group, a card of the second group, etc. Because this merging operation is not based on information punched in the cards, there is nothing to be compared.

Plugging—Figure 8

The only plugging necessary is for the control of the feeding and ejecting of the cards. If the Primary Feed Unit is directed to feed and eject a card each card cycle and the Secondary Feed Unit to feed a card (at the same time it automatically ejects a card) each card cycle, a card from each unit will fall in Pocket 2. The first secondary card will be filed ahead of the first primary card giving the sequence of secondary, primary, secondary, etc.

Primary cards are normally filed ahead of equal secondary cards when the operation of the Primary Feed Unit and the Secondary Feed Unit is controlled by the comparisons sensed by the comparing magnets. However, in this specific application of merging two groups of unpunched cards, the feed units are operating continuously. Since the Primary Feed Unit contains one more card station than the Secondary Feed Unit, the first secondary card will be ejected into the pocket ahead of the first primary card.

In order to have a primary feed and eject and a secondary feed each card cycle, the inlet hubs for these controls must be impulsed by one of the 5 common "Plug to C" hubs, which emit impulses every card cycle.
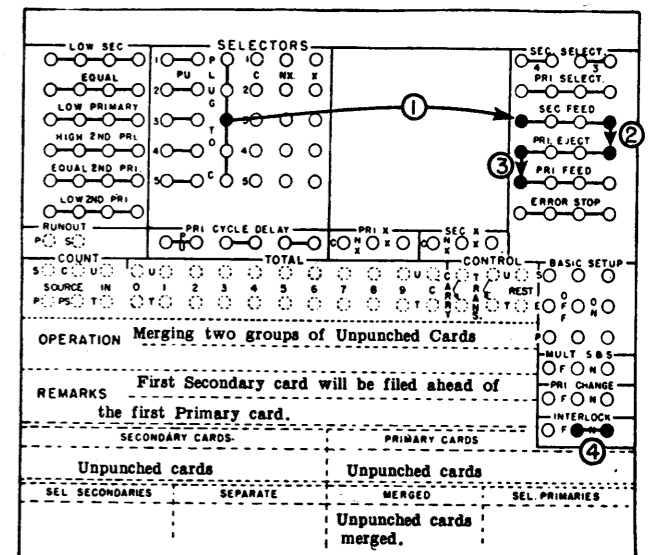

Figure 8

(1) *Secondary Feed every cycle.*
(2) *Primary Eject every cycle.*
(3) *Primary Feed every cycle.*
(4) *Both Feeds used; Interlock switch ON.*

CHECKING SEQUENCE

Function

The sequence of a set of cards can be checked to insure that no card is out of order. The two sets of brushes in the Primary Feed Unit make it possible to compare each card in the set with the card succeeding it. As indicated in the following illustration, a card out of sequence is detected by the fact that it is lower than the card preceding it.

121   122   122   123   125   124   126   127

Plugging—Figure 10

The first step in plugging is to connect the Primary Brushes to the 1st Primary Sequence Magnets and the Primary Sequence Brushes to the 2nd Primary Sequence Magnets. Any positions of the Primary Sequence Magnets can be used, since the control units compare two numbers by testing the 16 comparing positions suc-

cessively from left to right (Figure 9). The first position found to be unequal determines which of the two numbers is lower. If the controlling is to be done on the basis of more than one control field, the major or intermediate fields must be plugged to the left of the minor field.
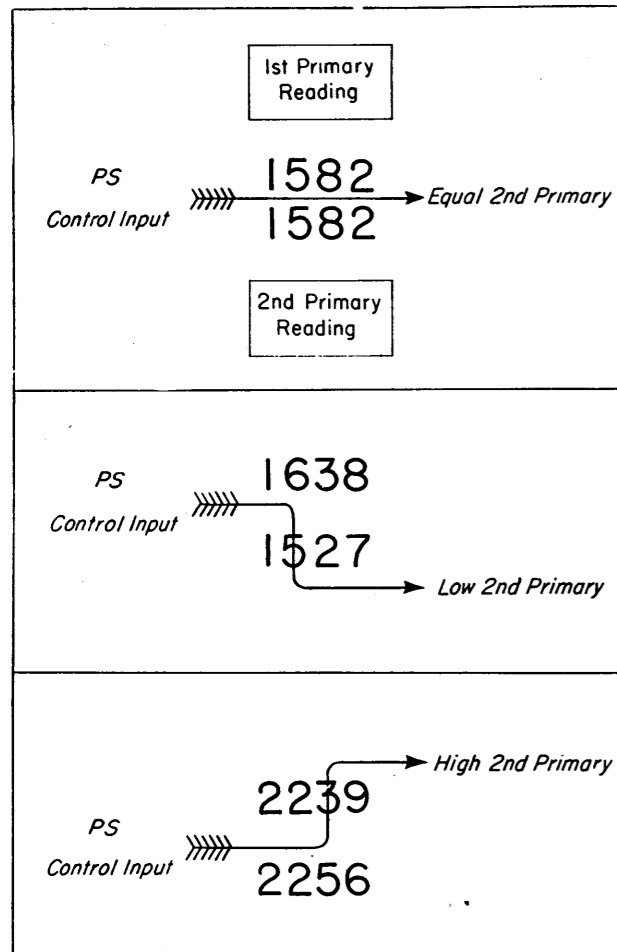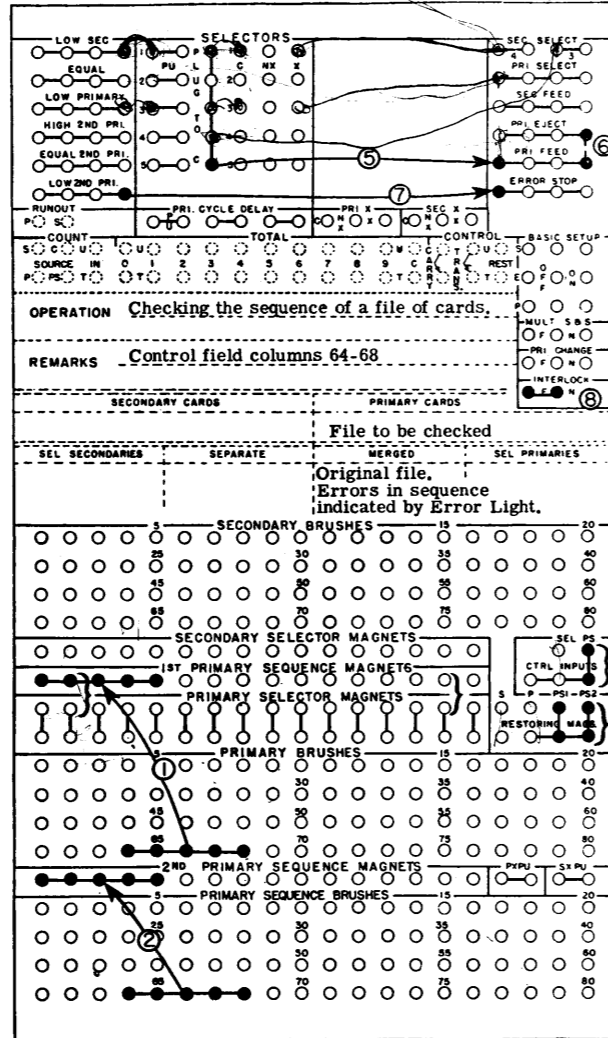
Figure 10

(1) *Primary Brushes connected to 1st Primary Sequence Magnets.*
(2) *Primary Sequence Brushes connected to 2nd Primary Sequence Magnets.*
(3) *Sequence Magnets (PS1 and PS2) restored on the Primary Feed Cycle.*
(4) *Sequence control input impulsed.*
(5) *Primary Feed every cycle.*
(6) *Primary Eject every cycle. (Not necessary on machines after May 15, 1939.)*
(7) *Machine stops and Error Light lights when an error in sequence occurs.*
(8) *Interlock Switch OFF; single feed operation.*

Figure 9

The Restoring Magnet hubs for each side of the Sequence Unit, PS1 and PS2, must be impulsed in order to have each card read into the Magnets. To have the Sequence Control Outlet hubs function, the Control Input for the Sequence Unit (PS) must be impulsed.

With the Primary Brushes connected to the 1st Primary Sequence Magnets and the Primary Sequence Brushes connected to the 2nd Primary Sequence Magnets, a result of Low 2nd Primary will indicate a card out of sequence. Therefore, a Low 2nd Primary Control Outlet impulse is connected to the Error Stop hub. These hubs when impulsed will cause the machine to stop and the Error Light to light.

Since the cards to be checked are placed in the Primary Feed Unit, a constant movement of primary cards through the machine is desired; that is, the feeding and ejecting of cards should be continuous. To obtain this action, a "Plug to C" impulse is plugged to the Primary Feed and Primary Eject Inlet hubs.

If an error in the sequence of the cards is detected, the Error Light will light and the machine will stop. In order to locate the error card, the operator should remove cards from the feed hopper and stacker, depress the Error Reset Key to turn off the Error Light, and depress the Run Out Key to move the cards remaining the the machine to the stacker. The error card will be one or both of the last 2 cards ejected to the stacker.

It should be noted here that the Error Stop does not indicate the specific card or cards out of sequence. The machine detects the error in sequence on the basis of the recognition of a "step down" in the sequence. The operator must check to determine the card or cards out of order.

The following illustrations show that the machine indicates only the presence of the "step down" condition.
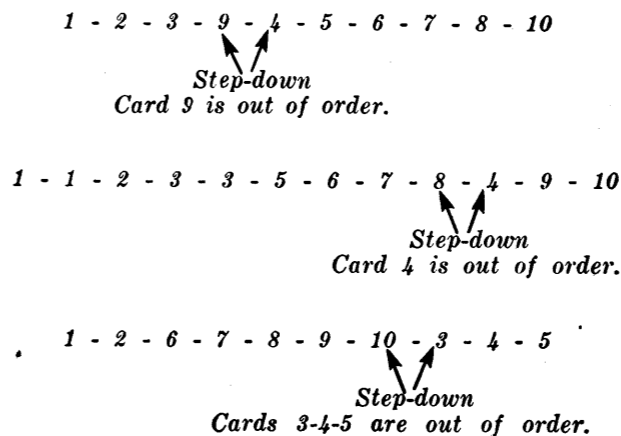
1 - 2 - 3 - 9 - 4 - 5 - 6 - 7 - 8 - 10
Step-down
Card 9 is out of order.

1 - 1 - 2 - 3 - 3 - 5 - 6 - 7 - 8 - 4 - 9 - 10
Step-down
Card 4 is out of order.

1 - 2 - 6 - 7 - 8 - 9 - 10 - 3 - 4 - 5
Step-down
Cards 3-4-5 are out of order.

CHECKING SEQUENCE WITH INSERTION OF TAB-INDEX CARDS

Function

When checking sequence it is possible to insert a tab-index card each time a step-down in sequence occurs. This operation is sometimes used in place of the Error Stop feature; instead of stopping the machine, an error causes an index card to be inserted while the machine remains in continuous operation.

Plugging—Figure 11

The tab-index cards are placed in the Secondary Feed Hopper, and the cards to be checked

Figure 11

(1) *Secondary Feed on a Low 2nd Primary condition (card out of sequence). This will insert a tab index card.*
(2) *Both feeds used—Interlock switch ON.*

for sequence are placed in the Primary Feed Hopper. The plugging of the Brushes, Comparing Magnets, Restoring Magnets, Control Inputs and Primary Feed and Eject hubs is identical to that for the normal operation of checking sequence. A Low 2nd Primary impulse is connected to a Secondary Feed Inlet rather than to the Error Stop. This will cause a secondary card to feed whenever an error in sequence is noted, thereby inserting the tab-index card immediately preceding the "low" card.

INSERTION OF CARD BEHIND EACH CONTROL GROUP

Function

An operation quite similar to the one described above is that of inserting a blank card behind each control group in a file of cards. The blank cards to be inserted are placed in the Secondary Feed Hopper, and the punched cards are placed in the Primary Feed Hopper. The end of a control group is noted by a High 2nd Primary condition and a secondary card is ejected behind the last card of each group.

101 101 Sec. 102 102 Sec. 103 Sec. 104

Plugging—Figure 12

The plugging of the Brushes, Comparing Magnets, Restoring Magnets, Control Inputs, Primary Feed and Eject is identical to that described for the previous operation. In addition, the Secondary Feed is impulsed on a High 2nd Primary impulse, and a secondary card will fall behind the last primary card of each control group.

MERGING

Function

In order to file together or merge two sets of cards both the Primary and the Secondary Feed units must be used. As the Primary Unit is under the Secondary Unit, primary cards of a given control number are filed ahead of secondary cards with the same control number. If name cards are to be merged in front of payroll summary cards, the name cards will be placed in the Primary Feed Hopper and the summary cards in the Secondary Feed.

Plugging

To compare the control fields in the two sets of cards, the Primary Brushes representing the

control field punched in the primary cards are connected to the Primary Selector Magnets; the Secondary Brushes representing the control field punched in the secondary cards are connected to the Secondary Selector Magnets.

The Selector Magnets must be restored; the Secondary on a secondary feed cycle, and the Primary on a primary feed cycle. The Control Input for the Selector Magnets also must be impulsed. The Interlock Switch must be plugged ON.

The next step in the plugging concerns the feeding and ejecting of cards which varies
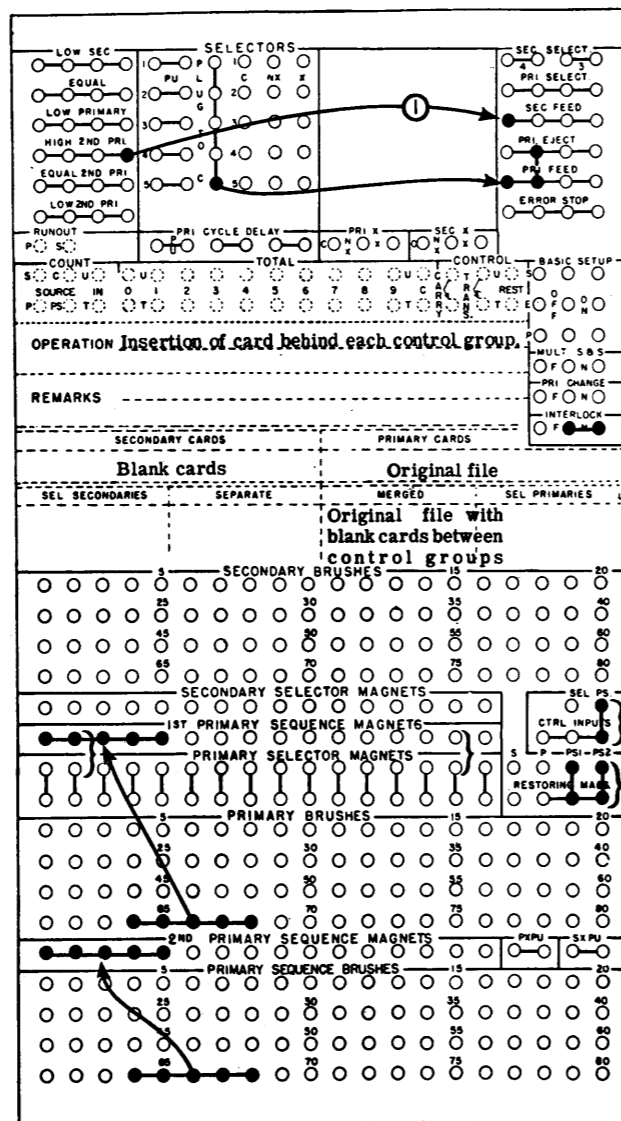
Figure 12

(1) High 2nd Primary indicates a new control group. Secondary Feed operates to insert blank card between control groups.

according to the file involved in the operation; that is, whether the file contains single or multiple card groups. In order that the control of the feeding and ejecting of cards may be thoroughly understood, three operations are analyzed, each presenting different conditions. The results of the analyses are then summarized and the plugging for feeding and ejecting explained.
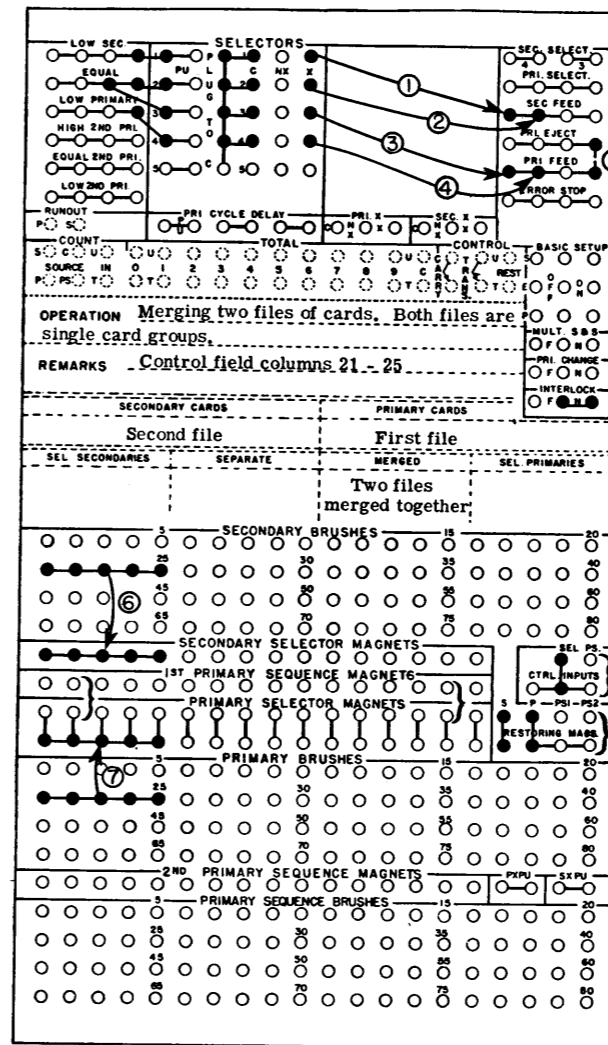

Figure 13

(1) Secondary Feed on Low Secondary.
(2) Secondary Feed on Equal.
(3) Primary Feed on Equal.
(4) Primary Feed on Low Primary.
(5) Primary Eject on Equal and Low Primary. (Not necessary on machines after May 15, 1939.)
(6) Secondary Selector Magnets plugged from Secondary Brushes.
(7) Primary Selector Magnets plugged from Primary Brushes.

Operation 1:

Merging with Single Card Groups. The control numbers punched on the cards are indicated in Figure 14, and the desired sequence of the merged group is shown in Pocket 2.

When the Start Key is depressed the Primary Feed Unit will feed three cards, and the Secondary Feed Unit will feed two cards. While the Primary Feed Unit is feeding the third card, the Secondary Feed Unit is stationary. During this initial feeding operation the first primary card will be read by the Primary Brushes, and the first secondary card will be read by the Secondary Brushes. The cards are then compared and the subsequent operation of the Feed Units will be under the control of the comparisons recognized and the control panel setup involved.

The chart of analysis explains the result of the comparisons and the movement of the cards.

A summary of the chart indicates that the feeding and ejecting for this operation is as follows:

Sec Feed on a Low Secondary, or an Equal
Pri Feed on a Low Primary, or an Equal
Pri Eject on a Low Primary, or an Equal

The plugging to achieve this feeding and ejecting of cards is shown in Figure 13. Instead of plugging the Control Outlets directly to the Functional Inlets for feeding and ejecting, the outlets are plugged through selectors. For in this operation, if an Equal impulse is connected directly to both a Sec Feed and a Pri Feed, and a Low Primary impulse is connected directly to Pri Feed, the Low Primary impulse which enters Pri Feed travels from there back to the Equal Outlet hubs, and from there to Sec Feed. To eliminate this condition, selectors must be used.

The five "Plug to C" hubs emit impulses each card cycle. If a "Plug to C" impulse is brought into the C hub of a selector, and if the selector is controlled on a Low Secondary condition, an impulse will come out of the X hub each time a Low Secondary condition occurs.

Operation 2:

Merging with single primary card groups and single or multiple secondary card groups. Multiple implies more than one card for a control group.

As seen in the analysis of Operation 2 (see Figure 15), although multiple secondary card

groups are involved, the feeding and ejecting conditions are identical to those in Operation 1:

Sec Feed on a Low Secondary, or an Equal
Pri Feed on a Low Primary, or an Equal
Pri Eject on a Low Primary, or an Equal

The plugging for this operation would be identical to that shown for Operation 1.

Operation 3:

Merging with single or multiple primary and secondary card groups. All of the primary cards of one control group must be filed ahead of the secondary cards of the same group.

The first analysis of Operation 3 (Figure 16) indicates that merging with multiple primary card groups requires feeding and ejecting conditions which are different from those of either Operation 1 or 2:

Sec Feed on Low Secondary
Pri Feed on Low Primary, or an Equal
Pri Eject on Low Primary, or an Equal

The plugging for this is shown in Figure 17.
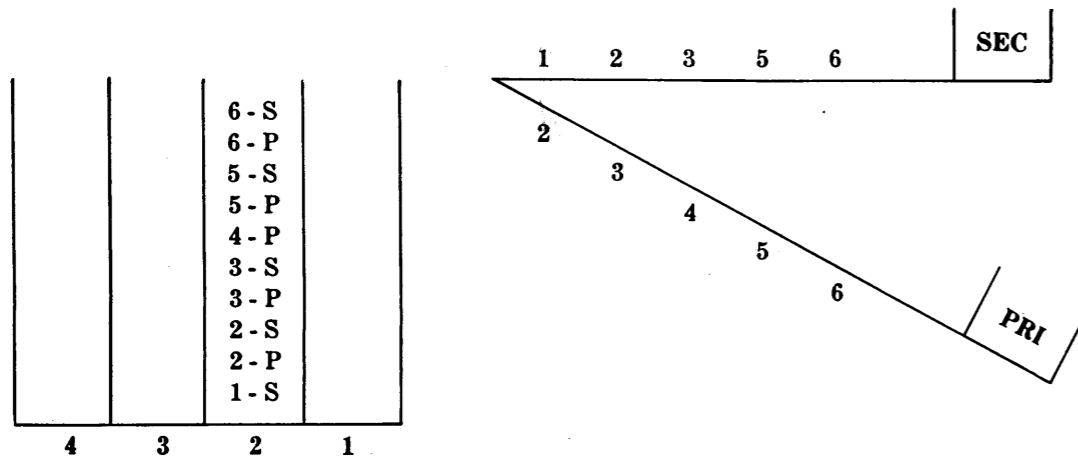
Cards	Comparison	Result	Card Movement		
			Sec Feed	Pri Feed	Pri Eject
Sec 1 / Pri 2	Low Sec	The Secondary feed should be operated to move the first Secondary card to pocket 2 and feed another Secondary card to the brushes.	✓		
Sec 2 / Pri 2	Equal	Both Primary and Secondary cards should be stacked. The Primary will go ahead of the Secondary. Another Pri and Sec should feed in.	✓	✓	✓
Sec 3 / Pri 3	Equal	Same as above - Equal.	✓	✓	✓
Sec 5 / Pri 4	Low Pri	Primary card should be ejected and another fed in.		✓	✓
Sec 5 / Pri 5	Equal	Same as above - Equal.	✓	✓	✓

Figure 14

The disadvantage of this approach is that when there are multiple primary cards, an equal secondary card is not stacked with the last equal primary card. The first equal secondary card instead is stacked on the next card cycle, thus requiring an additional machine cycle. This extra machine cycle can be eliminated by using the Sequence Unit Magnets in the merging operation. In this case, the Sequence Unit is used not only to check the sequence of the primary cards, but also to determine a change in the primary control groups. It thereby becomes possible to stack the first secondary card with the last primary of the same control group. This will result in a faster collating speed. In using the Sequence Unit to determine when the last card of a primary group is being ejected, only two conditions have to be noted; an equal reading (Equal 2nd Primary) in the Sequence Unit indicates that there are more cards of the same control group in the primary feed, while an unequal reading (High or Low 2nd Primary) sig-
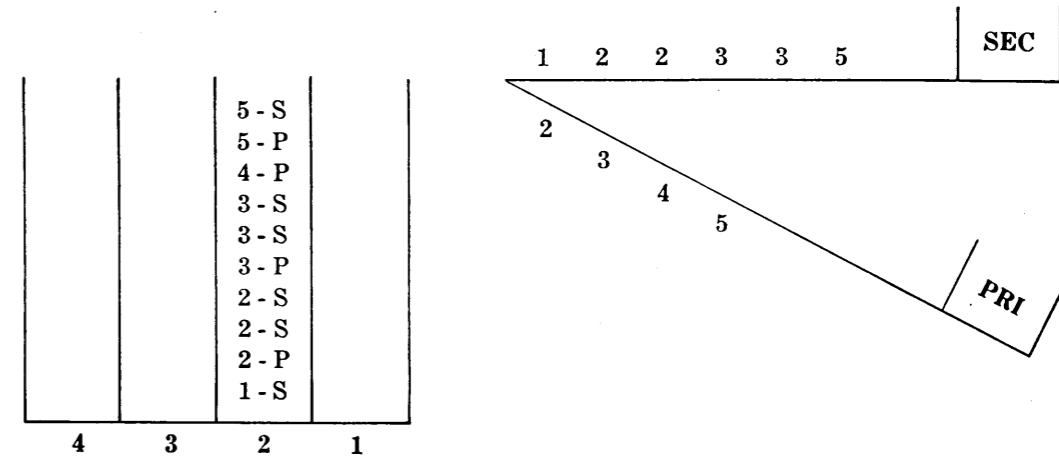
Cards	Comparison	Result	Card Movement		
			Sec Feed	Pri Feed	Pri Eject
Sec 1 / Pri 2	Low Sec	Secondary feed should operate to remove first Secondary card and feed another.	✓		
Sec 2 / Pri 2	Equal	Both Secondary and Primary cards stacked; Secondary and Primary cards feed.	✓	✓	✓
Sec 2 / Pri 3	Low Sec	Secondary Feed.	✓		
Sec 3 / Pri 3	Equal	Secondary Feed and Primary Feed and Eject.	✓	✓	✓
Sec 3 / Pri 4	Low Sec	Secondary Feed.	✓		
Sec 5 / Pri 4	Low Pri	Primary Feed and Eject.		✓	✓

Figure 15

nals that the last card of the primary group will be ejected on the next cycle. At this time, if the primary and secondary cards are equal, they may be ejected together.

An analysis of this second approach to Operation 3 is seen in Figure 18:

Secondary Feed on Low Secondary regardless of the reading in the Sequence Unit; or an Equal Selector reading together with an Unequal Sequence reading.
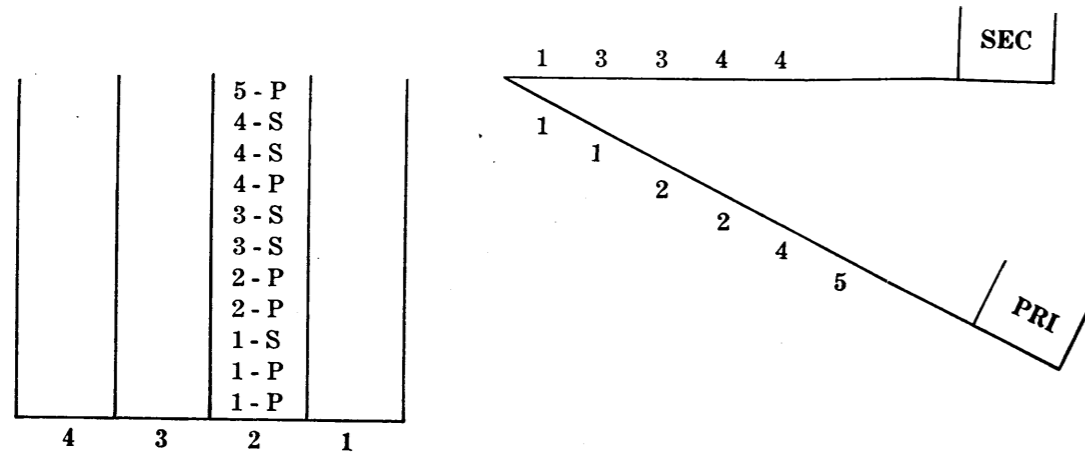
Primary Feed on an Equal or Low Primary reading regardless of the Sequence reading.

Primary Eject on an Equal or Low Primary reading regardless of the Sequence reading.

The plugging is shown in Figure 19.

Summarization of Operations 1, 2, 3

Three operations of merging have been presented: (1) with single card groups, (2) with

Cards	Comparison	Result	Card Movement		
			Sec Feed	Pri Feed	Pri Eject
Sec 1 ← Pri 1	Equal	All primary cards of a control group must be filed ahead of the secondary cards of the same control group; therefore, on an equal condition only primary feed and eject should take place.		✓	✓
Sec 1 Pri 1	Equal	Same as above - Primary feed and eject.		✓	✓
Sec 1 ↙ Pri 2	Low Sec	Secondary Feed.	✓		
Sec 3 ← Pri 2	Low Pri	Primary Feed and Eject.		✓	✓
Sec 3 ← Pri 2	Low Pri	Primary Feed and Eject.		✓	✓
Sec 3 ↙ Pri 4	Low Sec	Secondary Feed.	✓		

Figure 16

single primary card groups and single or multiple secondary card groups, and (3) with single or multiple primary and secondary card groups. The general conclusion which can be drawn from these analyses is that for any basic merging operation (no selection of cards) with single or multiple card groups, the control of feeding and ejecting of cards established in the second approach to Operation 3 is most satisfactory. It is

applicable to the conditions presented in Operations 1 and 2 as well as 3.

In addition to the plugging shown (Figure 19), the Primary Sequence Magnets and the Restoring Magnets and Control Input for the Sequence Unit must be plugged.
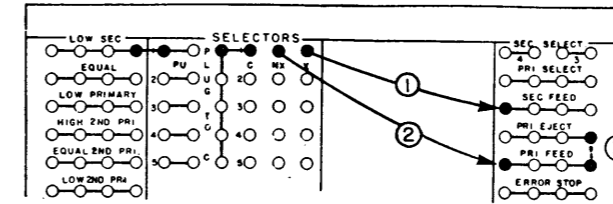
Figure 17

(1) *Secondary Feed on Low Secondary.*
(2) *Primary Feed on Low Primary or Equal.*
(3) *Primary Eject on Low Primary or Equal. (Not necessary on machines after May 15, 1939.)*
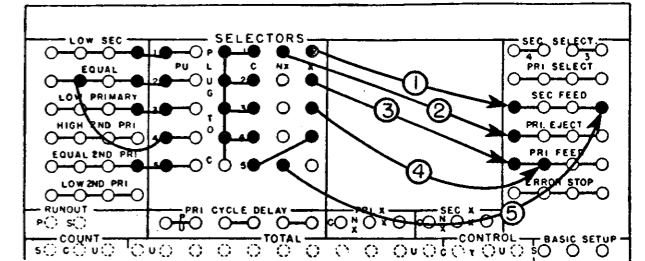
Figure 19

(1) *Secondary Feed on Low Secondary.*
(2) *Primary Eject on Low Primary or Equal.*
(3) *Primary Feed on Equal.*
(4) *Primary Feed on Low Primary.*
(5) *Secondary Feed on Equal reading in Selector Unit together with an unequal (High or Low 2nd Primary) reading in the Sequence Unit.*

Cards Compared			Comparison		Result	Card Movement		
Sel Unit	Seq Unit		Selector	Sequence		Sec Feed	Pri Feed	Pri Eject
	1st PS	2d PS						
Sec 1 ↖ Pri 1	1	1	Equal	Equal	Equal indicates Primary Feed and Eject; because of Equal Sequence reading, indicating a multiple card group, the secondary should remain stationary.		✓	✓
Sec 1 ← Pri 1	1	2	Equal	Unequal	Equal indicates Primary Feed and Eject; Unequal indicates last card of primary group, therefore, equal secondary card can move at same time as primary card.	✓	✓	✓
Sec 3 ← Pri 2	2	2	Low Pri	Equal	Low Primary, Primary Feed and Eject.		✓	✓
Sec 3 ← Pri 2	2	4	Low Pri	Unequal	Low Primary, Primary Feed and Eject.		✓	✓
Sec 3 ← Pri 4	4	5	Low Sec	Unequal	Low Secondary, Secondary Feed.	✓		

Figure 18

MERGING WITH SELECTION

Function

It is often necessary to select cards from a file during the merging operation. For example, if Payroll Earnings cards are to be merged behind Name cards preparatory to the running of Payroll Checks or a Register, it is necessary that for each Name card there be a Payroll card, and for each Payroll card, a corresponding Name card. In the following sample of cards, Payroll card 152 should be selected because it has no corresponding Name card, and Name card 154 should

151 152 153 155 156 Payroll—(Secondary)
151 153 154 155 156 Name—(Primary)

be selected because it has no corresponding Payroll card. An unmatched primary card is indicated when a Low Primary Control Outlet impulse is available. An unmatched secondary card is indicated when a Low Secondary Control Outlet impulse is available.

Plugging

The selection of the primary cards can be made by wiring from Low Pri to Pri Select. This will cause all unmatched primary cards to fall in Pocket 1. Selection of unmatched secondary cards is made by wiring Low Sec to Sec Select, either 3 or 4, which will cause these cards to fall in Pocket 3 or 4. Matched cards will be merged in Pocket 2.

The plugging for selection is added to the plugging for straight merging. *If, however, low secondary cards are selected AND the secondary card groups are multiple* (that is, more than one card for each control group), another change must be made in the plugging. In the normal operation of merging, the first card of a secondary group stacks along with the last primary card of the same control group. However, all the other secondary cards of the same control group are stacked as Low Secondaries. This is illustrated in the analysis in Figure 18. Therefore, if the machine were directed to select all Low Sec, not only would the unmatched secondaries be selected but also all but the first secondary card of a matched control group. To eliminate this condition, the Primary feed is prevented from feeding at the time the last card of the primary group and first card of the equal secondary group are simultaneously moved to Pocket 2. Because there is no Primary Feed, the reading in the Primary Selector Magnets and 1st and 2nd Primary Sequence Magnets will remain the same. All secondary cards of a control group will then compare with the reading from the last primary card of the same group and will

be stacked as equal secondaries. The only difference between this operation and that used for merging operations without selection, is that the Primary Feed does not operate on all Equal readings from the Selector Unit. (Wire No. 3, Figure 19.) The feeding of primary cards now takes place only on an Equal Selector reading together with an Equal Sequence reading. (Wire No. 1, Figure 20.)

The feeding and ejecting conditions in this operation are:

Secondary Feed on Low Secondary regardless of the reading in the Sequence Unit, or on Equal Selector Unit reading together with an unequal Sequence Unit reading.

Primary Feed on Low Primary regardless of the reading in the Sequence Unit, or on Equal Selector Unit reading together with an Equal Sequence Unit reading.

Primary Eject on an Equal or Low Primary reading regardless of the Sequence Unit reading.

The plugging for this operation is shown in Figure 20.

It will be noted here that this plugging is necessary only when merging and *selecting* low secondary cards, if the secondary card groups are *multiple* groups. To achieve maximum machine speed when selecting secondary cards which are all single card groups, the plugging would be the same as shown in Figure 19 for straight merging.
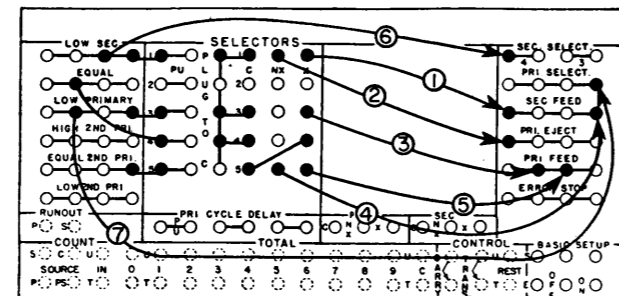

Figure 20

(1) *Secondary Feed on Low Secondary.*
(2) *Primary Eject on Low Primary or Equal.*
(3) *Primary Feed on Low Primary.*
(4) *Secondary Feed on Equal reading in Selector Unit together with an unequal (High or Low 2nd Primary) reading in the Sequence Unit.*
(5) *Primary Feed on Equal Selector Unit reading together with Equal Sequence Unit reading.*
(6) *Select all Low Secondary cards into Pocket 4.*
(7) *Select all Low Primary cards into Pocket 1.*

BASIC SET-UP SWITCHES

Because many operations on the Collator use these basic merging and selection setups, the external wiring of the feeding and selection has been eliminated by the substitution of switches. The Basic Setup Switches provided for this purpose facilitate the wiring for merging and selection operations.

The functions of the Basic Setup Switches are as follows: (See Figures 19 and 20.)

1. S—Secondary Feed Switch. When plugged ON, causes a Secondary Feed on a Low Secondary reading in the Selector Unit, thus performing the function of wire No. 1, Figures 19 and 20. When OFF, it has no action.

2. E—Primary Eject Switch. When plugged ON, causes a Primary Eject on an Equal or Low Primary in the Selector Unit, thus performing the function of wire No. 2, Figures 19 and 20. When OFF, it has no action.

3. P—Primary Feed Switch. When plugged ON, causes a Primary Feed on a Low Primary reading from the Selector Unit, thus performing the function of wire No. 4, Figure 19, and wire No. 3, Figure 20. When plugged OFF, it has no action.

4. Mult. S and S Switch—This is supplementary to the Primary Switch. When OFF, it causes the Primary Feed to operate on an Equal reading from the Selector Unit. When ON, the Primary Feed functions as indicated in No. 3 above.

5. Pri Change Switch—This is supplementary to the Primary and Secondary Switches.

   It supplements the Primary Switch as follows—when ON, it causes Primary feeding on an Equal reading from the Selector Unit together with an Equal reading from the Sequence Unit; when OFF, causes Primary feeding on an Equal reading from the Selector Unit regardless of the reading from the Sequence Unit.

   It supplements the Secondary Switch as follows—when ON, it causes Secondary feeding on an Equal reading from the Selector Unit together with an Unequal reading from the Sequence Unit; when OFF, the Secondary Feed functions as indicated in No. 1 above.

It is seen from the above analysis of the functions of the Basic Setup Switches that for all merging or matching operations performed on the Collator, Basic Setup Switches 1, 2, 3 and 5 are plugged ON, and Switch 4 (Mult S & S)

OFF or ON depending on the operation involved.

When selecting and there are multiple secondary cards, the Mult S & S Switch must be plugged ON. For all other operations it is plugged OFF.

Figure 21 illustrates the wiring necessary for merging cards when using the Basic Setup Switches.

Figure 22 illustrates the wiring necessary for merging with selection of Low Primary and Low Secondary cards when using the Basic Setup Switches.
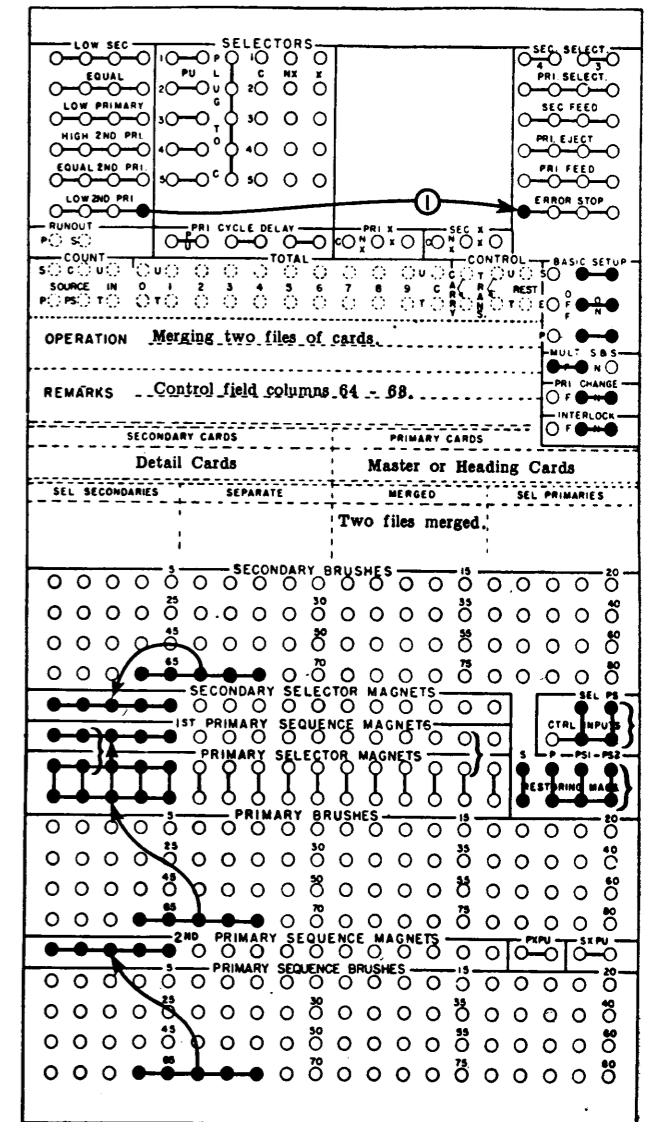

Figure 21

(1) *This wire is added if the sequence of the Primary Cards is to be checked.*

MATCHING

Function

Matching two sets of cards involves the use of all four pockets, two pockets to be used for the matched control groups, and two for the unmatched cards. The following illustration indicates the normal matching operation whereby unmatched primary cards are sent to Pocket 1, the matched primaries to Pocket 2, the matched
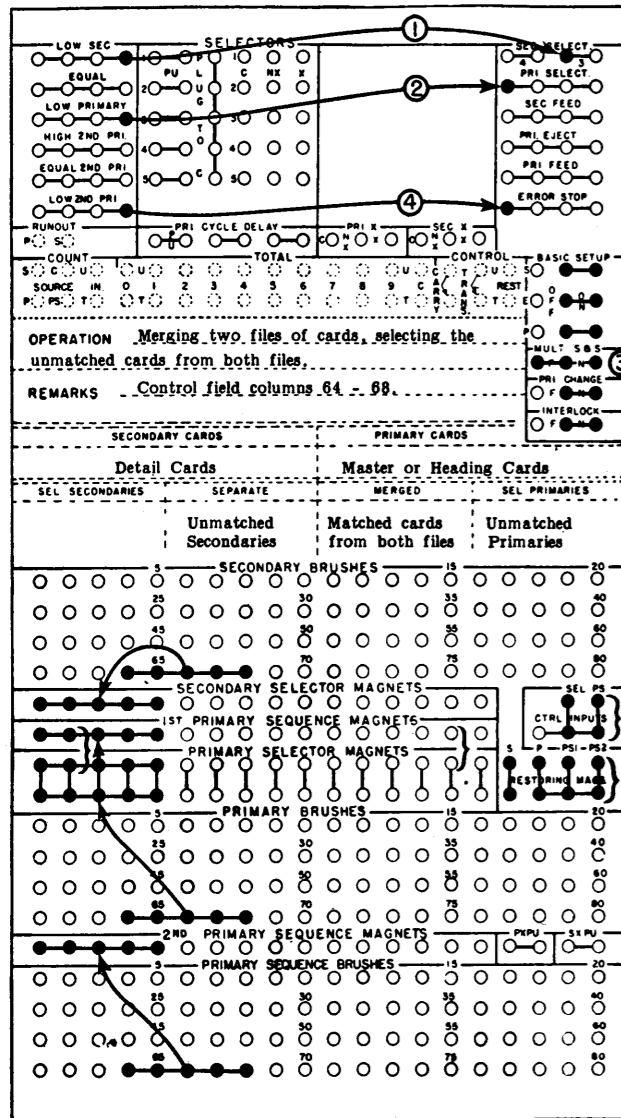

Figure 22

(1) *Unmatched Secondary cards selected in Pocket 3.*
(2) *Unmatched Primary cards selected in Pocket 1.*
(3) *Mult S & S switch ON when secondary cards consist of multiple card groups. OFF for all other operations.*
(4) *Added to check the sequence of the Primary cards.*

secondaries to Pocket 3, and the unmatched secondaries to Pocket 4. (See Figure 23.)

Plugging—Figure 26

To perform this selection, Low Pri is plugged to Pri Select, Equal to Sec Select 3, Low Sec to Sec Select 4. Since Equal Primaries are not selected, they will fall in Pocket 2. The remaining plugging is the same as for merging. Here, too, if multiple secondary groups are involved, the Mult S and S Switch must be plugged ON.

On Collators shipped prior to 11-1-39, third pocket selection is not controllable by plugging. A lever on the top of the machine controls the operation of Pocket 3. With the lever set to "Separated," matched secondary cards will eject to Pocket 3; if it is set to "Merged," matched secondaries will eject to Pocket 2. Pockets 1 and 4 must still be wired for selection.

NOTE: In any of the merging or matching operations the Low 2nd Pri may be connected to Error Stop in order to check the sequence of the primary cards. As has been mentioned, this feature of the machine indicates only that a "step down" has occurred. The result of this error in sequence will affect various operations in different ways. Therefore, a thorough check should be made in order to rectify any incorrect condition which might have resulted from the sequence error, especially if selection is involved.

For example, when merging two files of cards, and selecting the unmatched primaries and unmatched secondaries, secondary cards which should have been merged may be selected as a result of the primary sequence error. (See Figure 24.)

At the time that the sequence error is detected, the cards will stand as indicated in Figure 25.

The primary 3, being out of sequence, caused the secondary 3 to be selected as an unmatched secondary. Therefore, when such a condition exists, a check must be made to determine the status of the primary 3 card, that is, whether matched or unmatched. If matched, the corresponding secondary card should be filed with the primary in the proper place.

Other similar errors would result from a sequence error in other kinds of collating operations. In any case the operator should analyze the conditions of the specific application and thereby determine the extent to which checking is necessary. Such an analysis of the specific application will determine the procedure for rectifying any related errors resulting from the original sequence error.
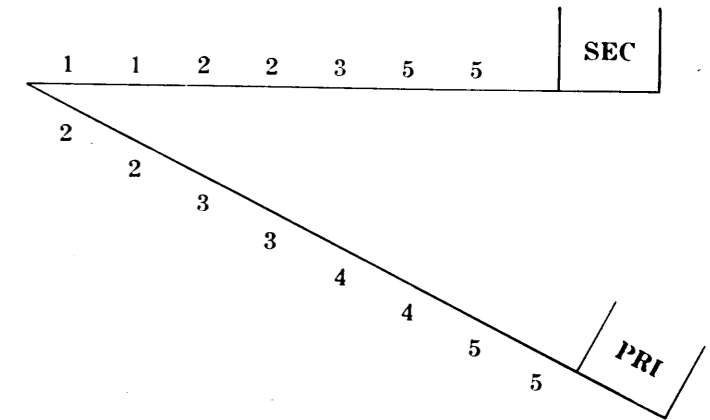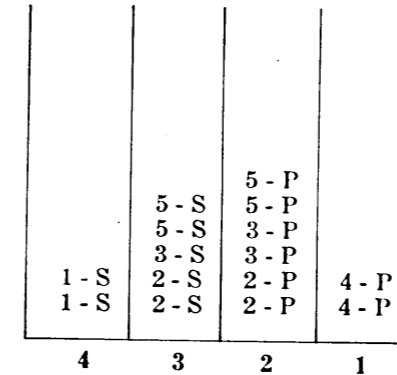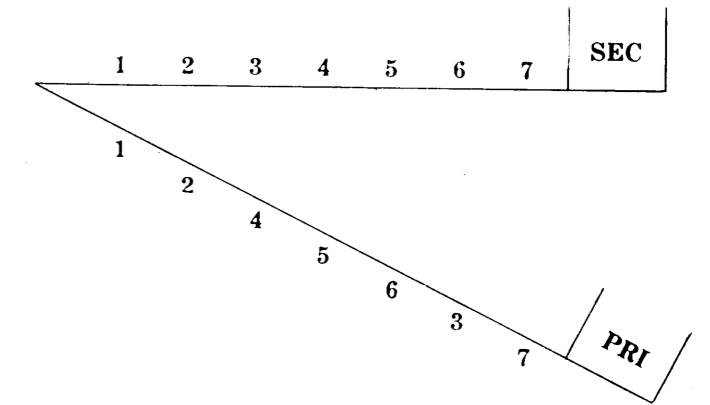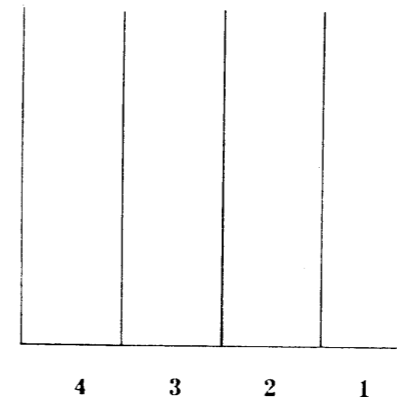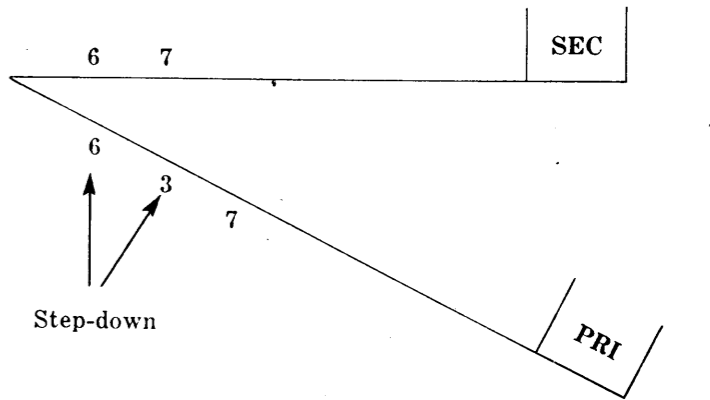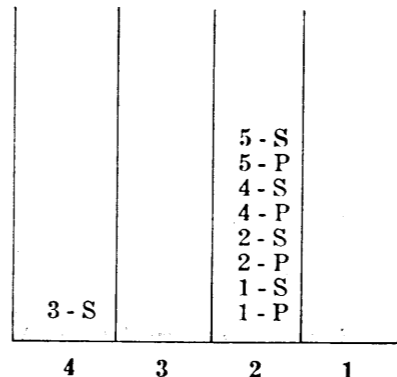
Figure 23

Figure 24

Figure 25

SELECTION OF X CARDS

Selection of X punched cards can be done during any operation. To select X punched secondary cards, the Secondary Brush reading the X punched column is plugged to the SXPU. A "Plug to C" is taken into the C hub of the Sec X selector and the X hub of the selector is connected to Sec Select 3 or 4. If NX Cards were to be selected, the NX hub would be connected to Sec Select.

To select X punched primary cards, the Primary Brush corresponding to the X punched column is connected to the PXPU hub. A "Plug to C" is entered in the C hub of the Pri X selector and the X hub is connected to Pri Select. If a Primary Sequence Brush is used to control the Selector, the card preceding the X punched primary card will be selected. (See Figure 27.)
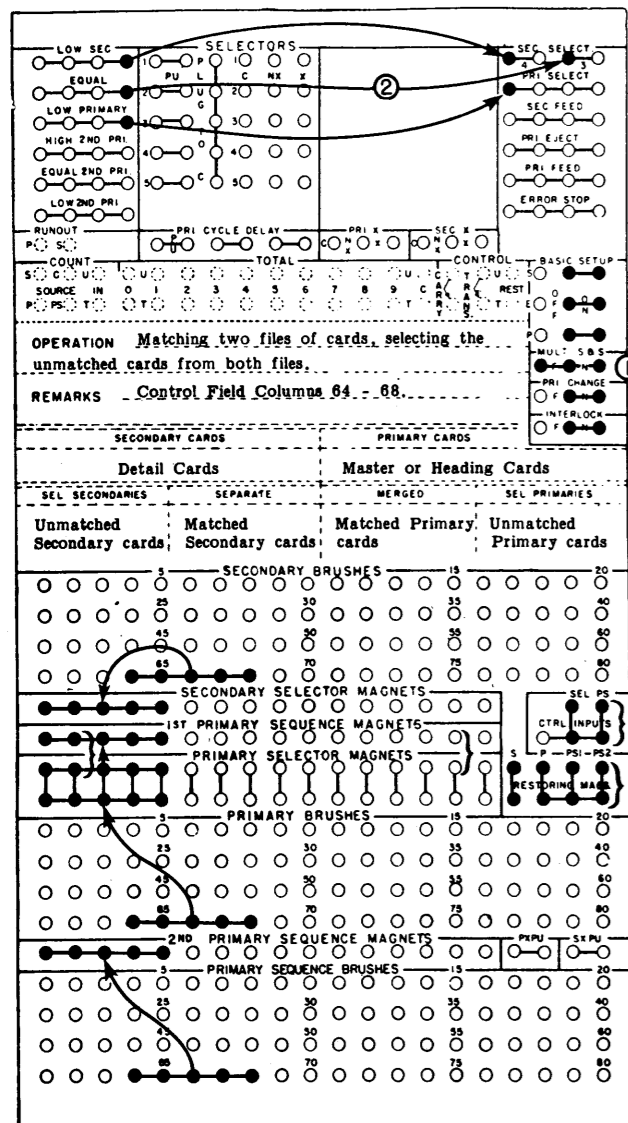
Figure 26

(1) *Multiple secondary card groups—Mult S & S Switch ON. Single secondary card groups—Mult S & S Switch OFF.*

(2) *Equal secondary cards will fall into Pocket 3. Equal primary cards will fall into Pocket 2.*
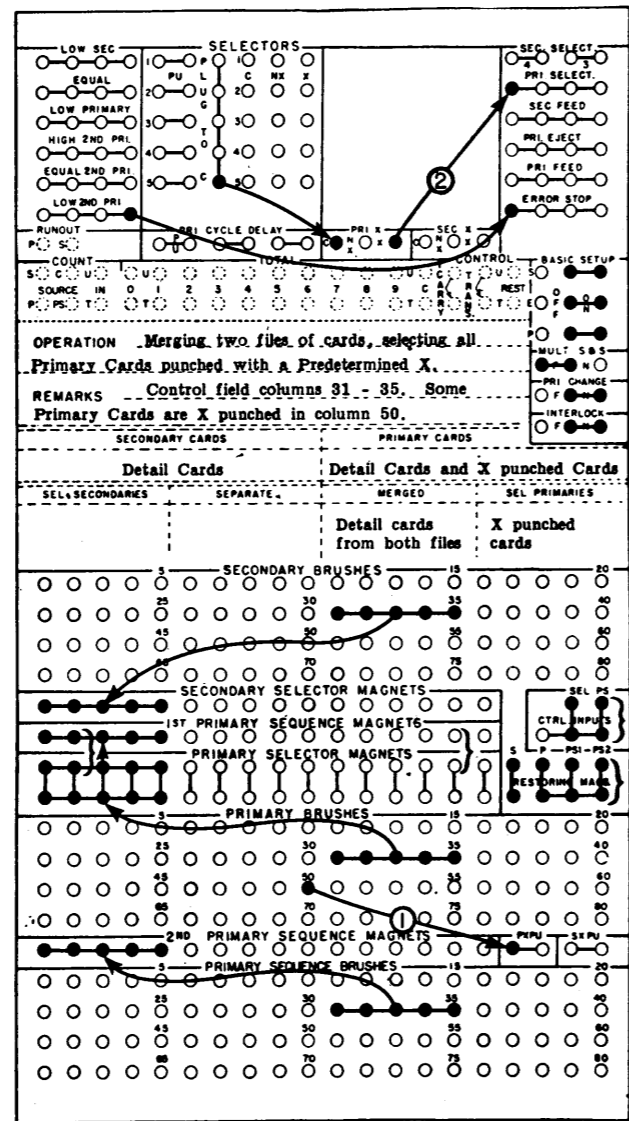

Figure 27

(1) *X50 read by the Primary Brushes.*

(2) *Impulse entered in "C" is directed from "X" for every X50 card.*

CYCLE DELAY UNIT

The Cycle Delay Unit is most commonly used in selection of the first card of a control group and the selection of single card groups. In general, the Cycle Delay Unit can be used to delay the action of any of the control outlet impulses, since the delay unit functions on the cycle following the cycle during which it is impulsed.

There are two types of Cycle Delay Units. On machines shipped prior to March 18, 1942, the unit is known as the Primary Cycle Delay Unit, because it is entirely under the control of the Primary Feed Unit (Figure 28). This unit consists of two common Pick-up hubs, two common C hubs, and two common X hubs. On this unit, if the Pick-up hub is impulsed on one cycle, there will be a connection established between the C hub and the X hub for the following cycle, after which the connection will be broken automatically.
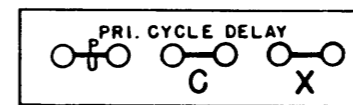

Figure 28

On machines shipped after March 18, 1942, the Cycle Delay Unit consists of two common Pick-up hubs, a C, an NX, and an X hub (as on conventional selectors), and, in addition, a DO (drop-out) hub (Figure 29).

Figure 29

This Cycle Delay Unit can be used in connection with either the Primary or the Secondary Feed Unit. The DO hub is required because, when setting up the control panel, it is necessary to associate this unit with either the Primary or the Secondary Feed Unit as desired. When used as a Primary Cycle Delay Unit, the DO should be plugged to the Pri Feed inlet. When used as a Secondary Cycle Delay Unit, the DO should be plugged to the Sec Feed inlet. However, in either case it is an impulse to the DO hub that causes the Cycle Delay Unit to be returned to its normal position, i.e., C. connected to NX.

Selection of First Card of Control Groups—Figures 30 and 31

The first card of each control group is indicated by a High 2nd Primary condition. If a High 2nd Primary impulse is connected directly to Pri Select, the last card of each group will be selected. Therefore, the impulse must be delayed one cycle. If the High 2nd Primary outlet is connected to the Pick-up hub of the Primary Cycle Delay and a "Plug to C" is entered
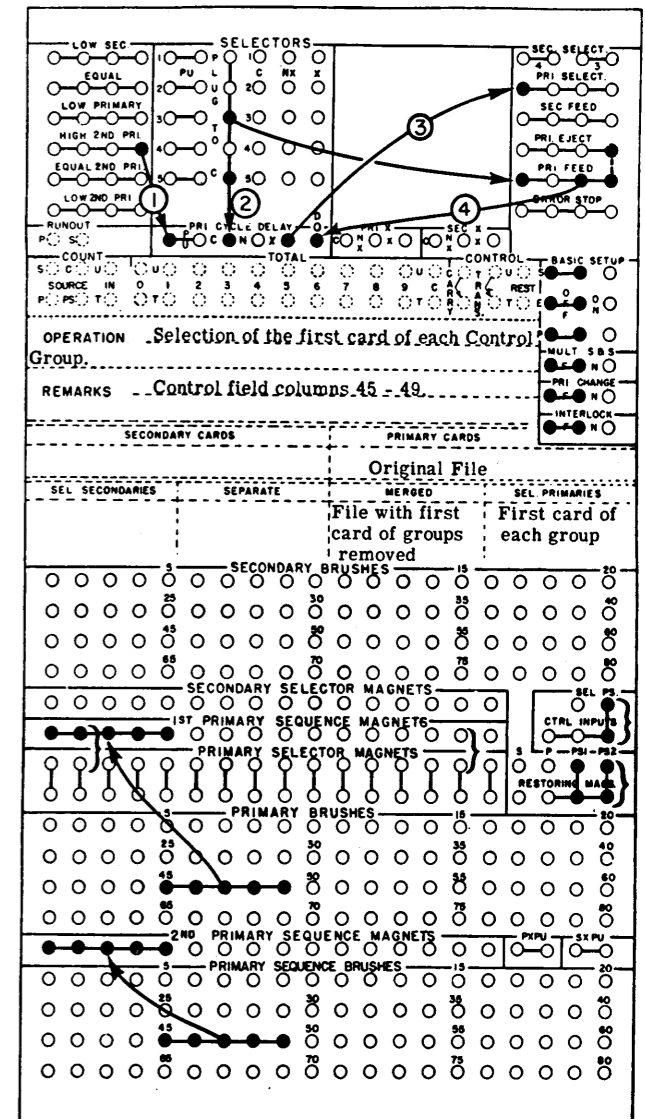

Figure 30

Cycle Delay Unit

(1) *High 2nd Primary indicates that the first card of a new control group is at the Sequence Brushes.*

(2) *Plug to C entered in C.*

(3) *Impulse directed from X one cycle later to select the first card of the control group.*

(4) *Drop-out impulsed by Primary Feed so that the connection between C and X may be broken.*

in the C hub, an impulse will be available at the X hub one card cycle later. If the X hub is wired to Pri Select, the first card of each group will be selected. The DO hub, if on the control panel, should be impulsed from "Pri Feed."

The Brushes, Comparing Magnets, Restoring Magnets, Control Input, and Feed and Eject hubs are plugged in the manner described for checking sequence.

Selection of Single Card Groups—Figures 32 and 33

Single card groups are recognized by a High 2nd Primary comparison followed by another High 2nd Primary. Therefore, selection must

101   101   102   103   103   104   104

take place on the basis of two consecutive High 2nd Primary conditions. This is done by controlling the Primary Cycle Delay on a High 2nd Primary and entering a High 2nd Primary in the C hub. The X hub is then connected to Pri Select. The first High 2nd Primary impulse will control the Cycle Delay Selector on the next cycle. Since a single card group is indicated by two consecutive High 2nd Primary impulses,

the second High 2nd Primary impulse, coming at a time when the Cycle Delay is in its controlled position, will pass from C to X and to Primary Select and select the single card groups. The DO hub, if on the control panel, is impulsed from "Pri Feed." The Brushes, Comparing Magnets, Restoring Magnets, Control Input, and Feed and Eject hubs are plugged in the manner described for checking sequence.

MISCELLANEOUS OPERATIONS

Comparison of Two Fields on a Card—Figure 34

It is possible to compare two fields on a card and select cards on which the two fields are equal or on which one field is lower or higher than the other; for example, the selection of accounts receivable cards on which Amount Paid is less than the Amount Due.

Either the Selector or the Sequence Unit can be used. If the Selector Unit is used, the Primary Brushes corresponding to one field (B) are connected to the Secondary Selector Magnets, and the Primary Brushes corresponding to the other field (A) are connected to the Primary
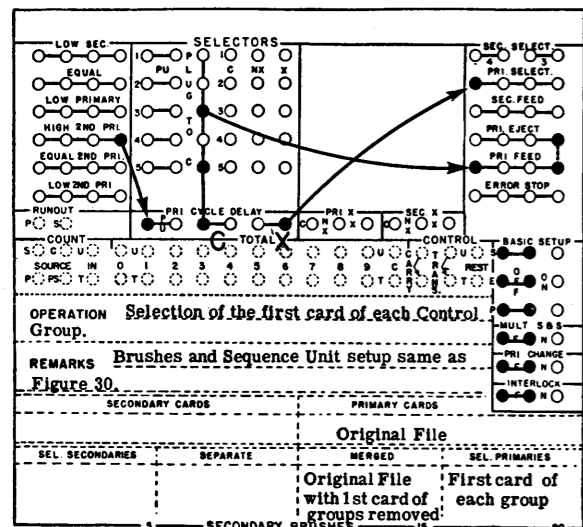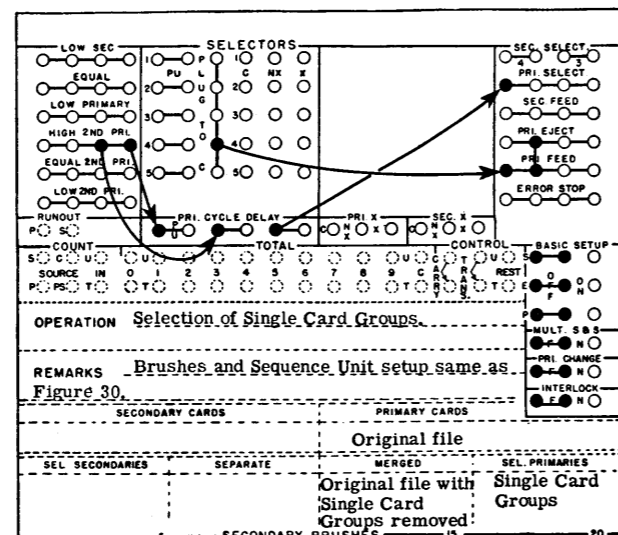

Figure 31

Figure 32

Selector Magnets. The Control Input for the Selector Magnets is impulsed normally. Both the Secondary and the Primary Selector Magnets must be restored on a primary feed cycle. Primary Feed and Eject are impulsed by a "Plug to C." If cards on which Field A exceeds

B are to be selected, a Low Secondary is plugged to Pri Select; if cards on which Field B exceeds Field A are to be selected, a Low Primary is connected to Pri Select; if cards on which Field A is equal to Field B are to be selected, Equal is connected to Pri Select.
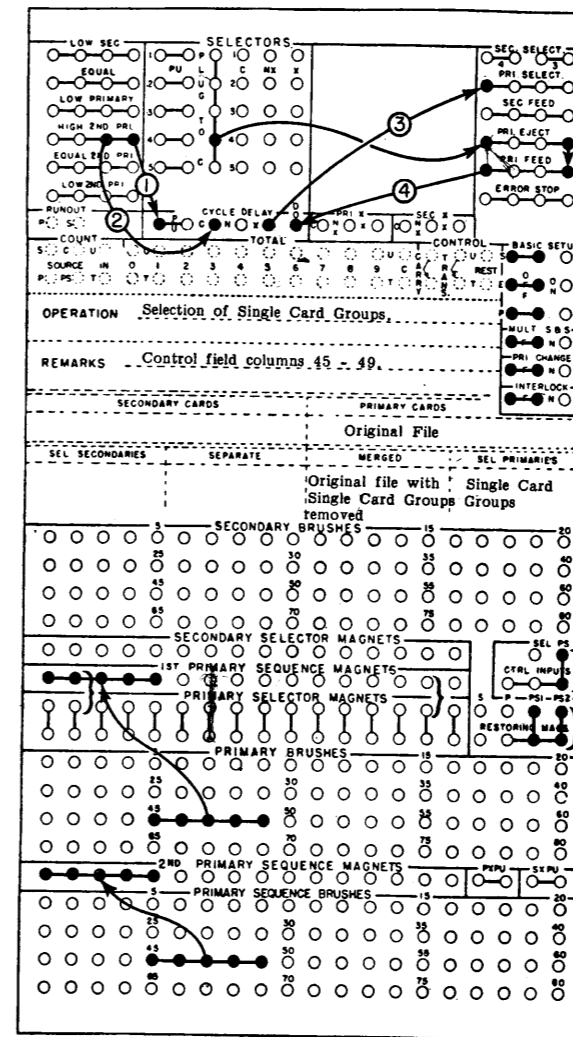

Figure 33

Cycle Delay Unit

(1) High 2nd Primary impulses the Cycle Delay Pickup hub.

(2) High 2nd Primary directed to the C hub.

(3) The impulse to select a Primary card comes out of the X if there is a High 2nd Primary condition preceded by a High 2nd Primary. This indicates a single card group.
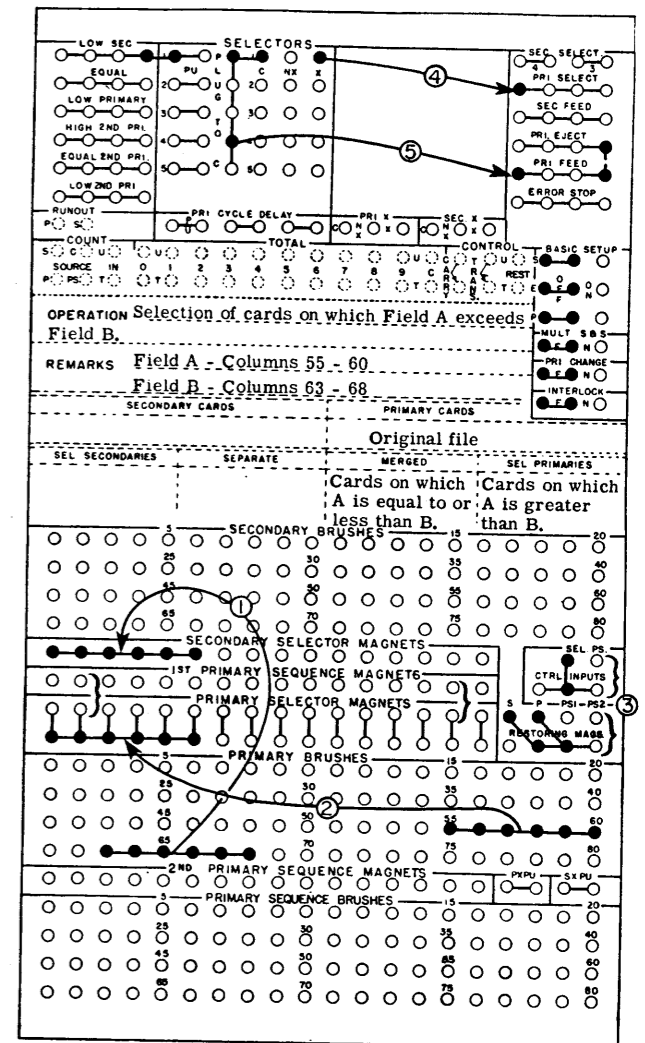
(4) Drop-out impulses from Primary Feed.

Figure 34

(1) Field B entered into the Secondary Selector Magnets.

(2) Field A entered into the Primary Selector Magnets.

(3) Secondary and Primary Selector Magnets are both restored from a Primary Feed impulse as both sets of Magnets are reading from Primary Brushes.

(4) Low Secondary indicates that Field A is greater than Field B.
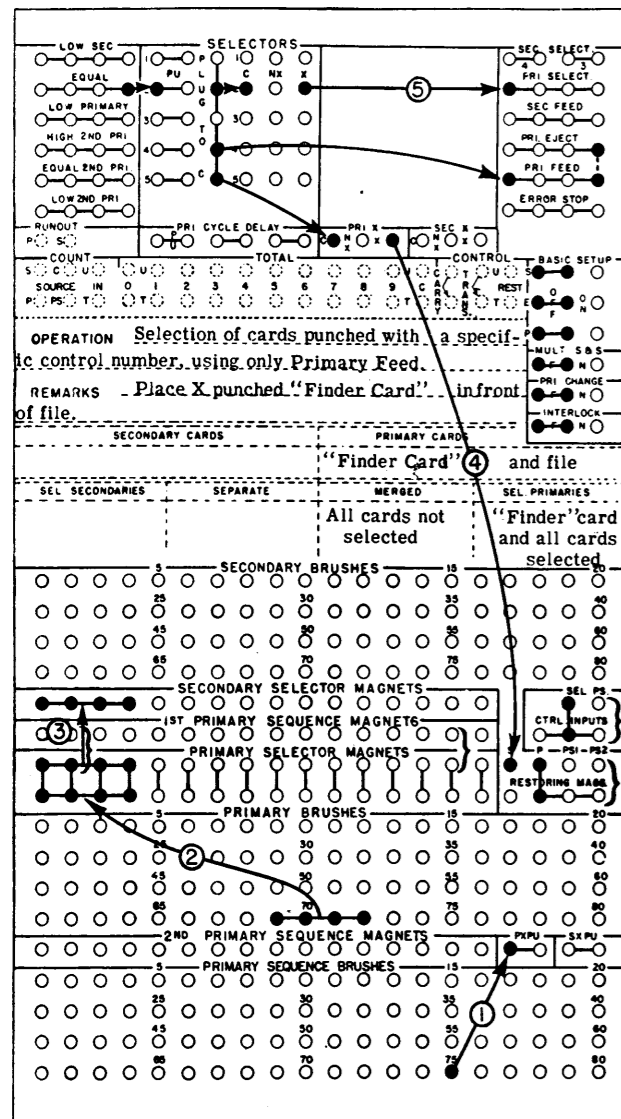
(5) Continuous Feeding and ejecting of cards.

OPERATION Selection of cards punched with a specific control number, using only Primary Feed.

REMARKS Place X punched "Finder Card" in front of file.

Figure 35

(1) X read by Primary Sequence Brushes to control the Primary X Selector.

(2) The Control field is read from the Primary Brushes into the Primary Selector Magnets.

(3) The control field is read from the Primary Brushes into the Secondary Selector Magnets.

(4) The Secondary Selector Magnets are restored only on an X75 card. Therefore, the number read from the control field of the "Finder" card remains in the Secondary Selector Magnets to compare with all of the cards in the file.

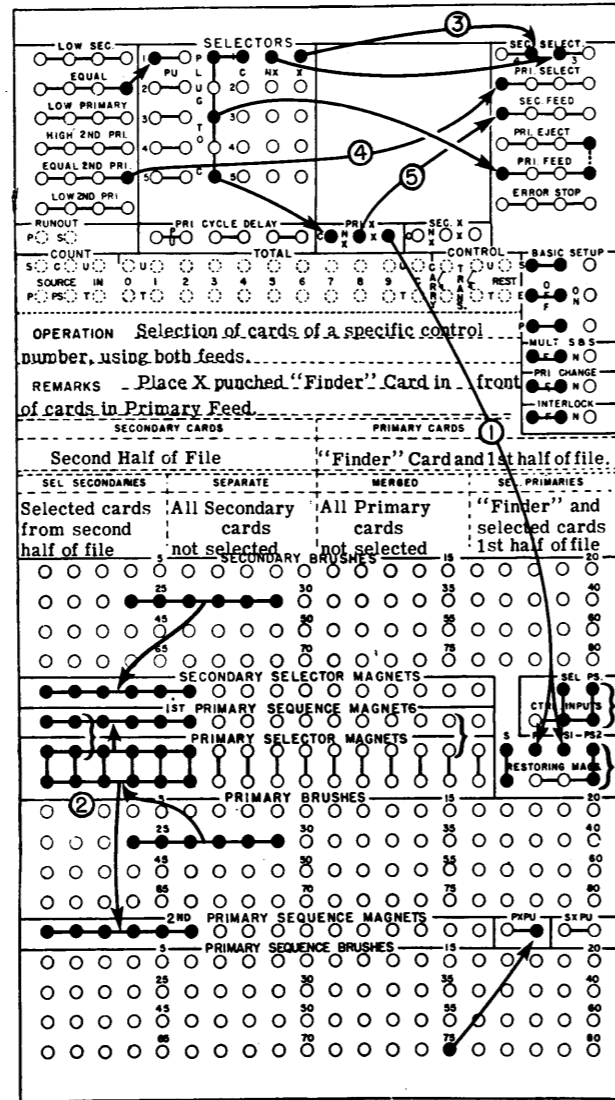(5) Cards equal to the number punched in the "Finder" card are selected.

OPERATION Selection of cards of a specific control number, using both feeds.

REMARKS Place X punched "Finder" Card in front of cards in Primary Feed.

Figure 36

(1) "Finder" card X controls the restoration of the Primary Selector and the 1st Primary Sequence Magnets. Reading from the "Finder" card will remain in these magnets to compare with the cards in the file.

(2) Control field connected by split wires to the 2nd Primary Sequence Magnets.

(3) Cards from the second half of the file equal to the control number in the "Finder" card are selected in Pocket 4.

(4) Cards from the first half of the file equal to the control number in the "Finder" card are selected in Pocket 1.

(5) The Secondary Feed is impulsed on NX80 to allow the "Finder" card to read into the Primary Selector Magnets before the first card in the Secondary Unit arrives at the Secondary Brushes.

Selection of Cards of a Particular Control Number—Figures 35 and 36

A file of cards can be searched for a particular control number; for example, a Master Name File in sequence by Employee Number can be searched for one specific Social Security Number. The control number is punched in an X punched card known as the "Finder" card which is placed in front of the file. The X punch is used to control the restoration of one side of either the Selector or Sequence Unit, so that only the "Finder" card will read in. The number punched in each detail card is then compared with that in the "Finder" card. Cards with numbers equal to, greater, or less than that punched on the "Finder" card can be selected.

Both sets of magnets can be used for this operation; under this condition one-half of the file is placed in the Primary Feed and the second half in the Secondary Feed, thus speeding up the operation. (See Figure 36)

NOTE—On machines shipped after March 18, 1942, it is not necessary to plug the Restoring Magnets position for that half of the Selector or Sequence Unit in which the "Finder" card number is stored. Whenever the Start Key is depressed and there are NO cards in the Primary Feed Unit, restoration of all magnets will take place automatically, regardless of whether or not their corresponding Restoring Magnet hubs are plugged. Automatic restoration will continue until a first primary card has passed the Primary Sequence Brushes. Therefore, if the number in the "Finder" card is plugged from the Primary Sequence Brushes to the magnets in which it is being stored, this number will be read in as the "Finder" card passes the Primary Sequence Brushes and will remain in the unit until all cards are run out of the Primary Feed Unit and the Start Key is again depressed.
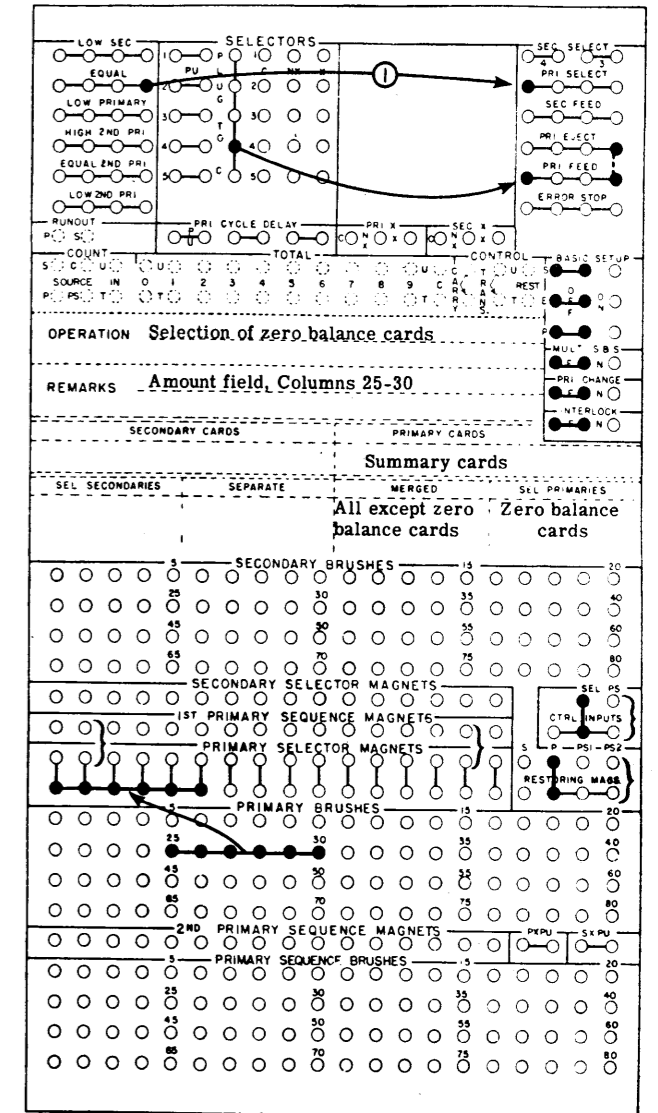
Selection of Zero Balance Cards—Figure 37

Another common application is the selection of Zero balance summary cards. The amount field is plugged from the Primary Brushes to the Primary Selector Magnets. The Secondary Selector Magnets are not wired. Since any number in the Primary Selector Magnets will then be compared with zeros in the Secondary Selector Magnets, an Equal control output impulse will indicate a zero balance card. These cards can be selected by plugging from Equal to Primary Select.

OPERATION Selection of zero balance cards

REMARKS Amount field, Columns 25-30

Figure 37

Primary Feed and Eject are wired from a "Plug to C" impulse to feed a primary card every cycle. Selector Control inputs and Selector Unit Restoring Magnets are plugged normally.

Selection of Cards Between Two Control Numbers—Figure 38

By extending the principle of controlling the restoration of the magnets, it is possible to select cards which have a control field between two limits, i.e., cards greater than the lower limit but less than the upper limit. The max-

imum and minimum limits of the numbers must be punched in a "finder" card. These fields then can be set up in the control units, one in the Sequence Magnets, and the other in the Selector Magnets. The control field in the detail cards is compared with two numbers. If any card is lower than the upper limit and higher than the lower limit, it will be selected.

Checking Sequence Using Both Feeds—Figures 39 and 40.

Use of both the Primary Feed Unit and the Secondary Feed Unit for checking the sequence of a file makes it possible to complete this operation in half the time required when only the Primary Feed Unit is used.
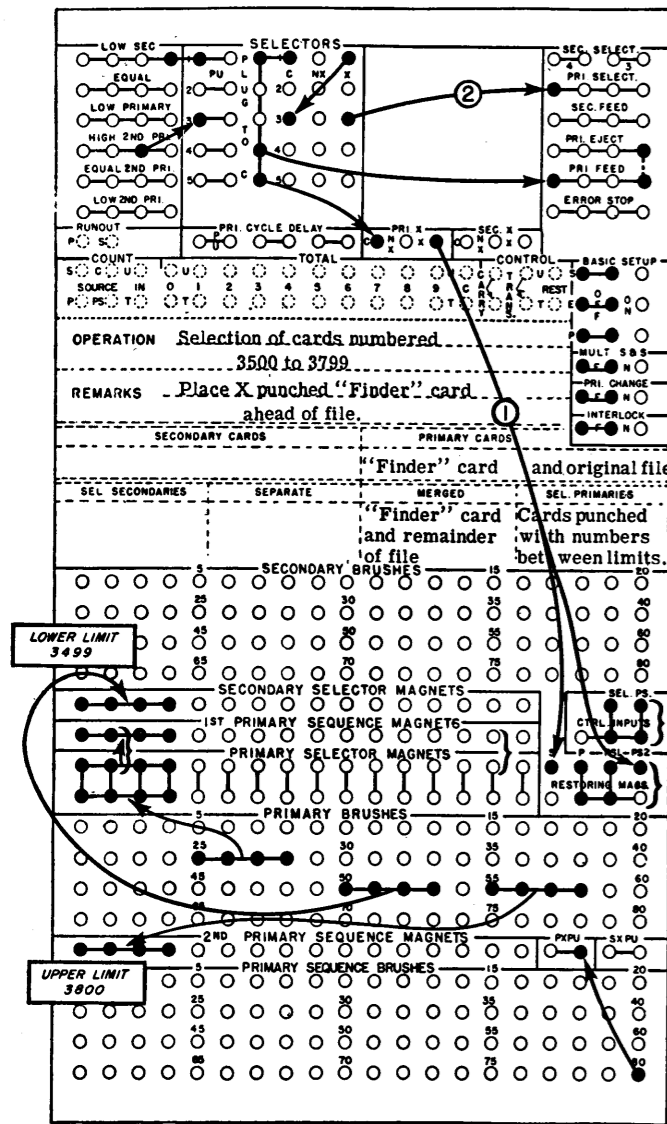

Figure 38

(1) "Finder" card X controls the restoration of the Secondary Selector and the 2nd Primary Sequence Magnets.

(2) Cards with numbers greater than the lower limit (Low Secondary) and less than the upper limit (High 2nd Primary) are selected.
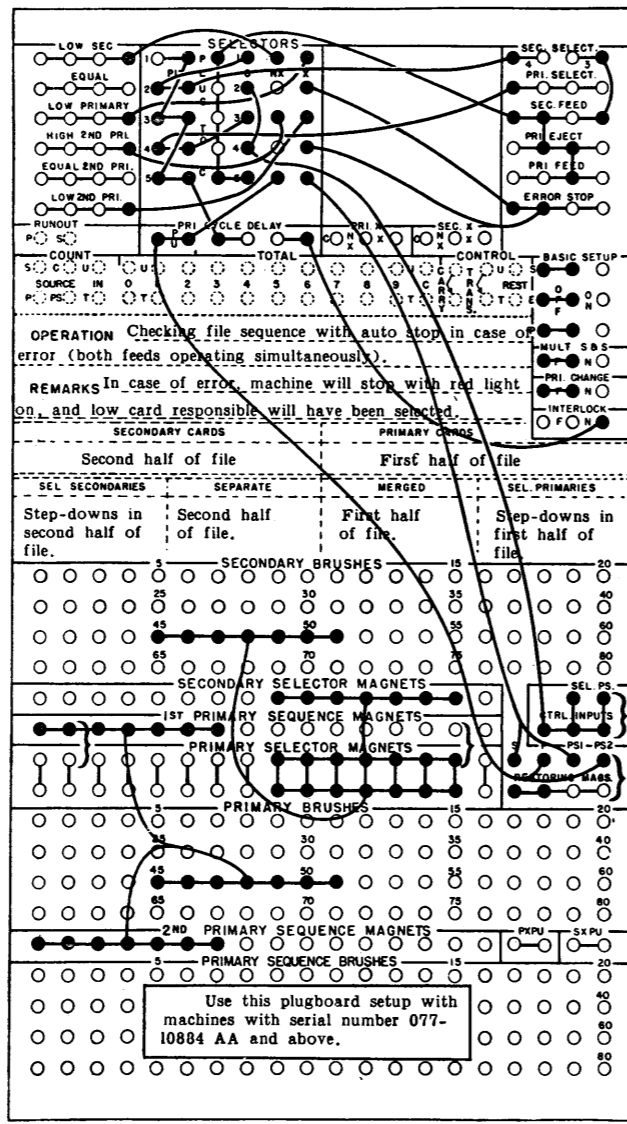

Figure 39

Figures 39 and 40 show the plugboard setup for using both feeds for checking the sequence of a file of cards. In case of an error in the sequence the machine will stop and the Error Light will flash ON. The low card will be selected after the error circuit is reset and the Start Key depressed.
Figure 40 should be used with all machines with serial numbers lower than 077-10884AA. On machines 077-10884AA and those with serial numbers higher than 077-10884AA use plugboard setup shown in Figure 39.

Coupling the Sequence and the Selector Magnets for Greater Capacity—Figures 41 and 42

The 16 comparing positions in the Sequence Unit and the 16 comparing positions in the Selector Unit may be coupled to make one comparing unit of 32 positions, for use with control fields of more than 16 columns. Figure 41 illustrates the plugging for merging or matching (with or without Primary Selection) with a control field of 32 columns. Figure 42 illustrates checking the sequence of a file with a control field of 32 columns.
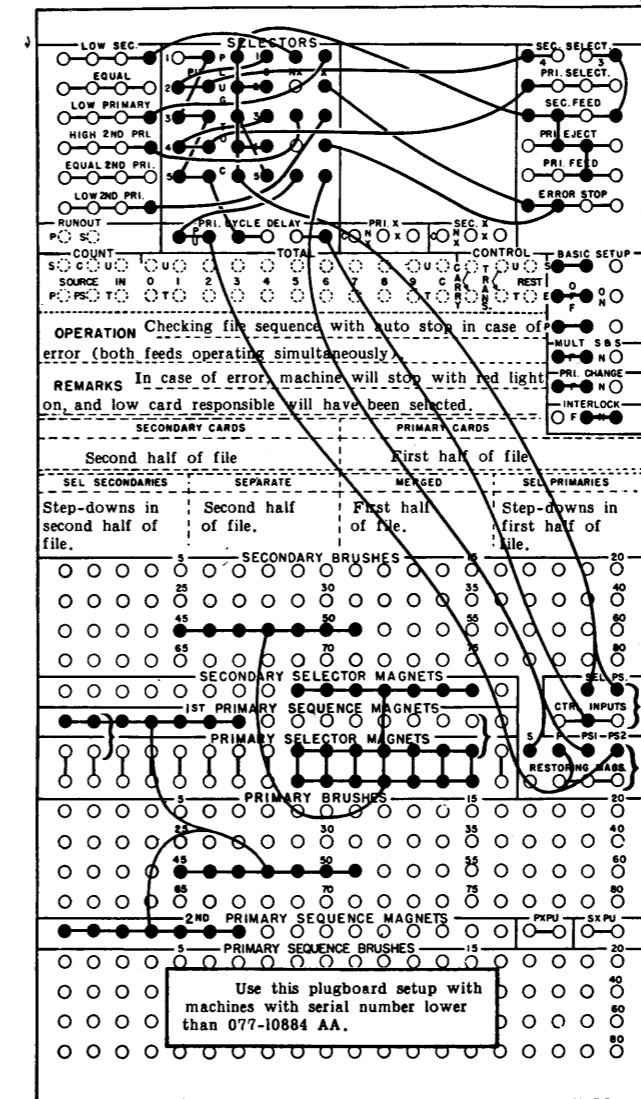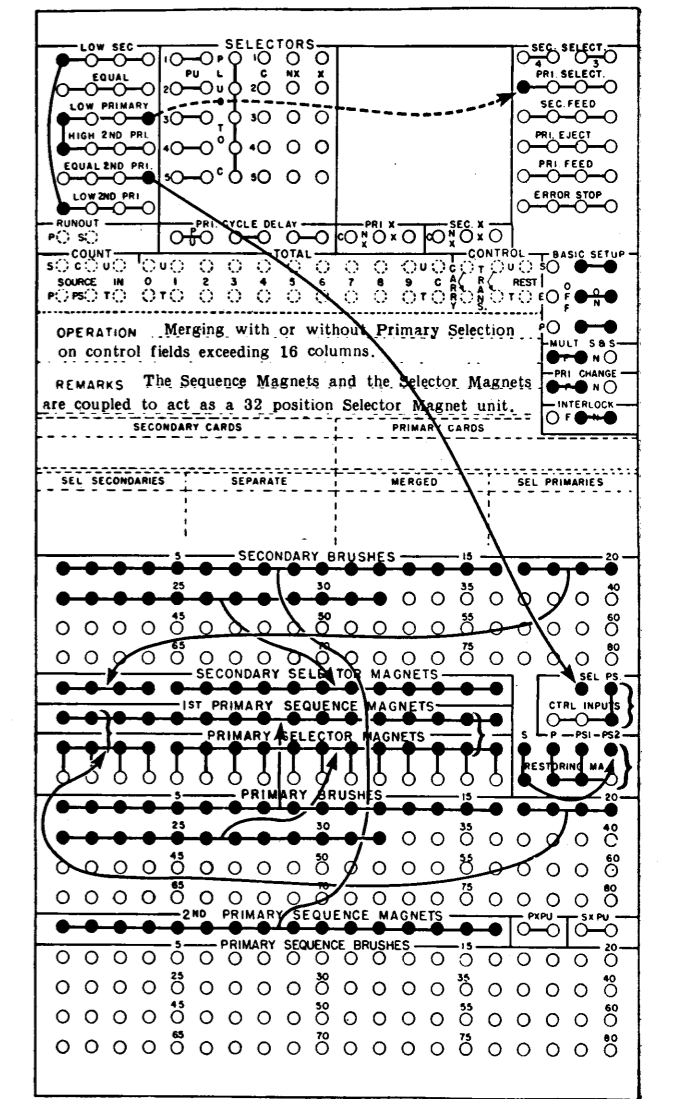

Figure 40

Figure 41

Checking Sequence of a File, Selecting All Low Cards—Figure 43

The control wiring shown in Figure 43 may be found useful for selecting from a file all cards which are not in sequence.

Assuming that the cards in the file are in the sequence shown in Figure 44, a Low 2nd Primary condition would be sensed when the 7 card is compared with the 5 card. This Low 2nd Primary would cause the No. 5 selector to suppress the restoration of the 1st Primary Sequence Magnets, thereby retaining the 7 in the 1st Primary Sequence Magnets. This 7 would

then be compared with all cards following until a card equal to or greater than 7 is encountered, after which time the restoration of the 1st Primary Sequence Magnets will be resumed.

IMPULSE TIMING

(See Figure 45)

The chart on Impulse Timing has been included in this booklet to assist in working out plugboard setups for unusual operations. It indicates the time at which the various outlets emit impulses or the time during which special circuits are in operation.
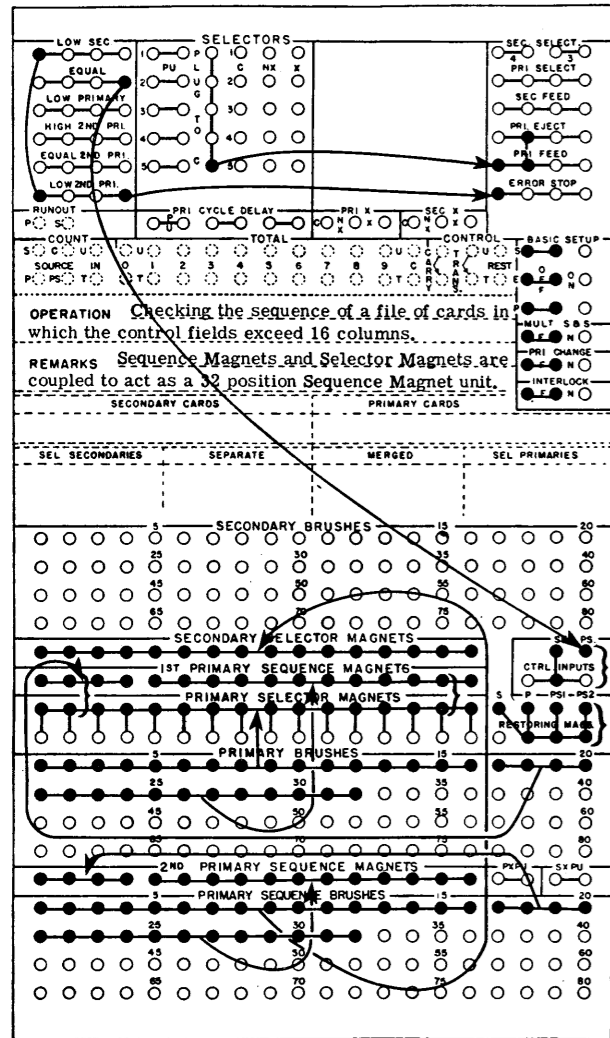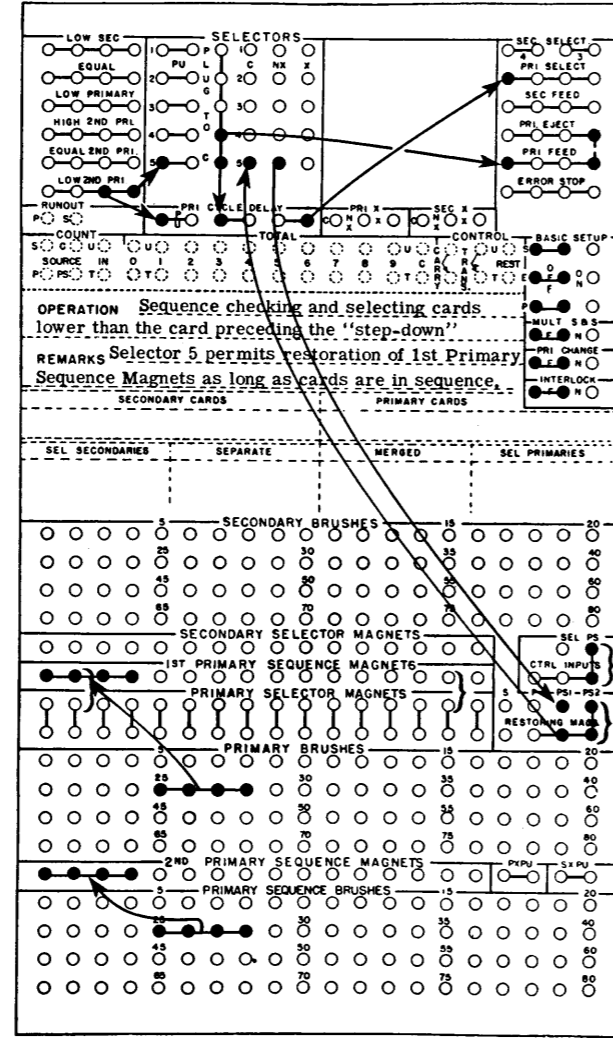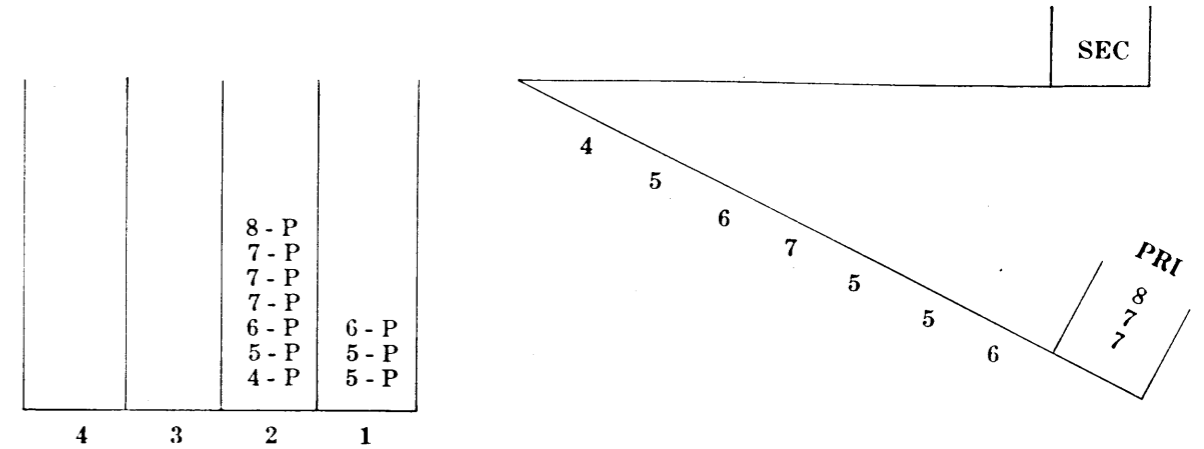

Figure 42

Figure 43

Figure 44

Figure 45

COLLATOR COUNTING DEVICE

The Collator Counting Device makes possible certain collating operations which involve a count of cards.

With the aid of this device, many applications such as the following are practicable:

Insertion of a fixed or variable number of cards behind a single master card.

Insertion of initial and overflow heading cards for continuous form listings.

Two- or four-column consecutive number checking.

These operations and others are described in detail in the eight typical operations which follow. Other similar operations to meet other field requirements can be set up following the principles illustrated.

Primarily the counting device consists of two single-position counters of 1-9 capacity which may be coupled together (by plugging) to form one two-position counter of 1-99 capacity. Each counter can be assigned to a different counting operation if neither count will exceed 9. With the counters coupled to count to 99, only a single variable can be counted. Although all illustrations are for a two-position counter, the four-position counter, which is also available, operates on the same principle.

The counters can add only unit impulses, and they can add only once during a machine cycle.

Complete flexibility is provided through the control panel (Figure 46) which permits interconnection with all standard machine functions.

RUNOUT. Used primarily to eliminate further counting and to provide for run-out selection of the cards remaining in the corresponding feed.
P—Outlet for an impulse when the Secondary feed becomes empty.
S—Outlet for an impulse when the Primary feed becomes empty.

SOURCE. Usually plugged to IN hubs.
S, P, and PS—Outlets for impulses when a card leaves the corresponding brush station.
C—Outlet for an impulse during every machine cycle as long as cards remain in machine.

IN—Inlet hubs to counter adding magnets. A counter adds 1 each time its IN hub is impulsed. When the two counters are coupled for 1-99 capacity, only the U hub is plugged; when they are used as separate 1-9 counters, both U and T hubs are plugged.

CARRY—Plugged together when the counters are used in 1-99 capacity; permit a carry from the Units counter to the Tens counter when the former passes beyond 9. When the counters are used separately, the Carry hubs are not plugged.

TRANSFER—Plugged together to transfer the number standing in the counter to one side of a control unit for comparison with a card reading. At all other times these hubs are not plugged.

RESTORATION—Inlets used to restore (reset) to zero the counters which they govern. Usually plugged from either the Pri Feed or Sec Feed hubs.

TOTAL. One set of hubs (0-9 and C) for each counter. The Total hubs may be compared to the emitter of a digit selector, and are used for:
1. Testing the counters during each cycle to ascertain when the total in the counters reaches a predetermined number.
2. Transferring a number from the counters to one side of a control unit for comparison with a card reading.
3. A combination of the above in which the counters are used separately. For such an operation the Units counter should be used for that part of the operation involving transfer.

Figure 46

INSERTING SECONDARY CARDS BEHIND SINGLE PRIMARY CARD

Function

It is possible to insert a predetermined number of secondary cards behind a single primary card.

Plugging—Figures 47 and 48

1. With the exception of the Interlock switch, all Basic Setup switches are plugged OFF.

2. Since the counters are employed in 1-99 capacity, the Carry hubs must be plugged.

3. Feeding is controlled through selector No. 5. This selector is operated on the cycle during which the counters reach the number 52. The plugging for the control of selector No. 5 is: From the Control Input hubs to the C hub of the Tens counter; from the 5 hub of the Tens counter to the C hub of the Units counter; from the 2 hub of the Units counter to the pick-up of selector No. 5.

4. The Cycle Delay plugging is necessary to permit the first primary card to feed ahead of the first secondary card on the run-in. When the Start key is operated at the beginning of the run, cards are automatically fed to the eject stations of both feeds. The secondary feed then operates through the plugging of the Cycle Delay and selector No. 5 until this selector is controlled.

5. As the first card leaves the Secondary Brushes station, an impulse is emitted from the S Count hub which, through the C and NX points of selector No. 4, reaches the IN hub of the Units counter and causes one (1) to be added. Secondary feeding and counting continue until 52 secondary cards have been stacked.

6. The single primary card is stacked simultaneously with the first secondary card by this plugging.

7. During every cycle an impulse originating from the Control Input hubs tries to reach the pick-up hubs of selector No. 5 via the Counter Total hubs. This circuit is completed on the cycle during which the counters reach 52; it suspends secondary feeding for one cycle, during which the Primary Feed operates.

8. During the Primary Feed cycle, the counters are restored to zero by this plugging. Following this cycle, the Secondary resumes feeding and the operation is repeated.

9. When the last primary card has been stacked and 52 secondary cards have been fed behind it, the S Runout hub energizes selector No. 4 which eliminates further counting, and selects all remaining secondary cards.

Figure 48 illustrates the revised plugging which should be used for this operation if the machine is equipped with the new type of Cycle Delay Unit (machines shipped after March 18, 1942).

NOTE: The secondary feed should be kept so supplied with cards that a few cards always remain after the last group has been counted. This is necessary to insure the insertion of a full complement of secondary cards behind the last primary card.
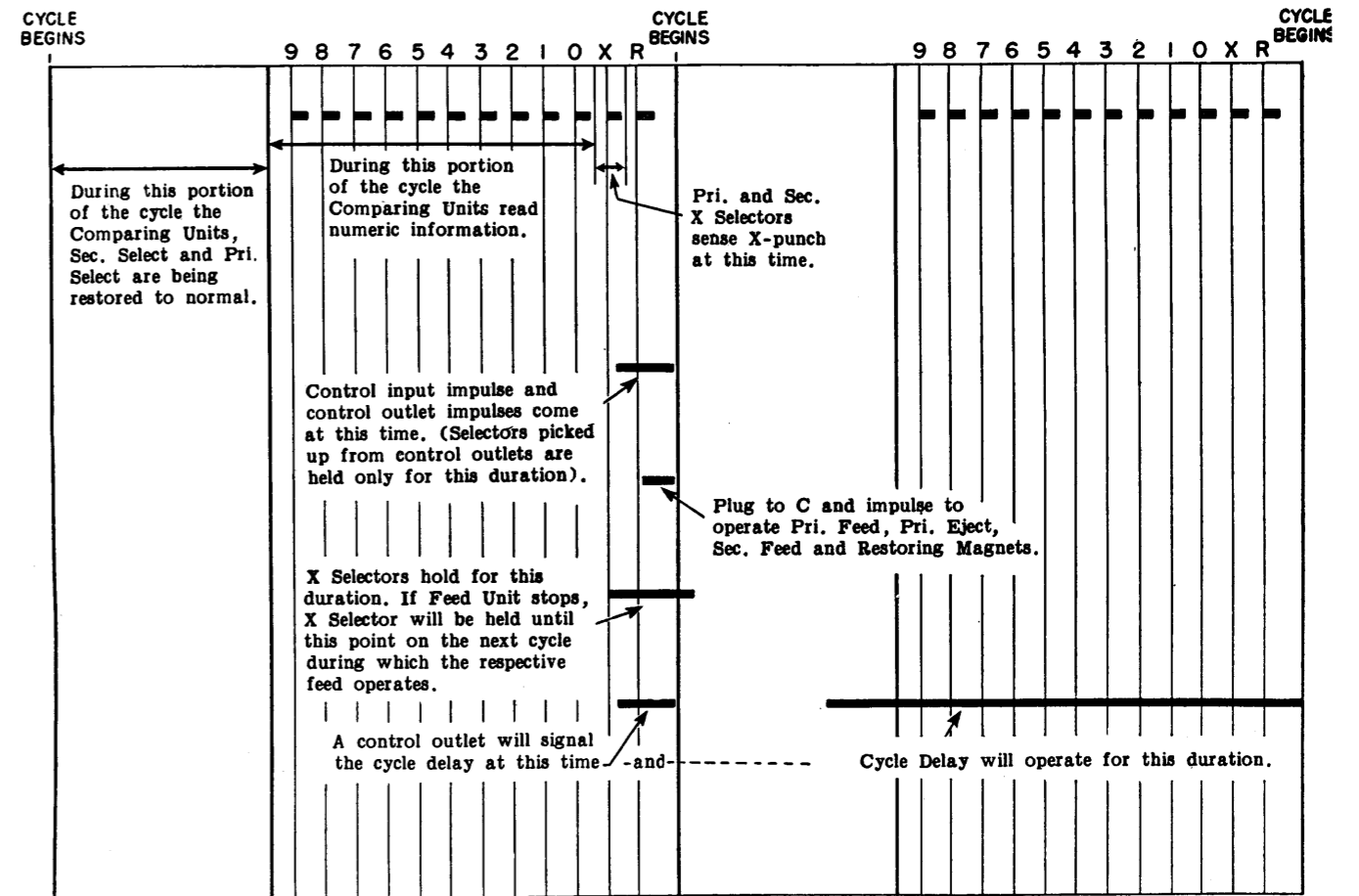

Figure 47

INSERTING PRIMARY CARDS BEFORE A SINGLE SECONDARY CARD

Function

It is possible to insert a predetermined number of primary cards ahead of a single secondary card. No punching is required in either the primary or the secondary cards. Unused primary cards are selected on the run-out. In this example, 32 primary cards are inserted.

Plugging—Figure 49

The plugging for this operation is identical in principle with the plugging for the preceding operation. Reference to the explanation for the preceding operation, and a comparison of the wiring diagrams, will reveal the reason for the slight variations in plugging.

INSERTING VARIABLE NUMBER OF SECONDARY CARDS BEHIND SINGLE PRIMARY CARD

Function

A variable number of secondary cards can be inserted behind a single primary card. The number of secondary cards to be inserted is determined by punching in the primary card. In this example it is assumed that the number of cards to be inserted may vary within the
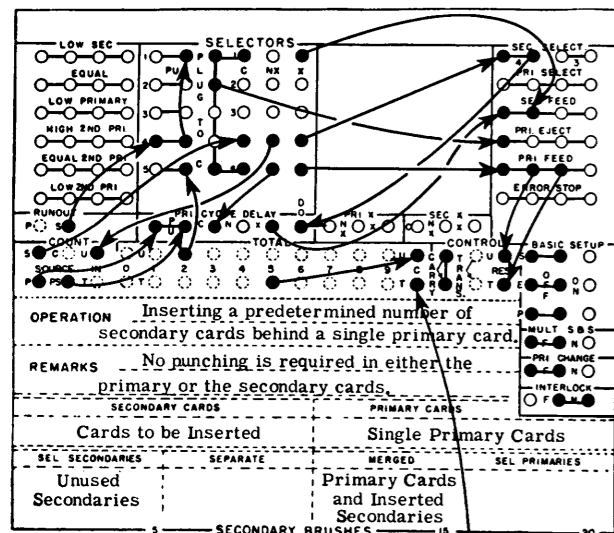
limits 1-99. Unused secondary cards are selected on the run-out.

Plugging—Figure 50

1. With the exception of the Interlock switch, all Basic Setup switches are plugged OFF.

2. Since the number of secondary cards to be inserted may exceed 9, the Carry hubs must be plugged together. Because transferring from the counters to a control unit is involved, the Total hubs 0 to 9 and the Transfer hub of the Units counter must be plugged to the corresponding hubs of the Tens counter.

3. Feeding is controlled by selector No. 2, which, in turn, is controlled by an Equal impulse from the Selector Unit.
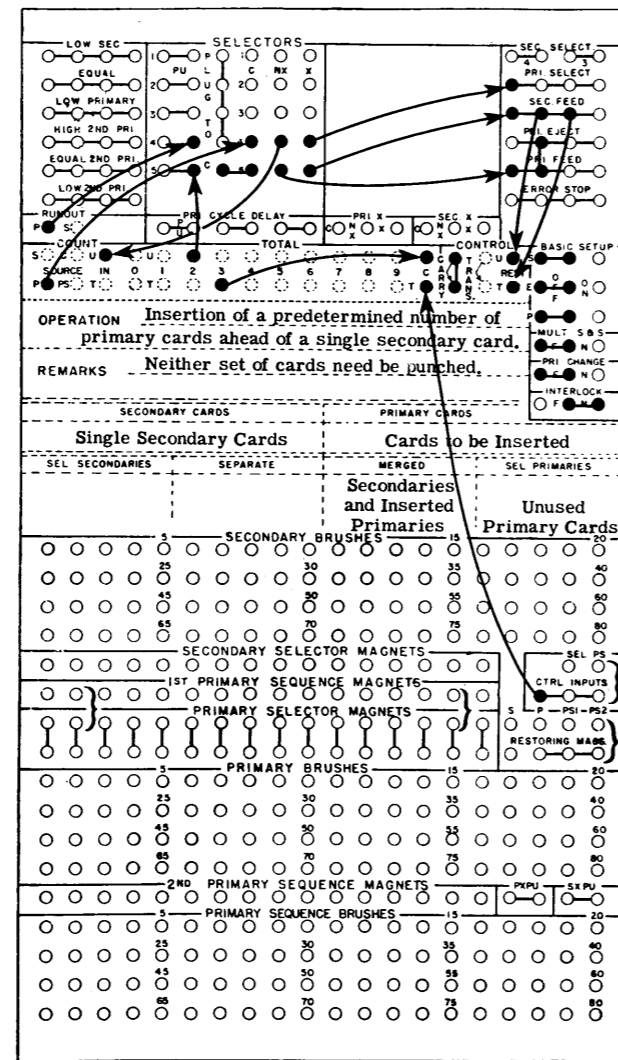
4. On the run-in, cards are automatically fed to the eject stations of both feeds. As the first primary card passes the Primary Brushes, a number punched in columns 34 and 35 is read into the Primary Selector Magnets.

5. This number is retained until the Primary Feed is again operated.

6. During every intervening secondary feeding cycle, the number in the Primary Selector Magnets is compared with a number transferred from the counters to the Secondary Selector Magnets.

7. This plugging stacks the first primary card simultaneously with the first secondary card.

8. As the first secondary card is fed, an impulse originating from the S Count hub reaches

the U-IN hub through selector No. 5, causing one (1) to be added in the Units counter.

Secondary feeding and counting continue until the number in the counters becomes equal to the number stored in the Primary Selector Magnets. When this occurs, an impulse reaches the pick-up hubs of selector No. 2 via the Equal hubs of the Selector Unit (wire 3).

9. When selector No. 2 is controlled, secondary feeding is suspended for one cycle.

10. During this same cycle, the Primary Feed operates and causes the counters to be restored to zero.

Following the primary feeding cycle (during which a new number is read into the Primary Selector Magnets), feeding of secondary cards is resumed and the operation is repeated.

11. When the last primary card has been stacked and the proper number of secondary cards has been fed behind it, the S Runout hub energizes selector No. 5 which eliminates further counting and selects all remaining secondary cards.

12. This plugging causes the restoration of the secondary side of the Selector Unit on each feed cycle, thus permitting the entry of the transferred counter totals to the Secondary Selector Magnets.

NOTE: The secondary feed should be kept so supplied with cards that a few cards always remain after the last group has been counted. This is necessary to insure the insertion of a full complement of secondary cards behind the last primary card.

INSERTING VARIABLE NUMBER OF PRIMARY CARDS BEFORE A SINGLE SECONDARY CARD

Function

A variable number of primary cards can be inserted ahead of a single secondary card. The number of primary cards to be inserted is determined by punching in the secondary card. In this example it is assumed that the number of cards to be inserted may vary within the limits 1-99. Unused primary cards are selected on the run-out.

Plugging—Figure 51

The plugging for this operation is identical in principle with the plugging for the preceding operation. Reference to the explanation for the preceding operation, and a comparison of the wiring diagrams, will reveal the reason for the slight variations in plugging.
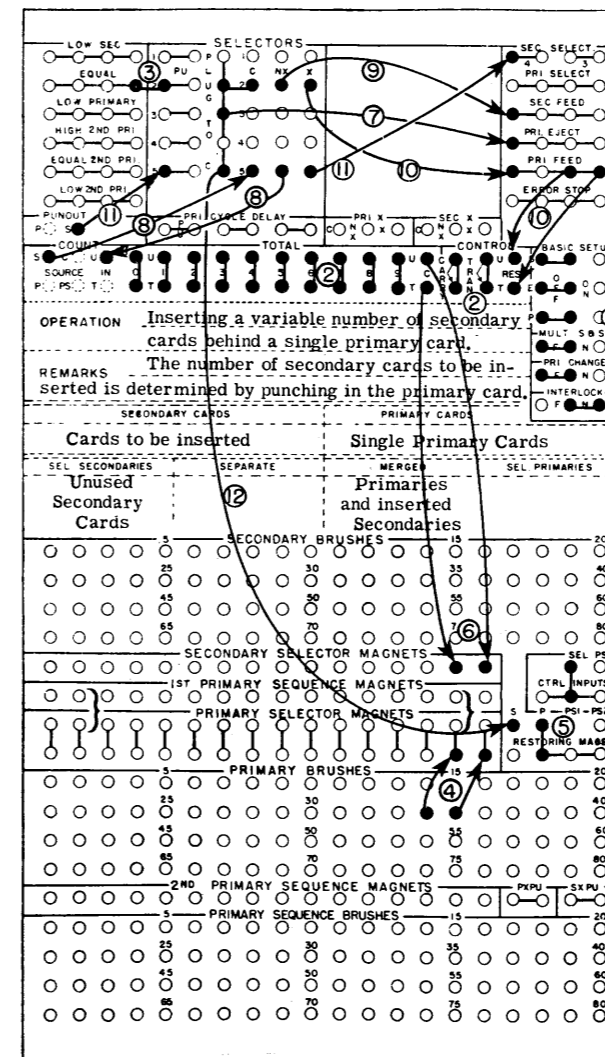
Figure 48

Figure 49

Figure 50

INSERTING SINGLE DESCRIPTION CARDS TO IDENTIFY A FIXED NUMBER OF CARDS WITHIN A CONTROL GROUP

Function

A single description card may be inserted to identify a predetermined number of cards within an account number group. Such description cards may be necessary to head initial and overflow sheets in a listing operation. Regular account-number punching is required in both description and detail cards. The description card file consists of a varying number of cards for each account number, the number being determined by the average number of cards in a control group. In the example shown, a description card is inserted preceding each group of 25 detail cards.

Plugging—Figure 52

1. Account Number from the two types of cards is compared in the Selector Magnets.

2. With the exception of the P switch, all Basic Setup switches are plugged ON, although in the case of the S switch, the ON circuit is completed through the C and NX hubs of Selector No. 5 to condition secondary feeding.

3. When the account number changes in the detail cards (Low Primary), the remaining primary (description) cards of that account number will be selected.
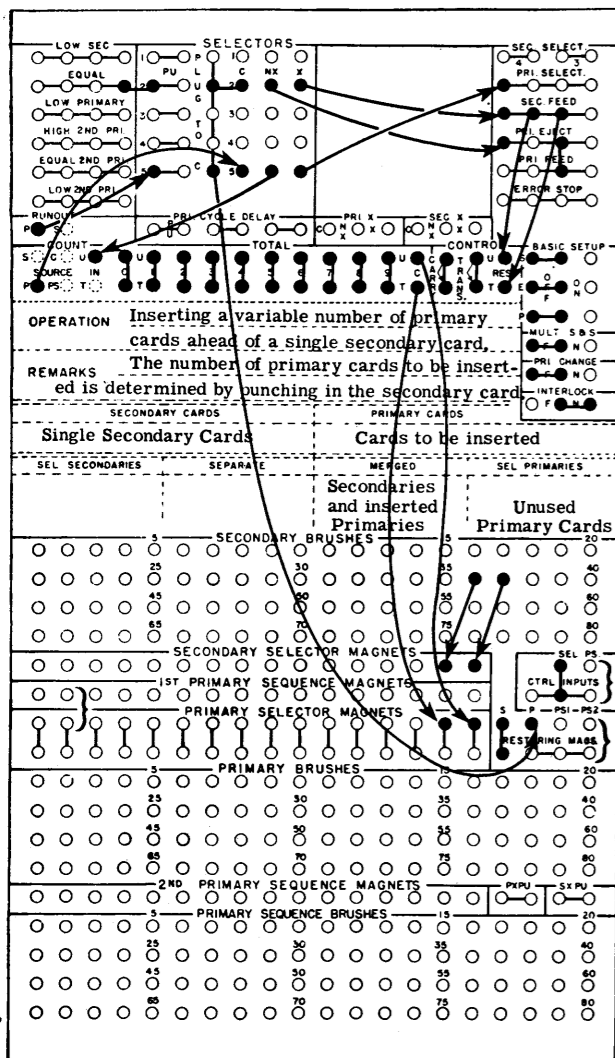
Figure 51
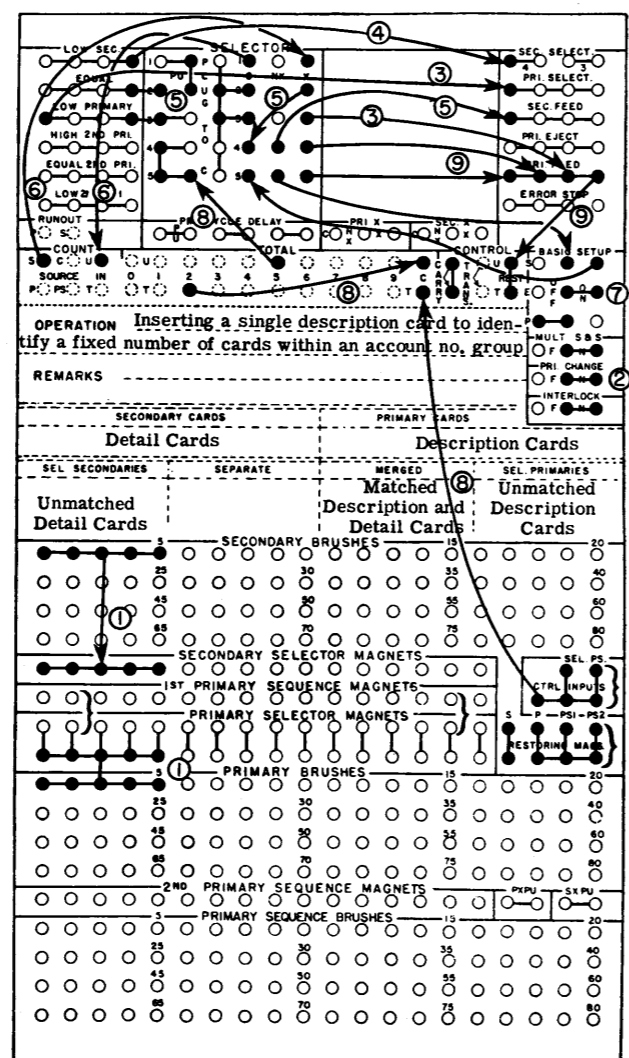
Figure 52

4. When the account number changes in the description cards (Low Secondary), the remaining secondary (detail) cards of that account number will be selected.

5. At the first match in account number, the Secondary Feed is operated by the indicated plugging of selectors 2 and 4.

6. At the first match in account number, counting begins under control of selector No. 1.

7. As the first equal secondary card is fed, the corresponding equal primary card is stacked.

8. Secondary feeding and counting continue as long as the equal account number exists and until the counters reach the number 25. When this occurs, an impulse controls selectors No. 4 and 5, and secondary feed (5) is stopped.

9. When selectors No. 4 and 5 are controlled, there is a Primary Feed cycle and the counters are restored to zero.

When this occurs, primary feeding ceases and secondary feeding begins, as does counting under control of selector 2. Secondary feeding and counting continue as long as the equal account number exists and until the counters reach the number 14. Then an impulse controls selectors 4 and 5, secondary feeding is stopped, and another set of heading cards is fed. During the first of these primary cycles, the counters are restored to zero.

The above operation is repeated until the account numbers become unequal, at which time heading or detail cards remaining from the previous group are fed and selected as low cards.

INSERTING A SET OF DESCRIPTION CARDS TO IDENTIFY A FIXED NUMBER OF CARDS WITHIN A CONTROL GROUP

Function

A set of description cards may be inserted to identify a predetermined number of cards within an account number group. Such sets of description cards may be needed to head initial and overflow sheets in a listing operation. Regular account-number punching is required in both description and detail cards. The description file consists of a varying number of sets of cards for each account number, the number being determined by the average number of cards in a control group. The last description card of each set must contain a distinctive X punch. In the example shown, 14 detail cards follow each set of description cards.

Plugging—Figure 53

The plugging for this operation is similar in principle to that for the preceding operation.

All Basic Setup switches are plugged ON, although switches S and P are conditioned by selector No. 4 and the Primary X distributor, respectively.

On the run-in, cards are automatically carried to the eject stations of both feeds. From this point, feeding is controlled by the Basic Setup, by selectors 3, 4, and 5, and by the Primary X selector. Feeding with selection takes place in either feed when the comparison indicates a low card in that feed.
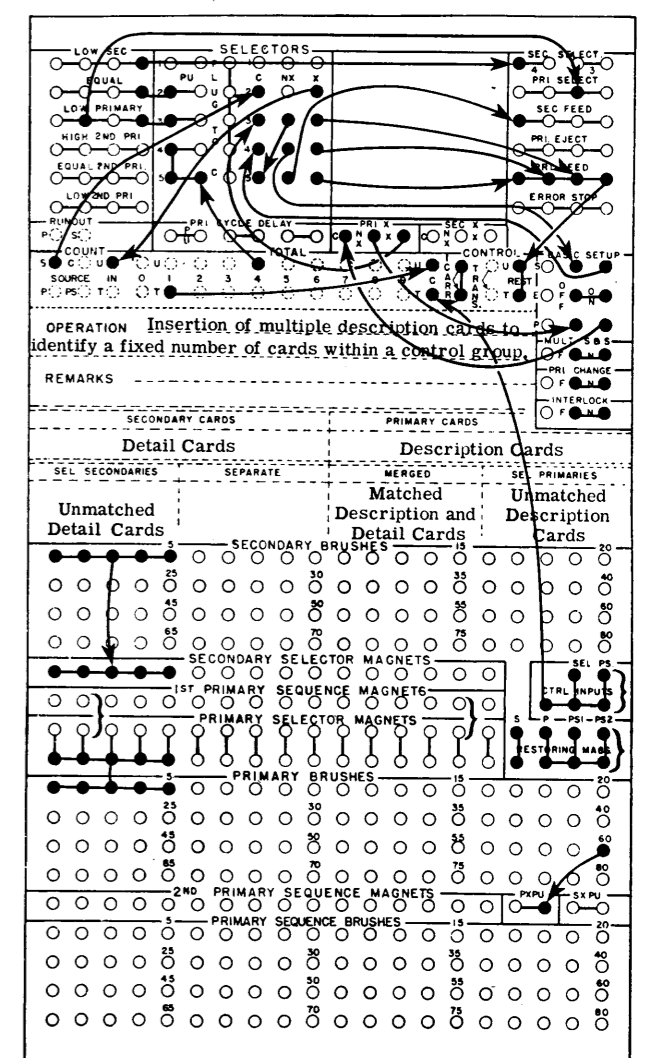

Figure 53

COLLATING A PREDETERMINED NUMBER OF PRIMARY AND SECONDARY CARDS

Function

A predetermined number of primary cards can be collated with a predetermined number of secondary cards. The predetermined number of either type of card cannot exceed 9. The last group must be inspected to determine that it was completed before either feed became exhausted. Unused cards are selected on the run-out. In this example, 4 secondary cards are collated behind 2 primary cards.

Plugging—Figure 54

With the exception of the Interlock Switch, all Basic Setup switches are plugged OFF.
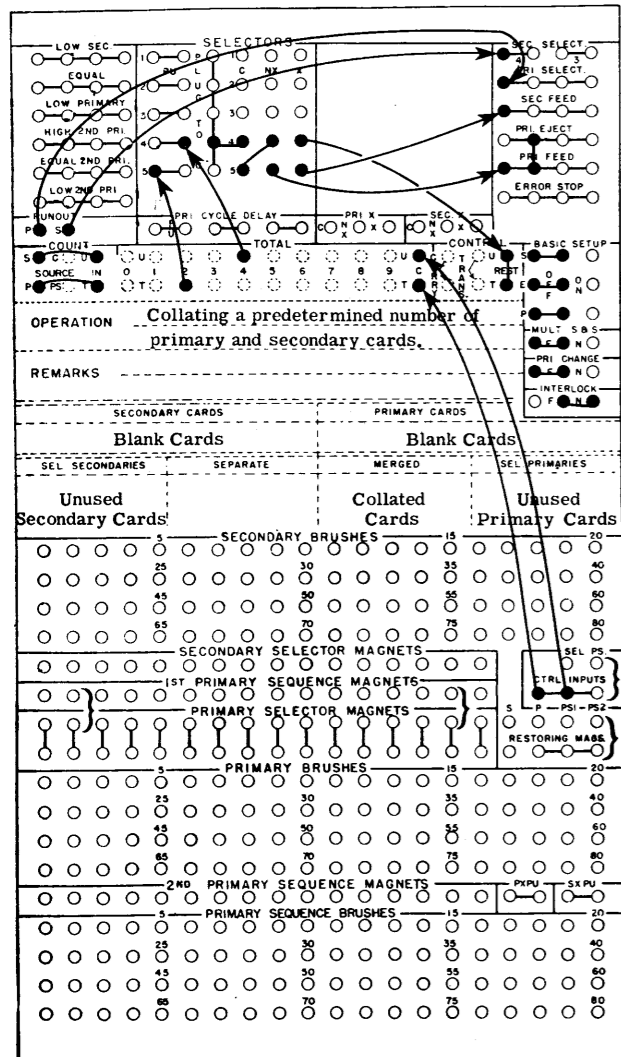
Figure 54

On the run-in, cards are automatically fed to the eject stations of both feeds. At this point primary feeding and counting begin under control of selector No. 5.

After two primary feed cycles, an impulse originating from the Control Input hubs operates selector No. 5 via the Total hubs of the Tens counter.

When selector No. 5 is controlled, primary feeding and counting stop, and secondary feeding and counting begin.

Upon the completion of four secondary feed cycles, selector No. 4 is controlled by an impulse from the Units counter.

When selector No. 4 is controlled, secondary feeding and counting stop, and both counters are restored to zero.

The foregoing operations are repeated until one of the feeds runs out of cards. As the last card in either feed is stacked, an impulse becomes available at the opposite Runout hub, and causes the selection of all cards remaining in that feed.

CONSECUTIVE NUMBER CHECKING

Function

The purpose of this operation is to verify the consecutive order of any consecutively-punched file of cards. Only two columns of a number can be checked in one operation. This should be adequate for most cases, since a check on the units and tens columns detects all discrepancies other than missing groups of 100, 1,000, 10,000, etc.

Missing numbers or groups of numbers (other than the groups listed above), duplicate numbers, and improperly filed numbers are denoted by the insertion of a blank card.

All but the last of duplicate numbers are selected. Unused blank cards are selected on the run-out.

Plugging—Figure 55

With the exception of the Interlock switch, all Basic Setup switches are plugged OFF.

Since the number being checked may exceed 9, the Carry hubs are plugged. Because transferring from the counters to a control unit is involved, the Total hubs 0 to 9 and the Transfer hub of the Units counter are plugged to the corresponding hubs of the Tens counter.

On the run-in, cards are automatically fed to the eject stations of both feeds. As the first

primary card passes the Primary Brushes a number is read into the Primary Selector Magnets from card columns 36 and 37. At this time, primary feeding is suspended and secondary feeding and counting begin under control of selectors No. 1, 2 and 3. (The plugging of the Secondary X distributor prevents insertion of more than one blank card to denote missing or improperly filed numbers.)

Once every secondary cycle a number is transferred from the counters to the Secondary Selector Magnets for comparison with the card reading stored in the Primary Selector Magnets.

When the transfer results in an equal comparison, an impulse from the Equal hubs of the Selector Unit operates the Primary Feed and permits a new reading to be entered in the Primary Selector Magnets. During the same cycle the number in the counters is increased by one. Primary feeding and counting continue until the equal impulse fails to be emitted from the Selector Unit. Failure of the equal impulse may result from the absence of one or more numbers, or from improperly filed numbers.

If one or more numbers are missing, a Low Secondary impulse is emitted. This impulse, through the selector No. 1 and the Secondary X distributor, causes the Secondary Feed to operate and insert one blank card. Secondary feeding and counting continue until the Equal impulse is again established. At this time primary feeding and counting resume.

Improperly filed numbers may result in either a Low Secondary or a Low Primary impulse. In the former instance, the operation outlined is repeated; in the latter, selector No. 3 suspends counting and causes the Secondary Feed to operate and insert one blank card.

During this cycle the counters are restored to zero. Restoring the counters creates a Low Secondary condition which again causes the Secondary Feed to operate. The blank card thus fed is selected by the plugging of the Secondary X distributor. Counting with secondary feeding and selection continues until the number in the counters becomes equal to the number in the Primary Selector Magnets.

The presence of duplicate numbers is detected by an Equal 2nd Primary impulse. This impulse, through selector No. 4 and an impulse

from the Equal hubs of the Selector Unit, stops counting, operates both feeds, selects all but the last of the duplicates, and inserts a blank card for every duplicate card selected. If duplicate numbers are preceded by missing or improperly filed numbers, the Equal 2nd Primary impulse will be retained until one of the operations outlined above has again established an impulse at the Equal Hubs of the Selector Unit.
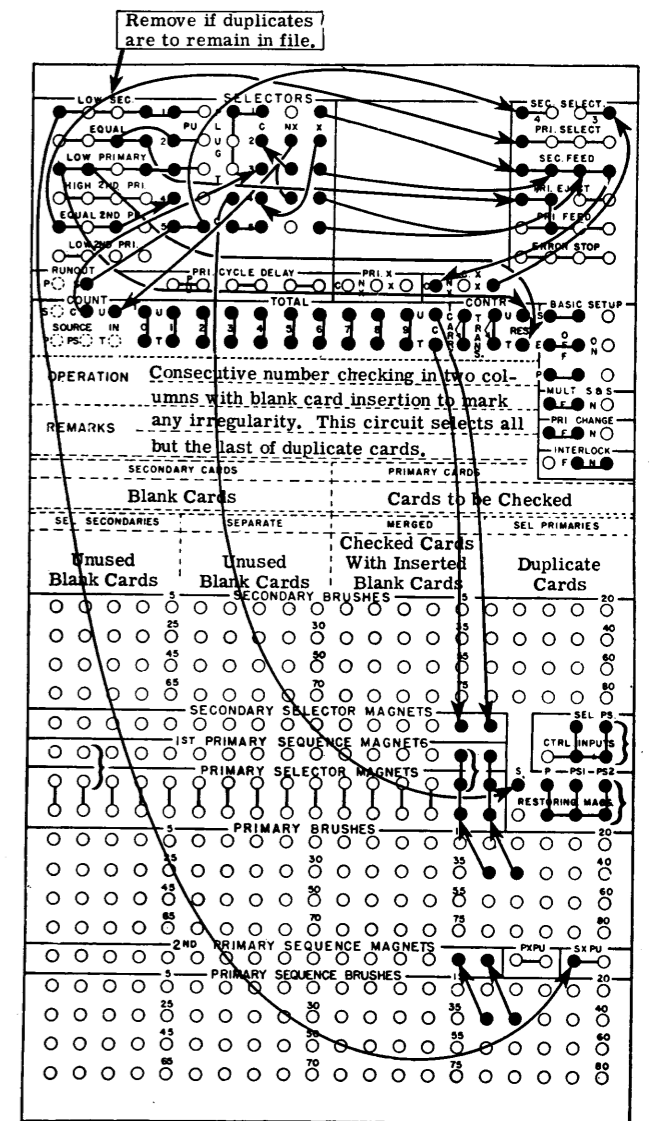

Figure 55

ALPHABETIC COLLATING DEVICE

The Alphabetic Collating Device can be specified as an extra feature to perform merging, matching and selecting of cards according to names, titles or other alphabetic information punched in the cards. As many as eight columns of alphabetic information can be used for those operations which require control of sequence and selection—that is, for those operations for which the capacity of the machine is 16 numerical positions. Without selection or sequence control, as for the merging of two sets of cards, 16 columns of alphabetic information can be read. This corresponds to numerical operations in which up to 32 numerical positions are used.

Two control positions are required for each alphabetic character because each is interpreted by the machine as a two-digit number. Three additional reading brush stations are installed to read the zone punching in 16 specified columns of the card. Corresponding hubs, located near the center of the panel, are labelled *secondary zone brushes, primary zone brushes,* and *primary sequence zone brushes.* As the names imply, only zone punches are read, but a zero zone is read as an *8,* an eleven (X) zone is read as a *7,* and a twelve zone is read as a *6.* With a regular brush wired normally to any magnet and a zone brush wired to a magnet immediately to the left, a letter is sensed as a two-digit number. An *A (12-1)* is read as 61; the twelve zone punch reads as a 6 and the lower punching normally as 1. The letters A through I are read as numbers from 61 to 69, the letters J-R read as 71-79, and the letters S-Z read as 82-89.

Since letters are read as numbers, the operation of the machine for alphabetic information is the same as the operation for numerical information except that each letter requires two magnet positions. The wiring for filing (or comparing) two sets of cards by 8 positions of name punched in each set is shown in Figure 56. Name cards in either set not matched by corresponding names in the other set will be selected.

The merging of two sets of cards in alphabetic sequence can be performed by reading up to 16 columns of alphabetic information. In this case, the wiring would be similar to that shown in Figure 41 for merging with up to 32 columns of numerical information. The only difference is the use of two magnet positions for each alphabetically punched column; the right-hand position of each two is wired from the **regular** brushes and the left-hand position is wired from the zone brushes.

Letters and numbers punched in the same columns of different cards would rarely permit a satisfactory sorting or collating operation to be performed, since a zero would be read as 80 which falls between R (79) and S (62). However, the automatic interpretation of a letter as a number permits the use of letters and numbers at the same time if they are punched in different columns of the card. The number of positions which could be read in such a combination code is determined by counting two positions for each letter and one for each numeral.

Figure 56

INDEX

JOGGLE
PLATE

SECONDARY
FEED HOPPER

PRIMARY
FEED HOPPER

STACKERS

CONTROL
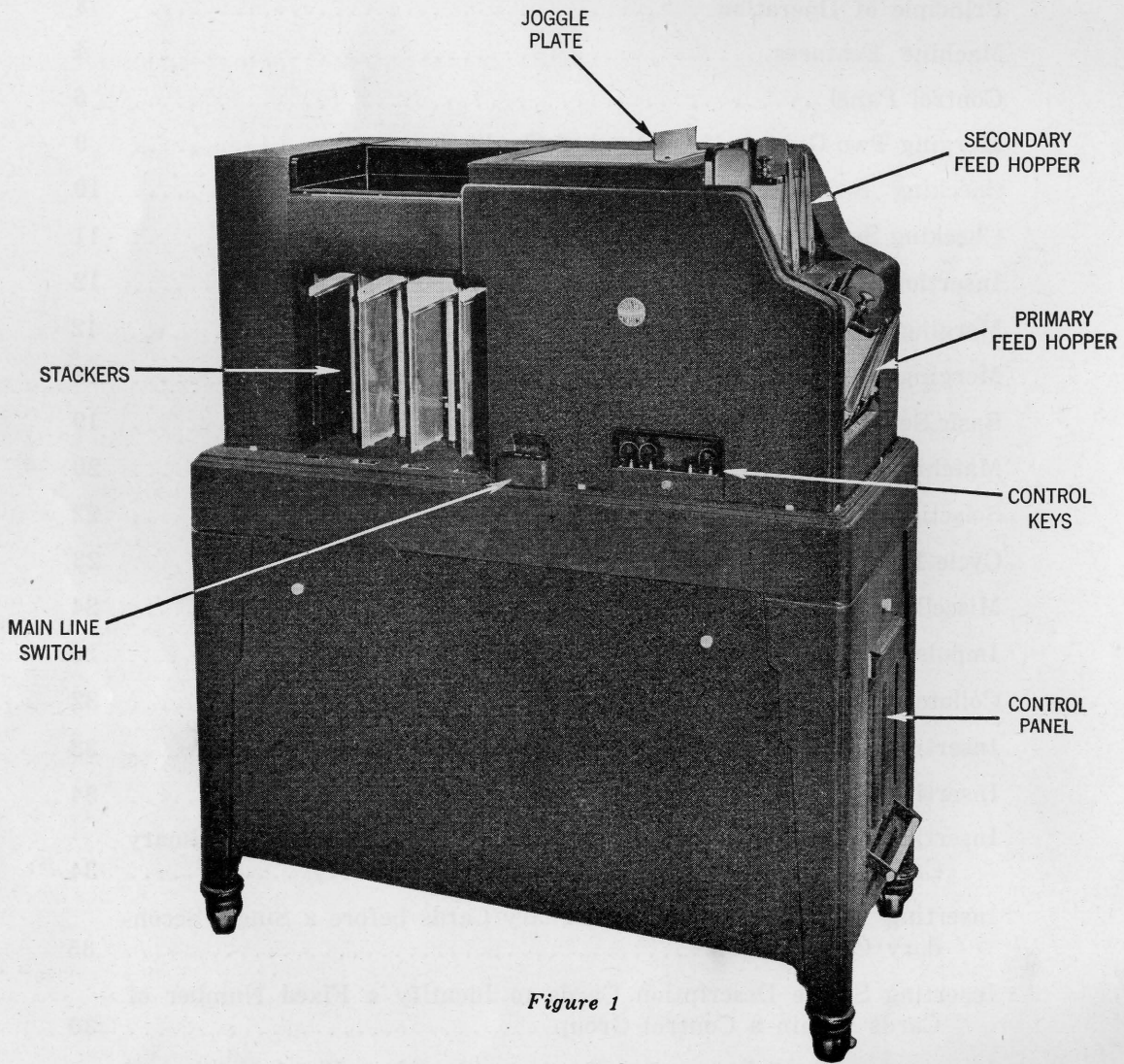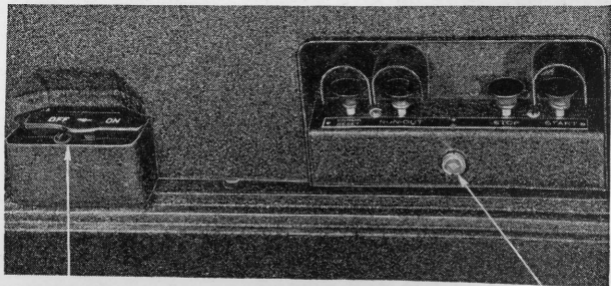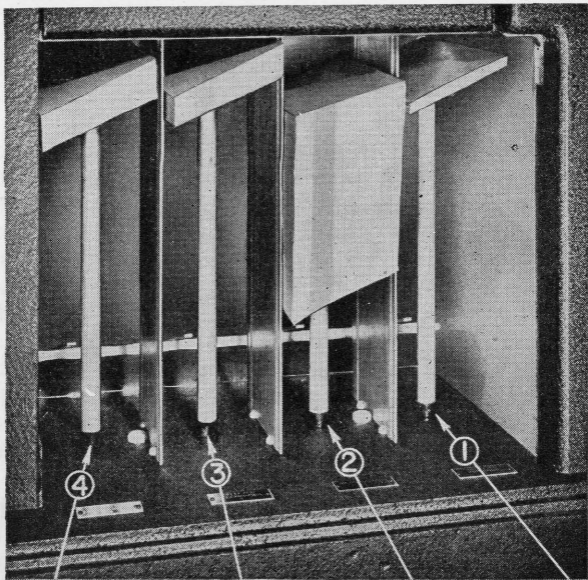KEYS

MAIN LINE
SWITCH

CONTROL
PANEL

Figure 1

IBM COLLATOR
TYPE 077

OFF ← ON

MAIN LINE
SWITCH

ERROR
LIGHT

Figure 3

| SELECTED SECONDARIES | SELECTED SECONDARIES | MERGED CARDS | SELECTED PRIMARIES |

Figure 5