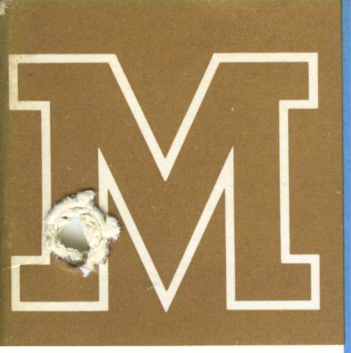

IBM

General Information Manual

Collators

IBM® General Information Manual

Collators

Contents

This is about collators – why collators were developed, what collators are, how collators do the jobs that make them a valuable addition in a business office.

Recordkeeping Develops

To show why the collator was developed, let's look at a short history of recordkeeping.

The Background

Recordkeeping is a major problem in modern business. Many factors have combined to make this so. Perhaps the most important of these factors is the margin of profit.

The margin of profit in modern business is now so small – smaller than ever before – that every decision made by business management significantly affects profit or loss. Furthermore, tax structures make complete and accurate recordkeeping necessary for simple compliance with the law.

It wasn't always this way. A long time ago, one man found that he preferred making axes to hunting. He found another fellow who preferred hunting to ax-making. The result: a simple transaction – weapons for food – no records.

But things changed. A skilled craftsman couldn't make all the products he could sell. He trained other people to make them under his supervision. Here were contracts for future delivery, employees, and anticipated prices. He had to acquire materials. He had to ship his products. He had to provide a place for his workmen to work. He had to keep records about his customers.

Business was growing up, and recordkeeping was born. The more important transactions were written in a book – each page a separate kind of information.

Then the Industrial Revolution mechanized business, and business came into its own. Here was production beyond belief. Contracts, credit, investment, workers, machines and equipment, inventory, sales, and marketing – each phase of business had its own requirements of documentation and recordkeeping.

Filing Problems

At first, businessmen tried to keep their records the same way, in a big book. Then they progressed to numbers of books. Instead of a page, a whole book was needed. Instead of a clerk, a staff of people – instead of a table top, a counting house, with many desks, many high stools, many struggling clerks. These clerks were struggling to keep up-to-date – not to lag too far behind the actual transactions. But they did lag behind. Records were far behind business operations.

An even bigger problem arose: filing the original documents from which these records were written, so that they would be accessible.

Accessibility – this was the big filing problem! It was completely impractical to refer to original documents. When information was needed from any phase of the business, it had to be dug out by searching through books and lists. Then the information had to be re-written and relisted. If reports were ever written, they were incomplete or inaccurate, or hopelessly out-of-date.

Thus, many filing systems were developed. Today you find many devices intended to provide orderly and accessible storage for documents of all kinds. Let's look at some of these files and filing devices.

Filing Methods

File Drawers

Perhaps the basic and most common filing system is a cabinet with several drawers (Figure 1). These drawers

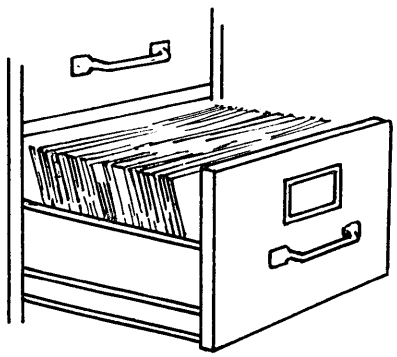

FIGURE 1. FILE DRAWER

must be large enough to accommodate the largest original document that is received. But, within a given file, the incoming documents can range in size all the way from a 3 × 5 card to a 9 × 12 sheet — or even larger.

The material on which the information is written can be anything from tissue to ledger card stock. The measurements and dimensions also vary. So standardization of size, material, and dimensions of documents is a problem in filing. In some file systems, it is actually necessary for the clerk to staple or paste the original document on a standard-size card to make it easier to put information into the file in its proper place, and to locate that information when it is needed. In other systems, the entire information is rewritten on a standard-size document.

Most such file-drawer methods require rewriting the filing code on the upper section of the document so that a file clerk can easily locate information when it is needed. Obviously, methods of this kind are expensive in man-hours.

It takes a long time to prepare the documents for filing. Then time is spent putting them away into the files. But worst of all, the information on those documents is not readily accessible.

Rotary Files

Another filing device is the rotary file — a large wheel rotating on a shaft, and with rods to hold preprinted forms that move freely on the rods (Figure 2).

Each form must be written separately from the document received in the office. The preprinted form is written by hand, or the information may be typewritten. Then the forms prepared during each business day must be taken to the rotary file, placed in their proper places, and the rods snapped back into position.

Rotary files come in various sizes. Small ones accommodate two or three hundred file cards; large ones, as many as five or six thousand file cards. But, again, the same problems must be considered:

clerical time to prepare these documents
floor space occupied by a large number of files
cost of acquiring and maintaining the devices

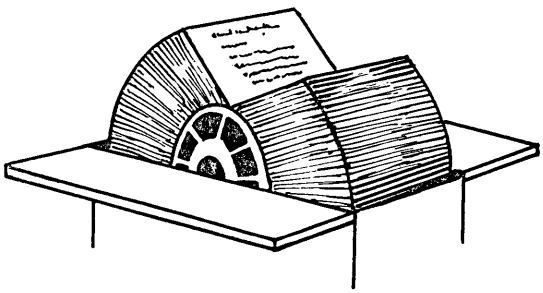

FIGURE 2. ROTARY FILE

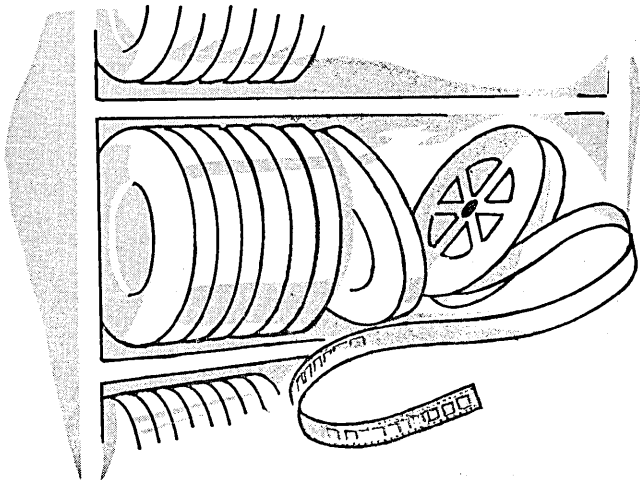

FIGURE 3. MICROFILM

The rotary file was designed to make information readily accessible. However, it is not very practical where the volume of information is large.

It has another disadvantage. When the information has been located, it must be written, reclassified, and relisted. Its principal use is for quick reference to individual items.

Microfilming

Some organizations file many of their documents by microfilming processes. Here, the original document is photographed on a film, and the reel is stored for future reference (Figure 3). Each reel is coded and placed in a rack. When necessary to locate a piece of source material, a clerk plays back the reel of film on a viewer until he locates the desired document. This is an ingenious way to approach the problem of space.

However, it has certain disadvantages. When the document has been located, the clerk must transcribe the information he wants to another piece of paper. He may have to search several reels of film to find all the information needed. When he has transcribed all this information to a list, it is not yet in its most usable form. A report must still be written.

Besides, the same problems are presented — easy accessibility of information, and flexibility of its use.

Requirements of Filing

Many devices, many methods, many systems are employed for filing information and making it available for future use. Let's try to sum up this problem by considering the minimum requirements of a good filing system. Then, we can evaluate the system by applying the businessman's standards — efficiency, accuracy, and economy. Here are the requirements:

1. Data must be complete and accurate.
2. It must be easily accessible.
3. It must be easy to get data in and out of the files.
4. It must be possible to cross-index.
5. It must be easy to compile information into reports.

These are the minimum criteria of filing and file maintenance. Most businesses have additional requirements. But here are the problems modern business must face in fulfilling these fundamental requirements:

VOLUME: Every detail, every scrap of information, is significant to the successful operation of a business. Filing and file maintenance must be designed to accommodate the large masses of detail.

SPACE: Floor space in offices is very expensive.

MANPOWER: Filing and file maintenance are not directly productive. The cost of personnel in this phase of the business operation greatly increases overhead costs.

COST: Apart from the investment in floor space and in personnel, the furniture and mechanical devices needed in any particular filing system are important factors in determining costs.

FLEXIBILITY: The data contained in these files is vital as the basis for management decisions. Information should be available, by any classification, on short notice.

ACCURACY: The accuracy of the information in the files must be verified. Furthermore, it must be in proper and logical sequence.

The Punched-Card Principle

While these problems of recordkeeping, filing, and file maintenance were developing, the punched-card principle was conceived and developed. IBM has produced machines that read information punched in cards, and make logical decisions based on predetermined standards for each set of circumstances.

Requirements Satisfied

Let's see how this data processing principle meets the requirements of business in filing and file maintenance, and let us note, too, how this concept goes beyond the requirements to provide greater advantages and more benefits.

VOLUME: Complete information of every single transaction is punched into cards. Original source documents are related to the punched cards to leave clear-cut audit trails. The cards have standard sizes and dimensions. Each card is a unit record of some transaction. After they have been coded and punched, large volumes of transactions are handled by machines.

SPACE: Original documents can be stored in low-cost storage space when the information on them has been transcribed to punched cards. Physically, the file cabinet designed to hold 120,000 punched cards — 10 million items of information — occupies four square feet of office floor space. The same amount of information, filed by source documents in manila folders, would require about twenty-five times as much floor space.

MANPOWER: Filing punched-card records and maintaining those files is accomplished by high-speed IBM equipment. The machines operate under the direct instructions of operating personnel. Some businesses that have converted from manual to punched-card methods show more than 500 percent increase in filing efficiency.

COST: IBM filing method results in economies in floor space and in personnel. Using this method means expanded possibilities for keeping detail records, and for making use of these detail records. Careful examination of the costs of acquiring and operating machines, devices, and equipment under various methods shows a reduced unit-cost-per-item of management facts with the punched-card method.

FLEXIBILITY: The punched-card method of recording information brings unlimited flexibility. Every detail of every transaction can be placed in the records in its proper sequence and its logical location. This information is always available. It can be located and removed on short notice, regardless of its sequence or location. Management decisions can be founded on factual information, made available at the proper time.

ACCURACY: Every time source information is coded into a punched card, transcription and the information are verified for complete accuracy. From this point on, the human element of error is re-

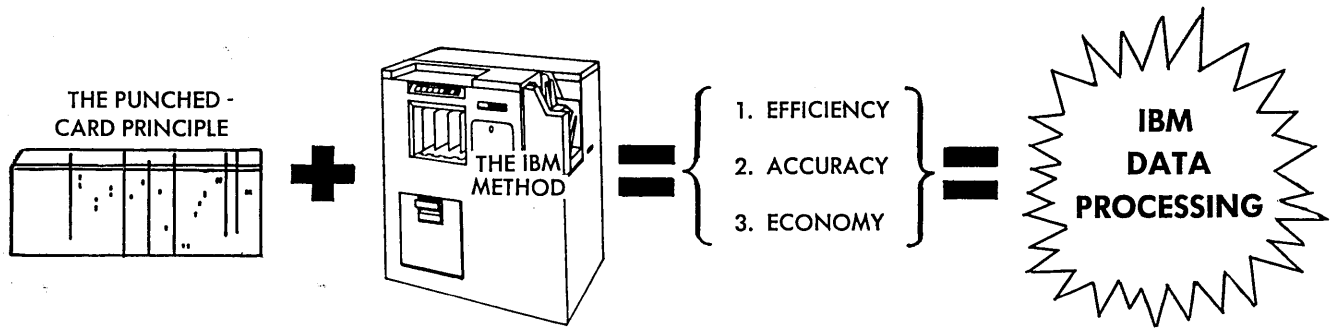

FIGURE 4. THE ROLE OF THE COLLATOR

moved. All handling, filing, writing, calcuating, and interpreting of this information is done mechanically. And at the same time, clear-cut audit trails are established, automatically providing extensive controls over all procedures.

This, then, results in efficient, accurate, and economical data processing — data processing that provides management with complete, factual information, whenever it is needed.

The IBM collator plays an essential role in this data processing (Figure 4).

Purpose of the Collator

The collator is expressly designed to solve some of these problems of filing and file maintenance:

1. Documents must be accurately filed. Each piece of information has an assigned place in the files, and should occupy that place at all times. We can say that it must have a given relationship to the information immediately preceding it and the information immediately following it. *This is sequence.*
2. Information must be easily accessible. It should be possible to locate a given piece of information and remove it from the files quickly. *This is selection.*
3. It must be possible to place data in the file easily. If a file is to be kept up to date, information is constantly added to it. The added information must be placed in its proper location in the files. *This is merging.*
4. It must be possible to check a file for correspondence with information in another file. When data does not conform to the pattern, it should be possible to locate and remove it from the files without disturbing the sequence of the remaining data. *This is matching.*

It is possible to combine some of these functions at times, to increase speed and efficiency.

The purpose of this manual is to discuss the following IBM collators with respect to their characteristics, their capabilities and functions, and their place in the unit-record, data processing picture.

IBM 85 Collator

IBM 87 Collator (alphabetic)

IBM 88 Collator

The Principle of Comparing

In filing operations information is compared with other information to determine its proper relationship. In developing a collating machine, therefore, the first resquisite is the ability to compare one item of information with another.

Total Values

The operation of the beam balance illustrates the principle of comparing. Let's place these items on each stage of a beam-balance scale. If the *total* weight of the three items on Stage A is exactly equal to the *total* of the three items on Stage B, the beam balance remains level; and the indicator points to zero, or equal.

If the total weight is greater on Stage A, the indicator points in that direction. A is greater than B.

But if the total weight is greater on Stage B, the beam balance inclines in the other direction. A has a lower value than B.

In the illustration (Figure 5), there are three weights on each of the stages.

The largest weight on Stage A is greater than the largest weight on Stage B.

The next largest weight on Stage A is smaller than the second largest weight on Stage B.

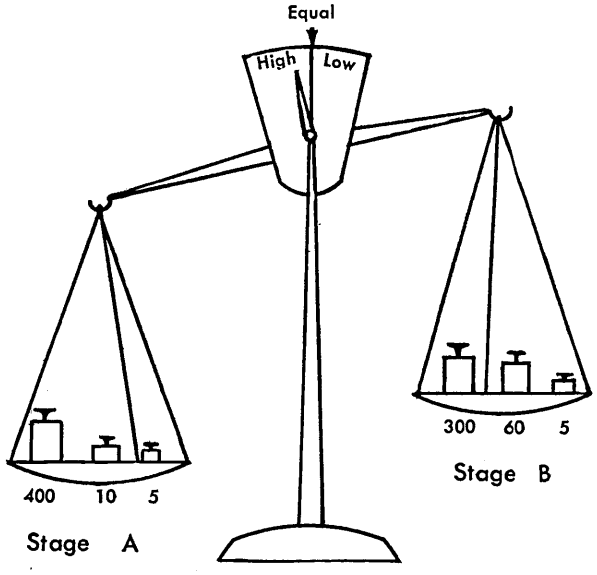

FIGURE 5. BEAM-BALANCE SCALE

The smallest weight on Stage A is exactly equal to the smallest weight on Stage B.

Yet, the reading on the beam balance indicator shows that A is *high* in relation to B. The *total* weight is greater.

In the Collator

IBM collators make this comparison mechanically or electrically in somewhat the same fashion as the beam-balance scale. Now let's look at the most important parts of any collator – its comparing or control units.

Control Units

Each collator has at least two control units. Though they are alike in function, each is named according to its primary operation: *sequence* unit for comparing in the same feed, and *selector* or *comparing* unit for comparing between feeds.

Each control unit has two sections. Each part records one piece of information and compares it with information in the other section. Three positions are used in this particular example (Figure 6).

We have labelled the upper half of the control unit *secondary read.* The number read at the secondary read station is stored in this half. The lower half of the unit is labelled *primary read.* The number stored in this half is read at the primary read station.

In position 1, the comparison shows that these two numbers are exactly equal. In position 2, the lower half is higher than the upper half – 6 in the lower, 1 in the upper. In the third position, however, the sec-

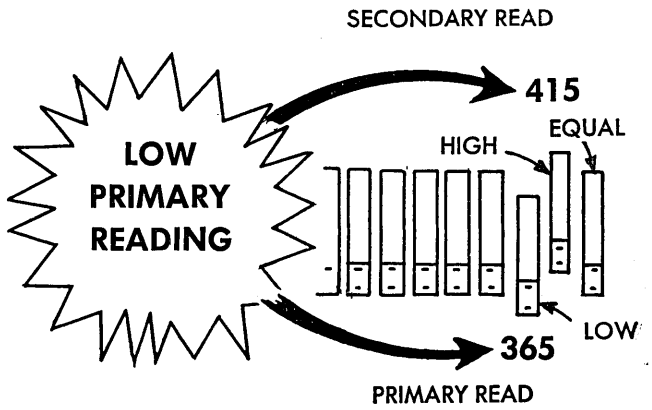

FIGURE 6. COLLATOR COMPARING

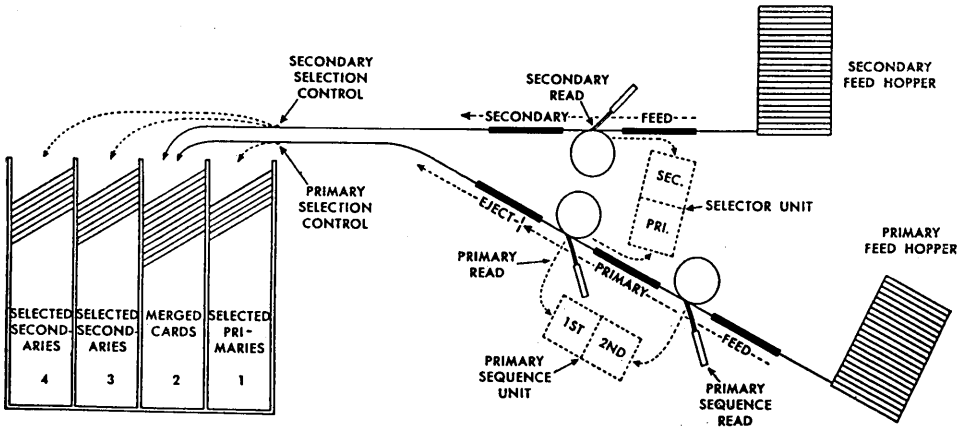

FIGURE 7. SCHEMATIC OF FEED UNITS — IBM 85, 87 COLLATORS

ondary read value, 4, is greater than the primary read value, 3.

The control unit acts just as the beam balance does. It uses the total value, rather than any of the individual values. The comparison is a low primary reading.

This, then, is the collator comparing unit — a unit that evaluates a piece of information to determine whether it is higher, lower, or equal, in comparison with another piece of information.

Machine Features

In addition to the control units, two other features — feed units and pockets — perform major functions in the collator.

Feed Units

Each machine has two hoppers for holding cards. One supplies the *primary feed;* the other, the *secondary feed* (Figure 7). The purpose of these feeds is to provide one card at a time for comparison in each feed.

The cards being processed in the primary feed pass a primary sequence reading station and then a primary reading station. These cards are read twice. The cards feeding in the secondary pass only a secondary reading station. (The 88 Collator has a sequence reading station in the secondary as well — Figure 8.)

Each one of these reading stations can read the information from any given field in the card, and send that information to a control unit for comparison. This method of comparing information offers tremendous possibilities of flexibility.

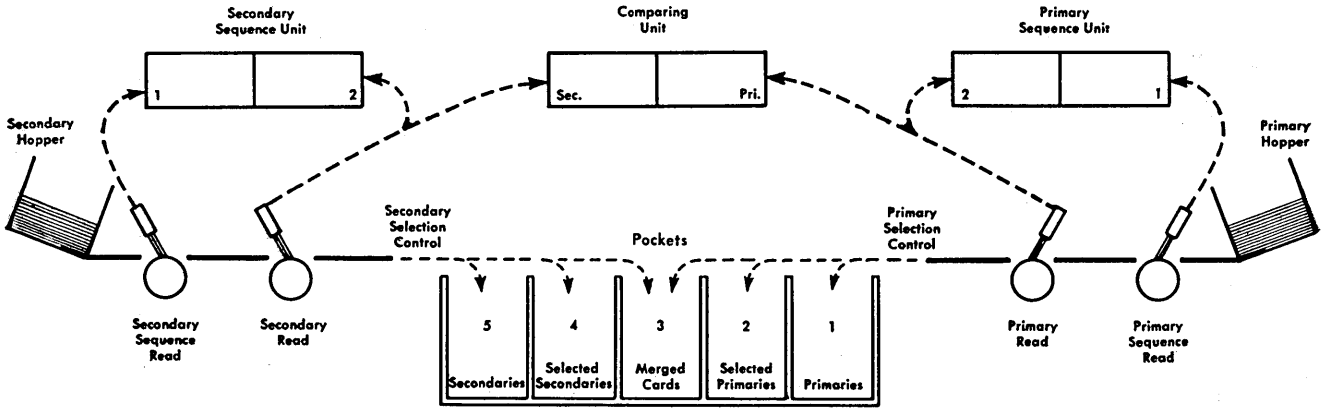

FIGURE 8. SCHEMATIC OF FEED UNITS — IBM 88 COLLATOR

Pockets

The next consideration is what to do with the results of the comparison. These decisions are the operator's wishes as indicated by wires placed in the control panel. As a result of these decisions, cards can be diverted into different channels.

The cards that were fed in the primary can be diverted into one of two channels (one of three in the 88 Collator). Cards that have been fed in the secondary feed can be diverted into one of three different stacker pockets. The merge pocket is the only one accessible from both feeds.

Let's take an application. We have a file of cards containing the names and addresses of all our customers. We'll call these master cards. We have another file of cards containing all the purchases made from us this month. We'll call these transaction cards. These could be files of any master and detail cards. This is what we want to do:

1. We want to know all the customers who have not bought anything this month.
2. We want a separate group of all the customers who did buy something this month.
3. Behind the name and address card of each customer who bought something, we want each card showing his purchases.
4. If there were any transactions that were not directly related to some customer in our name-and-address file, we want those cards in a separate group.

Figure 9 shows the use of the pockets in this application. We can put the master cards in the primary feed and the transaction cards in the secondary feed. The master cards can go into one of two pockets (one of three on the 88). Master cards for customers who made purchases are fed into pocket 2 (pocket 3 in the 88 Collator). All other master cards go into pocket 1 (or pocket 2 in the 88 Collator), and we know that master cards cannot go into any other pocket. Transaction cards in the secondary feed go into one of two pockets. Transactions that can be directly related to one of our customers go into pocket 2 (pocket 3 on the 88 Collator) directly behind the name and address card of the proper customer. All unrelated transaction cards go into one of the selected pockets associated with the secondary.

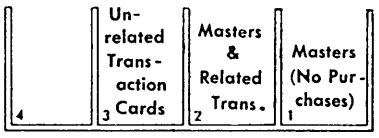

FIGURE 9. USE OF POCKETS

Perhaps we can best compare a collating machine with a man (Figure 10). The feeds are his hands, which take one card from each of two piles, transport them to the reading stations, or the eyes. The eyes read the information and send it to the control unit, the brain. The brain makes a comparison and sends signals along a network of nerves (the control panel), telling the hands where to put each one of these cards, in one of four piles.

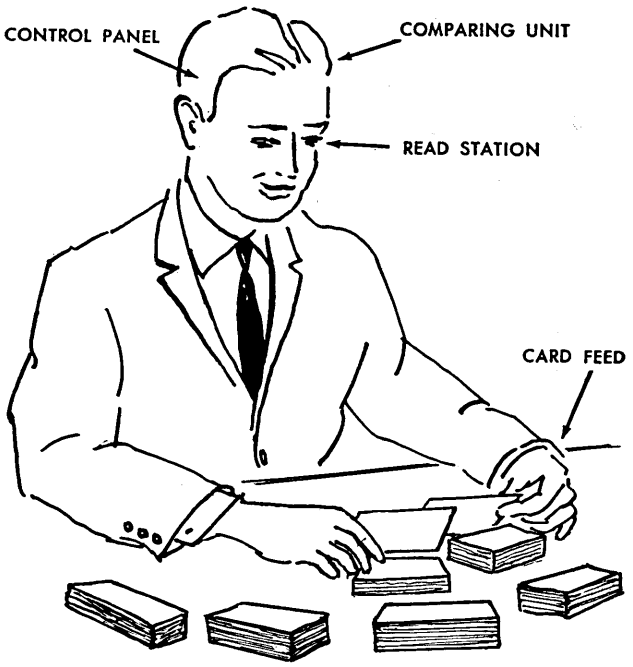

FIGURE 10. MANUAL COLLATING

What the Collator Does

Now, to see where the collator fits into filing and file maintenance, let's enumerate the four basic functions involved in filing and maintaining files:

Sequence Checking
Selecting
Merging
Matching

Every problem of filing and file maintenance fits into one of these operations. Combining these functions results in real economy and efficiency in processing data. Let's examine each and fix it firmly in mind.

Sequence Checking

We've said that all the information in a file should be in accurate sequence. Now let's suppose that a large business organization wants to print a roster of all its employees by department, by man number. This is a simple report-writing operation because all that need be done is process all the cards in the personnel file in an accounting machine. But if some of the cards are out of correct sequence (either in the wrong department, or out of sequence within a department), it might be necessary to rewrite the entire roster report. It is economically justifiable to check the accuracy of the sequence in the file.

The Principle

As cards pass through the machine, the collator compares each card with the one ahead. Since checking sequence is normally done for ascending order, an error in sequence is defined as a *step-down* condition in which a card is recognized as lower in number than the preceding card. An impulse, through control-panel wiring, normally stops card feeding and turns on the error light.

The Operation

The clerk places the cards from the beginning of the file in the hopper labelled *Primary Feed.* Wires in the control panel instruct the machine what to do for each set of circumstances – high, equal, or low.

Obviously, there should be no equals, or an employee number is duplicated. If the machine recognizes a low situation, then a card is out of sequence, and it should be brought to the attention of the operator in some way. If the machine recognizes a high situation, it's perfectly all right, and the operation

should proceed. The secondary hopper and the secondary feed are not normally used in this particular operation, except in the IBM 88 Collator.

The employee cards feed from the primary hopper into the machine. When the first employee card reaches the primary read station, the second employee card is at the primary sequence station (Figure 11A). The collator compares the two cards. The second employee number (for example, 10468) is higher than the first employee number (09363). The collator recognizes this and proceeds.

The first employee card goes into a stacker pocket. The next employee card moves to the primary read station, and a third employee card in the hopper moves to the primary sequence station.

Now the situation is different. The third employee number (10112) is lower than the previous employee number (10468). Obviously, it is out of numerical sequence.

But the operator instructed the machine (by control-panel wiring) to stop and flash a red signal whenever comparison showed anything other than a high situation; so the machine stops and an error light goes on (Figure 11B). Now the account clerk can remove the cards from the machine, locate the error, and place the misfiled card in its proper position (Figure 11C).

When cards are runout for a sequence-error condition, the step-down card is the second one runout. However, this card *may* or *may not* be the card out of sequence. A check must be made of several cards from both the stacker and the hopper to determine which card or cards are out of order so that they can be properly filed manually. Figure 12 illustrates three different types of sequence errors: In *A*, the step-down card (3) is out of order; in *B*, the card (9) preceding the step-down card is out of order; and in *C*, the step-down card (3) and the two following cards (4 and 5) are out of order.

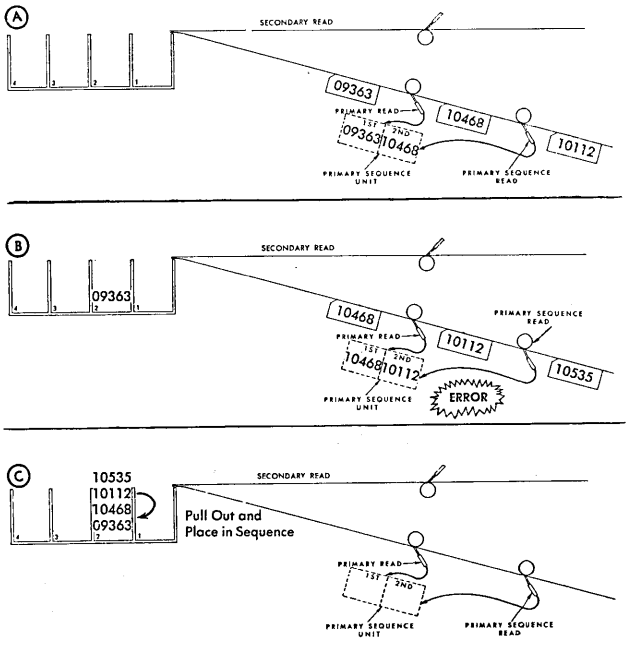

FIGURE 11. SEQUENCE CHECKING

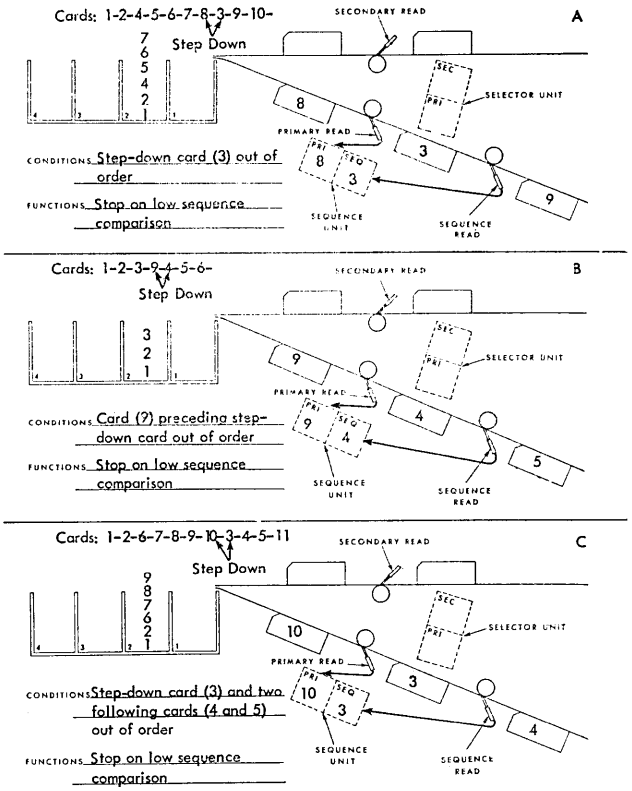

FIGURE 12. TYPES OF SEQUENCE ERRORS

Alphabetic Sequence Checking

Some business organizations maintain their customer files alphabetically by name and address. These can be sequence checked in two ways:

1. The alphabetic information is coded so that the account number assigned is a numerical code for alphabetic information. The collator then recognizes any error in numerical sequence.
2. The alphabetic information is checked for sequence directly by an alphabetic collator, or by a special device which adapts a numerical collator to comparing alphabetic punching.

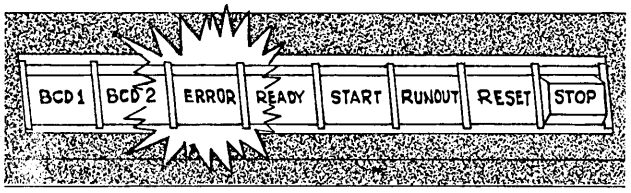

FIGURE 13. ERROR SIGNAL

Error Instructions

This, then, is sequence checking. The collator verifies the desired sequence of a file of cards, whether numerical or alphabetic. Whenever it encounters an out-of-sequence condition, the machine follows the instructions set up by control-panel wiring:

1. It can stop the machine and flash an error light (Figure 13). Then the operator can rearrange the sequence properly.
2. It can insert a signal card at the place where the out-of-sequence condition occurred, and continue sequence checking (Figure 14). This is a faster method because the machine does not stop. The operator can correct the out-of-sequence condition while the machine continues to run. The signal card can have a distinctive color, or it can have a corner cut different from the corner cut on the file cards.
3. The machine can select out-of-position cards and feed them into another pocket. The machine continues to run, and cards that have been selected into pocket 1 (Figure 15) can be placed in the proper position later.

A Basic Function

Sequence checking is only one of the operations the collator can perform. Usually, sequence checking is done in combination with some of the other functions.

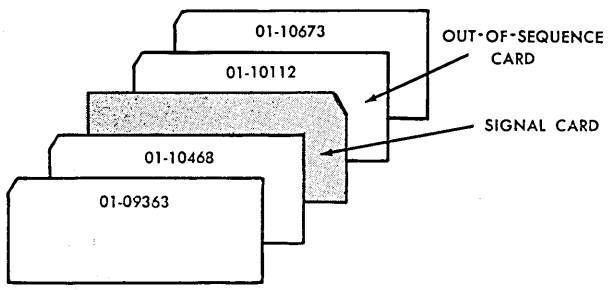

FIGURE 14. INSERTING SIGNAL CARD FOR SEQUENCE ERROR

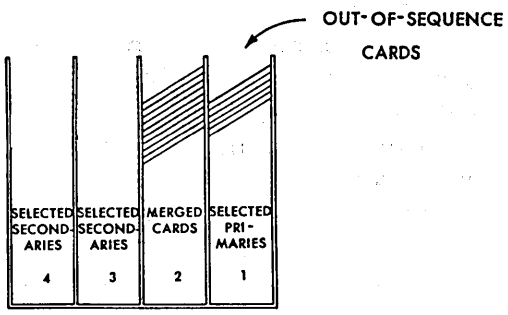

FIGURE 15. SELECTING OUT-OF-SEQUENCE CARDS

Sequence checking, like all other functions of the collator, is extremely flexible. There are many variations of sequence checking, but this, as we have described it, is the basic operation.

Selecting

Information must be accessible! It should be possible to locate a given piece of information and remove it from the files quickly. Obviously, if it is necessary to refer to some one card in the files, a clerk can locate the card manually and remove it, then replace it when it is no longer needed.

However, in many cases large numbers of cards must be removed from the files, and a financial or analytical report written from them.

The Need for Card Selection

Suppose you have a large history file of sales made to all of your customers. You want to examine the last purchase made by each customer, by date. A report showing the last time each customer made a purchase helps determine the effectiveness of the sales program and, perhaps, indicates customers who should get special attention from your salesmen.

Your file contains customer cards with the customer number punched in them, and behind them, in the order of date of purchase, the transaction cards.

Obviously, if you could get the last card of each customer number, you could list those on the accounting machine and have the desired report very quickly.

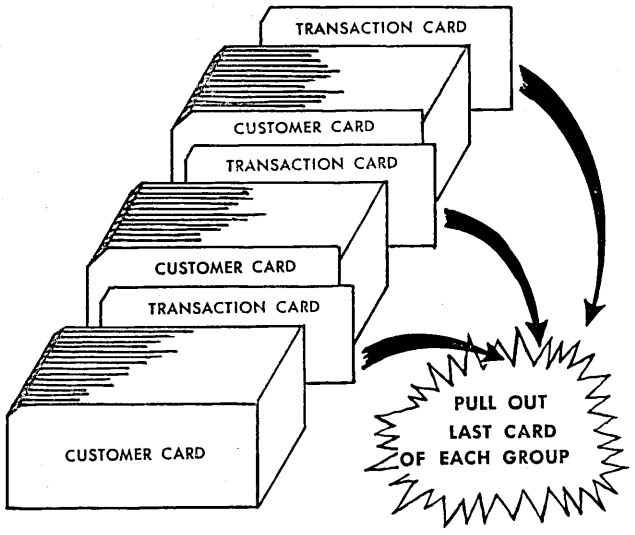

FIGURE 16. SELECTION

Each customer number represents a group. The last card of each group is the last transaction made by that customer. You want to select the *last* card of each control group (Figure 16).

The Operation

As cards pass through the feeds of a collator, they are normally directed in the primary feed to pocket 2 (pocket 1 in the 88 Collator). It is possible to divert primary cards into pocket 1 (pocket 2 or 3 in the 88 Collator). The operation is similar in the secondary feeds.

Each feed is equipped with select magnets that position the chute blades to guide a card to a particular pocket (Figure 17). In effect, each select magnet operates a little gateway, diverting a card from its normal path into an alternate path leading to one of the selected pockets.

When the collator is instructed to select a particular card or a particular group of cards, it means only that under certain circumstances the machine signals one of the select magnets.

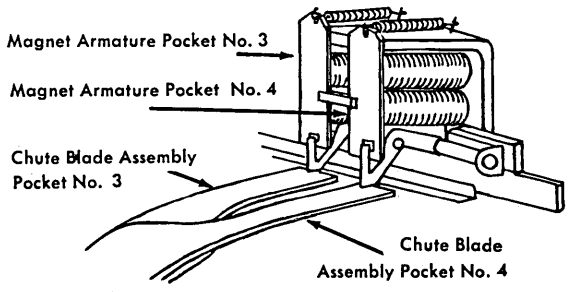

FIGURE 17. SELECT MAGNETS

Typical Examples

Now let's look at our example of card selection.

Selecting the Last Card of Each Group

The cards are placed in the primary feed of the collator (Figure 18), and the machine is instructed to select the last card of each group.

When the first customer card is at the primary read station, and the first transaction card is at the primary sequence station, the two customer numbers are read and compared (A). They are equal because they belong in the same group, and they continue to advance.

All the transaction cards in this customer number show equal readings (B) until the master card of the next group reaches the primary sequence station (C). At the same time the last card of the previous group is read at the primary read station.

Now there is a change in customer number. The file is arranged in ascending sequence, the low customer numbers followed by higher customer numbers. Therefore, the comparing unit recognizes a change from equal readings to a high reading. The collator flashes a signal to the primary select magnet, and the last card of the group is diverted into pocket 1. During this entire operation of feeding, reading, comparing, and selecting, the feeds do not stop. Maximum speed is achieved.

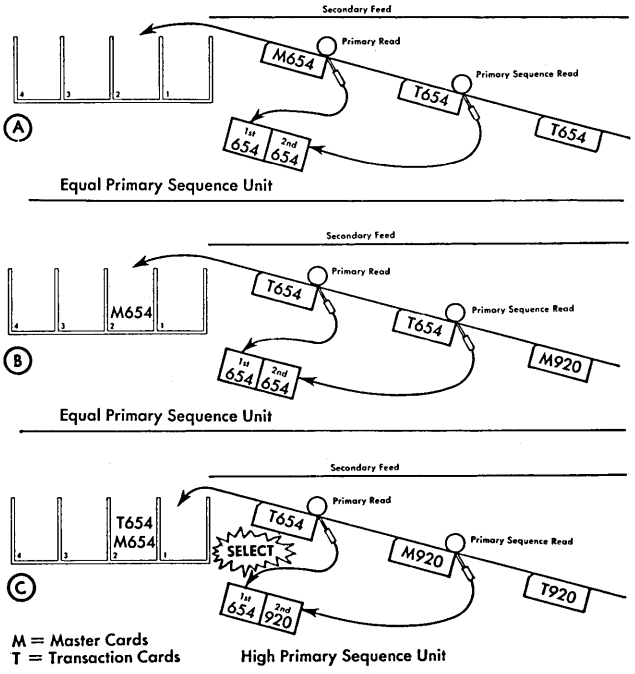

FIGURE 18. CARD SELECTION (LAST CARD OF EACH GROUP)

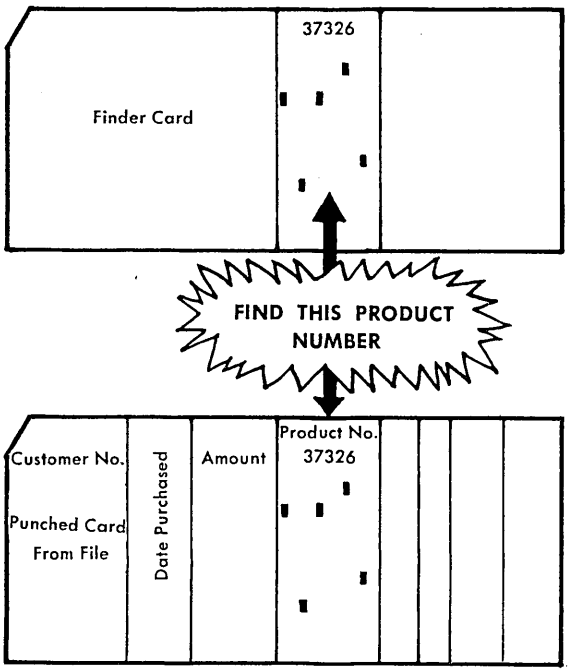

FIGURE 19. FINDER CARD

In this way the entire file is fed through the collator. Each time a master customer card is recognized, the card immediately preceding it is selected. When the operation is finished, the file is still in the same order as it was before. But the last card of each group has been removed. These are the cards for writing the report.

File Search

But in the same situation, suppose we had wanted to run a report of all the customers who had bought a certain product — say, product number 37326.

The purchases made by the customers were not in sequence by product number. Throughout this entire history file of customers and their purchases, there would be many transactions involving product number 37326. The problem, then, is to remove all the transaction cards with that product number, without disturbing the sequence of the master file.

The collator can do this using a *finder card.* This is the name given a card punched with a control figure for locating certain information. In this case, we punch into a card the number 37326, in the same card field in which the product number appears in the transaction cards (Figure 19).

The finder card is placed in the primary feed hopper, with the cards from the history file behind it.

In the IBM 85 Collator, for example, card feeding starts, the finder card reaches the primary sequence station first. The control number or finder number (in this case, 37326) is read at the primary sequence station and held in one half of the control unit. No other information is read from the primary sequence station during the entire process; therefore, this number remains in half of the comparing unit until the operation is completed.

The collator is instructed to select any cards passing the primary read station with a product number *equal* to that in the control card.

The control card is the first one to reach the primary read station. The number is compared with the control number. It is equal to the control number, and the collator flashes a signal to the select magnet to select this card. So the finder card is selected into pocket 1.

The cards advance. The next card does not have the same product number. It may be a customer master card, with nothing punched in the product field. This card is allowed to feed directly into pocket 2. Each card passing the primary read station is examined the same way. The number in the product field is compared with the control number punched in the finder card. Whenever the comparison results in an equal reading, the card is diverted into pocket 1. In all other cases, the card proceeds directly to pocket 2.

When the entire file has been processed by the collator in this way, we have two groups of cards (Figure 20):

The master file in its original sequence.

The finder card and all product cards number 37326 in sequence by customer number.

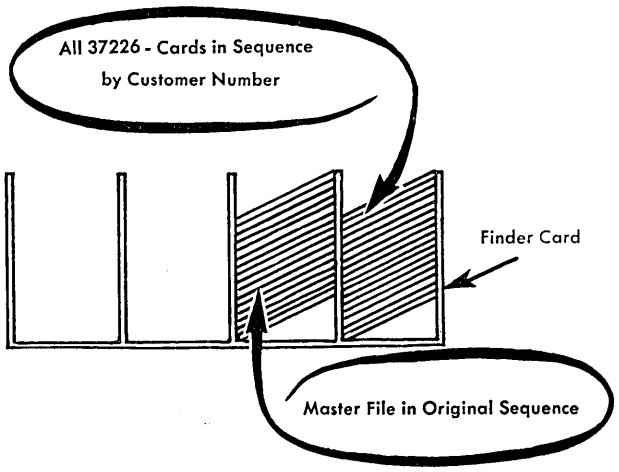

FIGURE 20. FINAL GROUPING

The collator can select cards on many different types of comparison:

select all X-cards

select everything but X-cards

select the first card in a group

select the last card in a group

select all single-card groups

select cards lower than a control number

select cards equal to a control number

select cards higher than a control number

select cards equal to either of two control numbers

select cards between two control numbers

select all cards except those between two control numbers

select cards higher or lower than, or equal to a control number, with the control number changing at different places in the file

All these operations are part of the function of selecting cards: Comparing two items of information with each other and diverting cards from the regular feed channels as a result of the comparison. This is the basic principle of card selection.

Selection can be performed in combination with the other operations of the collator.

Merging

It must be possible to get data into the file easily. If a file is kept up-to-date, information is constantly added to it. This added information must be placed in its proper location in the files.

As we saw in the discussion of card selection, often information is removed from the files. When it has been used, it must be returned to the files, easily and quickly. This is interfiling, or merging.

When merging, the collator combines two files of cards already in sequence, to produce one complete file, also in the proper sequence (Figure 21). This is one of the most important and useful features of the collator.

Maintaining a File

In many applications a year-to-date file is maintained. A sales-analysis year-to-date file is a good example. There is a card for each customer number, with total purchases to the end of the last accounting period.

At the end of the current accounting period, all accounts that have experienced sales activity are removed from the file, and a sales report written (Figure 22). The master file retains only those cards for customers who have not had any transactions during the current accounting period.

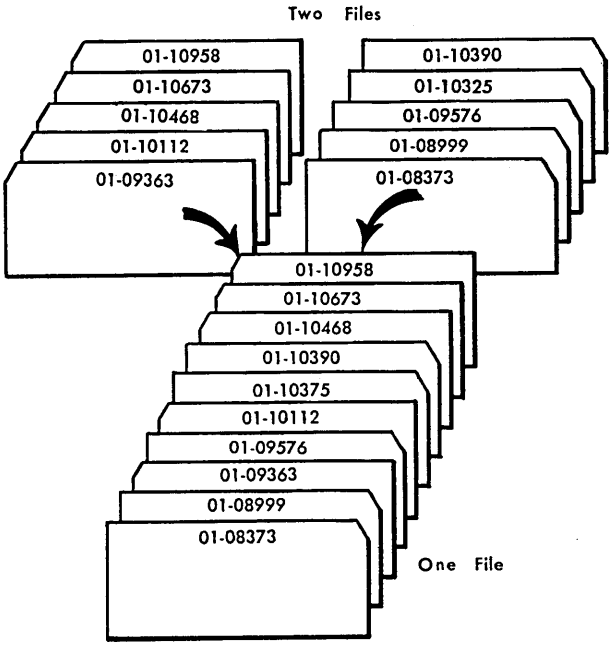

FIGURE 21. MERGING TWO FILES

While the sales analysis report is being written, new year-to-date summary cards are prepared. These new summary cards must go into the master file to replace the cards that were removed. In this way, the master file is kept up-to-date for the current account period. This is a merging operation.

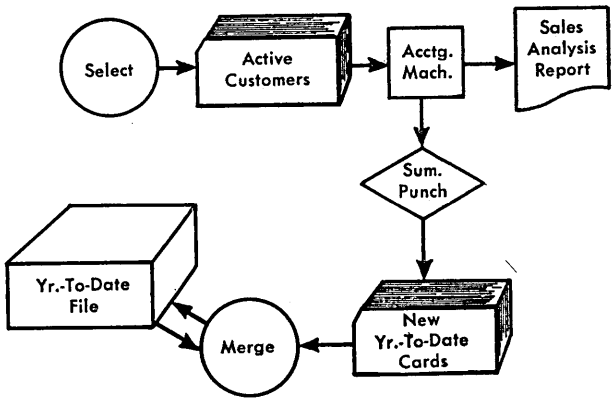

FIGURE 22. USE OF MERGING

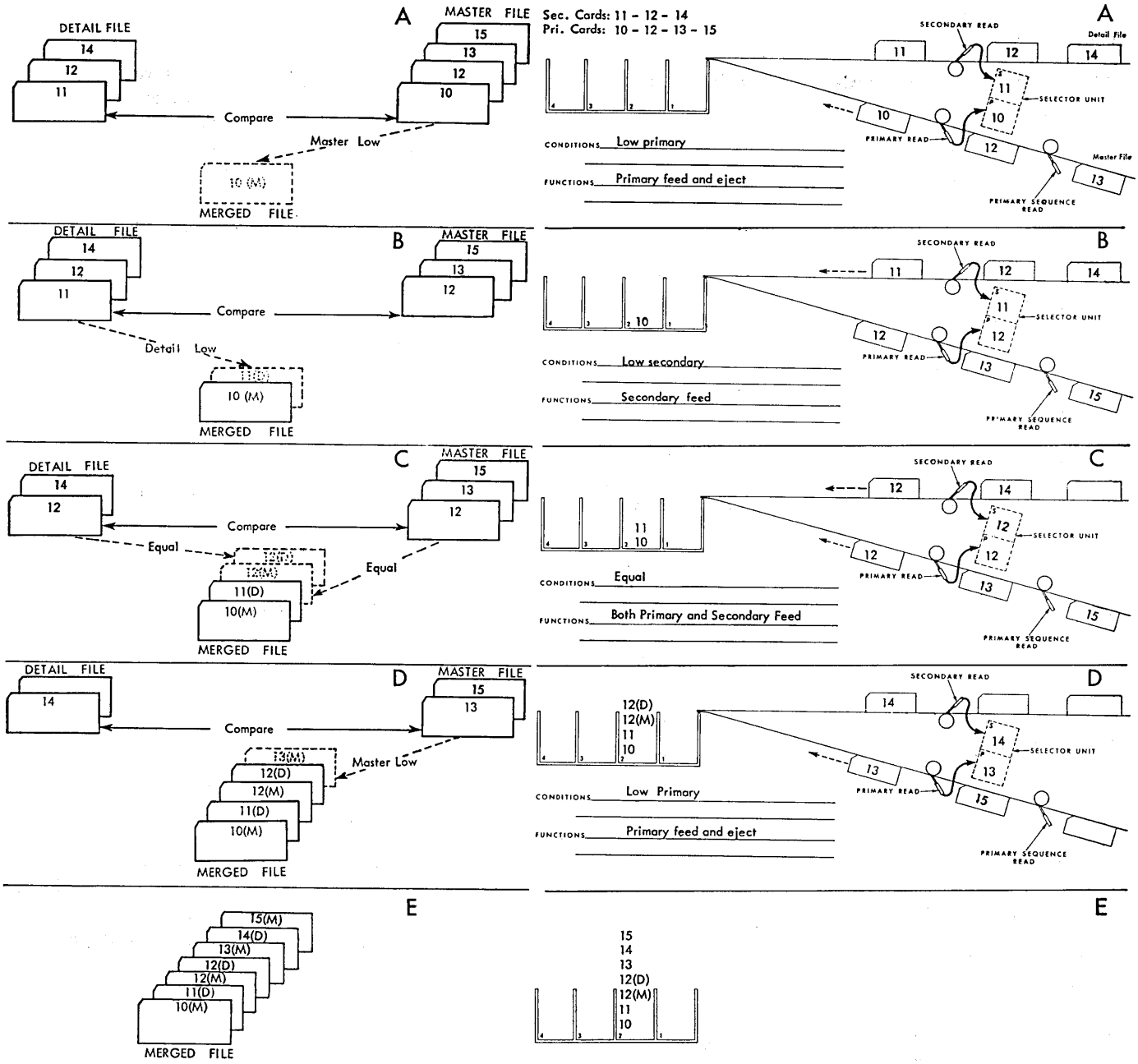

FIGURE 23. MERGING WITH THE COLLATOR

The Operation

Let's look at the schematic drawing of merging two files and the collator feeds (Figure 23). The cards from the master file have been placed in the primary hopper. The new summary cards (year-to-date cards prepared as a by-product of the sales analysis report, and called the detail file) have been placed in the secondary hopper. For illustration purposes, we have identified each card with a simplified account number. Cards are in ascending order.

Control-panel instructions allow the cards to proceed into the stacker only when comparison shows them to be low or equal.

When the machine is started then, the master cards advance into the primary feed until the 10-card is at the primary read station; the master 12-card is at the primary sequence station.

At the same time the summary 11-card has reached the secondary read station. The brushes read the account number information to the control unit.

The Primary Operates

In this operation, the control unit compares the master card at the primary read station with the summary card at the secondary read station. The comparison

shows that the master card is low (A). The machine is instructed to advance all primary cards one position.

The 10-card goes into the merge pocket 2 (pocket 3 in the 88 Collator).

The 12-card moves to the primary read station.

The 13-card moves to the primary sequence station.

The summary 11-card remains at the secondary read station.

Since the secondary feed did not operate, the half of the comparing unit that is reading account numbers from the summary card does not change. It retains the 11 reading. But when the primary feed advanced the master cards, the reading for the 10-card was restored to 0; and the unit then reads master 12-card.

The Secondary Operates

Now the control unit compares summary 11-card with the master 12-card in the primary (B). The account number of the summary card is lower, and this card obviously belongs in the file behind master 10-card.

The machine instructs the secondary feed to advance one card while the primary remains stationary.

So the 11-card goes into the stacker pocket directly behind the 10-card, and summary 13-card is advanced to the secondary read station.

The primary half of the control unit retained its 12-reading; the secondary half of the unit restored to 0 and then accepted the reading 13.

Both Feeds Operate

Now the control unit compares the master 13-card in the primary with the summary 13-card in the secondary (B). The account numbers are equal. Both cards belong behind the master 12-card. However, normally we want the master card ahead of detail cards in a file.

The machine instructs both primary and secondary feeds to advance one card. Because of the design of the collator, the master 12-card falls into pocket 2 ahead of the summary 12-card. Both halves of the control unit then restore to 0 and accept the next reading. [When several cards with the same number occur in both files, the machine normally feeds all those from the primary (master file) ahead of those from the secondary. The last of the master file and the first of the detail file then are fed as equals (C).]

Merging Accomplished

Another comparison, another decision – in this way the collator advances one card at a time into the stacker pocket until all the cards have been advanced into the stacker pocket, and the two files have been combined into one, in proper sequence (E).

This is a simplified version of card merging on the basis of punched information – numerical or alphabetic. Skillful use of the collator produces many variations with great flexibility in combination with other basic functions.

Matching

It must be possible to check a file for all data fitting master patterns. Any data that does not correspond should be removed from the files without disturbing the sequence of the remaining data. This is a matching operation.

Matching involves two files of cards (Figure 24). One file (the master file) is searched for any cards corresponding to the cards in the second, or detail file. Unmatched cards are separated from either file.

This is very much like selection except that the finder information changes as soon as it has been matched. Instead of trying to find all cards in the master file that agree with a finder card, we are looking for the one card (or group of cards) that agrees with the first detail card to be matched, then the one card (or group) agreeing with the next detail card, and so on.

For Example – Check Reconciliation

Very frequently, check reconciliation uses the collator's ability to match cards. For instance, the paymaster of a corporation may issue 10,000 pay checks. At the end

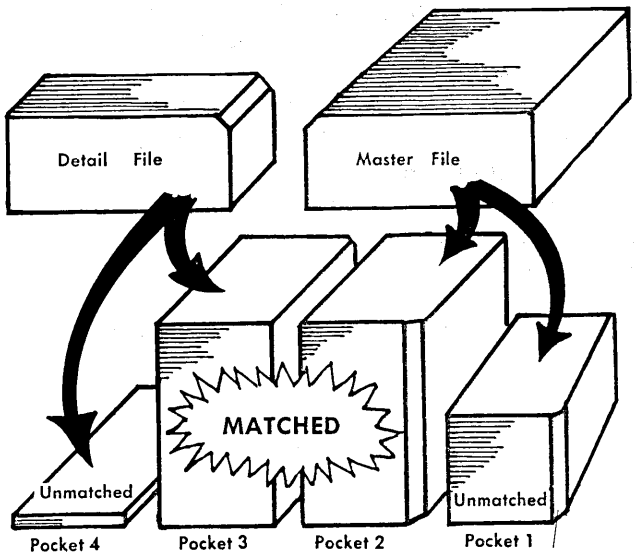

FIGURE 24. MATCHING

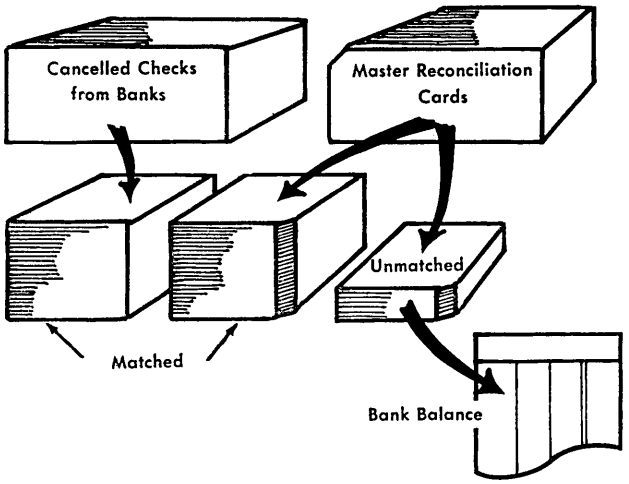

FIGURE 25. CHECK RECONCILIATION

of a week, he can reasonably assume that most of these checks have been cashed or deposited, and have been returned from the banks. He should have received a cancelled check for each employee who had been paid on the previous payday. Therefore, there should be one cancelled check in the file for each check written the previous week (Figure 25).

By matching the current file of cancelled checks against the reconciliation file, the payroll department can determine which checks have not cleared the bank. There should be one cancelled check for each reconciliation card.

The active reconciliation file is placed in the primary feed of the collator, and the cancelled checks in the secondary feed (Figure 26). Control-panel wiring instructs the collator to match these cards against each other.

As the cards pass through the two feeds, comparisons are made between the reconciliation cards and cancelled checks (A). Whenever the check number is the same as the number punched in the reconciliation card, the machine is instructed to divert the check into pocket 3 (pocket 4 in the 88 Collator). Simultaneously, the reconciliation card with the matching check number is fed into the pocket 2 (B).

When the check number in the reconciliation card is lower than the number of the cancelled check at the secondary read station, it means that the check has not cleared the bank. Therefore, the unmatched reconciliation card in the primary feed is diverted into pocket 1 (C).

There should be no unmatched checks in the secondary. Obviously, there should be no check issued without a corresponding card in the reconciliation file. This is a good control check on the procedure because it tells us that no checks were issued without reconciliation cards and that no reconciliation cards have been removed.

The collator processes both files this way (D):

Matched primary cards (reconciliation cards) in pocket 2.

Matched secondaries (cancelled checks) in the pocket 3 (pocket 4 in the 88 Collator).

Unmatched reconciliation cards in the pocket 1. The payroll department uses these unmatched reconciliation cards to verify the balance on the bank statement.

Unmatched cancelled checks (if there are any) are diverted into pocket 4 (pocket 5 in the 88 Collator). These unmatched cancelled checks are given special handling to determine why no reconciliation cards are in the file.

This is the basic matching operation. It illustrates only the principle of matching and the way the IBM collator does it. There are many variations of the matching operation.

Combined Collator Operations

The IBM collator has been built for versatility. Although each one of the functions we have described so far — sequence checking, card selecting, merging, and matching — are individually valuable in handling problems of filing and file maintenance, most applications combine two or more of the basic functions of the collator. Filing problems are so correlated in the IBM data processing method that a single collator procedure can serve several purposes at one time. Each combination of operations reduces recordkeeping costs.

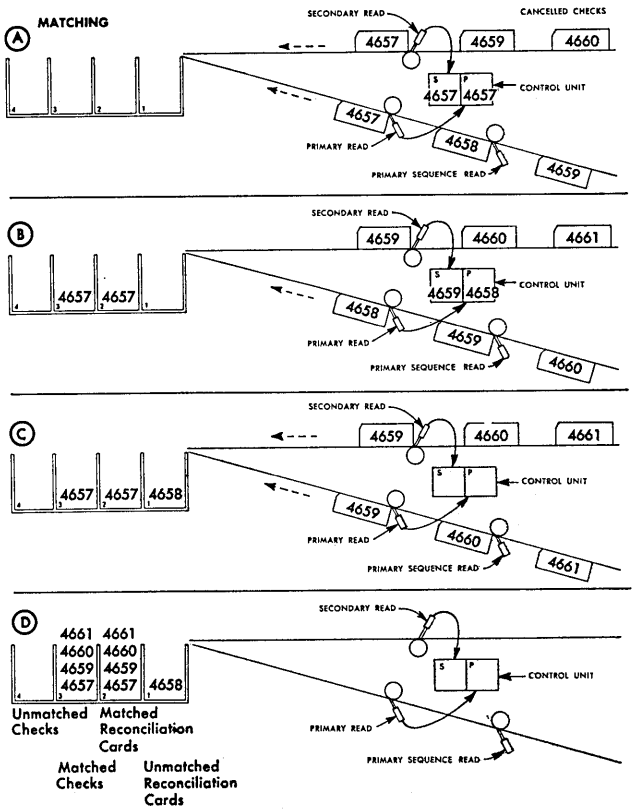

FIGURE 26. MATCHING FOR CHECK RECONCILIATION ON COLLATORS

Machine Summary

Now that we have had an introduction to the basic functions of IBM collators, let's look at the machines themselves. We can see how they differ from one another, and the special features available to extend the versatility of each machine.

Machine Comparisons

IBM 85 Collator (Figure 27)

The IBM 85 Collator performs the four major operations of selecting, sequence-checking, merging, and matching of numerical information. The sequence (low to high) is 0 to 9. Each feed operates at 240 cards per minute. Depending on the operation, the two feeds may operate separately, alternately, or simultaneously. Thus, the total number of cards processed can vary from 240 to 480 cards per minute.

Each control unit has 16 comparing positions. Two 8-position groups of blank-column detection are standard. Each hopper holds approximately 800 cards. Each pocket holds approximately 1000 cards.

The special features available in the 85 are:

- Alphabetic Collating Device
- Alteration Switch
- Auxiliary Card Counter
- Collator Counting Device
- Control Unit Splits (grouping: 4-4-4-2-1-1)
- Interchangeable Feed
- Postcard Stock Feed

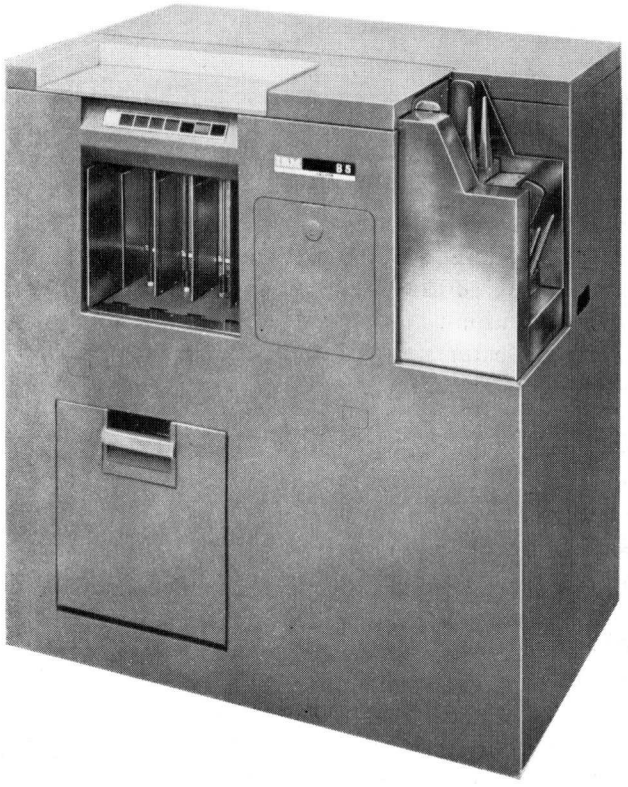

FIGURE 27. IBM 85 COLLATOR

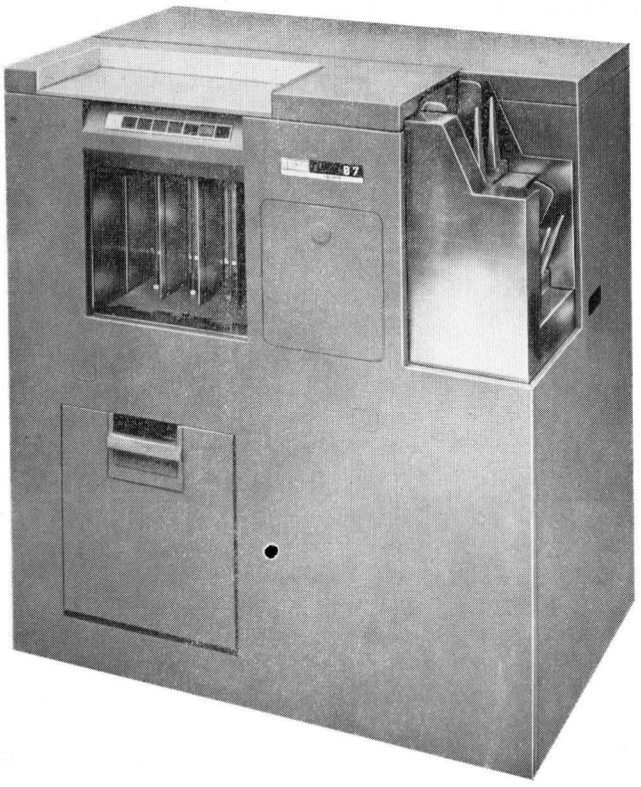

FIGURE 28. IBM 87 COLLATOR

IBM 87 Collator (Figure 28)

The major difference between the IBM 85 and the IBM 87 is the standard ability of the IBM 87 to perform collating operations on alphabetic and special-character information. The sequence (low to high) is: blank, special characters, letters A through Z, and digits 0 through 9. The 87 Collator is available in two models of different control-unit capacity: 19 and 16 comparing positions.

Special features available for the IBM 87 are:

- Auxiliary Card Counter
- Collator Counting Device
- Interchangeable Feed
- Postcard Stock Feed

IBM 88 Collator (Figure 29)

The IBM 88 Collator is a high-speed numerical collator. Operating speed for each feed is 650 cards per minute. With both feeds operating, up to 1300 cards per minute (78,000 cards per hour) can be processed.

In addition to the four major collator functions (selecting, sequence checking in both feeds, merging, and matching), this collator performs the function of editing by checking numerical punching for double punches as well as blank columns. The 88 Collator is available in three models of different control-unit capacity: 22, 16, and 10 comparing positions. The primary feed hopper has a file feed (3600-card capacity). Five pockets permit multiple selection of cards.

The special features available for the IBM 88 Collator are:

- Alphabetic Collating Device
- Alteration Switches
- Auxiliary Card Counter
- Collator Counting Device
- Control-Unit Splits
- Digit Selectors
- File Feed for Secondary

Special Features

In addition to the flexibility that is a basic feature of collators, several special devices have been developed to answer certain definite needs.

Alphabetic Collating Device

This special device adapts a numerical collator for comparing alphabetic information. Selecting, sequence checking, matching, and merging are possible by names, titles, or any other alphabetic information punched in the cards. When the alphabetic collating device is installed, each card column in which alpha-

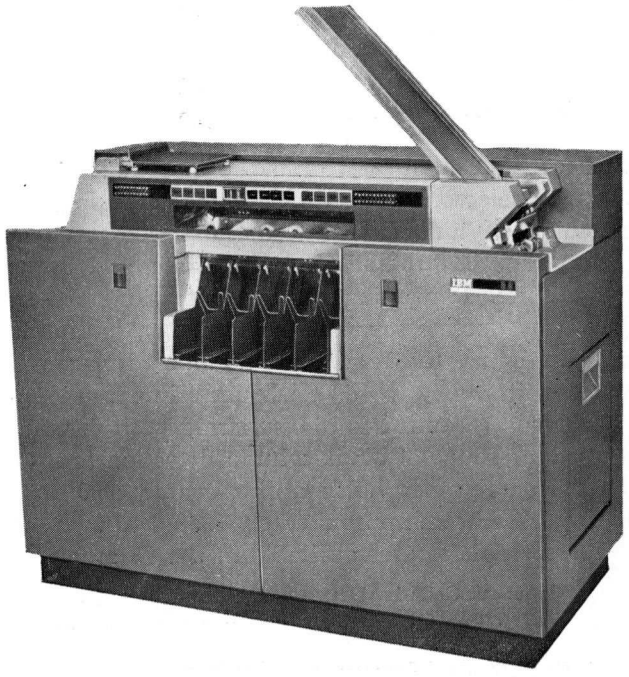

FIGURE 29. IBM 88 COLLATOR

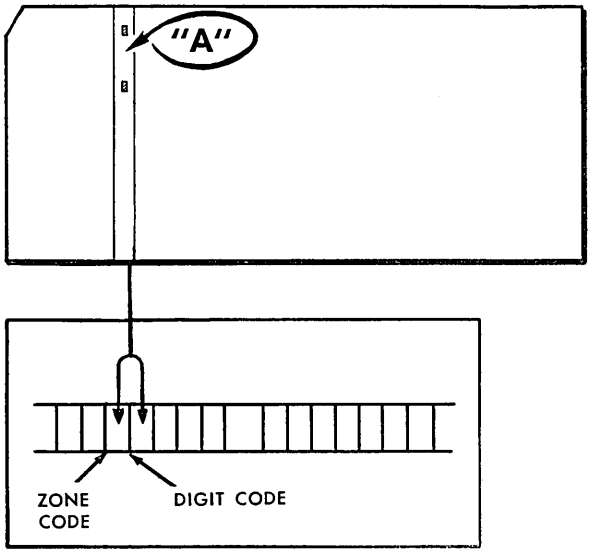

FIGURE 30. READING ALPHABETIC INFORMATION

betic information may appear requires two comparing positions — one for the zone portion of the letter, and the other for the digit portion (Figure 30).

Alteration Switches

Toggle switches mounted on the machine permit using one control panel for several different operations without changing the wiring.

Auxiliary Card Counter

Some problems involving card counting can be handled by auxiliary card counters. Each has a capacity of five positions, from 0 to 99,999 (six positions in the 88 Collator). This counter accepts signals from the collator to count the total number of cards passing through either feed, or the number of cards conforming to a specific pattern set up by control-panel wiring. Either one or two counters can be installed on the collator (Figure 31). If two counters are installed, each one operates independently of the other.

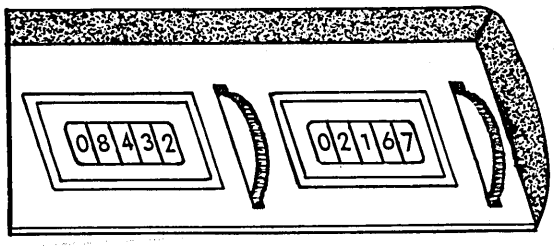

FIGURE 31. AUXILIARY CARD COUNTERS

Collator Counting Device

Often special problems arise in applications requiring collator functions controlled by counting cards. The collator counting device has the dual ability to send and to receive instruction signals. Here are some of the things that can be done with a collator equipped with the counting device:

1. Insert a predetermined number of cards before or behind each master card. The master cards could be identifying cards, signal cards, group descriptions, heading cards, etc.
2. Insert variable numbers of cards ahead of or behind master cards. The variable number depends on information punched in the master cards (Figure 32). This application is used as preparing cards for physical inventory, production control cards, job tickets, statistical surveys, installment loan, Christmas Club coupons, etc.
3. Insert a single card ahead of a predetermined number of cards within a single control group. For instance, shipping instruction cards should precede billing cards on each bill printed. If the number of detail cards for any given customer exceeds the capacity of a single bill form, the shipping instructions should be repeated on the following form. Therefore, a new shipping instruction card would be inserted each time the detail billing cards exceed a predetermined number.
4. Insert a set of cards ahead of a predetermined number of cards within a control group. This is similar to the previous operation. The shipping instructions or descriptive information may exceed the capacity of a single card. It is possible to use more than one card. But each card in the instruction set must be punched with the control number

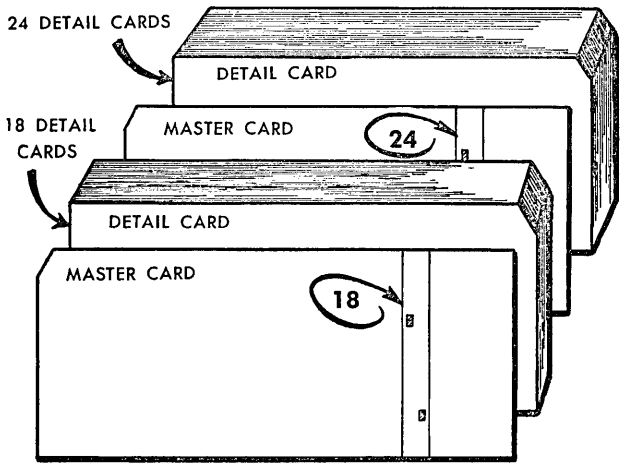

FIGURE 32. INSERTING A VARIABLE NUMBER OF CARDS

of the group to which it is related, and the last card of the set should have a significant X-punch.

5. Search for missing cards in a consecutively-numbered file. This feature can be used to assist in controlling such things as consecutively-numbered checks, dividend certificates, stock certificates, or any card-form procedure that requires accounting for each document. The collator can review the control cards and insert a blank card each time the numbers are not in consecutive order.

This device consists of two single-position counters. Each counter can count from 0 to 9, and then reset to 0 again. When coupled, the counters can form one 2-position counter to count up to 99, and then reset to 0.

Control-Unit Splits

Sometimes more comparing units of smaller capacity are helpful in processing data. The Control-Unit Split feature makes it possible to use the collator for any of its functions while controlling on more than one card field.

This device divides the standard control unit into isolated groups. Each group of positions acts like an independent comparing unit, but with reduced capacity. The groups of positions can be used separately or in combination.

Digit Selector

This device isolates specific digits. The entry hubs are common with successive exit hubs for each punching position. An impulse to the common hub is available only from the corresponding exit. The isolated digit can be used to operate digit-controlled functions.

Connected to a source of digit impulses, the digit selector can serve as a digit emitter.

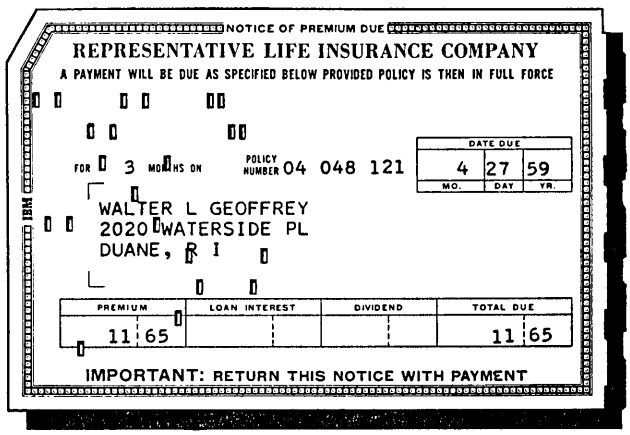

FIGURE 33. STUB CARD

Feeding Devices

Interchangeable Feed

This device permits a collator to handle either 51- to 66-column IBM cards or 80-column IBM cards. The collator operator can make the change by adjusting plates in the feed hopper.

Stub cards (Figure 33) are very commonly used as coupons for Christmas Clubs, charge sales slips, installment loan coupons, postal money order forms, inventory cards, and many other applications.

Using an interchangeable feed permits mechanical handling of filing and file maintenance operations without reproducing the stub card into the standard 80-column card.

For instance, 51-column stub cards can be made up into sales books. As sales are made, the 51-column portion of the card is detached by the clerk and sent to accounts receivable. The stubs are arranged in account number sequence, and then merged into the accounts-receivable open-item file.

Postcard Stock Feed

This device permits using cards that meet U. S. Postal regulations.

File Feed — Secondary Feed

A second file feed can be installed on the 88 Collator to accommodate processing large volumes of cards in the secondary (Figure 34).

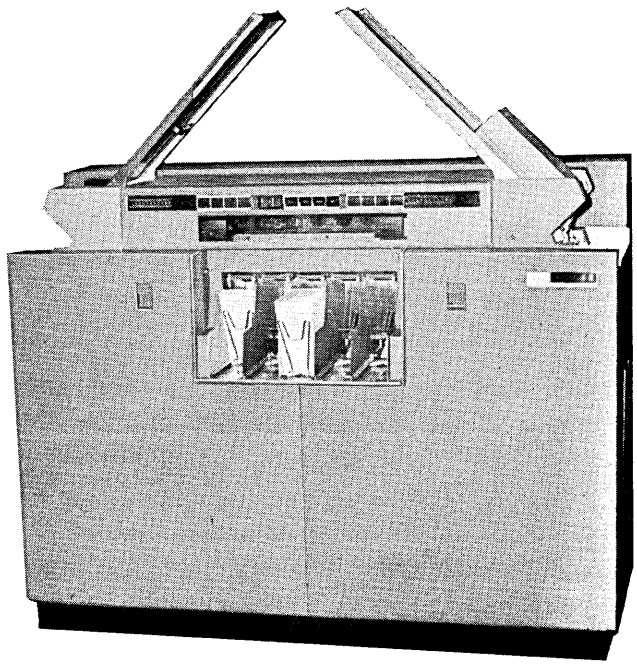

FIGURE 34. SECONDARY FILE FEED

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