Punched Card Data Processing Principles

Section 7: Other IBM Unit Record Machines

IBM Personal Study Program

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IBM Personal Study Program

The IBM Personal Study Program offers the opportunity to develop an understanding of and an appreciation for the tools of data processing, their operation and application. In recent years, the use of automatic data processing equipment has been extended into almost every area of business, government and science. As a result, the need for people knowledgeable in the subject has multiplied manifold—and is continuing to multiply.

The purpose of the IBM Personal Study Program is to help satisfy this need by providing simplified self-study texts covering the fundamentals of data processing. With the background these texts provide, the interested student will be prepared to delve further into those areas of greatest interest to him and his career.

Contents

Section 7: Other IBM Unit Record Machines

This is the last section of "Punched Card Data Processing Principles." The data processing machines discussed in this section are "supporting" in nature. The presentation of each machine in this section is less detailed than the presentation of machines in previous sections and, in a few cases, the presentation is merely expository. However, any concepts not previously discussed are presented in detail.

The IBM Interpreters

Some of the previous sections have examples of cards which have been processed by an IBM interpreter. In punched card data processing terminology, interpreting is the translation of punched holes into printed information *ON* an IBM card.

It is often required that manual reference be made to some cards in a file (timecards in a timecard rack, name and address cards in a file, etc.). Locating the desired card by reading the holes is time-consuming—the cards would have to be completely lifted from the file to check all the rows for holes. By printing the chosen data on or near the top edge of the card, it is necessary only to scan through the file to locate the desired card.

The most common interpreter in use in data processing installations is the IBM 548 (see Figure 1). It is capable of interpreting the holes in a card and printing the interpreted characters in the space above the 12-row of the card (upper printing position) and in the space between the 11 and 12 row of the card (lower printing position). The printing position is chosen by twisting a knob. One pass through the machine is required for printing in either of the two spaces.

The printing is accomplished with typebars (see Figure 2). The width of each typebar is equivalent to one-and-one-third card columns. Therefore it is possible to print a maximum of 60 characters on either of the interpreting lines at one time. The IBM 548 Interpreter can process cards at a rate of 60 per minute.

> 1. *What are the conditions that dictate whether a card should be interpreted?*
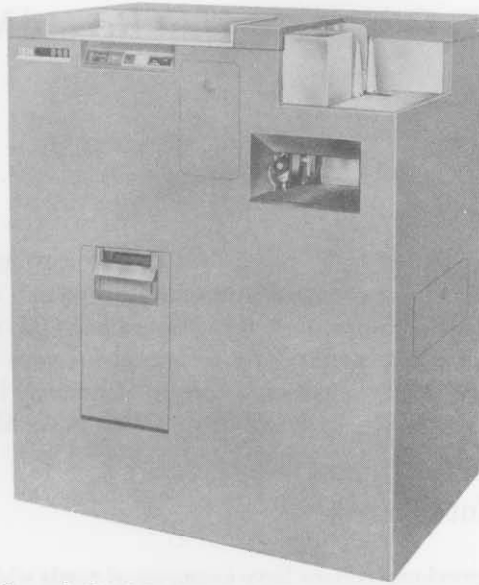> 2. *Describe the location where interpreted holes may be printed.*

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Figure 1. IBM 548 Interpreter.

SPECIAL CHARACTER FROM 12 PUNCHING

IF 12 IS PUNCHED BAR POSITIONS HERE
FOR MOVEMENT THROUGH A TO I

12 ZONE

SPECIAL CHARACTER FROM 11 PUNCHING

IF 11 IS PUNCHED BAR POSITIONS HERE
FOR MOVEMENT THROUGH J TO R

11 ZONE

ELECTRICAL ZERO

IF 0 IS PUNCHED BAR POSITIONS HERE
FOR MOVEMENT THROUGH S TO Z

0 ZONE

SPECIAL CHARACTER FROM 0 – 1 PUNCHING

POSITIONS HERE WITH NOTHING PUNCHED

IF NO PUNCHING IN 12 – 11 – 0 BAR POSITIONS HERE
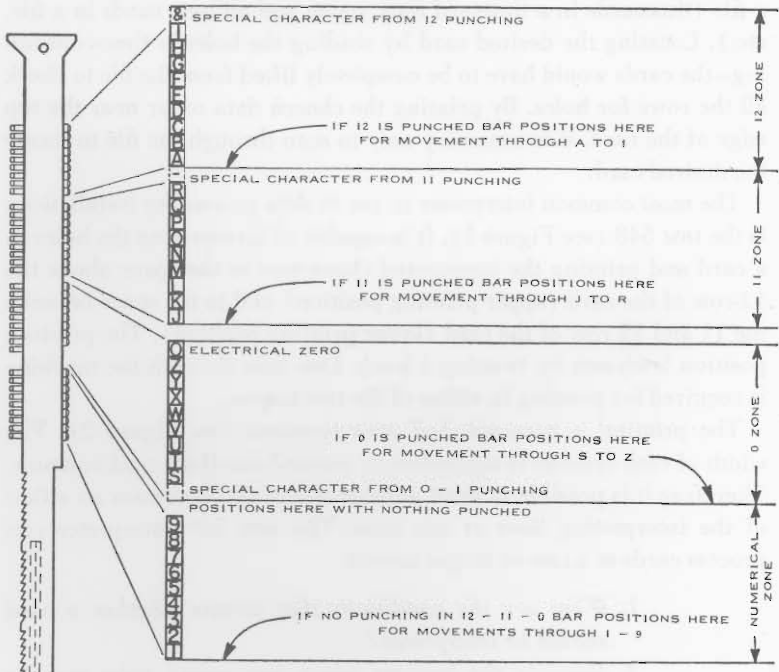FOR MOVEMENTS THROUGH 1 – 9

NUMERICAL ZONE

Figure 2. Note that the Interpreter typebar is primarily grouped according to zones whereas the IBM 402 typebar is primarily grouped according to digits.

3. *How many typebars are there on an* IBM *548 Interpreter?*

4. *How many passes through the interpreter are required if 15 characters are to be printed on one line and 20 on the other line? How many passes are required if all 80 columns are to be interpreted?* *
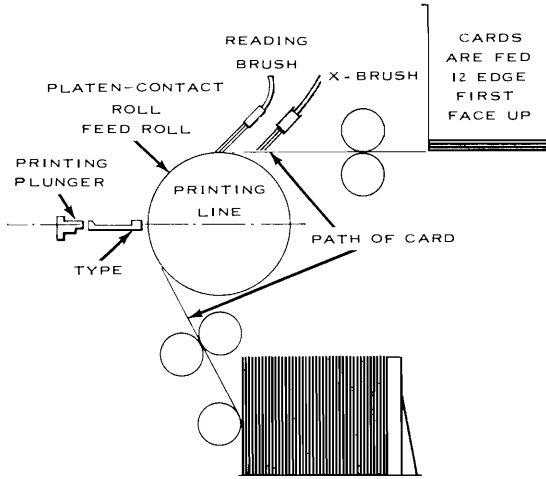

Figure 3. Note that cards are entered for processing, 12 edge first, face up.

Card Path

The path of the cards through the IBM 548 is illustrated in Figure 3. When a card is fed from the hopper, it first encounters a set of five X-brushes. These X-brushes are designed to recognize only holes in the X row of a card. Any of the five X-brushes may be positioned by the operator to read any column of the card. After encountering the X-brushes, the card is read by the 80 reading brushes. Each of these brushes has a corresponding control panel hub which can be connected to the print entry hub corresponding to the chosen typebar. After the card has been completely read, it passes the typebars which have been set up to print the required character. From there the card passes into the stacker.

5. *How many X-brushes are there? How many reading brushes?*

6. *In what row must a hole be located to be recognized by an X-brush?*

*Review questions have been interspersed throughout the text. If, as in this case, the question is marked with an asterisk, the answer is supplied at the end of the book. If the question is not marked with an asterisk, the answer can be found in the text preceding the question. When the book is completed, answer all questions again—this time without using the book. Then compare your answers with those in the book.

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IBM 548, 552 INTERPRETERS, CONTROL PANELS
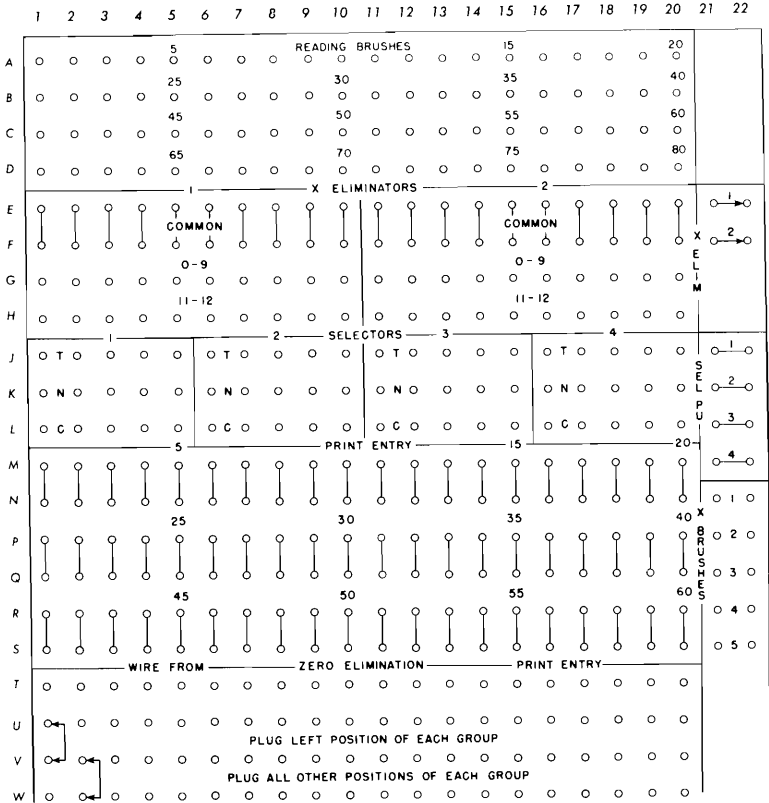
IBM 548 CONTROL PANEL

Figure 4.

IBM 548 Control Panel

Figure 4 is a control panel diagram for the 548 Interpreter. The impulses from the reading brushes may be wired directly to print entry or first be selected before being wired to print entry. (Selection may be required if cards of two different formats are intermixed in a file to be interpreted. The selector should be picked up with an impulse from one of the X-brushes. Thus the X-brushes of the interpreter are similar to those of the IBM reproducing punches.)

If an X punch is used for card identification and the column in which it is located is to be interpreted, the column should first be column-split before being wired to print entry. Column-splits on the 548 are called X-Eliminators and, on the control panel, must be wired ON if they are to function. As with all IBM machines that have a

Figure 5. Each time a line is printed with the required data, the 557 can also print a slash mark at the edge of the card.

printing capability, the IBM 548 is equipped with a zero print control feature which is referred to as Zero Elimination.

> *7. Suppose that column 5 is punched with an X for identification purposes and that column 5 is to be interpreted for its digit punch only. How would the effect of the X punch be eliminated?*

There are a number of data processing jobs which require the periodic recording of printed information on a document called a ledger card. One of these data processing jobs is in the area of installment loan accounting. Each time the borrower makes a payment, the date of the payment, the present balance, the payment amount and the new balance are printed on a succeeding line of the card. Figure 5 is an IBM ledger card prepared by an IBM 557 Alphabetic Interpreter.

The basic operation of the IBM 557 is to read information punched in a card and print that information on the same card. Printing is accomplished by means of 60 typewheels (see Figure 6), at a rate of 100 cards per minute.

The basic IBM 557 can print on any one of 25 lines by manually selecting the print position. Twelve of the printing positions are on the rows and 13 of the printing positions are between the rows, above the 12 row and below the 9 row.

> *8. How many printing positions are there on a basic IBM 557? How is the printing line selected?*

There are a number of special features that can be added to the basic IBM 557. Some of these are:

1. Card-to-Card Comparing. This allows a printing operation similar to the interspersed master card gang-punching operation on IBM reproducing punches. That is, it is possible to have master card to detail card printing. Then, when there is an unequal comparison, printing is suspended.
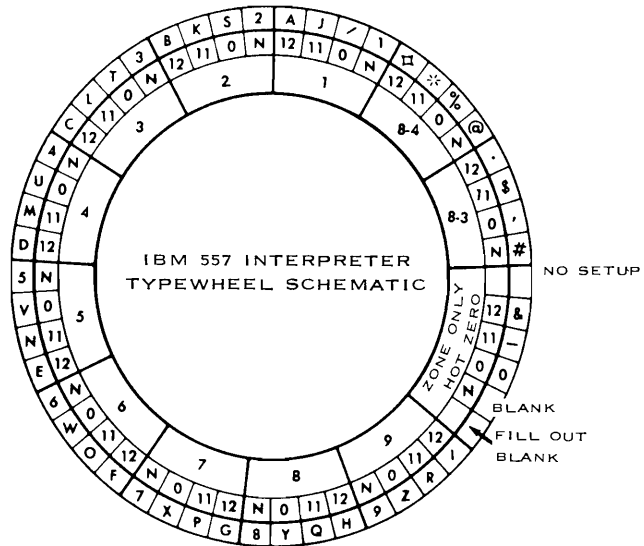
5

Figure 6. Typewheel. The basic printwheel prints the alphabetic, numerical and 3 special characters (&, — and /). The printwheel shown here is capable of printing an additional 8 special characters.

2. Selective Line Printing. This allows the 557 to "find" the next available printing line. Each time a line is printed on the detail card, an indicating mark is made at one end of the line. As the detail card passes through the machine it is scanned for the number of marks (postings) that have been previously made. The combination of number of marks and control panel wiring causes the card to be positioned for the next printing line (not necessarily consecutively). All 25 lines may be used.

(Card-to-Card Comparing and Selective Line Printing were employed in the printing of the installment loan ledger card.)

3. Proof. This feature provides the 557 with the ability to check the printing of characters punched in the card or set up by the emitter.

4. Emitter. This allows the printing of characters without the corresponding holes punched in the card.

The IBM 101 Electronic Statistical Machine

The decisions made in government and business are usually based on specifically organized statistics. The gathering of a few facts is a relatively simple task. The correlation of these facts (statistics) is often a time-consuming and complex operation. For example, a firm employing many thousands of people in locations all over the United States may want to open a new facility. Although the company will hire many local residents, it must bring in certain key, experienced

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employees to form the nucleus of the staff. To determine who these key employees should be, the company examines its punched card personnel file located in the central data processing facility, consulting in particular such data fields as:

1. Occupation code
2. Occupation grade
3. Date hired
4. Marital status
5. Number of dependents
6. Location of plant where employed
7. Willingness to relocate
8. Rents or owns home
9. Special skills
10. Education (regular)
11. Special training
12. Military status

The personnel department determines which occupation codes and grades, etc., are essential and within what limits certain qualifications may fall. If the thousands of employee cards looked at fail to produce an individual who meets all twelve conditions, the cards are analyzed to see how many employees meet eight, nine or ten of the qualifications. Such counting analyses are the special ability of the IBM 101.

In appearance the 101 looks very much like a conventional IBM sorter (see Figure 7). It can sort cards (cards are processed at a rate of 450 per minute) according to multi-digit punching, and according to punching between any desired values by control panel wiring. In addition, it has the same capabilities as the regular IBM sorters.
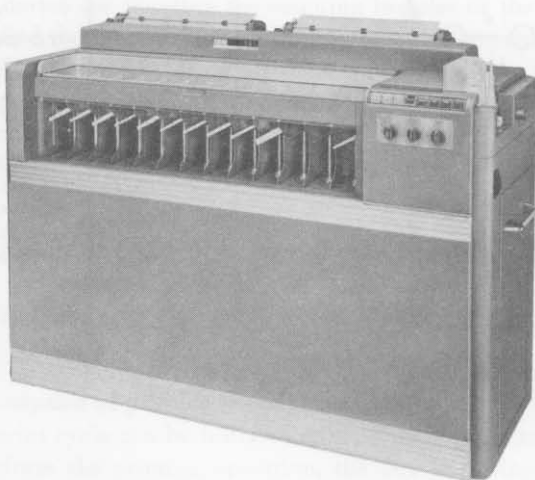

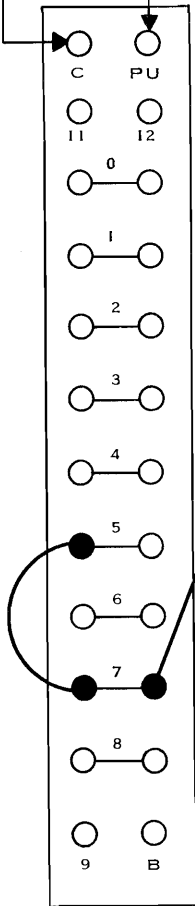Figure 7. IBM 101 Electronic Statistical Machine.

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FROM COL. 31
MILITARY STATUS

1. 1A
2. 1D, 1R
3. 2A, 2R
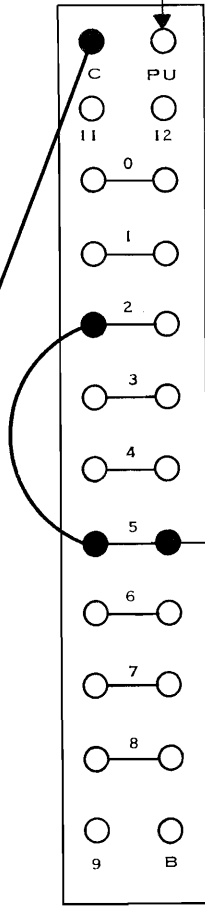4. 3A, 3R
5. 4A
6. 4F
7. 5A

FROM COL. 32
MARITAL STATUS

0. SINGLE
1. MARRIED, NO CHILDREN
2. MARRIED, 1-2 CHILDREN
3. MARRIED, 3-5 CHILDREN
4. MARRIED, OVER 5 CHILDREN
5. WIDOWED
6. SEPARATED OR DIVORCED
7. HEAD OF FAMILY

IMPULSE FOR
COUNTING

TO COUNTER
FOR ADDING A 1

THIS INDICATES A
MILITARY STATUS
OF 4A OR 5A AND A
MARITAL STATUS
OF MARRIED WITH
1-2 CHILDREN OR
WIDOWED.

DISTRIBUTOR
1

DISTRIBUTOR
2

Figure 8.

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For counting the cards that meet the required conditions, the 101 can be supplied with up to 60 *unit* counters, so called because they are used for counting *unit* records. When a *unit* record meets certain requirements, a 1 is added to the *unit* counter.

For selecting the counter into which the 1 is to be added, and for selecting the pocket into which the card is to be sorted, the IBM 101 is equipped with two different devices.

One of these is a distributor. By control panel wiring, the distributor is instructed which column is to be examined. Then either an impulse for sorting or an impulse for counting is wired into the distributor. The one-column distributor has 13 exits for the entering impulse, one exit for punched holes in any of the card rows, and one exit if there is no punching in any of the rows. Figure 8 shows how two distributors can be used together for counting when the required punching is detected.

> 9. *How many classifications can be counted in one pass? That is, how many unit counters can the 101 be supplied with?*
> 10. *How is a distributor set up to work with the desired column?*

A 101 may be equipped with up to six 1-column distributors. In addition, a 101 can be equipped with one 2-column distributor. This device must be instructed with control panel wiring, which two columns (usually adjacent, but not necessarily) are to be examined. An impulse for either counting or sorting entered into this device has 100 exits corresponding to the values 00 to 99, ten exits corresponding to values by the units group, tens group, twenties group, etc., and one exit when an X has been punched in the high-order column.

The other device for selecting the counting impulse or the sorting impulse is called the recode selector. Figure 9 shows the components of a recode selector and what is required for it to transfer. An IBM 101 may be equipped with up to 60 of these. Figure 10 shows how two recode selectors and two digit emitters (a 101 may have up to 14 of these) are used in place of the column distributors of the previous figure.

> 11. *What is the total number of exits from the two-column distributor?*
> 12. *What condition must be met for a recode selector to transfer?*

The 101 is capable of printing the amounts accumulated in its units counters. A print cycle can be initiated either manually or automatically. To perform the printing operation, the 101 is equipped with either one or two carriages similar to the ones used on typewriters.

ILLUSTRATING
A SELECTOR
AS NORMAL
WHEN NEITHER
PICKUP HUB
IS IMPULSED.

ELECTRICAL
SOURCE

TRANSFER

COMMON

NORMAL

ILLUSTRATING
A SELECTOR
AS NORMAL
WHEN ONLY ONE
PICKUP HUB
IS IMPULSED.

ELECTRICAL
SOURCE

TRANSFER

COMMON

NORMAL

ILLUSTRATING
A SELECTOR AS
TRANSFERRED
WHEN BOTH
PICKUP HUBS ARE
SIMULTANEOUSLY
IMPULSED.
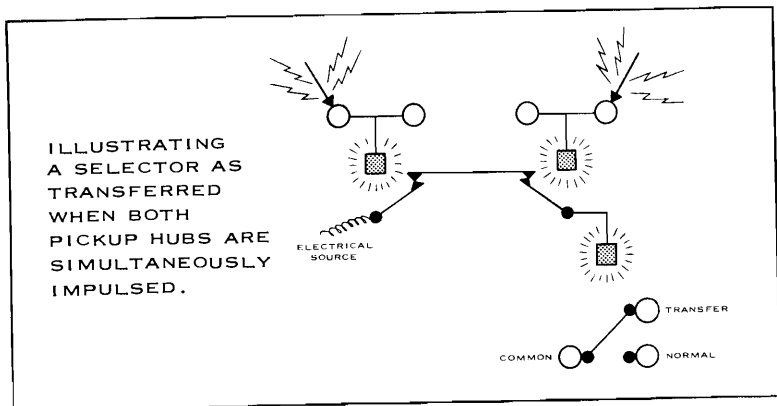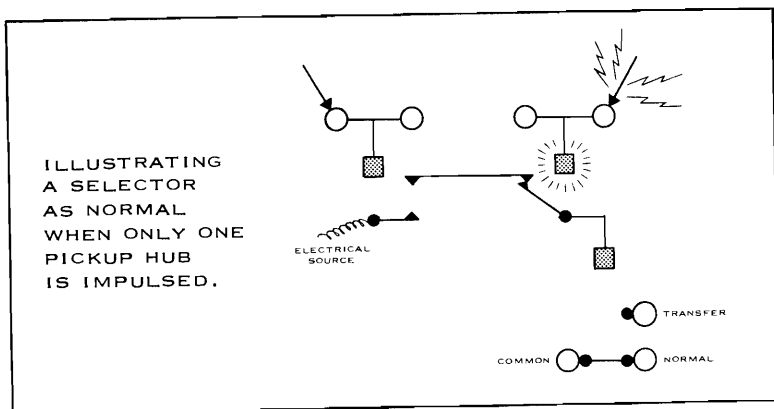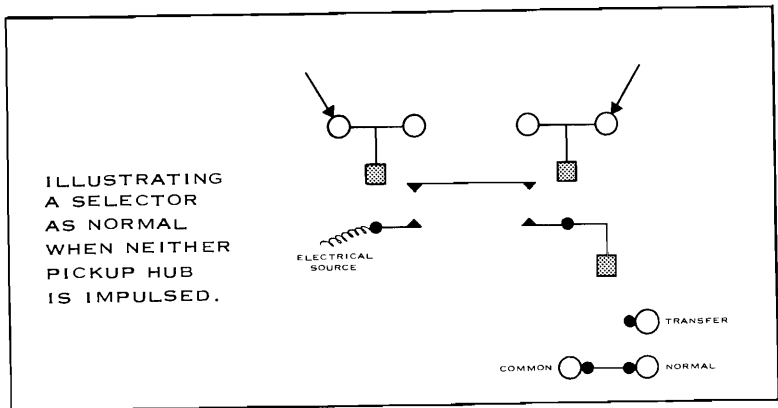
ELECTRICAL
SOURCE

TRANSFER

COMMON

NORMAL

Figure 9.

A 101 may also be equipped with counters capable of accumulating the values punched in cards for a total of up to twelve positions. The accumulation of quantitative data is often required at the same time that the statistical counts are being made. For example, when the per-
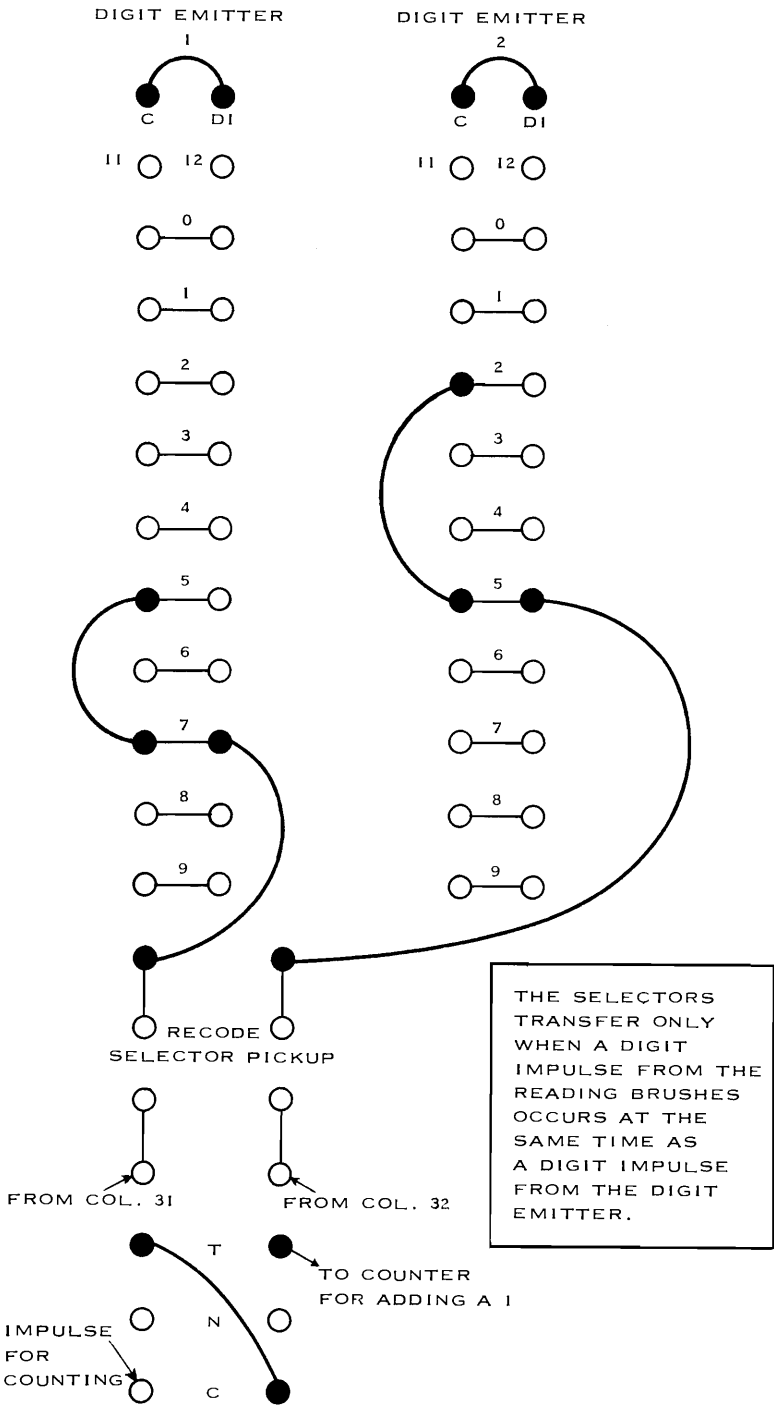
10

Figure 10. A recode selector has a "double" pickup hub. Both hubs must receive simultaneous impulses for the selector to transfer.

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sonnel cards (mentioned earlier) are being counted, it is possible to accumulate the wages or salaries of the employees that meet the qualifications.

Many companies which are equipped with IBM computers make use of the 101 with its distributors and recode selectors for editing purposes. When a large proportion of the data punched into cards is coded, it is recommended that the codes be checked for consistency before processing in the computer. For example, an insurance application card may have been punched with one code indicating the age of the applicant as being 17-21 years old and another code indicating that he is a neurosurgeon. The 101 control panel can be set up so that these two incompatible codes would not be recognized, and therefore the card punched with the inconsistent codes would be sorted into the reject pocket.

The IBM 108 Card Proving Machine

The 108 is designed for data processing installations which require a machine similar to the 101 for editing purposes, but do not require the statistical counting feature of the 101. The 108 processes cards at a rate of 1,000 per minute.

The 108 performs its card-proving functions with up to 80 recode selectors, six 1-column distributors, one 2-column distributor, 20 sequence-checking positions, and 20 double punch and blank column detection positions. In addition, the 108 may be equipped with up to six counters capable of addition and subtraction, each of which can accumulate up to a twelve-position total.

An IBM 108 is often used in conjunction with large data processing computers such as the IBM 705, 7070, etc. Before data, punched in cards, enters the computer, the cards are checked for consistent coding. At the same time, "check" data can be accumulated for totals. These totals are recorded for a "check." Then, when these cards are processed by the computer, the same "check" data is again accumulated. The two totals are compared. If they are unequal, attention is called to the fact that one or more of the cards were not processed successfully.

The IBM 528 Accumulating Reproducer

It is shown in Section 6 that summary punching is accomplished with two machines, one of which is equipped with a comparing feature and has counters for accumulation, and one of which is equipped with punch dies for punching the desired results. For many data processing users, this provides an ideal combination, since, when a report with
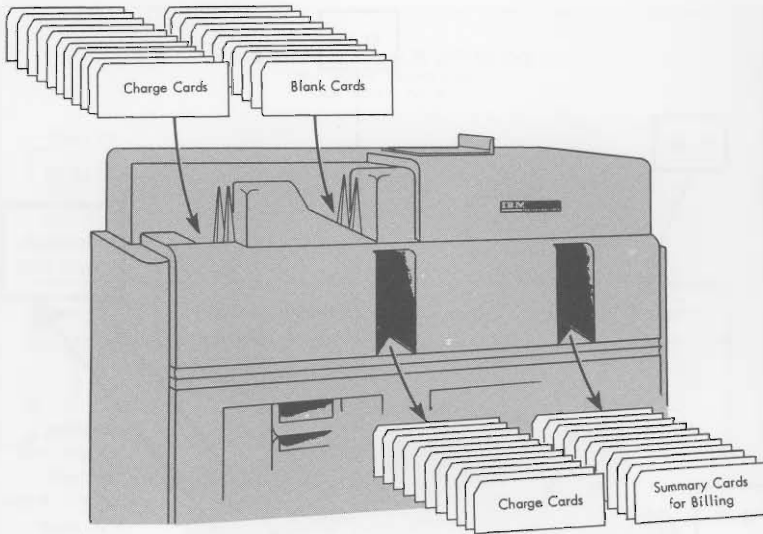
Figure 11.

subtotals is being prepared, a card with the subtotal (summary card) can be prepared at the same time.

There are a number of data processing users who require summarized data in punched card form only—that is, they do not require a report of the printed summaries or totals. One example is a public utility company whose primary product is a daily service and who bills its customers with punched cards. The punched card bill is prepared from current service charge cards, special service charge cards, household appliance purchase cards and past-due charge cards. About 85% of the customers have only a current charge card—the other 15% have an average of three cards each.

By processing these various cards (in customer-number sequence) in the IBM 528, summary cards for billing are prepared using only one machine (see Figure 11). About two-and-one-half hours are required for preparing summary cards for 10,000 customers. (The 402-514 combination for summary punching would require about seven hours—but with printed totals, of course.)

To accomplish its summary-punching functions, the 528 can be equipped with up to 48 counter positions and ten positions of Group Control (to serve the same function as comparing entries and exits of the accounting machines). The 528 can punch cards at the rate of 100 per minute. When one card is read for each card punched, reading is controlled to take place at a rate of 100 cards per minute. When a card is being read for accumulation, the reading rate is controlled to take place at 200 cards per minute.

In addition to its self-contained summary-punching capabilities, the 528 is capable of all reproducing and gang-punching requirements.
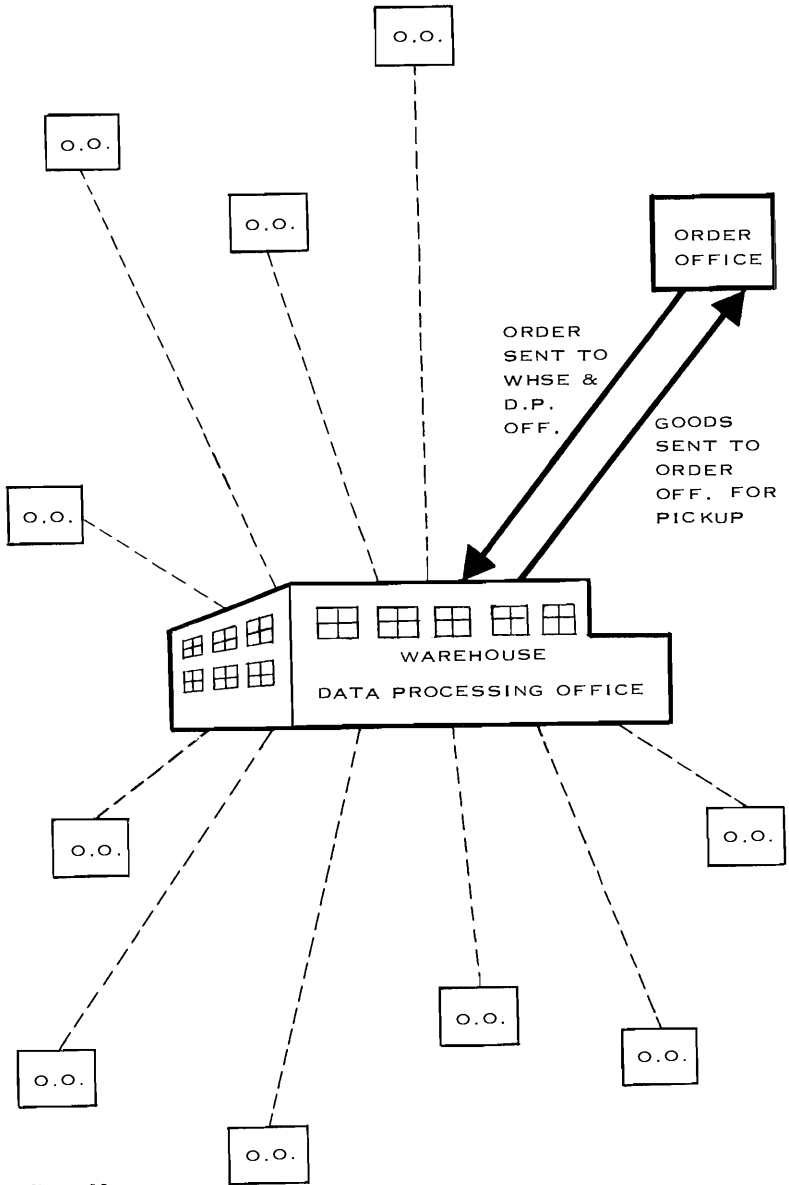
Figure 12.

The IBM 826 Typewriter Card Punch

There are several data processing applications in which the data to be processed originates in far-flung locations. An example of this is a mail-order company with a centrally located warehouse and data processing office, and order offices in cities served by the warehouse (see Figure 12).

A & C WHOLESALE DRUG CO.
7315 WEST THIRD AVE.
NEW YORK N. Y.

SOLD TO

MUELLER DRUG CO.
325 CARTER AVE.
ROCHESTER, N. Y.

QTY.	PROD. CODE	PRODUCT DESCRIPTION	PACK	UNIT COST	AMOUNT
5	A133	IRANA TOOTH POWDER	DOZ	6.00	30.00
13	1658	ASPIRIN	EA	.96	12.48

IBM 826 Typewriter Card Punch.

At the same time that the order is prepared on the typewriter . . .
a card is prepared on the card punch.

Figure 13.

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At the order office, the customer, either in person or by telephone, tells the clerk his name and address, and then shows the clerk which items he wishes to order. For each item, the clerk writes such data as catalog number, description, quantity, unit price, shipping weight and amount.

After the handwritten order form has been completed, it is given to a typist. The typist then prepares the required number of copies. (The original is sent to the customer to show what has been *ordered*. Another copy is filed in the order office.)

The IBM 826 allows the typist to prepare cards at the same time that she is typing the order (see Figure 13). The 826 may be set up to permit typing without punching, or to permit punching without typing. It may thus be used as an ordinary typewriter or as a card punch.

The cards and one of the copies are sent to the city where the warehouse and data processing office are located. The copy is used for obtaining the item from the warehouse. When the available items are packed for shipment, the corresponding cards are processed by an accounting machine. The accounting machine prepares a packing slip and invoice from these cards. Later, the accounting machine also prepares a sales analysis report from the same cards.

The IBM 870 Document Writing System

When order writing is a major data processing application, as in the case of manufacturers or distributors of electrical supplies, liquor or drug store supplies, the order writing can be accomplished with an IBM 870 Document Writing System (see Figure 14).

Most manufacturers and distributors do business with "steady" customers. For this reason, manufacturers and distributors using data processing equipment have name and address cards for each of their customers. Likewise, the manufacturer or distributor often has a file of item cards in which each card contains pertinent data about the item. (This may include unit price, description, item number, etc.)

When an order is received, the name and address card of the customer and the item cards are selected from the file and entered into the 870 at (A) (see Figure 14).

By control panel wiring, some or all of the information in the cards is typed on the order acknowledgment form. The variable information such as date and quantity is supplied to the 870 by using the auxiliary keyboard (see (B) in Figure 14). A carbon copy is used for obtaining the items from stock.

As the item cards proceed through the 870, control panel wiring causes the variable data from the keyboard to be punched. Also, the program drum is set up for duplicating customer number (the origin of this is the name and address card).

When the order acknowledgments have been prepared, the name and address cards are returned to the file. The item cards are then sent to the central data processing facility. There the item amount is calculated, as are discounts, if any. The item cards are then used for invoice preparation and the writing of sales analysis reports.

When two typewriters are used (see Figure 14), one may type the order acknowledgment and the other may type the addresses on continuous-form envelopes. Likewise, a second card punch may be added. Its function may be to produce a set of cards identical to the cards that enter the 870. These cards would then be used to replenish the file.

The leftmost component is used for preparing paper tape and is called a paper tape punch. (The paper in this tape is thin and narrow. A roll of paper tape looks very similar to a roll of masking tape.) Some or all of the data originating from Ⓐ or Ⓑ can be recorded (in the form of round holes) in the paper tape. When all of the required data has been punched into the paper tape, the paper tape can be sent in an envelope to the main data processing location.

Answer to Asterisked Question

4. If a card is to be interpreted on two lines, two passes are required, no matter how many characters are printed on each line.

To interpret 80 columns requires two passes, since the maximum number of positions that can be printed on one pass is 60.

This is hardly a disadvantage, however, since it is very seldom that more than sixty positions require interpretation.

Ⓐ

Ⓑ
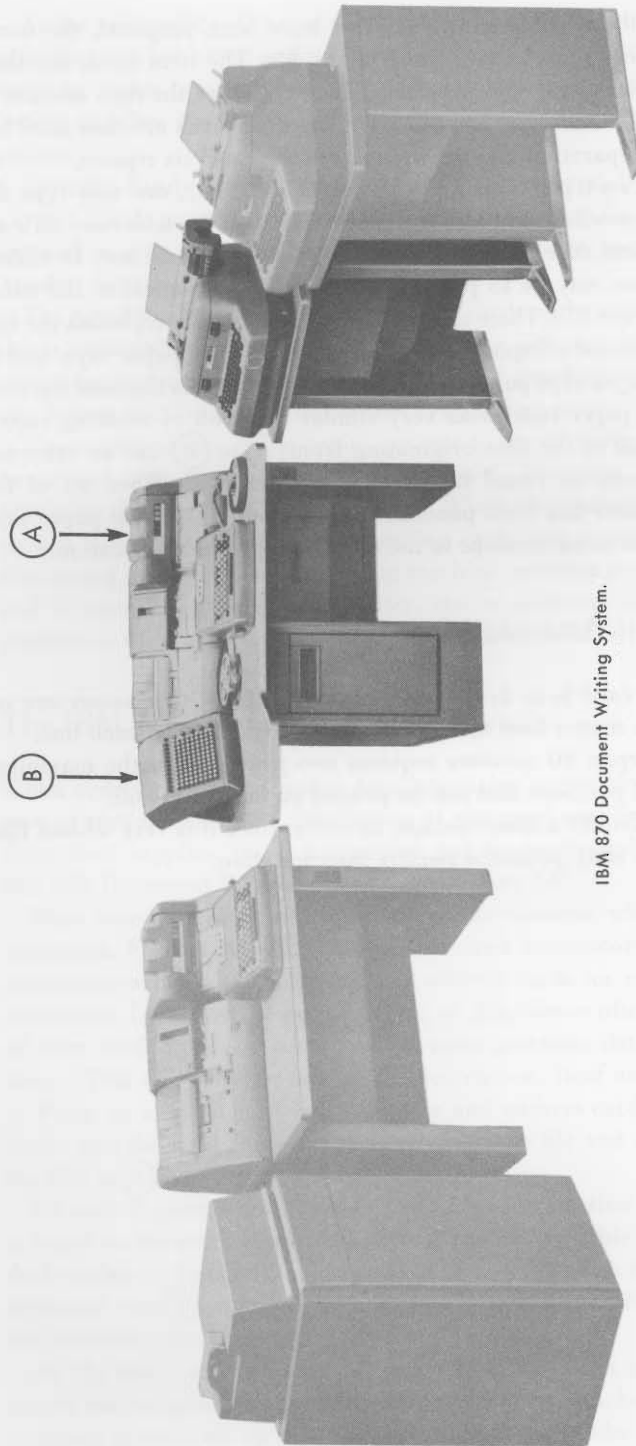
IBM 870 Document Writing System.

Figure 14. An 870 Document Writing System may comprise up to six components. The system used in this text is indicated in the unshaded area.

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