

IBM

**IBM 83 Sorter**

Manual of Operation

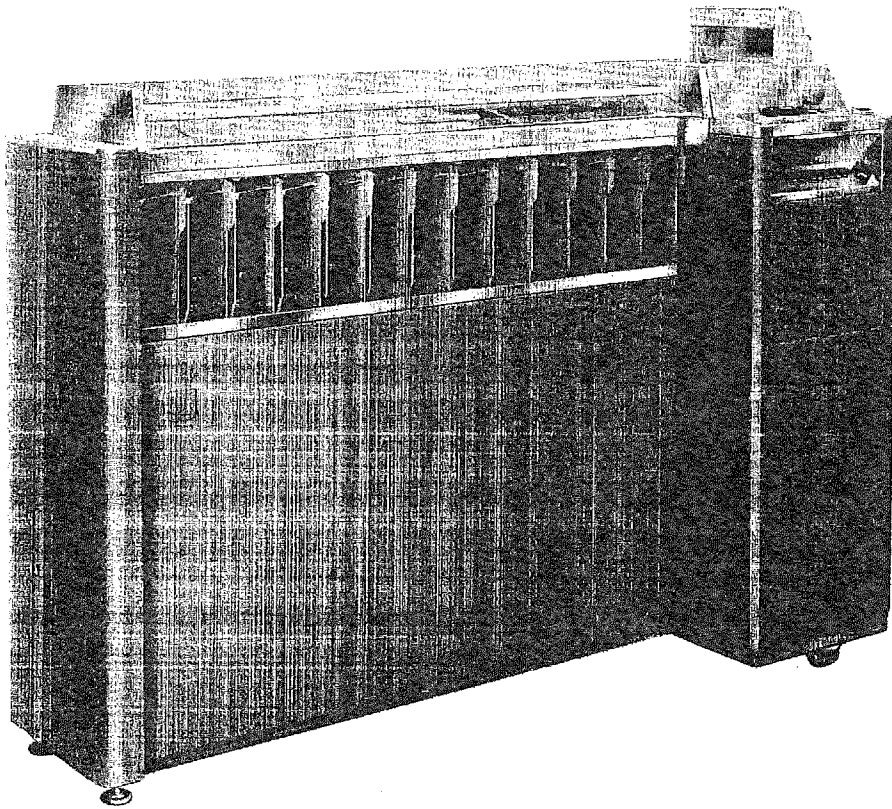
MINOR REVISION (December, 1959)

This edition, Form 222-6639-5, is a minor revision of the preceding edition but does not obsolete Form 222-6639-4. The principal changes in this edition are:

Page 11 Block Sorting Example

Page 20 Group Sorting Device

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IBM 83 SORTER

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## IBM 83 SORTER

ONE OF the most important parts of any accounting system is the sorting or classifying of unit records. In the IBM system of punched card accounting, the 83 Sorter, with an operating speed of 1000 cards per minute, affords a speedy and accurate method of arranging cards into any desired sequence for the preparation of reports.

During the sorting operation, cards may be automatically edited to check that the punching conforms to a selected pattern. Editing is switch-controlled and may be omitted when it is not desired. The detection of an error may reject the card and stop the machine, or it may reject the card without stopping.

All of the steps in the operation of the 83 Sorter are simple. The operator merely places a group of cards in the feed hopper, sets the sort switch, positions the sorting brush on the column to be sorted, and depresses the start button. Thirteen pockets receive the cards during the sorting operation—one pocket for the rejected cards (those with an error or having no hole punched in the column being sorted) and twelve other pockets, corresponding to the twelve punching positions on the card. The machine stops automatically when a pocket is filled or if the hopper runs out of cards.

### Card Feeding

The Sorter is equipped with a horizontal card-feeding mechanism which permits refilling the hopper while the machine is in operation. The hopper holds about 1200 cards. Cards are automatically taken, one at a time, from the bottom of the pack and fed past the brush which reads the holes punched in a selected card column. Electronic tubes and electrical relays analyze the holes and determine the pockets into which the cards are to be deposited. Feed rolls then carry the cards to the proper pockets where they are stacked. The speed of the machine is 1000 cards per minute.

When cards are being fed, do *not*: (1) rest a hand on the cards in the hopper, (2) use heavier than normal card weights, or (3) fill the hopper higher than the side plates. The extra weight causes mis-feeds, missorts, and rejecting of cards. *Tab index cards do not fit in the hopper and cannot be sorted.*

### Pocket Stops

Each pocket of the sorter has an automatic pocket stop. The sorter stops when any one of the thirteen pockets is filled to capacity with cards. The pocket stops are adjustable and may be set so that each pocket will hold approximately 400, 565, 735, or 900 cards. Figure 1 shows the pocket stop control knob as seen from the front of the machine. From this position, the operator can adjust the control knob by moving it until it clicks into one of the four positions. The four positions for pocket capacity control are indicated from left to right as 400, 565, 735 and 900 cards. After the cards have been removed from a loaded pocket, the machine can be restarted by depression of the start key.

A jam bar is installed the length of the machine. Any card that is bent or distorted enough to trip the jam bar as it passes through the sorter will open the jam contacts. When the jam contacts are opened, the machine stops very quickly, before three to five more cards are fed.

### Sorting Brush

The sorting brush may be set on any column by rotating the round knob located at the front of the feed hopper. Each full rotation of this knob moves the brush three columns. A one-third turn (120 degrees) of the knob will move the brush one column.

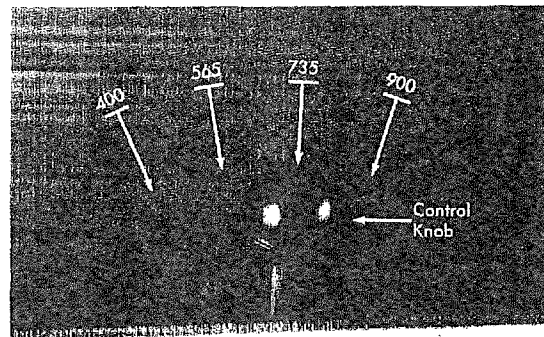


FIGURE 1. CONTROL KNOB FOR ADJUSTABLE POCKET STOP

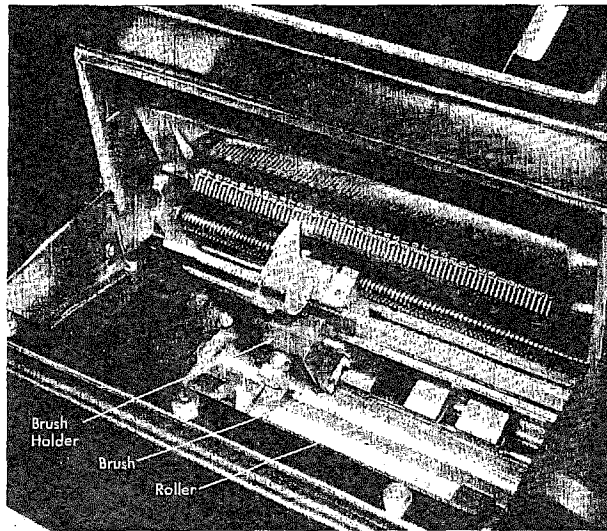


FIGURE 2. SORTING BRUSH AND BRUSH HOLDER

The brush may be moved across a number of columns by turning the knob so that the brush holder is in a raised position, lifting the sorting pointer, and moving the brush holder to the desired position. A column indicator guide and pointer are located above the brush, in a position readily visible to the operator, for convenient setting of the brush on the column to be sorted. Figure 2 shows the sorting brush and its holder.

### Sort Brush Gage

The sort brush gage located below the contact roll cover is used to set the sort brush for correct projec-

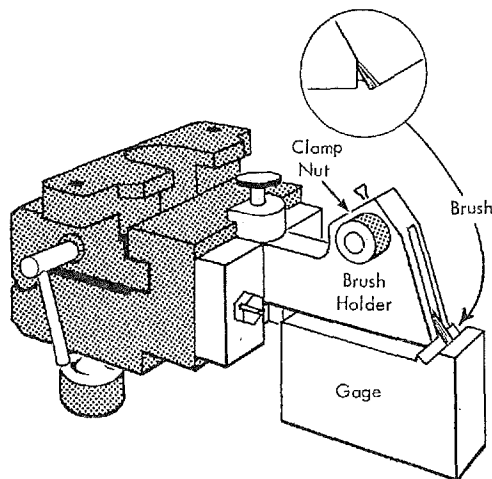


FIGURE 3. SORT BRUSH GAGE

tion. This is done by locating the sort brush holder on the gage as shown in Figure 3. It is important that the brush be firmly seated in the V notch of the gage when the knurled clamp nut is tightened. The condition of the brush and accurate timing are extremely important in a machine operating at high speed.

### Switches, Keys and Lights

The *main line switch* must be turned on to operate the machine. When this switch is first turned on, there is a short delay to warm up the tubes before the machine can be operated.

The following switches, keys and signal lights are shown in Figure 4.

There are twelve *digit suppression keys* which are used to suppress sorting on specific punches. Each key represents one digit or zone in a column and when a key is depressed, the corresponding punch is not read by the brush and can have no effect on sorting. To unlatch or reset the keys, merely run the fingertip along the bottom edge of all keys.

The *sort selection switch* determines the pattern into which the cards will be sorted. The five settings of this switch are: numerical, zone, alphabetic-1, alphabetic-2, and alpha-numerical.

When the *edit switch* is on and the column has extra punches that do not conform to the pattern selected by the *sort selection switch*, the card will be rejected. These cards will be classed as errors noted below.

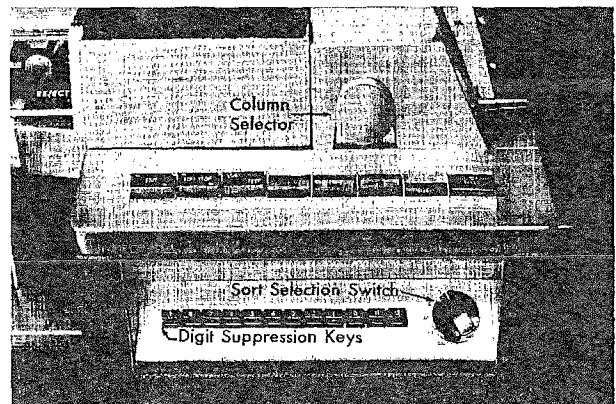


FIGURE 4. SWITCHES, KEYS, AND LIGHTS

Numerical. Cards are sorted on the basis of the first hole read as the cards pass the sort brush. Blank cards are rejected, and any cards with more than one punch in the column being sorted will be rejected as an error if the edit switch is on.

Zone. Cards are sorted on the zone (0, 11, 12) punches only. Digit punches 1-9 are ignored. Cards without a zone punch are rejected, and any card with more than one zone punch in a column will be rejected as an error if the edit switch is on.

A-1 (Alphabetic sort 1). Cards punched with a digit and a 12 zone in the column being sorted are sorted on the underpunched digits 1-9. Cards punched with an 11 zone are sorted to the 11 pocket. Cards punched with a zero zone will sort to the zero pocket. Blank cards, and cards with one digit punch (1-9) or only a 12 zone punch, are rejected. Cards with multiple digit punches or multiple zone punches will be rejected as an error if the edit switch is on.

A-2 (Alphabetic sort 2). Cards having a zero or 11 zone punch are sorted on the underpunched digits 1-9. Blanks, cards punched with a zero or 11 zone only, with digits 1-9 only, or letters A through I, will be rejected. Error is the same as A-1.

A-N (Alpha-numerical). Cards punched with a digit punch and no zone punch are sorted to their respective digit pockets, 11 zones sort to the 11 pocket, 12 zones sort to the 12 pocket, and zero zone punches will be rejected. Blank cards will also be rejected. Error is the same as A-1.

The *edit switch* is set ON to reject errors without simultaneous machine stopping. When this switch is off, cards are sorted without editing (edit-stop must also be off).

The *edit-stop switch* is set ON when rejecting of errors with simultaneous machine stopping is desired. When this switch is off, cards are sorted without editing (edit must also be off).

If either the edit or edit-stop switch is on, errors as defined by the selected sort pattern will be rejected. If the edit-stop switch is on (or if both switches are on), an error will also stop the machine.

The *test switch* is used by the customer engineer to check timing. A card with a 9 and 2 hole punched

in column 40 is fed into the machine by manually turning the feed rolls. With the test switch on, the test (edit) light will be on when the brush reads the 9 hole. At this point the lower edge of the 2 hole should align directly beneath the throat knife. When the machine has been timed in this manner, brushes installed using the brush gage should be in time without further adjustment.

The test switch must be set to sort while performing any sorting operation.

The *start key* is depressed to begin sorting.

The *stop key* performs two functions: it is used to stop the machine during sorting operation, and it is used to reset the error circuits when the machine has stopped with the error light on. For example, when the edit feature is used with the edit stop switch on, any error card sensed will be rejected and stop the machine with the error light on. The operator should then:

1. Depress the stop key to reset the error circuits and turn off the error light.
2. Depress the start key which should resume feeding.

If, however, the error light did not turn off when the stop key was depressed, it may be assumed that one or more additional error cards have been sensed. This is possible because from three to five cards feed past the sort brush before the machine stops, and one or more of these cards could be in error. In this case a second depression of the start and stop keys is necessary before the machine will continue to feed automatically. The following sequence of key depressions is necessary when two or more error cards cause an edit stop:

1. Depress stop key; error light remains on.
2. Momentarily depress start key (the machine will feed but only as long as the start key is depressed); error light remains on.
3. Depress stop key; error light turns off.
4. Depress start key; machine continues to feed automatically.

In any event, all error cards will be sorted to the reject pocket.

The *power-on light* glows when the main line switch is on.

The *edit light* glows when edit-stop is on and the machine senses an error. It also glows when the test switch is set to TEST and the brush is reading a hole in the card.

## OPERATING PRINCIPLES

As illustrated in Figure 5, cards are fed horizontally from the hopper and pass directly under a brush and over a contact roll. If the card has an 8 punched in the column being sorted, the brush will "read" the hole by completing an electrical circuit when the brush makes contact with the roll through the 8 hole in the card column. This brush reading will cause an electronic memory tube to start conducting. Current passing through the tube is used to pick up a sort analyzer relay. If the brush reads more than one hole in the column, it will pick up one tube and therefore one analyzer relay for each hole read.

After the card column is completely read from 9 through 12, an electrical impulse is sent through the network of analyzer relays to a sort magnet. The sort magnet selected for operation will depend on the punches in the card column and the setting of the sort selection and edit switches. When edit and edit-stop are both off, cards with multiple digit (9-1) punches in a column will be analyzed as if only the lowest (under-punched) digit were punched. For example, a card punched with a 3 and an 8 in the same column will be analyzed as an 8 and sorted accordingly. Cards with multiple zone (0-11-12) punches will be analyzed similarly. A card with both a 12 and a zero zone punch will be analyzed as a zero.

When the sort selection switch is set on N, digit (9-1) punching takes precedence over zone (0-11-12) punching. At all other switch settings, the zone punching takes precedence.

Figure 5 shows that, with the sort selection switch set to N, edit stop on, and a card punched with an 8 in the column being sorted, the sort impulse will

pass through the analyzer network and reach the 8 sort magnet. This magnet will pull down the 8 chute blade. Whenever a chute blade is pulled down, all the blades underneath it will be pushed down. The 7, 6, 5, 4, 3, 2, 1, 0, 11, and 12 blades are all under the 8 blade and will be pushed down. There will be a gap between the 8 and 9 blade into which the card is guided. The card travels between the blades until it reaches the 8 pocket where it is stacked with other cards having an 8 in the sorted column. Figure 5 also shows the next card. The 6 punched in the next card has caused the 6 tube to conduct but the 6 relay will not be picked up until the card ahead has entered the chute blades.

With this system of indirect or selective sorting, cards are not directed to a selected pocket until all the punches in a column have been analyzed. This makes possible a pre-edit of the analyzer relays before the card is directed to a pocket so that cards which do not meet certain conditions need not be sorted. For example, a card with an 8 punch is not the same as a card with both an 8 and a 12 punch. The analyzer relays will be set up differently for the two cards and the cards may be sent to different pockets.

Figure 6 shows in tabular form the sort and edit pattern for each setting of the sort selection switch.

## OPERATION

THE OPERATION of the Sorter is extremely simple. It is important, however, for an operator to acquire skill in handling the cards properly and to analyze each job in order to adopt the most efficient routine for handling it.

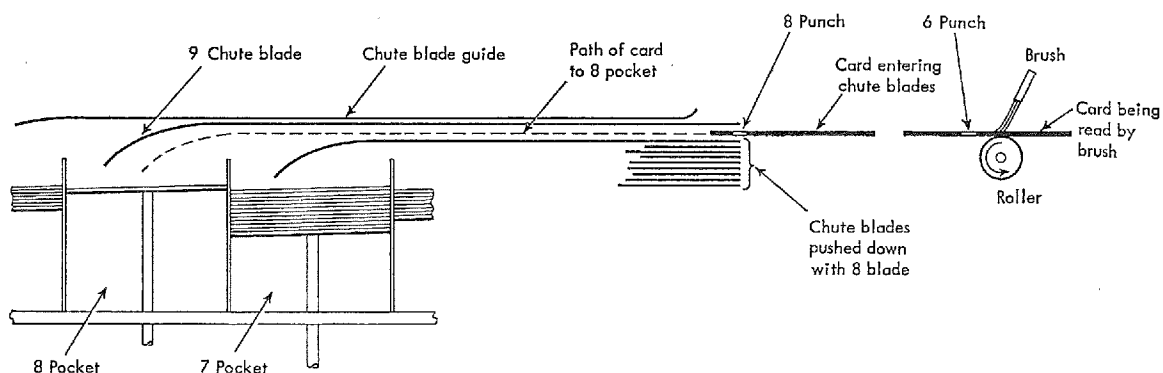


FIGURE 5. SORTER OPERATING PRINCIPLE



SORT SELECTION SWITCH SETTING	POCKETS												REJECTS REGARDLESS OF EDIT	ERRORS (When edit or edit-stop is on)
	9	8	7	6	5	4	3	2	1	0	11	12		
Numerical	9	8	7	6	5	4	3	2	1	0	11	12	Blanks	Multiple-punched cards (incl. letters)
Zone										0	11	12	Any card without a zone punch	Any card with more than one zone punch
Alpha-1	I	H	G	F	E	D	C	B	A	0 S-Z	11 J-R		Blanks and cards with a 12 zone punch but no digit punch. Digits 1 to 9.	Any card with more than one zone punch or with more than one digit punch
Alpha-2	R,Z	Q,Y	P,X	O,W	N,V	M,U	L,T	K,S	J 0-1				Cards with 0 or 11 zone only. Blanks. Letters A to I, and 12 zone spec. char. Digits 1 to 9.	Same as A-1
Alpha-Numerical	9	8	7	6	5	4	3	2	1	0 (digit)	11 J-R	12 A-I	Blanks, 0 zone (S-Z)	Same as A-1

This pattern is based on cards being fed face down, 9 edge first.

FIGURE 6. SORTING PATTERN FOR STANDARD MACHINE

To begin an operation, the sort selection, edit, and test switches are set at the proper positions and the brush is moved to the position corresponding to the column to be sorted.

### Numerical Sorting

The normal method of sorting is to sort first on the units column and, as the cards are removed from the pockets, stack them so that for the next sort on the tens column all of the 0's will be followed by the 1's, 2's, 3's, and so on, in succession. This process is then repeated for the columns of hundreds, thousands, and so on, until the entire classification field has been sorted.

The principle upon which this method of operation is based is illustrated by the example in Figure 7. Fifteen cards, punched in a two-digit field with numbers from 11 to 23, are in miscellaneous order when they are first placed in the hopper. On the first sort, on the units column, all cards punched 1 in that column fall in pocket 1, all cards punched with a 2 in that column fall in pocket 2, and so on. As the cards are removed from the pockets, those from pocket 1 are placed face up and in front of those from pocket 2, and the cards from pocket 3 are placed behind those from pocket 2. Thus, when the stack of cards is again placed in the hopper for the second sort, on the tens column, they are fed from the

hopper in the order 1, 2, 3 according to the units column sort. On this second sort, all cards punched 1 in the tens column fall in pocket 1, and the cards punched 2 fall in pocket 2. When they are removed and the cards from pocket 1 are placed face up and in front of those from pocket 2, the whole file of cards will be in numerical order from 11 to 23.

This sorting process could be illustrated further by the use of larger numbers, but from the above it will be observed that upon completion of the second sort, all cards will appear in groups arranged in correct numerical sequence.

The procedure for sorting cards to arrange them in proper sequence according to major and minor classifications follows the same general principle. If the above two-digit numbers were subclassifications within a major classification represented by a one-digit field, a third sort on that third column would bring these groups together with the subclassifications in order within each major group, as shown in Figure 8.

As a general rule, the sorts for the minor or subclassifications are made first and the sorts for the major groups are made last.

After the brush and switches are set, cards to fill the hopper about two-thirds full are taken up and held loosely in one hand on the joggle plate, with the back of the cards toward the operator and one end of the cards against the end plate. The cards are

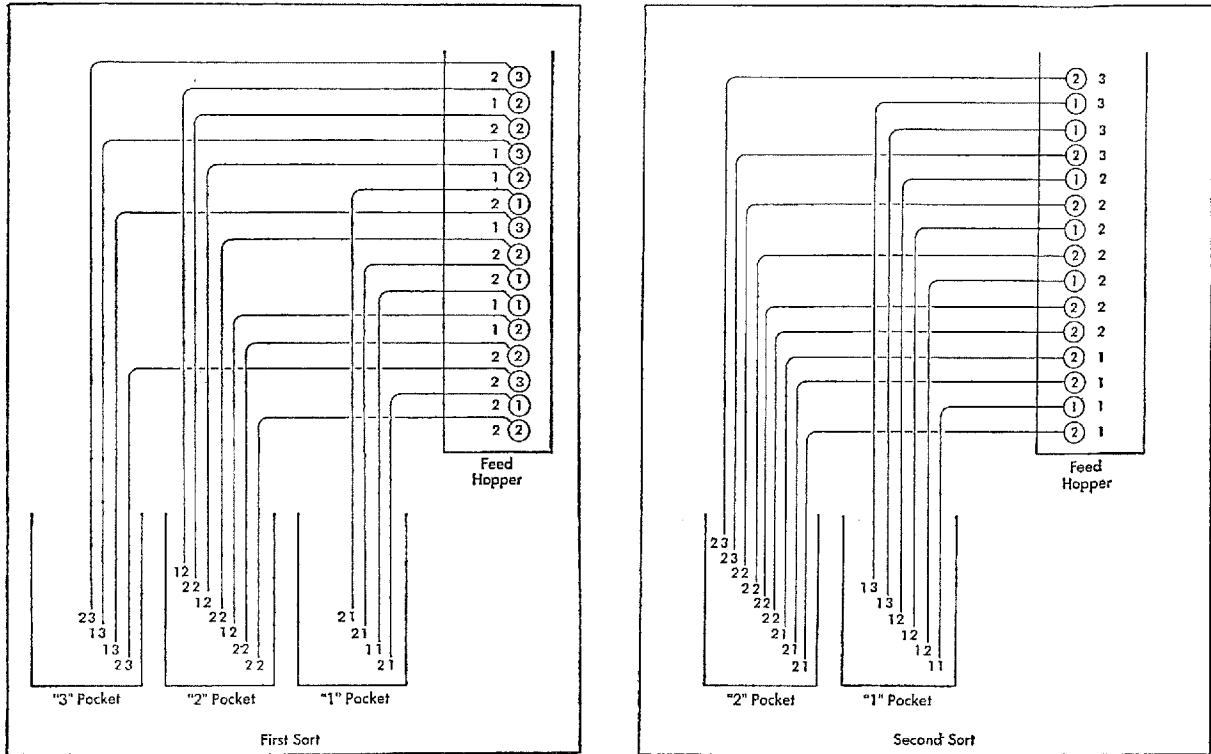


FIGURE 7. SORTING PRINCIPLE, NUMERICAL SORTING

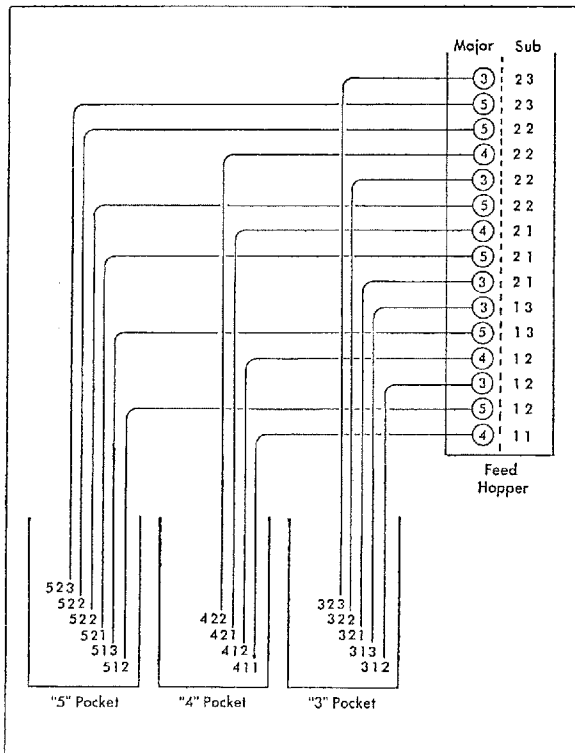


FIGURE 8. SORTING BY MAJOR GROUPS

then joggled on the other end and tapped at the top until all sides are even. Next, the cards are placed face down (printed side down) in the hopper so that the lower (9's) edge will feed into the machine first. The card weight is placed on top of the cards.

Depression of the start key will begin the feeding of cards. After the machine has been started, it will continue to operate until the hopper has been emptied, a pocket becomes full, or a damaged card fails to feed. While one pack of cards is running through the machine, another pack may be prepared and placed in the magazine in order to maintain continuous operation. Cards may be removed from the pockets while the machine is running, but care should be exercised not to catch another card being conveyed into the pocket from the chute blades while doing so.

Cards taken from the Sorter may be placed face down in the compartments of a sorting tray as an aid in maintaining their proper sequence. As they are taken from the pockets they may be conveniently checked with a sorting needle, or by holding the cards to the light and sighting through the punched holes.

## Block Sorting

Ordinarily, cards are sorted by beginning with the units column, but when a large quantity is to be handled it is usually advisable first to separate the cards into groups. This is done by sorting the columns at the extreme left of the field. Each resulting group is then sorted in the customary manner. For example, if cards are to be arranged so that all cards for each customer will be together and all customers within each state will also be grouped, the cards should be sorted first according to state, and then each state group should be sorted by customer. The cards for each state should be kept segregated.

In this way, all the cards for state 01 could be sorted in customer number sequence and started through the accounting machine while the cards for state 02 are being sorted to customer sequence.

The advantage of block sorting lies in the reduction of time required for preparing complete reports, by making possible the concurrent operation of the accounting machine and sorter. For example, 20,000 cards must be sorted to prepare a report showing sales by customers and by state. The state code is a two column field; the customer code a four column field. Therefore, the 20,000 cards must pass through the sorter six times to classify them by customer by state. The sorting operation would require two hours if the speed of the sorter is 1000 cards a minute:

$$\begin{aligned} \text{Cards} \times \text{sorting columns} \div (\text{sorting speed per minute} \times 60 \text{ minutes}) &= \text{sorting time} \\ (20,000 \times 6) \div (1000 \times 60) &= \text{sorting time} \\ 120,000 \div 60,000 &= 2 \text{ hours} \end{aligned}$$

This means that, according to the ordinary sorting routine, it would be two hours after the sorting operation began before the accounting machine could begin producing the required report.

The block method of sorting would require only 40 minutes to classify the cards by state:

$$\begin{aligned} (20,000 \times 2) \div 1000 \times 60 \\ 40,000 \div 60,000 &= 40 \text{ minutes} \end{aligned}$$

If there were no more than 2000 cards for any one state, they could be classified by customer in only eight minutes:

$$\begin{aligned} (2000 \times 4) \div (1000 \times 60) \\ 8000 \div 60,000 &= 8 \text{ minutes} \end{aligned}$$

Thus, with block sorting, report preparation could begin only 48 minutes after the sorting is begun.

Although the sorter and accounting machine time for the preparation of the report will remain the

same, regardless of the method of sorting, block sorting makes it possible to begin the report and complete it three hours sooner than if the regular sorting method were used.

Unless speed in the preparation of finished reports is essential, or the accounting machine would be idle while the sorting is being done, there is no special time advantage in block sorting. It does, however, permit the convenient subdivision of one job among several sorters.

## Pre-Sorting

Whenever a peak load of sorting is involved in the preparation of month-end reports, the load may be reduced by performing the block sorting on a daily or semi-weekly basis. The detail cards referred to in the above example could be pre-sorted each week according to state, so that at the end of the accounting period only the sorting on the customer classifications remains.

## Sequence of Sorting for Reports

Proper report scheduling is extremely important in attaining maximum economy in the preparation of reports by IBM Accounting Machines. These machines can sense changes in major and minor group classifications of cards, in order to accumulate and print totals automatically for those groups. The cards used in preparing a report of this kind must be sorted first according to the minor group classification, and then according to the major group classification. When several different reports are to be prepared from the same set of cards, with the same fields representing different classifications on two or more of the reports, the sorting operations should be considered in planning the order of preparation of the reports.

The following illustration compares two methods of preparing a number of reports from the same card (Figure 9). Five reports are to be prepared showing total hours and amounts for each major and minor classification as follows:

1. By Employee
2. By Part subdivided by Operation
3. By Operation subdivided by Employee
4. By Department subdivided by Order
5. By Order subdivided by Part



### Alphabetic Sorting

Alphabetic sorting normally requires two sorts on each column because a letter is coded as two holes punched in a single column.

The letters A to I are coded as the combination of a 12 zone punch and one of the digit punches 1 to 9, the letters J to R are coded with an 11 zone and a digit, and the letters S to Z are coded with a 0 zone and one of the digits 2 to 9. Thus, a 12 zone punch and a 1 digit punch represents the letter A; 12-2 represents B; 11-1 represents J, and so on.

Alphabetic sorting on the 83 is accomplished by setting the sort selection switch on A-1 and setting the brush on the column to be sorted. The cards are fed into the machine normally, 9's first, face down. The letters from A to I will be sorted into pockets 1 to 9 on the first pass. The letters J to R, which have 11 zoning, will be in the 11 pocket. The letters S to Z, which have zero zoning will be in the 0 pocket. Any cards blank or punched with a 12 zone or digits only in the column being sorted are rejected. If cards punched with either letters or digits in a column are to be sorted, they should be pre-sorted using the A-N setting of the sort selection switch.

The edit-stop switch should be on so that any cards with double-punched digits or double-punched zones will reject and stop the machine.

At the end of the sort on A-1, the rejects, which are the cards with no punching in the column being sorted, should be placed in front of the pack. The cards should be removed from pockets 1 to 9 and placed behind the rejects. These are the A to I cards which are sorted. The cards in the 0 and 11 pockets should be removed and kept separate ready for the second pass. Only the cards punched with letters

A to I are sorted on the first pass.

The sort selection switch should be changed to A-2, but the brush setting should not be changed for the second pass. It is not necessary to put the rejects and A to I cards through again.

The 11 and zero zone cards must be fed through the machine separately on the second pass. The 11's are fed through first. This sorts the J to R cards. They are removed and put behind the A to I cards. The last sort on the zero zone cards sorts the letters S to Z and these cards are removed and placed at the end of the deck.

This sorting is repeated on each column to be sorted until the job is completed. Normally alphabetic sorting is done by starting at the right-hand column of a field in the card and progressing to the left until all the columns are sorted.

### Alpha-numerical Sorting

When the sort selection switch is set to A-N, all the digits will be sorted, but cards punched with letters will be sorted to their respective zone pockets. Any digit punch under a zone punch in a column will be ignored. This method offers a quick means of separating alphabetic and numerical punches. The digit zero and the zone zero are separated automatically. A zero with no digit underpunch is sent to the zero pocket; a zero with a digit underpunch (1-9) is rejected.

When either letters or numbers may be punched in a column, the cards should be sorted using the A-N setting to separate the letters from the digits. The digits 0 to 9 will be sorted. The 12 zone, 11 zone, and zero zone letters should then be sorted separately using the A-1 and A-2 switch settings.

## SPECIAL DEVICES

SPECIAL devices may be installed on the 83 Sorter to extend the application possibilities of the machine.

### ALPHABETIC SORTING DEVICE

WHEN this special device is installed, the sorting patterns for settings A-1, A-2, and A-N are permanently changed. A card column may be sorted alphabetically by passing all the cards through the machine on the selected column once and a part of the cards a second time. It is not necessary to remove any sorted cards from the machine until the column is completely sorted.

Figure 10 shows the sorting pattern for a machine equipped with the alphabetic sorting device. With this pattern, the first pass of the cards on a column will sort all the cards punched A, C, E, G, I, L, O, R, U, and X into pockets 0 to 9. The letters B, D, F, H, J, M, P, S, V, and Y will be sorted into the 12 pocket. Letters K, N, Q, T, W, and Z will be sorted to the 11 pocket. Blanks and cards without letter coding will be rejected.

The switch is changed to A-2 for the second pass and the cards in the 12 pocket, followed by the cards in the 11 pocket, are fed without removing any cards from the 0 to 9 pockets. At the end of the second pass, the column is completely sorted.

This method of alphabetic sorting is superior to others because ten letters, including all the vowels, are sorted in one pass and it is not necessary for the operator to remove sorted cards from the pockets until the sort is complete. Figure 11 illustrates schematically the method of sorting alphabetically using the alphabetic sorting device.

### Alpha-numerical Sorting (with Alphabetic Sorting Device)

When the sort selection switch is set to A-N, the digits 0 to 9 will be sent to the 0-9 pockets. The letters K, N, Q, T, W, Z will be sent to the 11 pocket, and the letters B, D, F, H, J, M, P, S, V, Y will be sent to the 12 pocket. Cards punched with a zone 11 punch only will be sent to the 11 pocket and 12 zone cards will be sent to the 12 pockets. All other cards,

including the letters A, C, E, G, I, L, O, R, U, X and the 0-1 combinations, will reject.

### AUXILIARY CARD COUNTER

A SPECIAL electrically operated card-counting mechanism, by means of which a 1 is registered for each card passing the brush, may be connected to any Sorter in such a manner that the dials may be easily read for manual transcription of totals. The counter does not affect the normal speed or method of operation of the machine to which it is attached. The maximum capacity of the device is 999,999. Normally, this mechanism counts only the total number of cards passing through the machine. A count by pockets may, however, be made by a second sort. The customary method is to run all the cards through the machine in the regular sorting operation, and at the same time to determine the total number of cards. Then the largest group from any individual pocket is set aside, and the cards from each of the other pockets are run through the machine separately for group totals. The total of these groups may then be deducted from the grand total number of cards, to determine the number of cards in the largest group. This eliminates the necessity of running the latter group through the machine a second time.

When more than a single sorting and counting operation is to be performed, the counting for each group resulting from one sort may be accomplished as each group is fed through the machine to effect the next sort.

### CARD COUNTING UNIT 978

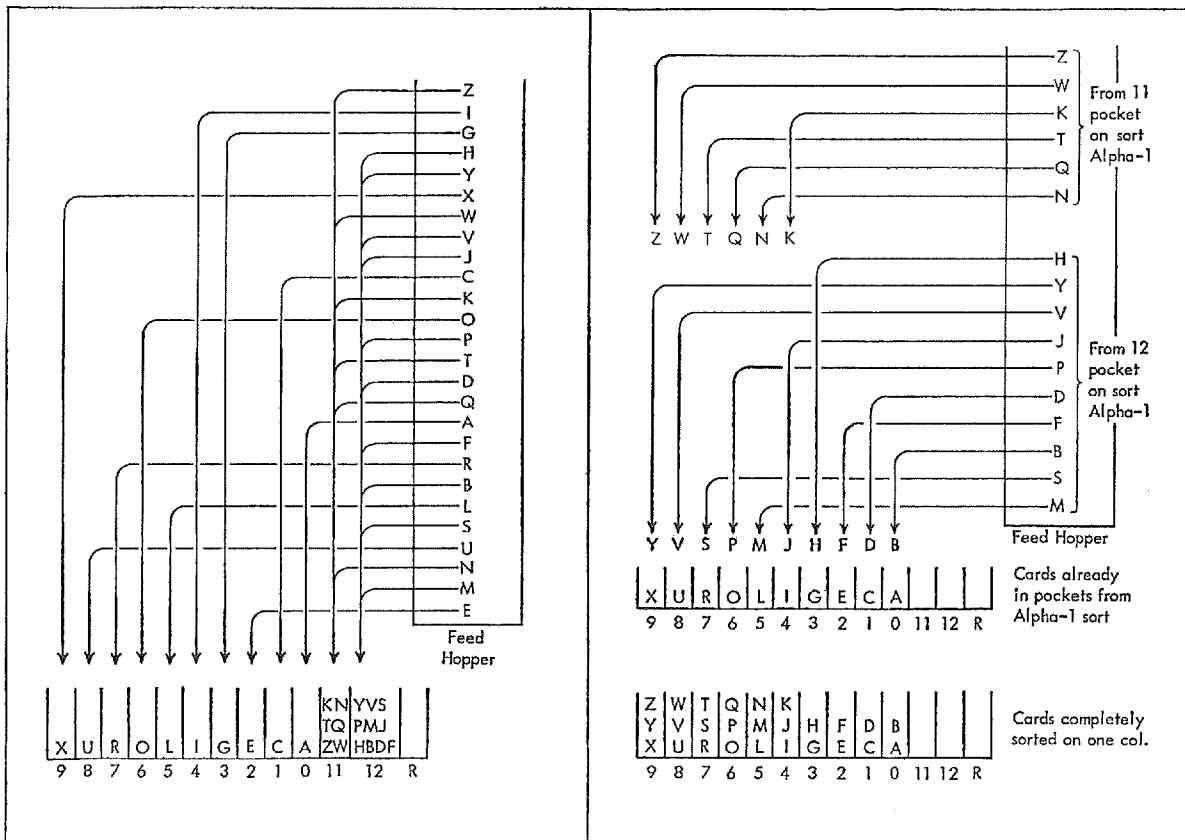
THE 978 Counting Unit (Figure 12) can be placed either on the 83 sorter on a desk or table convenient to the sorter. When it is on a separate table, a recorder can work undisturbed while an operator handles the cards. Or, of course, the 978 can be left on the sorter so that the operator can also record without leaving the machine.

When the *count switch* is turned on, it will count all holes punched in a given column of the card, and

SORT SELECTION SWITCH SETTING	POCKETS												REJECTS REGARDLESS OF EDIT	ERRORS (When edit or edit-stop is on)
	9	8	7	6	5	4	3	2	1	0	11	12		
Alpha-1	X	U	R	O	L	I	G	E	C	A	KN QT WZ	BD FH JM PS VY	Cards punched with digits only, zones only, 0-1 combination, or blank	Any card with more than one zone punch or more than one digit punch
Alpha-2	Z Y X	W V U	T S R	Q P O	N M L	K J I	H G	F E	D C	B A			Same as A-1	Same as A-1
A-N	9	8	7	6	5	4	3	2	1	0	KN QT WZ 11	BD FH JM PS VY 12	Blanks. A,C,E,G,I, L,O,R,U,X and the combination 0-1.	Same as A-1

This pattern is based on cards being fed face down, 9 edge first.

FIGURE 10. SORTING PATTERN FOR ALPHABETIC DEVICE



SWITCH SET ON A-1

SWITCH SET ON A-2

FIGURE 11. SORTING PRINCIPLE, USING ALPHABETIC DEVICE

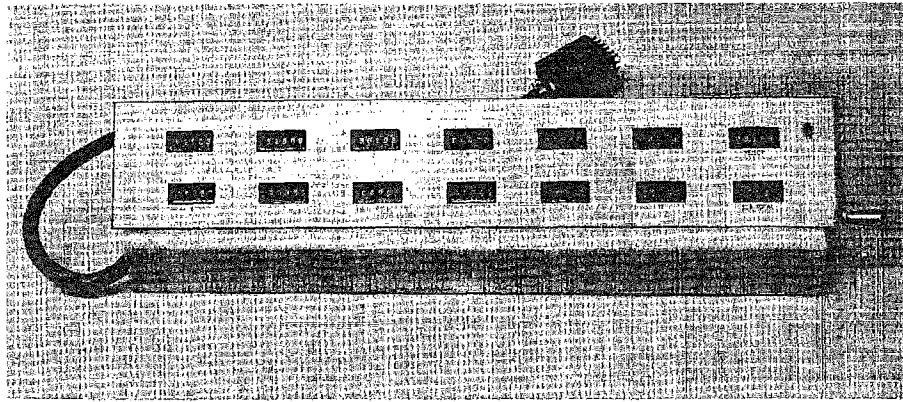


FIGURE 12. 978 CARD COUNTING UNIT

also the number of cards not punched in that column. It may also simultaneously sort cards into numerical sequence depending on whether the *count only switch* is on or off.

The counting mechanism is connected to the sorter by a flexible five-foot cable. It may also be detached for storage when not in use. The card counting unit contains 14 five-digit adding counters: one for each pocket, one for rejects, and one for sub-totals. When a grand total is required it can be accumulated in the auxiliary card counter.

All counters are cleared by depressing the clear lever and rotating the clearing crank two turns to a locked position. If the cable is not connected to the sorter and the count switch is turned on, or if the clear lever has been depressed accidentally but the counters have not been cleared by rotating the clearing crank, the sorter will not operate.

### Switches

Two switches control the counting unit operations. They are located below the digit suppression keys on the front panel.

The *counter switch* is turned on whenever cards are counted. When this switch is turned on the counter unit must be connected to the sorter.

The *count only* switch is turned on to suppress all sorting while cards are being counted, without disturbing their original sequence.

The *digit suppression keys* can be used to suppress sorting, during a count operation, on punches corresponding to the keys depressed.

### IBM FILE FEED

THIS device, installed on an 83 Sorter, triples the sorter's hopper capacity—from 1200 to approximately 3600 cards. This allows up to 3½ minutes of continuous running time without reloading. The file feed considerably reduces card handling and card joggling so that one operator can efficiently handle two sorters simultaneously. It takes less operator time to run two file-feed equipped sorters than to run one sorter without this device. If only one sorter is used, the time saved by the file feed can be used to run other equipment.

The file feed magazine itself is about 25 inches long and extends at a 45° angle from the hopper over the top of the machine (Figure 13). In normal operation, the modified card weight is in the hopper at the start of a job. Cards are loaded on the magazine with the 9 edge down and the column-1 end toward the operator. Usually, it is not necessary for the operator to fan and joggle the cards because this is automatically done as the cards enter the hopper from the magazine.

Depressing the start key allows about 300 cards to feed on top of the card weight in the hopper. As the cards are fed, the device automatically fans the cards and joggles them at the 12 edge and the column 1 end.

Once the hopper is filled, feeding stops. The hinged front joggle plate must be swung out to allow access to the hopper so the card weight may be removed (Figure 14). The weight should then be placed behind the cards on the magazine. The joggle plate



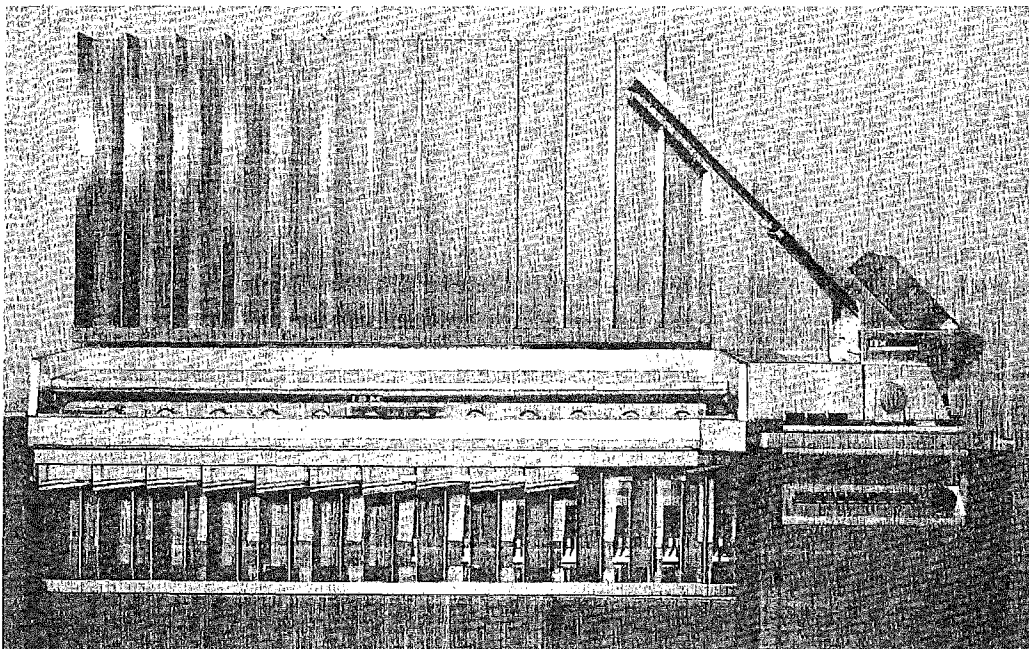


FIGURE 13. SORTER WITH FILE FEED

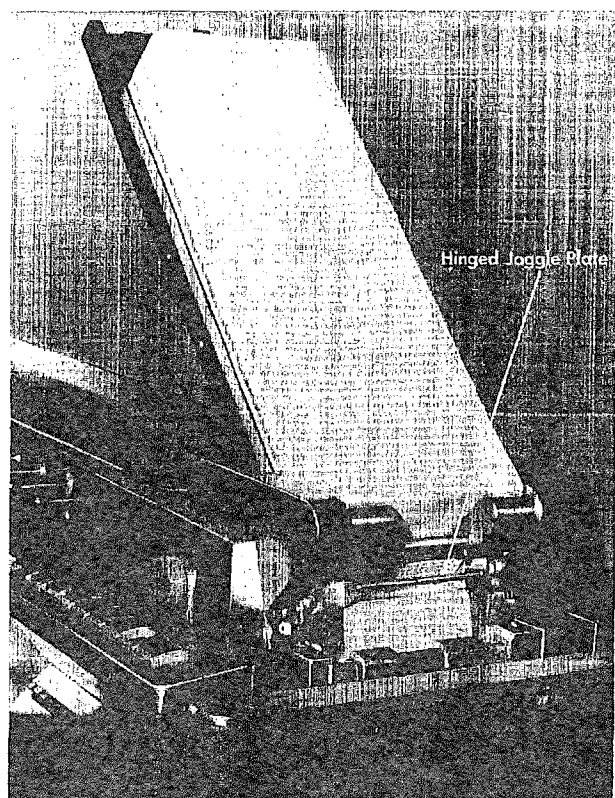


FIGURE 14. HINGED JOGGLE PLATE

must be returned to its normal position and the start key depressed again. A constant volume of about 300 cards is maintained in the hopper, except on run-out.

As the cards enter their proper pockets, they are again joggled automatically by a pocket joggler (Figure 15). This vibrates against the top half-inch of the cards as they enter the pockets, keeping them evenly stacked at all times. The pocket joggler may be easily raised out of the way when the pockets are

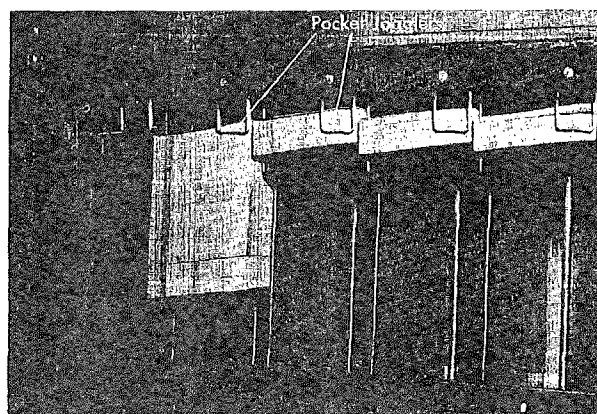


FIGURE 15. POCKET JOGLERS

to be emptied, or the cards may be pushed down below the juggler and then removed. The pocket juggler is included in the file feed device for the 83 Sorter.

To prepare for the next column sort, the card weight may be placed in back of the cards in the file feed magazine followed by the cards for the next sort. When the weight reaches the hopper bed and feeding stops, the operator can empty the pockets, move the brush to the next desired column, remove the weight, and again depress the start key.

By a simple operation, the magazine can be raised to an almost vertical position to permit access to the brush and feed rolls. It is not necessary to remove the cards from the magazine before it is raised. When the magazine is at its 45° angle, the reject and 12 pockets in the upper sorting tray are limited to 1400 and 1800 cards, respectively. When the magazine is raised, these pockets are completely accessible.

Jobs of 300 cards or less may be run without feeding from the magazine. To do this, it is necessary to swing the joggle plate out so that the cards, with the weight on top, may be inserted directly into the hopper. The joggle plate must then be returned to normal position and the start key depressed. As this method bypasses the magazine feeding feature, the operator should fan and joggle the cards before inserting them directly into the hopper.

The file feed device can be installed on an 83 Sorter in the field or at the factory.

### CARD RACKS

TWO DIFFERENT card racks may be used with the 83 Sorter. The above-the-feed rack with a card capacity of 3000 cards is installed on a stand behind the sorter. The lower rack with a capacity of 2500 cards is installed in front of and just below the sorter pockets where it is easily available to the operator. Both card racks have the pockets numbered to correspond to the pockets of the sorter.

Card racks used on the earlier sorters such as the 80 and 82 can be used with a special stand available for this purpose.

### SORT SUPPRESSION DEVICE

THE SORT suppression device permits the separation of cards into either the reject or 12 pocket without

changing the sequence of the cards within each of the two groups. It is useful in the removal of unpunched cards, since they will be rejected, and all other cards will fall in the 12 pocket in their original sequence. The main advantage of sort suppression is in selecting cards containing specific digits without disturbing the sequence of the selected or the unselected cards. For example, assume all digit suppression keys are depressed except the 2, 4, 6, and 8 keys (sort selection switch at N). This arrangement will cause cards punched 2, 4, 6, and 8, to sort into the 12 pocket and all other cards to enter the reject pocket. Thus, the sequence of the cards in both pockets remains undisturbed. Cards punched with a 12 will sort into the 12 pocket if the selector switch is set to N and the 12-digit suppression key is not depressed.

Using the sort suppression feature in conjunction with the edit stop makes it possible to edit cards without disturbing their sequence. For example, all numerical cards in a given column can be sorted into the 12 pocket and the errors will fall in the original sequence with the cards in the reject pocket. Thus, the cards which pass the edit test will also be in the original sequence. The edit stop switch can be used to locate the point at which error cards enter the reject pocket.

It is also possible by using this same principle to do a blank-column and double-punch detection test on a single column without disturbing the sequence of the cards. This is done by turning the sort selection switch to N when the edit and sort suppression switches are on. (The sort suppression switch is shown in Figure 16.) If only a few columns need be analyzed, this is a rapid process.

Sort suppression in combination with the alpha-sort device can be used to select certain alphabetic characters without disturbing the sequence of the cards. For example, to select the letters A, B, and C from a group of cards, the alpha-sort switch is turned on, and the sort selection switch is set to A1; the digit suppression keys are all off except 12, 1, 2, and 3. The selected letters will sort to the 12 pocket and all others will be rejected in their original sequence. This type of selection will generally be confined to letters within the same zone group unless, however, the digit under-punches are the same as those desired within another zone group.

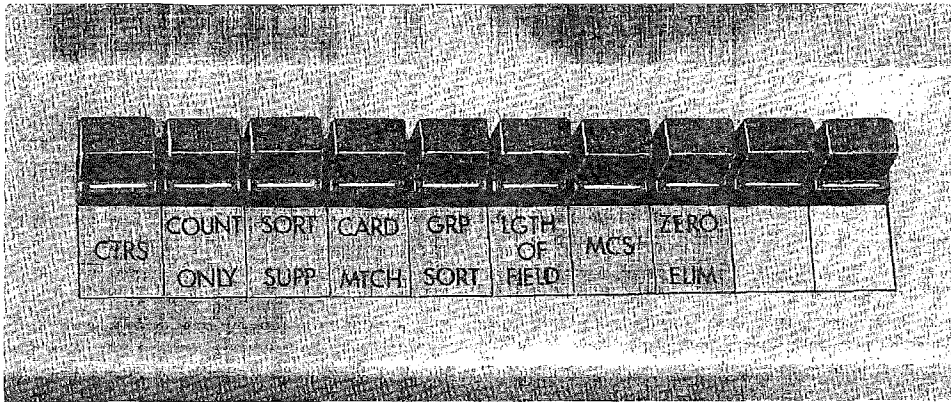


FIGURE 16. SPECIAL DEVICE SWITCHES

### CARD MATCHING DEVICE

THIS DEVICE removes from a file of cards, those master cards that are not preceded by corresponding matching detail cards. For example, name and address cards may be treated as master cards, in which case the device is used to remove the inactive name and address cards from the file.

All matching master and detail cards sort into the 11 pocket. Any master cards without matching detail cards sort into the reject pocket.

The chute to the 11 pocket is closed for unmatched master cards by one of two reading methods:

1. The *corner cut* method, when the first master card with the proper corner following the details is sensed by an offset sorting brush set to track on the edge of the card opposite to the rail brush. This method can only be used for groups having single master cards.
2. The *significant punch* method, which is used for either single or multiple master cards, depends on a distinctive punch in the last master card fed from each group. This punch is sensed by the regular sorting brush; consequently, an offset brush is not necessary.

Operation of this device requires that the detail cards precede the master cards in the file because the chute to the 11 pocket is opened by the details and closed by the master card.

When using this device, the sort selection switch is always set to N, and all digit suppression keys are depressed except the one corresponding to the corner cut (9 for lower corner, 12 for upper corner) or actual punching used to identify the master cards. If master cards are fed 12 edge first, the correspond-

ing digit suppression key settings would be in reverse order (Figure 4). For example, the 9 key will control 12 punches, the 8 key will control 11 punches, and so forth.

The leading edge of master cards that pass under the rail brush used for recognizing detail cards must have square corners. In addition, master cards should never have a 9 or 12 in column 1 or 80, when these columns are adjacent to a rail brush set for sensing column 1 or 80. When the significant punch method is used, this punch cannot be in the four columns adjacent to a rail brush set for corner cut cards, and is increased to six columns when the rail brush is set to read column 1 or 80.

The card-matching-device switch is located on the front panel below the digit suppression keys.

### GROUP SORTING DEVICE

GROUP sorting permits sorting an entire group of cards according to the punching in a leading master card. A corner cut on a leading edge in this master card is recognized by a special brush mounted on either the front or rear rail of the machine. Once a card is recognized as a leader, it is sorted according to the holes read by the regular sorting brush. Detail cards which follow are sorted into the pocket set up by this leader card regardless of the punching in the detail cards. These detail cards sort into the same pocket until the leader card for the next group is recognized, or, in some cases, until a special trailer card for the current group is sensed. The leader card must have either a lower or upper corner cut on either the left or right side. A lower corner cut must be used if leader

cards are to be fed 9 edge first, and an upper corner cut if leader cards are fed 12 edge first. Once a leader card sets up the group pocket, all following detail cards with square corners sort into the same pocket.

If the trailer card feature is used, a trailing edge corner cut is recognized by a rail brush which may be the same one used to recognize the leader cards, or another rail brush can be mounted on the opposite rail. Once the trailer card is recognized, it is sorted into the pocket selected by the preceding leader card. All cards following the trailer card are rejected until a new leader card is recognized. The sort selection switch, edit switch and edit stop switch can control exactly as for standard card sorting.

A switch located on the front panel below the digit suppression keys turns the group sorting device on or off. When this feature is installed, the normal sort brush cannot be set in the six end columns of the card adjacent to the rail brush. The operator may remove the rail brush to permit normal sorting on all card columns.

#### MULTIPLE-COLUMN SELECTION DEVICES

THE OPERATIONS of multiple column selection, testing for zeros in the high-order positions of a field, determining blank columns to the right in alphabetic fields, and selecting cards with common digits in any

of ten consecutive columns, all depend on this ten-position brush assembly.

*Multiple Column Selection* selects into a single pocket, on an initial pass through the machine, those cards punched with a predetermined numerical or alphabetic code in ten or less consecutive card columns. For example, all cards punched ASDF may be selected in one pass through the machine.

*Common Digit Selection* sorts out all cards which have one or more common digit punches. For example, all cards with one or more X's in ten or less consecutive columns may be selected in one pass through the machine.

*Zero Elimination* permits greater speed in the completion of sorting operations by rejecting those cards which require no further sorting (those with all zeros to the left). For example, a card with a part number 000000028 would be rejected on the third sort.

*Length of Field* distributes cards into the pockets as determined by the last significant column punched in the field, regardless of the remaining spaces to the left. For example, short names like Dow and Jones which require fewer sorting passes can be separated from longer names like Christianson and Mainbocher on an initial pass through the machine.

These features use a ten-position brush assembly that is inserted by the operator in place of the regular sort brush assembly, a small control panel located

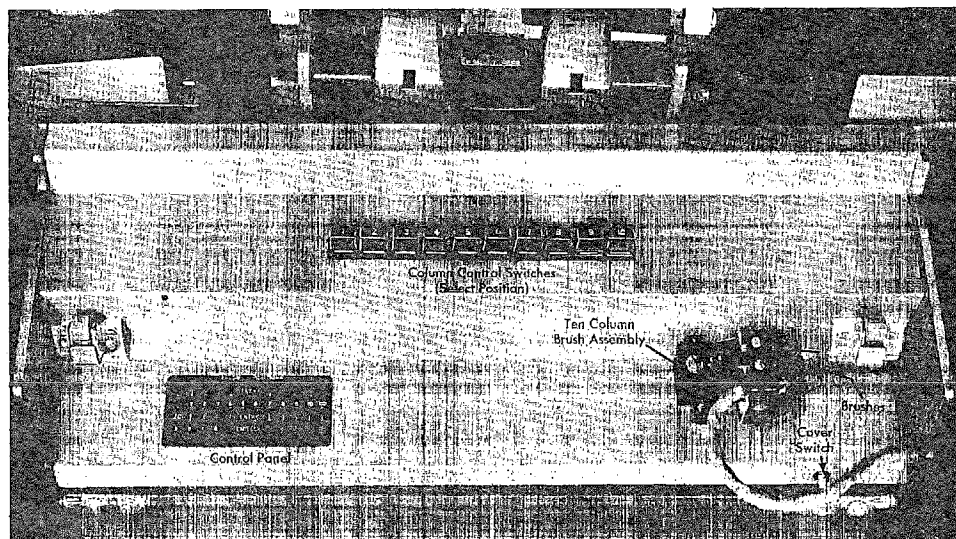


FIGURE 17. TEN-COLUMN BRUSH ASSEMBLY CONTROL PANEL AND SWITCHES

on the right end of the machine, ten column-control switches, and a control off-on key on the front of the machine. Figure 17 shows the column control switches, control panel, and the brush assembly.

### Control Panel

Each brush of the ten-position brush assembly has a double set of entry hubs on the control panel, labeled *brush position entry 1-10*. Two sets of entry hubs are provided for each brush position to allow setting up combinations of codes without creating back circuits. A back circuit can occur when an emitted zone or digit is common to several positions. The brush entries are normally wired from the emitter with the alphabetic, numerical, or code combinations in the cards.

The *emitter* generates an impulse for each punching position on the card (9-12). For instance, emitter hub 4 will emit an impulse at the same time the 4 position of the card is being read.

The *CD SW* (*Common Digit Switch*) must be wired on in a common digit selection operation.

The *ZE* (*Zero Elimination Emitter*) is a source for a test impulse to recognize zeros or zone punches only to the left of significant digits.

### Keys

**Column Control Keys.** A single column control key operates a switch for each of the ten brush positions. These keys provide two basic functions; when they are raised, the brushes are connected for a select operation, and when they are depressed the brushes are connected for a sort type operation.

**Operational Control Keys.** There is one control key for each operation: multiple column selection (MCS), zero elimination (ZE) and length of field (LF). The corresponding control key must be depressed (on) when a particular operation is being performed. An internal interlocking feature prevents more than one multiple column operation at any one time. If more than one control key is depressed, the key farthest to the left will take precedence.

The normal-sort and edit test circuits are not operative during any of these operations.

### Selection of Alpha-Numerical Punching

Figure 18 shows control panel wiring and switch settings for multiple-column selection of all cards

Brush Pos.	1	2	3	4	5	6	7	8	9	10
Select			A				7		J	
Punched			12				7		11	
Col. UP (Select) Sw. DOWN (Off)	1	2	3	4	5	6	7	8	9	10

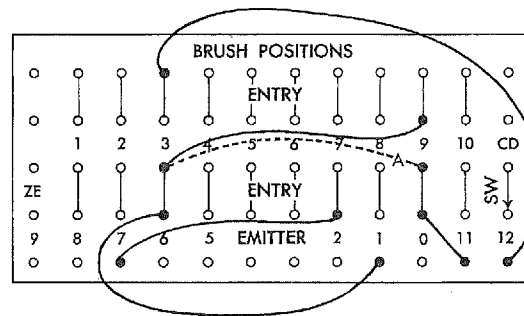


FIGURE 18. MULTIPLE-COLUMN SELECTION, CONTROL PANEL WIRING AND SWITCH SETTINGS

punched A 7 J in columns 3, 7, 9. Columns 1, 2, 4, 5, 6, 8 and 10 are not to be tested. All selected cards will sort into the zero pocket. All cards that do not meet the desired pattern will be rejected.

1. The MCS control key is on (depressed).
2. Column control keys 3, 7, and 9 are set to select (up) in order to compare the card punching with the predetermined emitted pattern A 7 J.
3. Column control keys 1, 2, 4, 5, 6, 8, and 10 are depressed in order to prevent testing on these columns.
4. Combination punches 12-1 (A) are wired to any of the entries of brush position 3.
5. Emitter position 7 is wired to brush entry hub number 7.

6. Combination punches 11-1 (J) are wired to entries of brush position 9. Note that emitter position 1 is used in two brush readings. Care must be taken to isolate position 1 to prevent a connection between the 12 zone of letter A with the 11 zone of letter J. A back circuit would occur if wire A (dotted line) were wired into lower brush entry 9 instead of upper brush entry 9. This would connect the 11 zone with brush entry number 3 which should receive the 12-zone impulse only.

### Selection with Blanks and Special Codes

Figure 19 shows control panel wiring and column-control switch settings for multiple-column selection of alphabetic, numerical, multiple punch code combinations, and blanks.

1. The MCS switch is on (depressed).
2. Column control switches 1, 2, 3, 4, 5, 6, 7, 9, and 10 are up in order to compare the card punching with the predetermined pattern. Note that column switch 5 is up to verify the presence of a blank column. No wiring in a particular brush position with the column control switch up must find a blank card column if a card is to be selected.
3. Column control switch 8 is down in order to prevent testing column 22 read by brush 8.
4. Emitter positions for the predetermined sort pattern are wired to the proper brush readings.

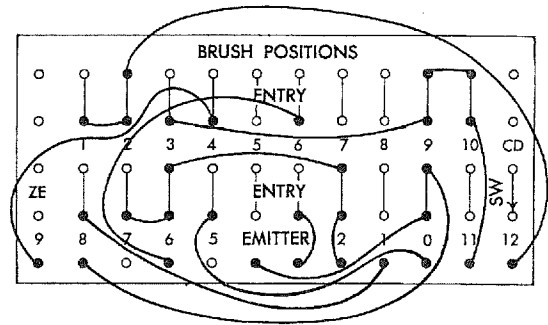
### Normal and Block Sorting with Ten-Position Holder

During multiple-column operations it is not necessary to remove the brush holder to perform block or normal sorting on a few adjacent columns. For normal sorting the 10's position brush is set to the units position of the field. From this point the brush performing the sort is selected by means of the column control keys. The multiple-column selection, length of field, and zero elimination keys on the front panel must be off (raised).

The sort is started by depressing the column control key for the ten brush. On the second pass, the column control key for the nine brush is depressed, and so on, as the sort progresses. All keys to the left of the column being sorted must be raised. As the keys are depressed, the key to the right is automatically disconnected.

### Common Digit Selection

The ten-position brush holder in combination with a pluggable switch on the control panel allows selection of a common digit or several common digits from any of the ten columns. When this switch is wired on, the columns that will be analyzed are connected through the sort side of the column control keys. Therefore, the column control keys corresponding to the brush positions being searched are depressed. The cards will sort into the common digit or digits pockets. Whenever two common digits are recognized within the same card, the first digit



Brush Pos.	1	2	3	4	5	6	7	8	9	10
Select (Card cols. 15-24)	A	B	K	Z		6-3	2		*	11
Punched	12	12	11	0	B L A N K	6	2	O M I T	11	11
Col. UP (Select) Sw. DOWN	1	2	3	4	5	6	7		9	10

FIGURE 19. MULTIPLE-COLUMN SELECTION, CONTROL PANEL WIRING AND SWITCH SETTINGS

read will control the sort pocket. For example, all cards with one or more X's in columns 3-9 may be selected using the common digit feature of the machine. These cards will sort into the zero pocket. All others will be rejected. Figure 20 summarizes the operation.

1. The common-digit selection switch is wired on. The MC, LF, and ZE are off (raised).
2. Column control keys 1-7, which correspond to the brush positions being searched, are depressed.
3. Column control keys 8-10, which sense card columns outside the required field, are made inoperative by setting them to up (select).
4. All digit suppress keys except 11 are depressed to disregard any card punches other than those with X's.

### Zero Elimination

The ten-column brush assembly in combination with the control switch ZE on the front of the machine and a pluggable zero-elimination emitter hub on the control panel permit automatic rejection of cards which require no further sorting. The cards

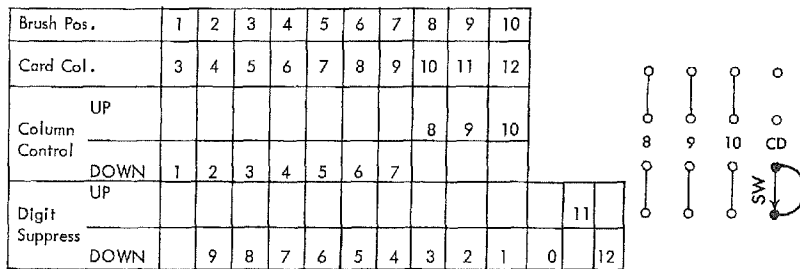


FIGURE 20. COMMON DIGIT SELECTION

will be distributed into sorter pockets according to four classifications.

1. Cards will be rejected whenever the columns to the left of the columns being sorted are blank or punched with 0's, 11's, or 12's only. These rejected cards require no further sorting and are available for immediate report preparation or other operations.

2. If the column being sorted is blank, any punching 1-9 in any sensed column to the left will sort the card into the 12 pocket.

3. If the column being sorted is punched with 0,

11, or 12, and any punching 1-9 occurs in a column to the left, the card will sort as read into the 0, 11, or 12 pocket.

4. If the column being sorted is punched with any digit 1-9, the card will sort into the corresponding pocket regardless of the punching in any positions to the left.

Figure 21 shows sorting in numerical sequence columns 5-14, omitting column 9. Columns 14, 13, and 12 have been sorted.

Brush Position	1	2	3	4	5	6	7	8	9	10	Sort Pocket	Sorting Complete	
Card Column	5	6	7	8	9	10	11	12	13	14			
Card No 1	3	0	0	0	O M I T T E D			0	7	0	12		
2	3	0	0	0		0	0	1	0	3	0		
3	0	0	0	4		0	0	2	5	2	0		
4	0	0	0	0		0	0	2	9	7	Reject	X	
5	0	0	0	7		0	11	3	6	9	11		
6	0	0	0	0		0	11	3	6	9	Reject	X	
7	12	0	0	0		0	0	4	6	8	Reject	X	
8	0	0	0	0		8	2	6	9	3	2		
9							2	8	7	5	2		
Column Control	UP (Select)	1	2	3	4	5	6						
	DOWN (Sort)							7	8	9	10		

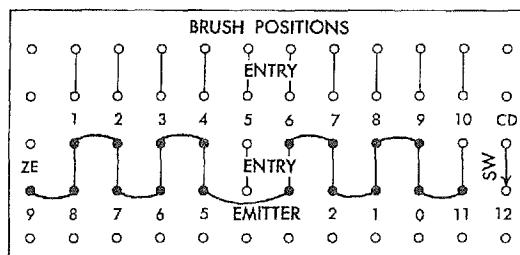


FIGURE 21. SORTING PROCEDURE, ZERO ELIMINATION

1. The zero-elimination control switch (ZE) is on (depressed); MCS and LF are off (raised).

2. The zero-elimination emitter is wired to either brush position entry corresponding to the card columns to be tested.

3. Depress the column control switch corresponding to the units position of the field.

4. Depress each successive column control switch to the left (tens, hundreds, and so on) as the sorting continues. Note that all column control switches for positions to the right of the column being sorted, as well as for the column being sorted, must be set to sort (down) whether inside or outside the required field. All switches to the left of the column being sorted must be set to select (up) whether inside or outside the regular columnar field.

**Length of Field**

The ten-position brush assembly in combination with the length-of-field control key and column control switches permit variable-length fields to be distributed into the pockets as determined by the last significant punched column, regardless of intervening spaces to the left. Hence, cards may be sep-

arated by length of names punched in a field. This effectively reduces the total number of card passes required to alphabetize the field.

Figure 22 shows the pocket distribution of cards with a 17-column city and state field. The brush holder is set to read the ten right-hand columns 8-17 in order to determine the last position that needs to be sorted.

1. The length-of-field switch is on (depressed).

2. The column control switches 1-10 are up (select).

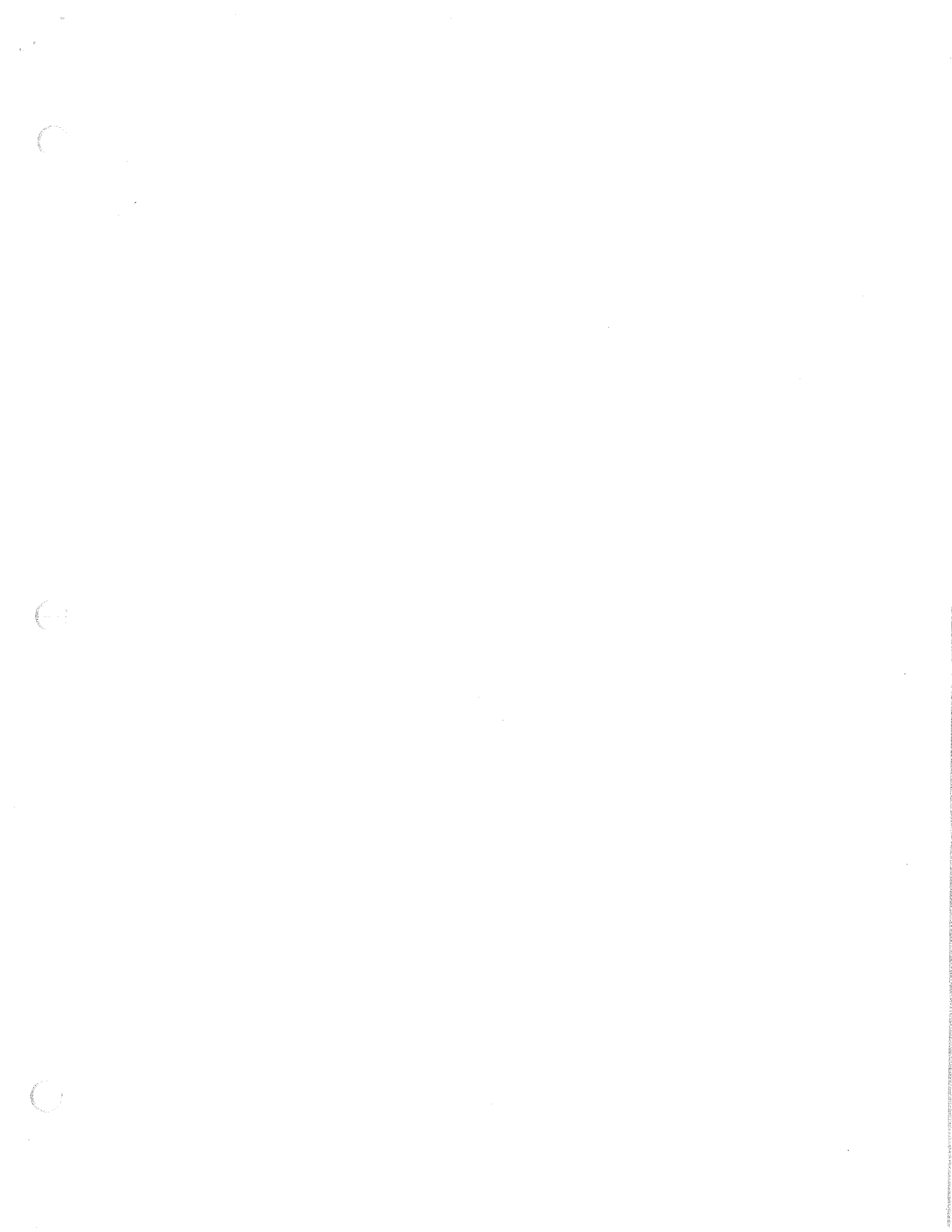
3. At the end of the length-of-field sort, the cards will be distributed according to the pattern shown in Figure 22.

4. After the cards are distributed according to the last significant digit, they are removed from the pockets and stacked separately according to the columns where alphabetic sorting will start. Cards from pocket 11 are sorted alphabetically first, followed by the cards from pocket "0," which are placed in front of those from the first sort and sorted on the next column. Then cards from pocket 1 are placed in front of the previous two alphabetic sorts and the sorting continues in this manner for the remaining columns.

Card Col.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Pocket
Brush Position								1	2	3	4	5	6	7	8	9	10	
Card No.																		
1			(BLANK)															9
2	R	Y	E	N	Y													9
3	M	A	C	O	N	G	A											8
4	M	O	N	R	O		L	A										7
5	L	E	B	A	N	O			A									6
6	S	T	R	L	O	U	I	S		O								5
7	C	A	R	L	S	B	A	D										4
8	F	A	I	R	M	O	N	T		M	I	N	N	N				3
9	W	I	N	N	E	M	U	C						V	Y			2
10	T	H	E	R	M	O	P	O			S			W				1
11	W	A	L	L	A		W	A			A			W				0
12	A	R	K	A	N	S	A	S			I			Y				11
Col. UP (Select)									1	2	3	4	5	6	7	8	9	10
Sw. DOWN (Sort)																		

FIGURE 22. LENGTH-OF-FIELD SWITCH SETTINGS





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